Integrated Solutions

Power, Control, Monitoring and Sensing Technology

Carling Technologies®
Innovative Designs. Powerful Solutions.

Contents

Total Vehicle Control

Carling Technologies has an unmatched track record for providing total vehicle control solutions to the medium- and heavy-duty truck, bus, agricultural, construction and specialty vehicle markets. From electromechanical switches to Multiplexed Power Management Modules and multifunction touchscreen displays, our diverse portfolio of product platforms can provide your company with a combination of standard and custom solutions to address all your vehicle electrical/electronic needs.

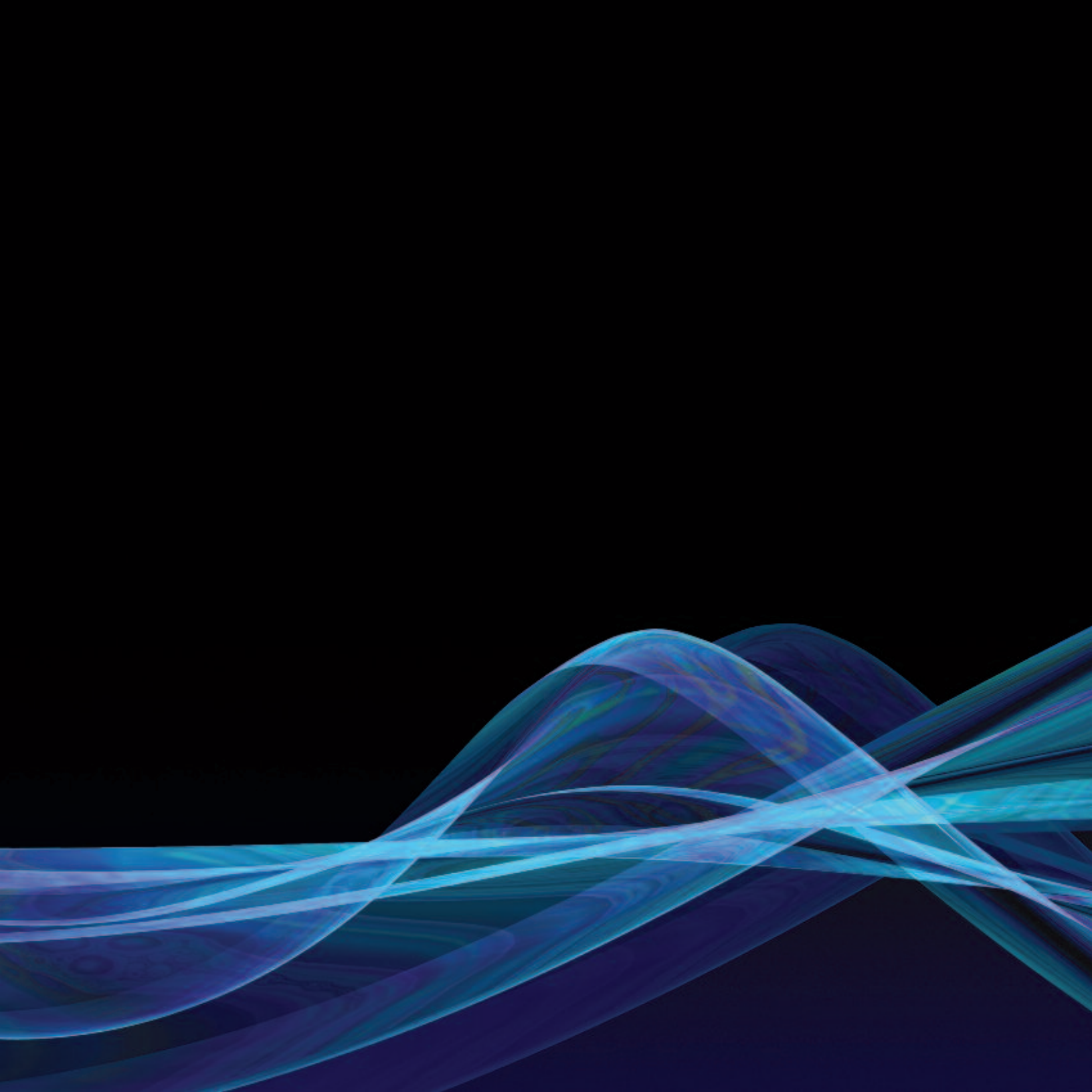
A History of Success

We offer a wide array of standard and configurable products, in addition to custom solutions, across many different industries. We have successfully branded customized solutions for customers in a variety of markets, from aviation to marine, truck, bus, and construction and agricultural equipment. We'll work diligently with your team to understand your application needs and build an integrated system that provides ultimate reliability and performance — cost effectively.

The Power to Provide

A vertically integrated company with manufacturing facilities on three continents, Carling offers complete solutions — from concept and design to tooling, fabrication and manufacturing, with attention to quality and cost competitiveness. As a single source provider, we are able to respond quickly, providing an in-depth knowledge of mechanical, electromechanical, electrical and electronic technologies, as well as incorporating the latest in software developments.

We have a passion for solving your toughest application challenges. With Carling Technologies, the power is in the pursuit of perfection.



Carling Technologies Multiplex Solutions

Carling Technologies is an industry leader, specializing in highly reliable solutions for your multiplexing system applications. We provide expertise in the mechanical, electronic and software development required for a total-vehicle-automation solution. All standard and custom components meet or exceed IEC and SAE mechanical, electrical and electromagnetic requirements.

What Is Multiplexing?

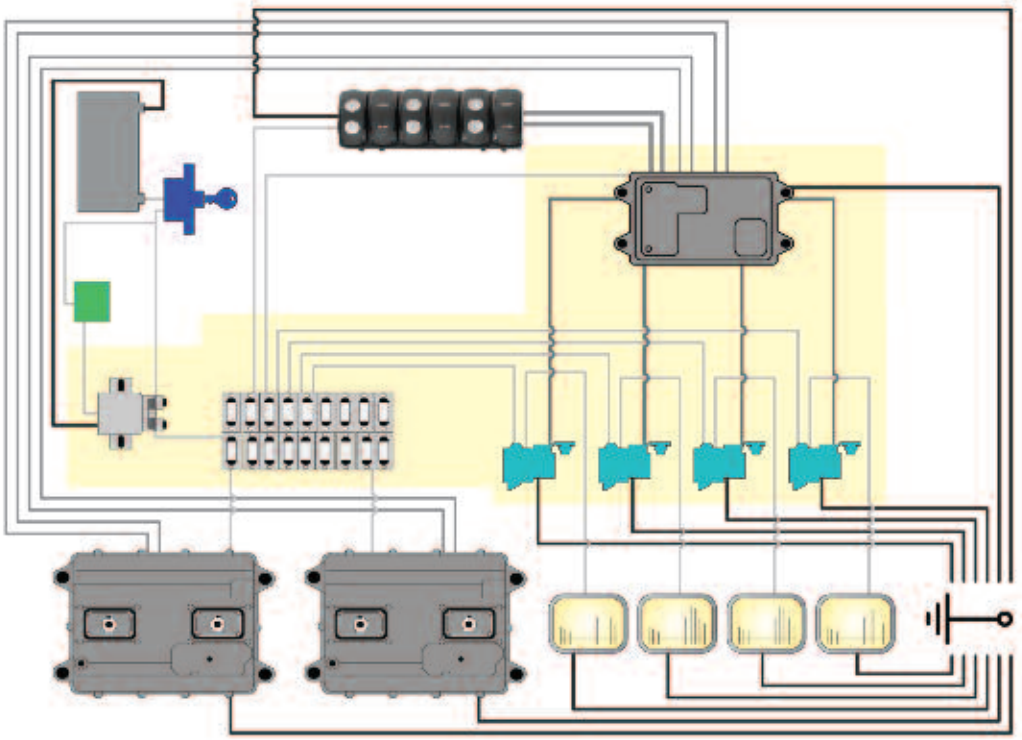
Multiplexing is sending simultaneous multiple parallel digital signals or streams of information on a carrier, in the form of a single, complex signal, and then recovering those separate signals at the receiving end. CAN bus has become the accepted standard for vehicle-multiplexed systems. Carling Technologies is experienced with the variations of CAN Bus protocol — J1939, ISO Bus 11783 and LIN bus — and we will develop the optimal system based on your specific needs.

In analog transmission, signals are commonly multiplexed using frequency-division multiplexing, in which the carrier bandwidth is divided into sub-channels of different frequency widths — each carrying identical parallel signals. In digital transmission, signals are commonly multiplexed using time-division multiplexing, in which the multiple signals are carried over the same channel in alternating time slots.

Benefits of Multiplexed Power Management

- Minimizes overall weight by reducing wire size, length and complexity
- Eliminates auxiliary components, including flashers and timers
- Eliminates conventional fuse boxes, circuit breakers and relays
- Simplifies diagnostics
- Increases reliability
- Manages loads — individual load voltage, current monitoring and reporting
- Provides preventive maintenance capability for inductive loads, such as motors and pumps
- Provides open and shorted load protection, indication and warning
- Adds unparalleled intelligence to your electrical system
- Provides flexibility — customizable, scalable and expandable as needed

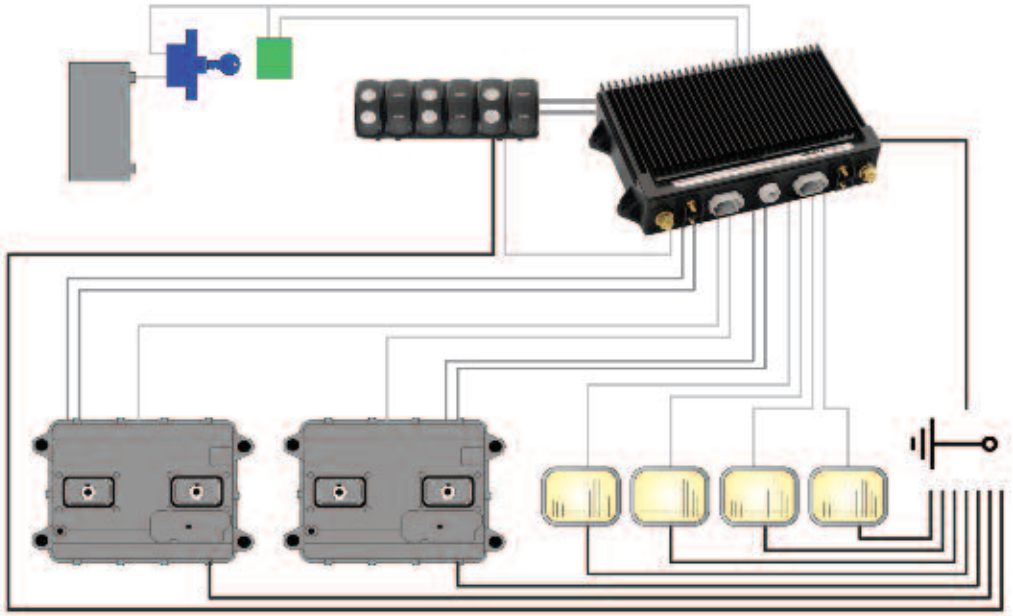
Example of Conventional Power Management



Area replaced by Multiplex Solution

- Relay driver module
- Four relays
- Fuse box w/fuses
- Main relay

Example of Multiplexed Power Management



Truck Applications

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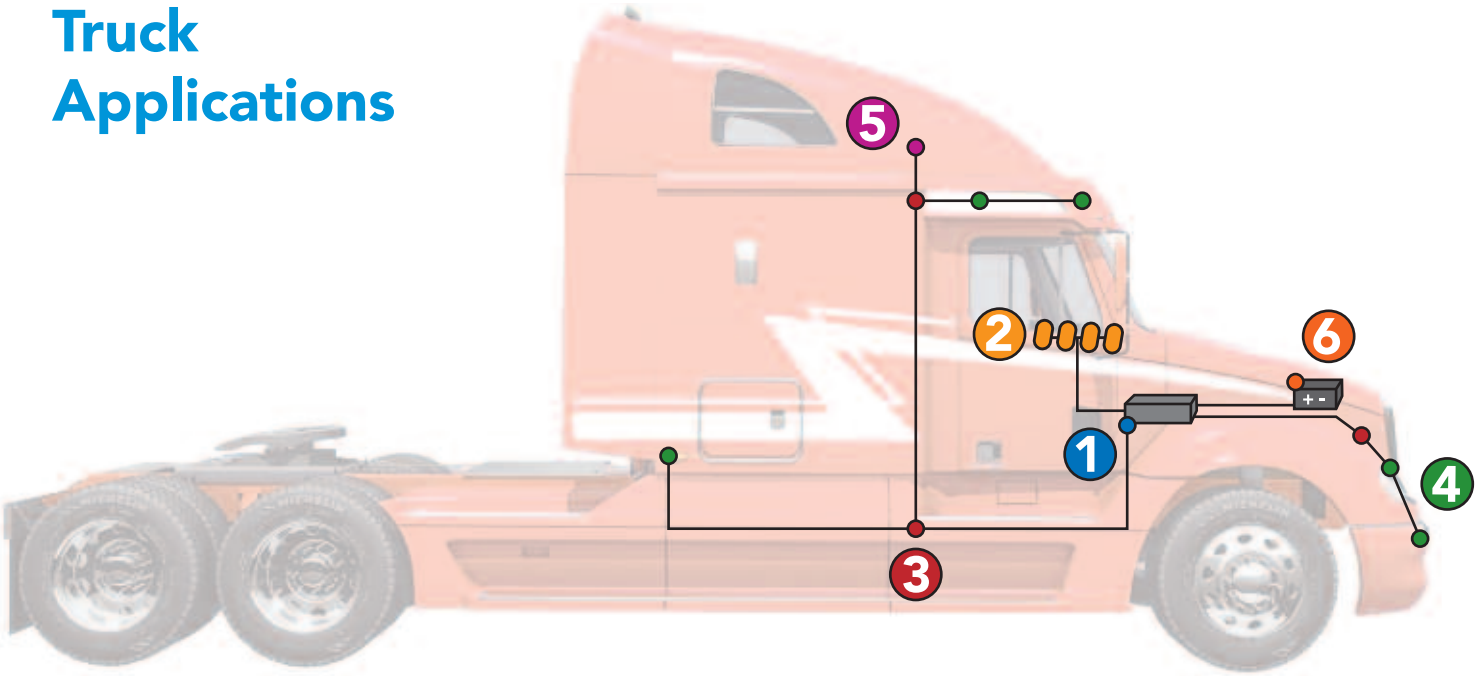


1 Multiplexed Power Management Modules (MPMM)

- J1939 CAN network power distribution
- Multiple MPMM units can be used on the same vehicle
- Electronic circuit breaker status monitored via the CAN network
- Provides diagnostic capabilities and field programmability
- Power management/load shedding
- Controls switches, switch modules, monitors, gauges, interior and exterior lighting, GPS antennas, etc.
- Power from the battery is routed through the MPMM. The MPMM distributes the power and electronically protects the circuits

2 Human Machine Interface Products

- Carling multi-switch modules, individual nodes and discrete switches are controlled by the MPMM
- Gauges, monitors, HVAC and other loads can also be added to the MPMM network

3 Simplified Wiring

- Communication signals are carried over a J1939 CAN communication cable
- Simple four wire system
- EMI/RFI protected
- Minimize vehicle's load connections by reducing wire size, length and complexity
- Easy installation

4 Loads

- MPMM controls interior and exterior light functions throughout the vehicle
- Includes exterior and interior lights
- Dimming capabilities
- Provides inrush protection

5 GPS Antenna/Receiver

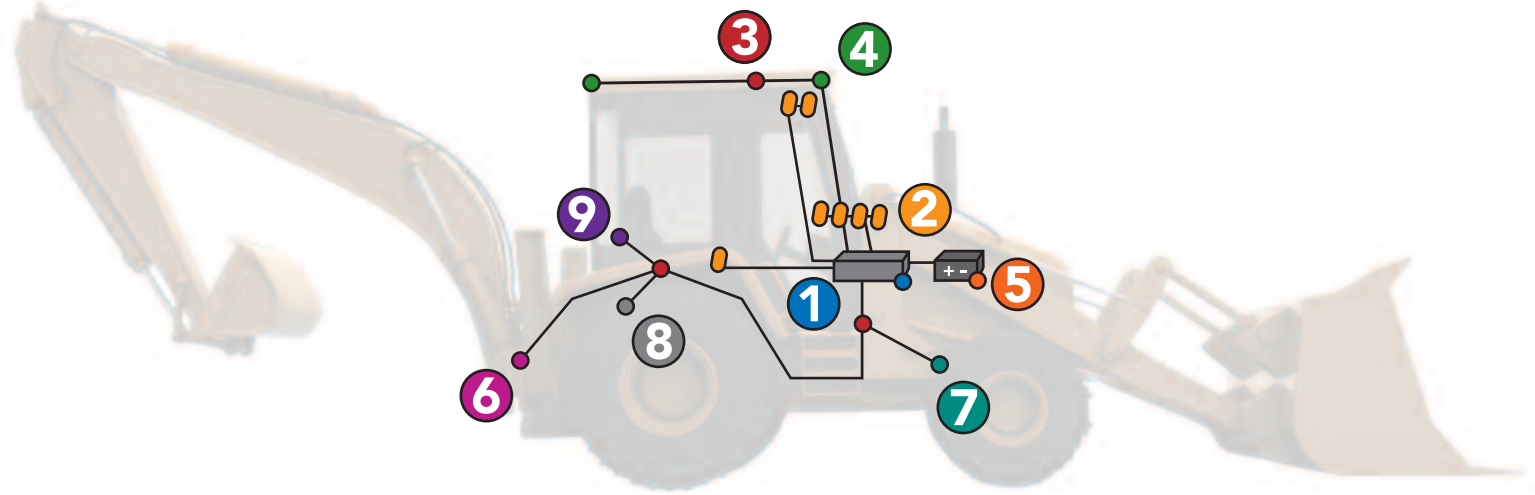
- Plug and play device connects directly to the CAN network, communicating to a dedicated display within the cab

6 Battery

- Distributes power through the MPMM
- MPMM monitors the inrush and regulates the power
- MPMM provides power management capabilities allowing extended battery life

Off-Road Equipment Applications

Off-Road Equipment Applications



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6 Stabilizer Up/Down

7 Parking Brake

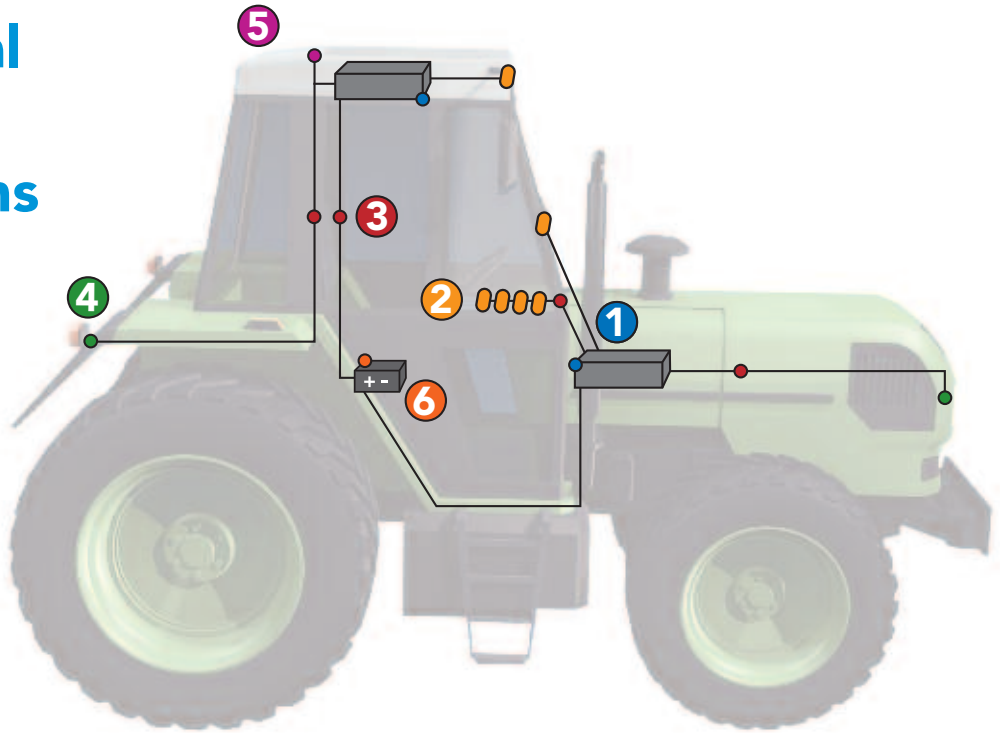
8 Differential Lock

9 Joystick/Backhoe

- Functions Up, Down, Left, and Right
- Lights the *Joystick* LED on the Backhoe Display

Agricultural Equipment Applications

Agricultural Equipment Applications



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Heavy Equipment Applications

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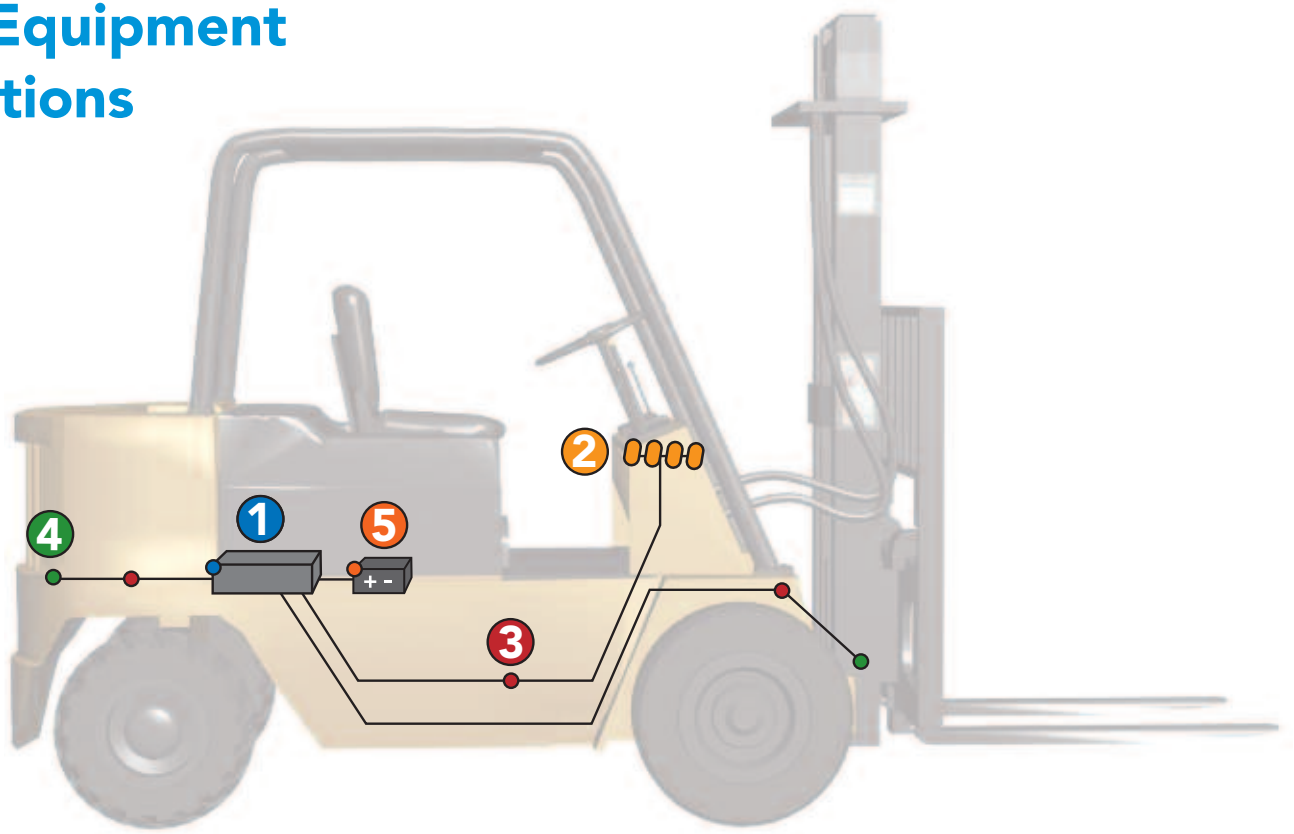

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Bus and RV Applications

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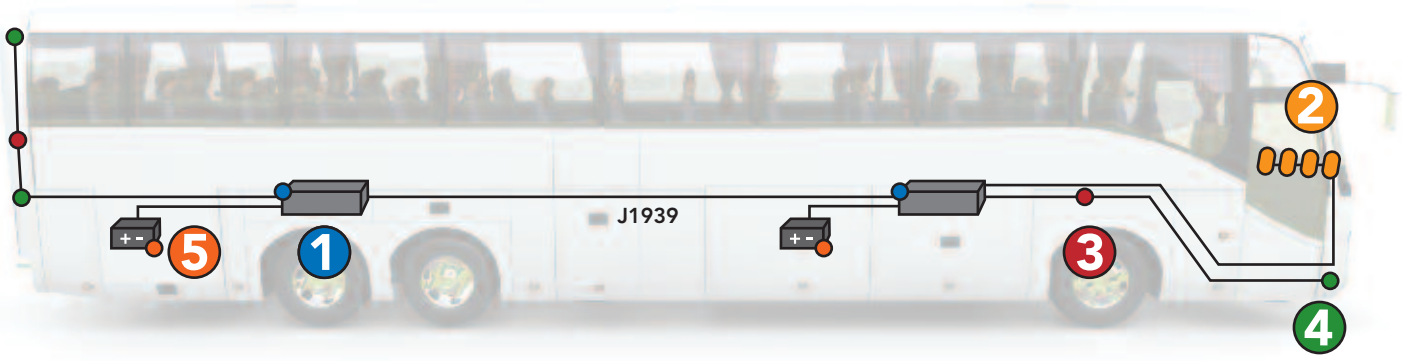

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Total Vehicle Control

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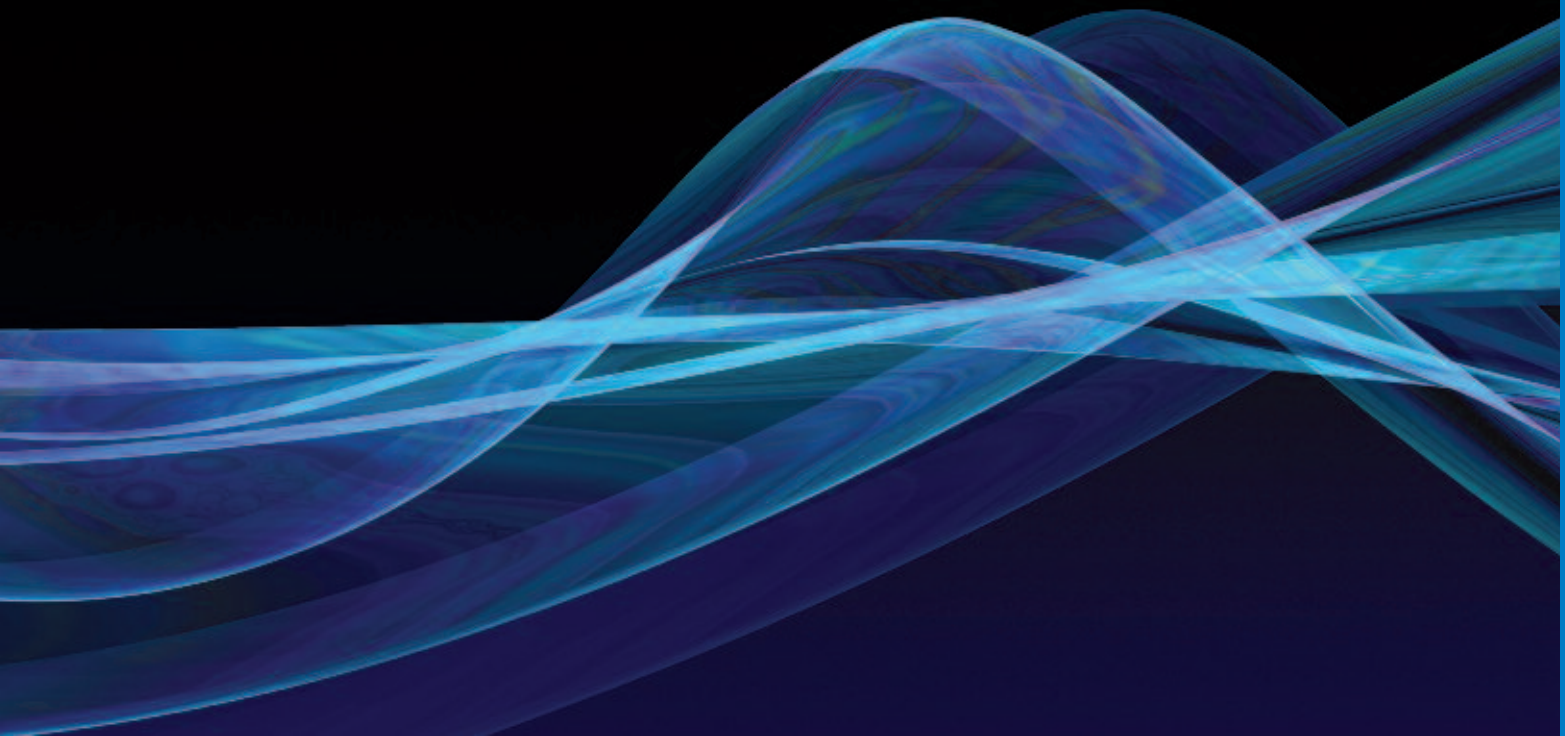


Total Vehicle Control Product Road Map

Electro-mechanical Switches




Electronic Controls







Addressable Switches and Operator Control Modules




Graphical and Multifunction Touchscreen Displays




Gateways

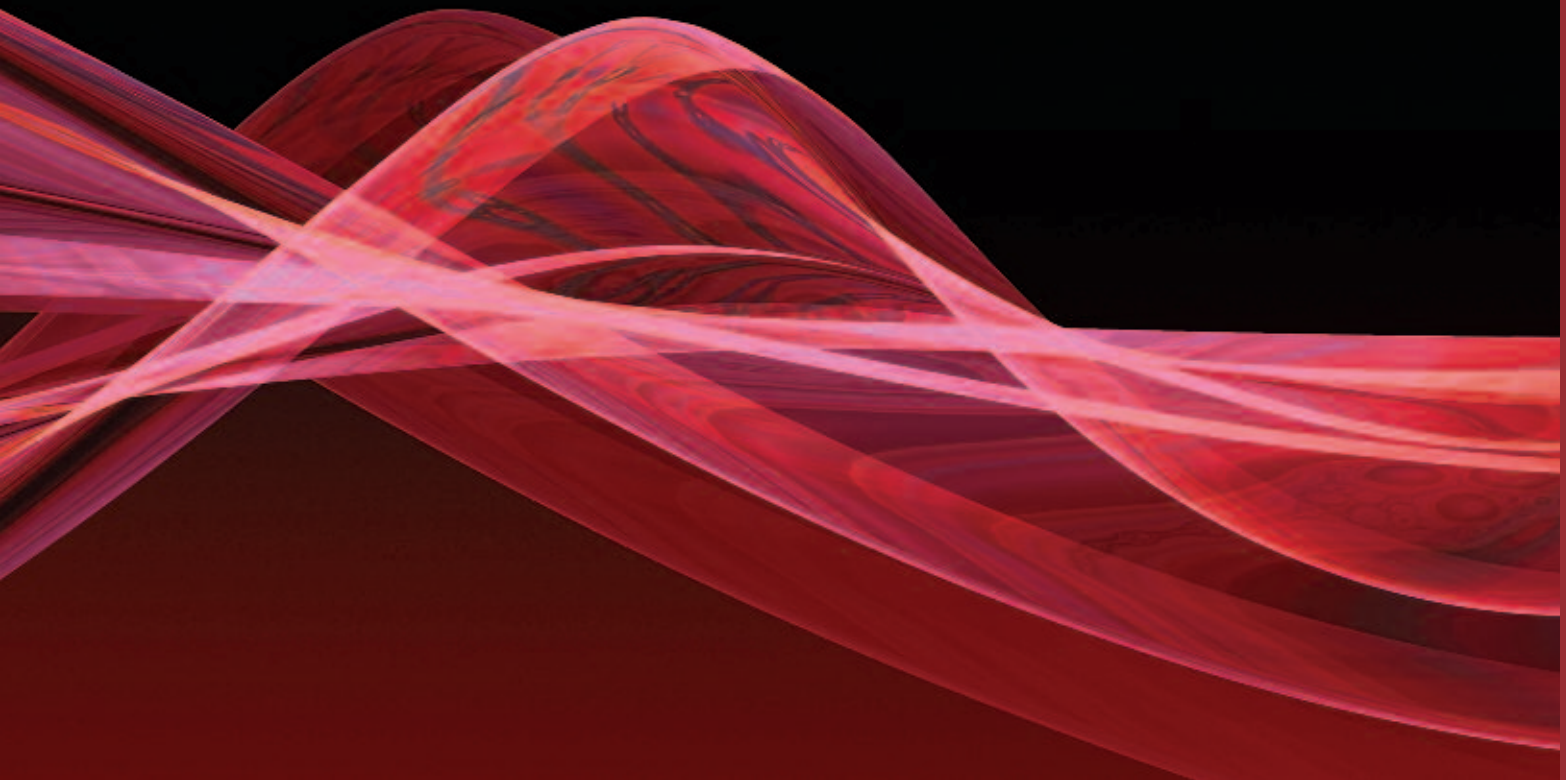




Multiplexed Power Management Modules

Navigation Instruments


Electromechanical Switches



Electromechanical Rocker Switches

V-Series Contura® Sealed Rocker Switches

Our sealed V-Series Contura rocker switches deliver the performance you demand along with the flexibility you need. IP66/68 sealing, above the panel, Ignition Protected UL1500 ratings, and an operating temperature from -40°C to +85°C are just a few of the features of this product.

This attractive switch is available in several actuator styles with various rocker and paddle designs, including laser etched actuators and several lens options, and locking rocker actuators.

A full complement of electrical ratings, circuitry, actuator/bezel choices, polarized connectors, indicator lights, and other accessories make the Contura a preferred choice in the transportation sector.

W-Series Watertight Rocker Switches

The fully sealed W-Series features complete IP68 protection, even below the panel, where the critical connection is made from the vehicle's wiring harness. When used in conjunction with the integrated connector, the totally submersible W-Series provides a seal for up to ten individual wires, assuring compatibility with even the most complex circuitry.

Like the Contura series, the W-Series also offers a wide variety of options, including Progressive and Hazard Warning circuits, Dual level and multicolor LED illumination, and electrical ratings up to 10A 24VDC. Additional actuator styles, including rocker, paddle and locking rocker, will also be offered in the future. The W-Series fits an industry standard panel opening and is an easy retrofit for the Contura or any switch.

L-Series Sealed Rocker Switches

The L-Series is sealed to IP67 above the panel, and is able to withstand temperatures from -40°C to +85°C.

Features include more than 300 switch and lamp circuit combinations, LED illuminated lenses or laser etched rockers, as well as hundreds of legend choices, connectors, and actuator styles. Mounting panels, hole plugs and illuminated indicators are also available in this attractive L-Series style.

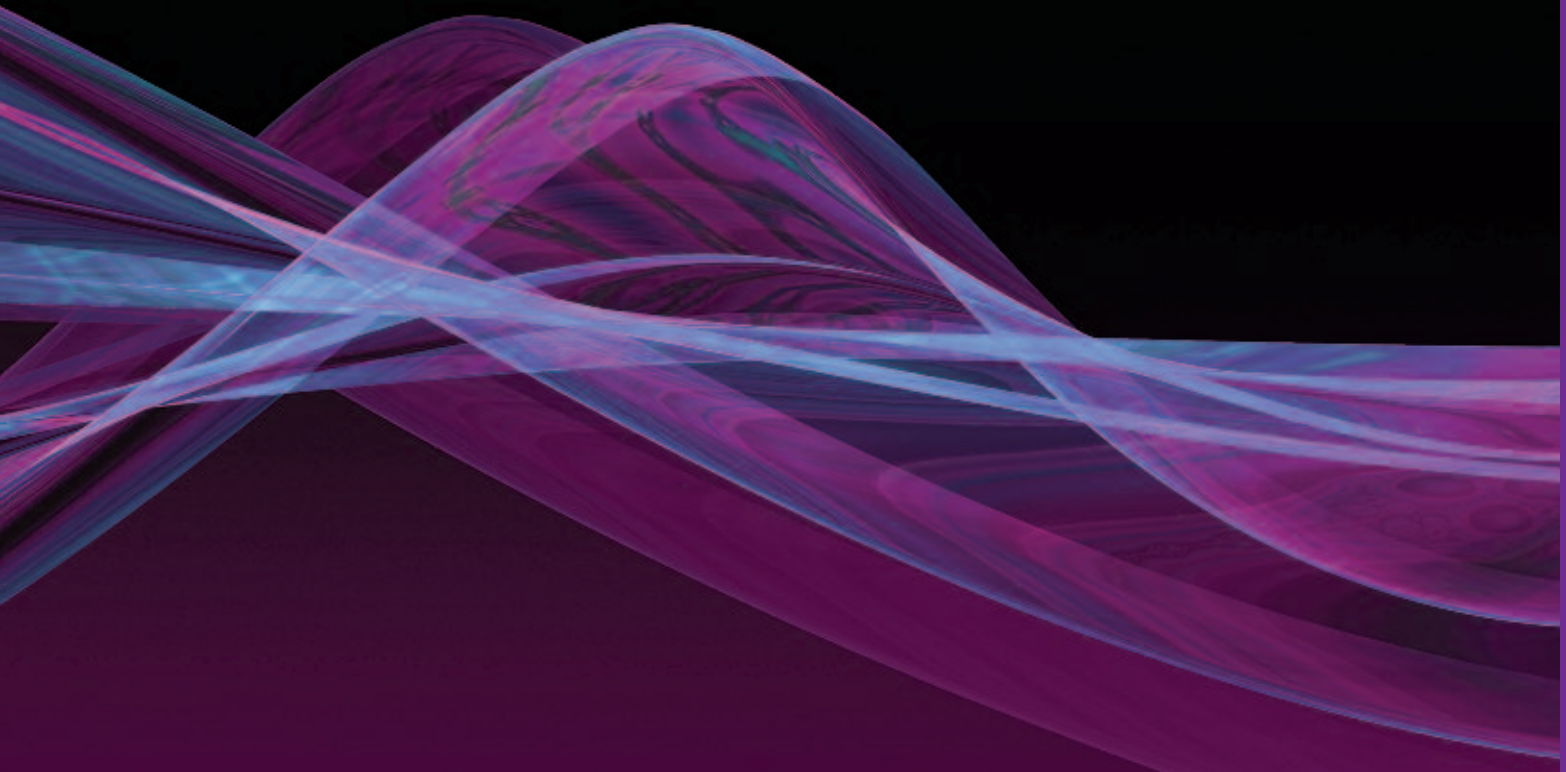
Combined with its sleek aesthetics, the L-Series easily integrates into the most demanding applications around.

S-Series Rocker Switch

The S-Series rocker switch is designed with the vehicle operator in mind. Features, such as abbreviated travel-throw actuators, ergonomic rockers, illumination in up to three detent switch positions, and non-teasable snap action circuitry, provide the driver with easily recognizable and simple to operate controls — allowing the main focus to be where it needs to be, on the road. Designers will appreciate the 10A 24VDC rating, clean bezel-less design, integrated low insertion force connector and polarized switch base for quick installation.

All these great features combined with more than 1000 available laser etched or padprinted legends allows the S-Series to be seamlessly incorporated into just about any cab interior environment.

Electronic Controls



Electronic Controls

LD-Series
Dimmer Control

The LD-Series dimmer control is an extension to the L-Series family of electromechanical switches, which provides programmable circuitry, superior design and unparalleled performance that will afford seamless integration into most any dash panel.

A variety of options, current ratings and number of linear or non-linear dimming steps are available. The LD-Series dimmer control contains no mechanical contacts, thereby providing a longer electrical life, and it is not affected by environmental conditions, operating in temperatures from -40°C to +85°C.

The LD-Series dimmer control offers superior performance, functionality and aesthetics, assuring compliance with most any customer requirement while exceeding SAE J1113 and SAE 1445 EMI standards.

LW-Series
Wiper/Washer Control

The LW-Series wiper/washer control combines the reliability and performance of the L-Series electromechanical switch, along with the sleek aesthetics to seamlessly integrate into most any dashboard design. The wiper/washer control features a robust packaging design that protects critical components and prevents PCB degradation caused by environmental elements. There are six intermittent settings for the wiper speed, in addition to continuous settings and a wash function. Our integrated design provides an added benefit with the cost savings realized by the reduced need for insulated wires and connectors.

LMR-Series
Mirror Rotate Control

The LMR-Series mirror rotate control, another extension to the L-Series family of electromechanical switches, provides the ability to control both driver and passenger side mirrors, using joystick action in four directions. It provides up/down and left/right positioning. The reliable, compact design incorporates sliding contacts and a circuit board, which are protected from dust and moisture by an internal boot.

The compact LMR-Series mirror rotate control fits into an industry standard mounting hole, easily integrating into any dashboard panel.

Cruise Control

The cruise control assembly digitally communicates with the VECU to provide the proper signal when the operator presses a button on one of the controls. The left control includes acceleration and deceleration, while the right control panel includes the OFF/ON and Resume buttons.

This product withstands temperatures from -40°C to +85°C, relative humidity up to 95%, condensation, direct sunlight and mechanical vibrations. The two controls are housed in an integrated assembly to minimize wiring. The expert design integrates seamlessly with the vehicle steering and wheel styling and is designed to meet customer-specific requirements for safety and ease of accurate assembly. Carling engineers will work with you and your vehicle design team to develop a customized cruise control solution for your specific needs.

Horn Control

The horn control is housed in an integrated assembly to minimize wiring and provides a flexible, yet durable actuator cover to endure exponential presses. It withstands temperatures from -40°C to +85°C, relative humidity up to 95%, condensation, direct sunlight and mechanical vibrations and was designed as a cost-effective alternative to traditional horn controls. This rugged control has an operating voltage of 12 to 24 VDC. Carling engineers will work with you and your vehicle design team to develop a customized cruise control solution for your specific needs.

Light Control Module

The light control module is a multifunctional package that encompasses four critical controls within one easy-to-install, space saving unit. Controls include a high-current rotary switch, which controls parking lights and headlights; a push-pull feature on the switch to operate fog lights; an adjacent high-current thumbwheel dimmer switch to select the desired brightness for dash lighting; and an additional miniature rocker switch for auxiliary high-current lighting functions.

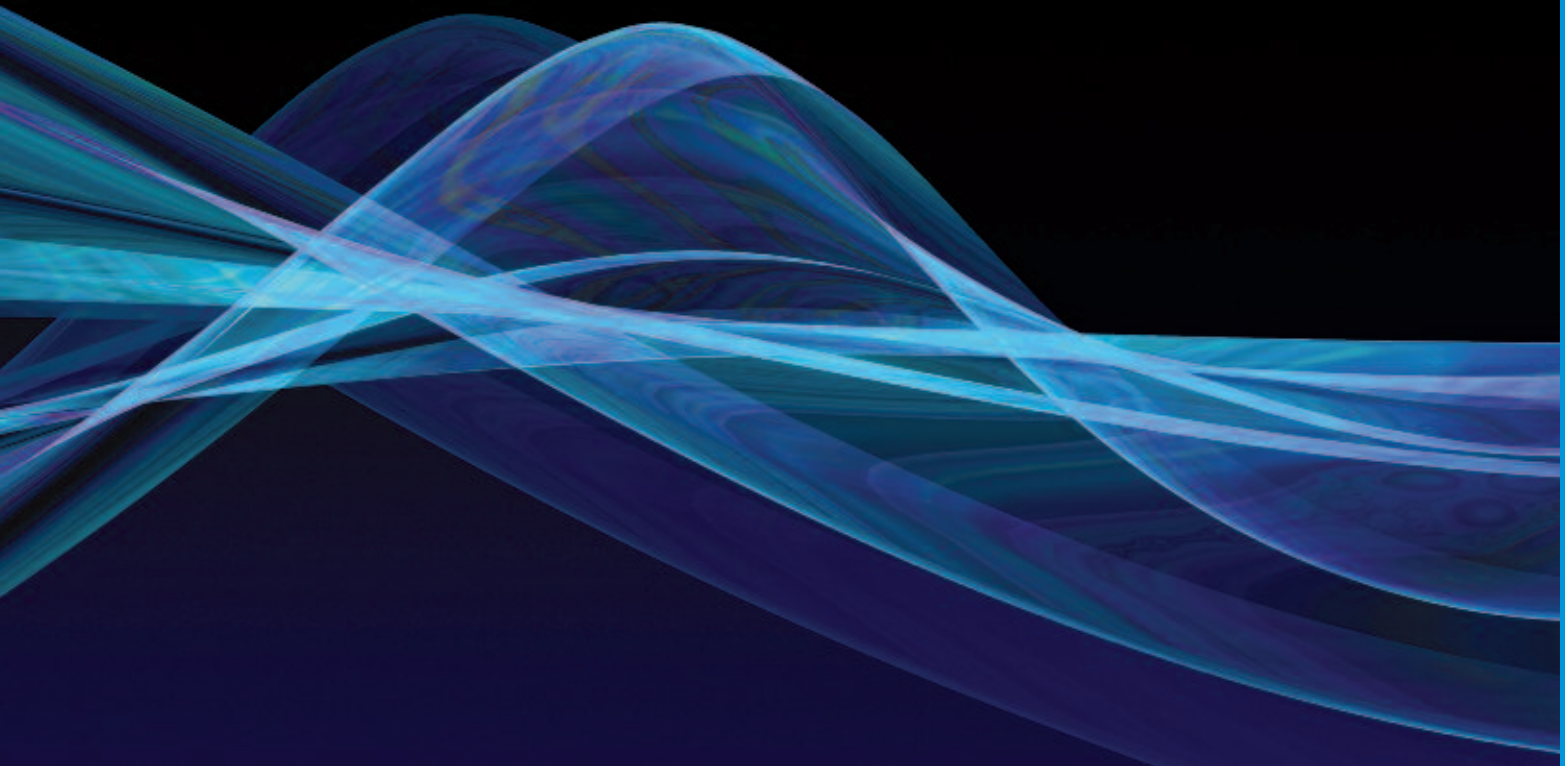
The light control module is a compact, sleek, operator friendly, cost effective module. The rugged high-current switch design allows high-current loads to be handled without the previously required costly relays in the switch circuit. The snap-in design and integrated keyed connector make installation easy, and the compact design uses little valuable dashboard space.

HVAC Motor Controller

The HVAC motor controller efficiently controls heating and ventilation and interfaces with the vehicle's VECU to adjust the speed of the HVAC blower motor. There are two connections in the controller, one to the load through the harness and another to the VECU. The signal from the VECU controls the motor speed and creates a soft start that will suppress any inrush during the motor's start up.

The HVAC motor controller operates at 12 or 24V and drives DC motors up to 30A. It provides over-voltage protection, up to 100V for two minutes, meeting automotive requirements for EMC, vibration and shock. These features help extend the life of the HVAC unit and prevent the nuisance blowing of fuses or circuit breakers. The HVAC controller is sealed to IP68, to protect it from the extreme environmental conditions subject to the blower housing. The HVAC Motor Controller is compact and uses fewer components and connections than traditional motor control devices.

Addressable Switches and Operator Control Modules



Addressable Switches and Operator Control Modules

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N-Series Addressable Switches

The N-Series is a conventional rocker or paddle style switch that is connected to the ECU rather than the load. Connecting to the ECU allows the switch to be placed in any panel location, allowing greater flexibility in panel design. The switch ID is configured through a resistive ladder circuit implemented in the switch, and each switch function is identified by a resistor value that is assigned to that function. There are up to 144 distinct switch IDs available per switch grouping. These switches are available in both two and three position, with maintained and momentary functions. The N-Series uses smaller gauge wire than traditional switches, thereby reducing the size, weight and cost of the wire harness.

Operator Control Modules

Operator control modules use industry standard SAE J1939 CAN and NMEA communication protocols. Using a single connector to the CAN bus via a communications cable, wire harnesses are reduced or simplified, thus saving space, weight and cost. Relying on the embedded software, the module is configurable to your specific load requirements and diagnostic needs.

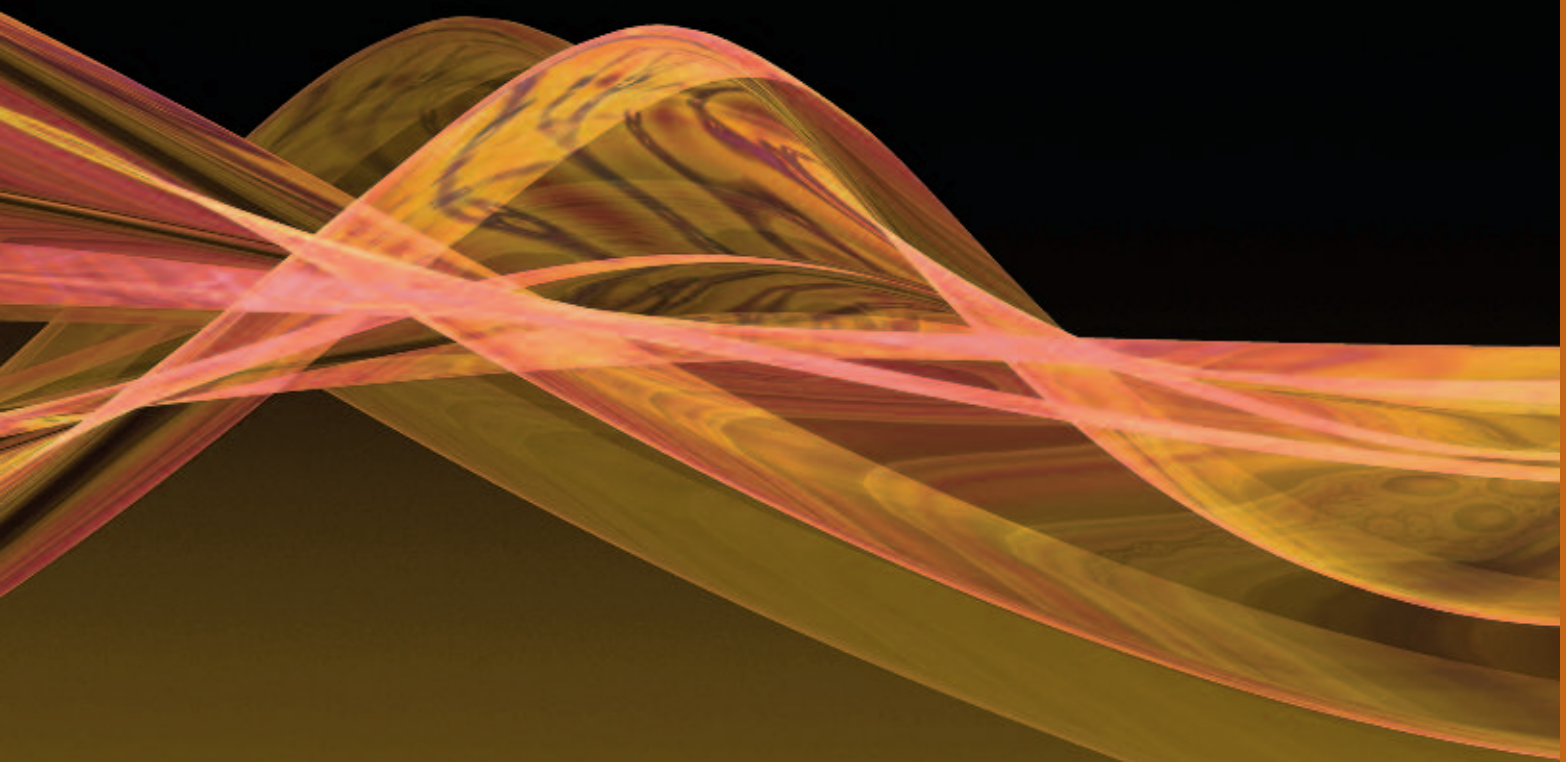
The compact touchpad is available in standard or custom silicone designs for the many HMI controls. The sleek touchpads provide a distinctive tactile feel for the operator, and they incorporate wear-resistant lasered graphics for long life. These Operator Control Modules are available with many features, including multiple function lighting and back lighting that has variable dimming controlled by CAN data.

Designed to provide a distinctive tactile feel for feedback to the operator, the touchpads incorporate wear-resistant lasered graphics for long life. These modules are available with many features including back lighting and multiple function lighting on each control.

Multiplexed V-Series Rocker Modules

Multiplexed V-Series rocker modules use industry standard SAE J1939 and NMEA communications protocols. The rocker module provides the look and feel of a traditional electro-mechanical switch with the connection benefits of a multiplexed module. Using one cut-out for six switch functions, the multiplexed V-Series rocker modules save assembly time, and greatly simplify wiring and harness requirements, making them a cost-effective solution.

Graphical and Multi-Function Touchscreen Displays



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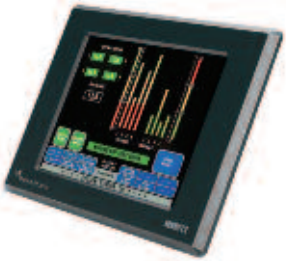


Graphical Color Displays

Graphical color displays are high resolution, sunlight-viewable color displays that allow easy interpretation of instrument data through custom display configurations, featuring easy-to-use five-key illuminated keypads.

Unlike traditional single display units, graphical color display users can choose numeric, gauge or graph formats, with cycling options possible. These displays directly connect to the J1939 network to display any or all the information captured throughout the vehicle, including AC power, battery, tach, engine, environment, fuel management, GPS, time, transmission, weather, and wind. Various audio and visual alarms are also programmable, and the display is engineered and manufactured to the highest standards. Its compact waterproof housing will provide years of reliable performance. The compact design conserves mounting space and reduces overall system cost.

Multifunction Touchscreen Displays

Multifunction touch screen displays allow the operator to monitor and control all AC and DC electrical loads. The easy to use configuration software can utilize custom layouts and graphics, which are displayed on a high quality, color transflective screen.

This impressive sunlight-readable display includes an 80° viewing angle, and is backlit with edge light type cold cathode fluorescent lamps. The display comes with an adjustable brightness function, sleep mode function, audible alarm, programmable switch text and other functions.

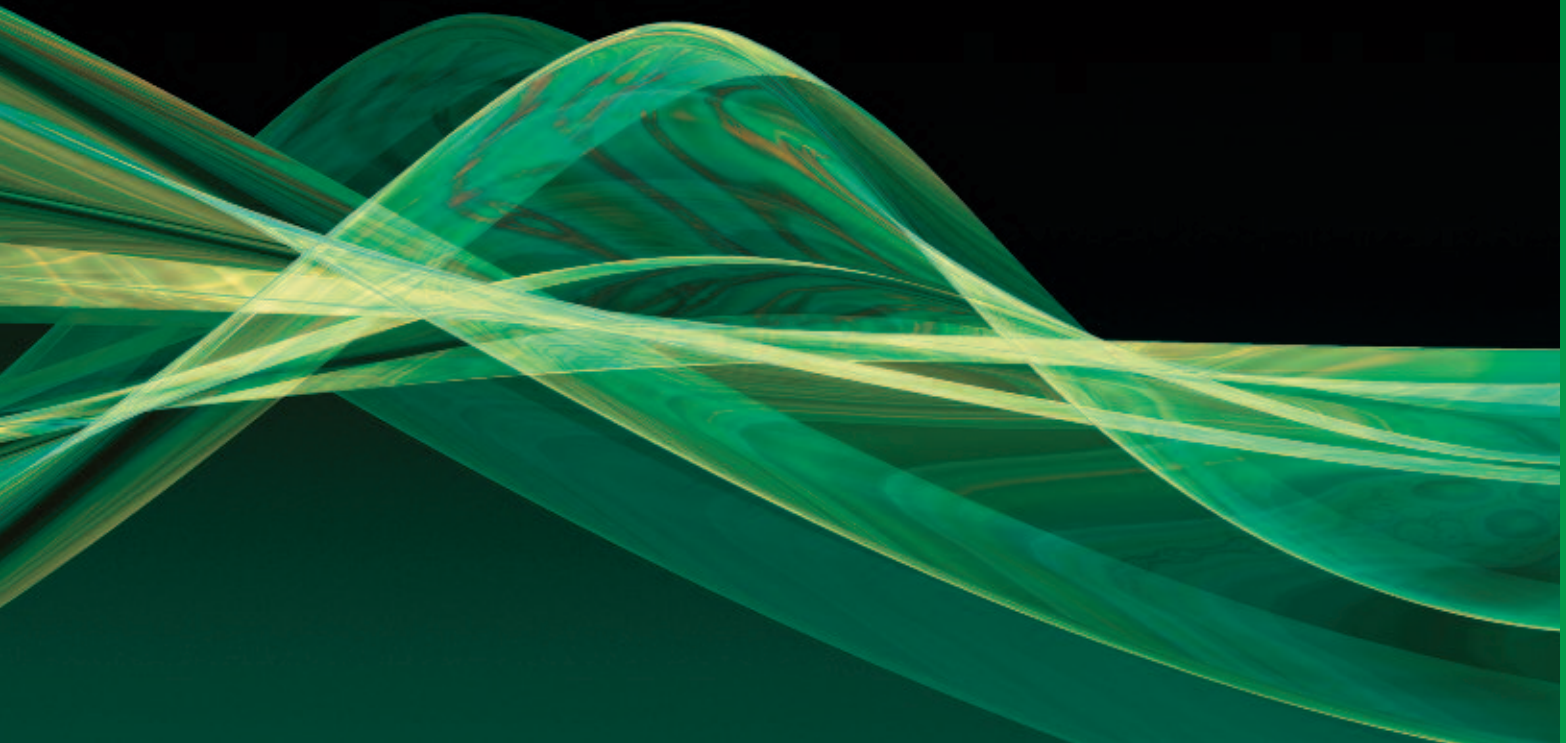
This user-selectable touchscreen panel is designed with a redundant communications interface, utilizing Controller Area Network (CAN) protocol. The circularly polarized, resistive touchscreen provides excellent viewing in high ambient light environments, making the display usable anywhere within the vehicle cab.

System Monitors

System monitors provide both visual and audible indications for functions requiring immediate attention. The monitors incorporate dead-front technology, in the OFF mode, with sunlight-readable legends.

The overlays and legend colors can be easily customized to meet any specific application. Features also include dimming, self-test and user defined functions.

Gateways



Gateways

Switch Interface Gateway

The switch interface gateway allows total flexibility to interface with conventional switches. It converts discrete inputs received from up to eight conventional switches to a serial CAN communications link. This module eliminates heavy gauge wires used in traditional switch wiring and simplifies harness complexity. It uses a single SAE J1939 communications cable from the module to your MPMM.

An 18-pin coaxial connector is provided, which allows switch dimming and external power functions. The switch interface gateway provides an operating temperature range of -40°C to +70°C. The switch interface gateway's rugged compact design allows total flexibility in switch panel designs.

Engine Gateway

The engine gateway connects directly into the J1939 network and monitors various switch functions and translates switch and monitor protocol to J1939 protocol, without drawing any power. The engine gateway is compatible with any engine, transmission or generator set that is equipped with a J1939 interface. When linked, the critical engine, transmission and genset data is distributed through the vehicle over a single cable, where it can be monitored by a compatible display, including Carling's graphical and multifunction touchscreen displays.

USB Gateway

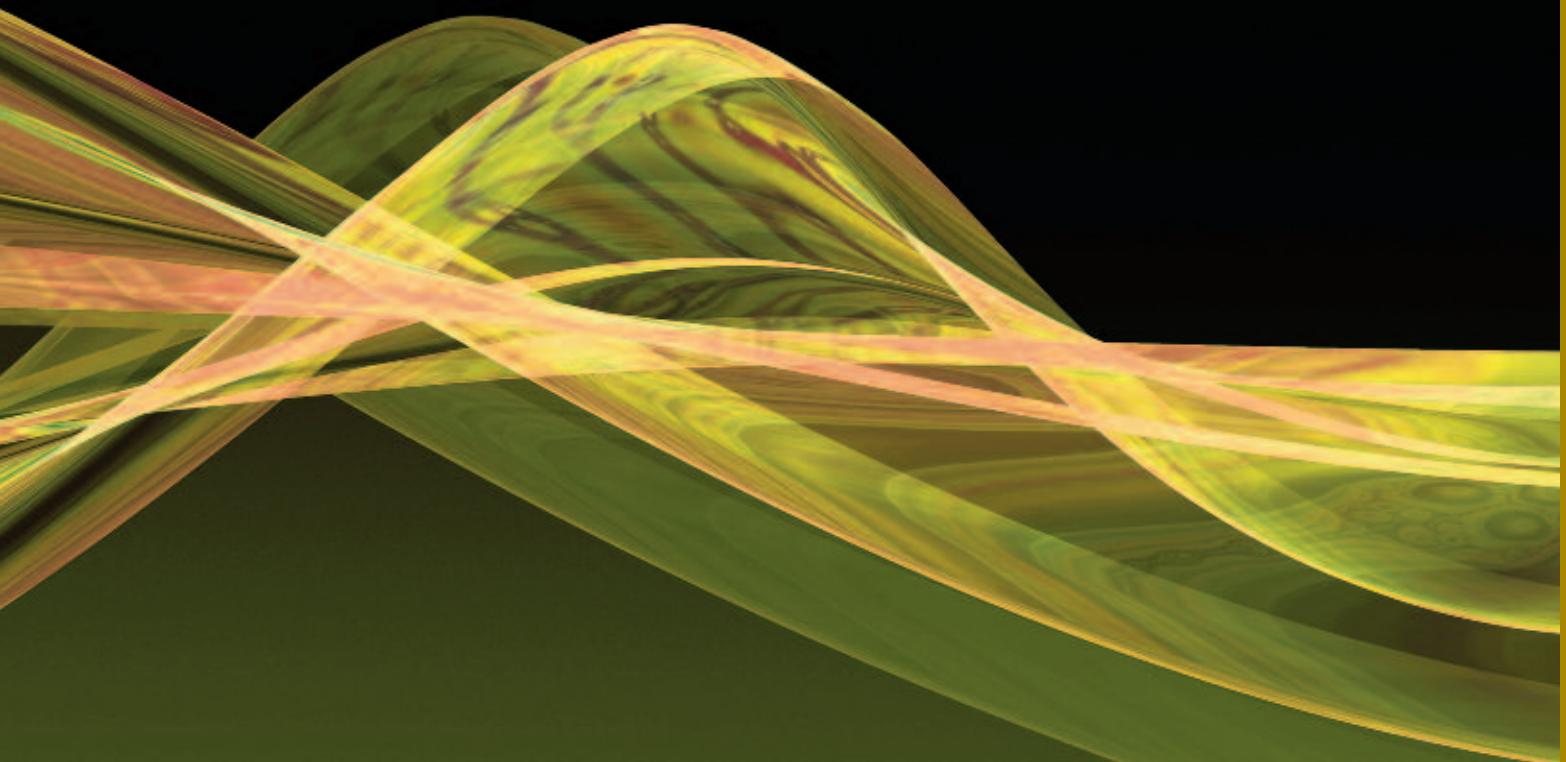
The USB gateway provides PC data management and bridges the PC with the CAN network, through a USB port. It provides diagnostics and monitoring capabilities. In addition, programming capabilities are available. The USB gateway provides one simple connection between the network and the PC, which eliminates conventional multiplexers and greatly simplifies and reduces wiring.

Analog Engine Monitoring Gateway

The analog engine monitoring gateway plugs directly into the engine wire harness and converts analog signals over a communication cable to a J1939 monitor. This gateway is used to monitor several functions, including tachometers, engine hours, coolants and oil pressure.

The analog engine monitoring gateway is compatible with existing instrument panels and key switches. Thus, these components do not have to be removed to be upgraded to newer digital technology.

Navigation Instruments



Navigation Instruments

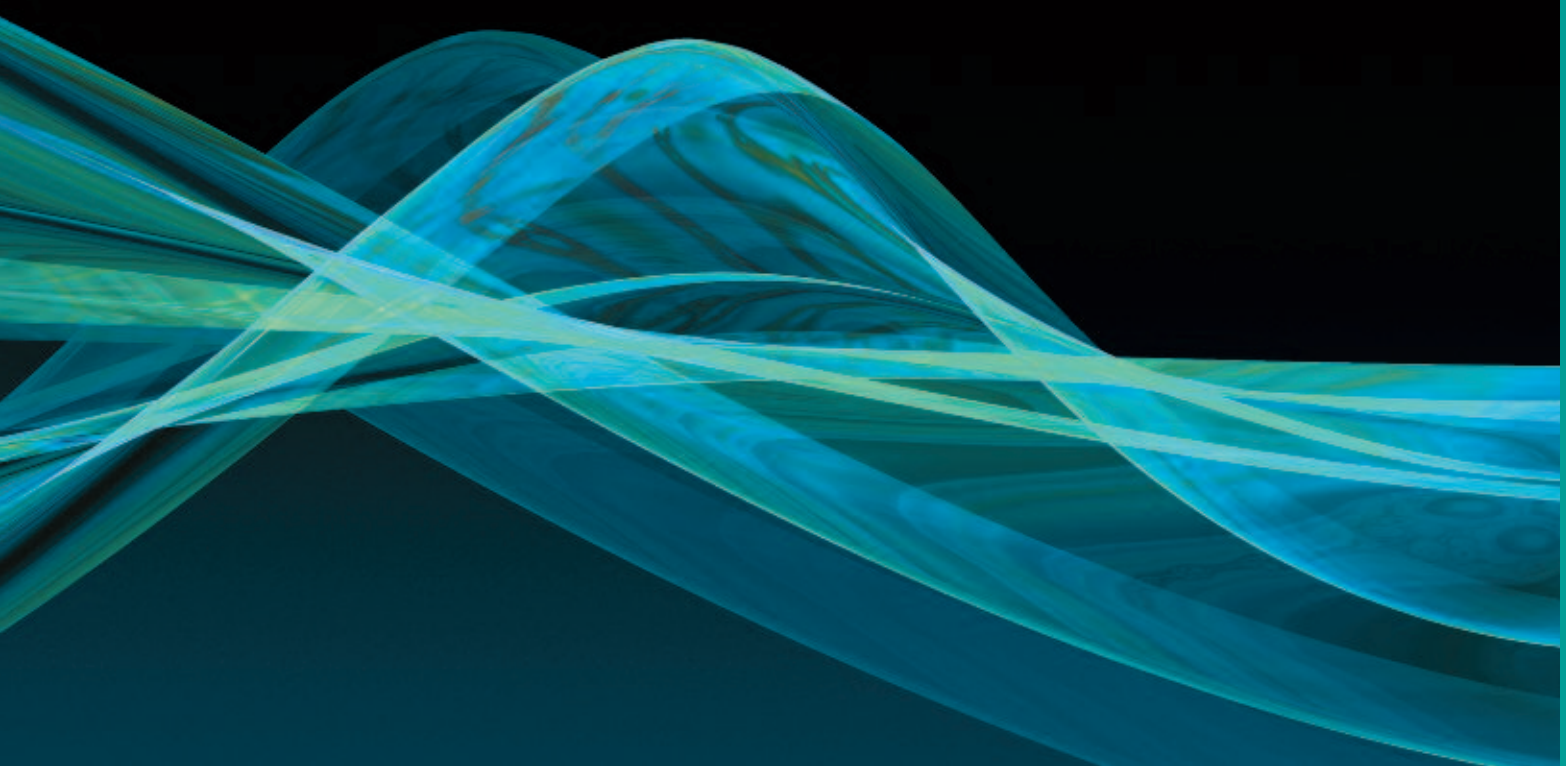
GPS Antenna/Receiver

The GPS antenna/receiver is a plug and play device that provides reliable position fixes ten times per second. It connects directly to the network and communicates with navigational software, chart plotters, autopilots and dedicated instrument displays such as the multi-function graphical display. The GPS antenna automatically decodes GPS correction signals from Satellite Based Augmentation Systems (SBAS), including the North American Wide Area Augmentation System (WAAS), the European Geostationary Navigation Overlay System (EGNOS), and the Asian Multifunctional Transport Satellite-based Augmentation System (MSAS) to provide better than 3m accuracy. The GPS antenna is easily mounted to any 1" standard mount, with its standard 1" – 14 male threads, and its compact, waterproof housing provides years of reliable performance.

Ultrasonic Wind/ Weather Station

The outdoor wind/weather station measures wind speed and direction, air temperature, barometric pressure, and relative humidity. The wind measurement is performed using ultrasonic sensors, so there are no moving parts to wear out or get in the way. This system accurately measures wind speed and direction under a tilt of up to 30°; when used with Carling's multifunction color display, the operator can view both apparent and true wind speed and direction, dew point, and wind chill factor.

Multiplexed Power Management Modules



Multiplexed Power Management Modules

Multiplexed Power Management Modules

DC Power Management Module

The MPMM is a 16-channel, field programmable controller utilizing J1939 CAN bus communications. It provides programmable circuit protection for current level, inrush and time delay, in addition to auxiliary functions, including dimming functions, via discrete inputs. TheMPMM has a total current capacity of 125A, with up to 30A continuous load on four channels, and 15A max capacity on the remaining seven channels. It has seven PWM cirThe controller also includes motor reversing control circuits and bridge circuits, and can operate at 12V and 24V.

This EMI/RFI and lightning-strike protected system is CE compliant, with specifications compliant to IEC61000 for voltage protection and CISPR22 for EMI/RFI. It includes remote circuit reset and is offered with custom power management capabilities to increase battery life. The MPMM is flexible and includes programmable configurations. Software updates are easy to install, and single point of service can be completed from a PC or from within the cab. Circuit characteristics of the MPMM allow the operator to track current usage, shut down abnormal current usage, track load shedding, and handle inrush current up to 90A. The MPMM greatly reduces switch panel wiring and simplifies the wire harness, while eliminating the fuse block, relays and relay driver modules.

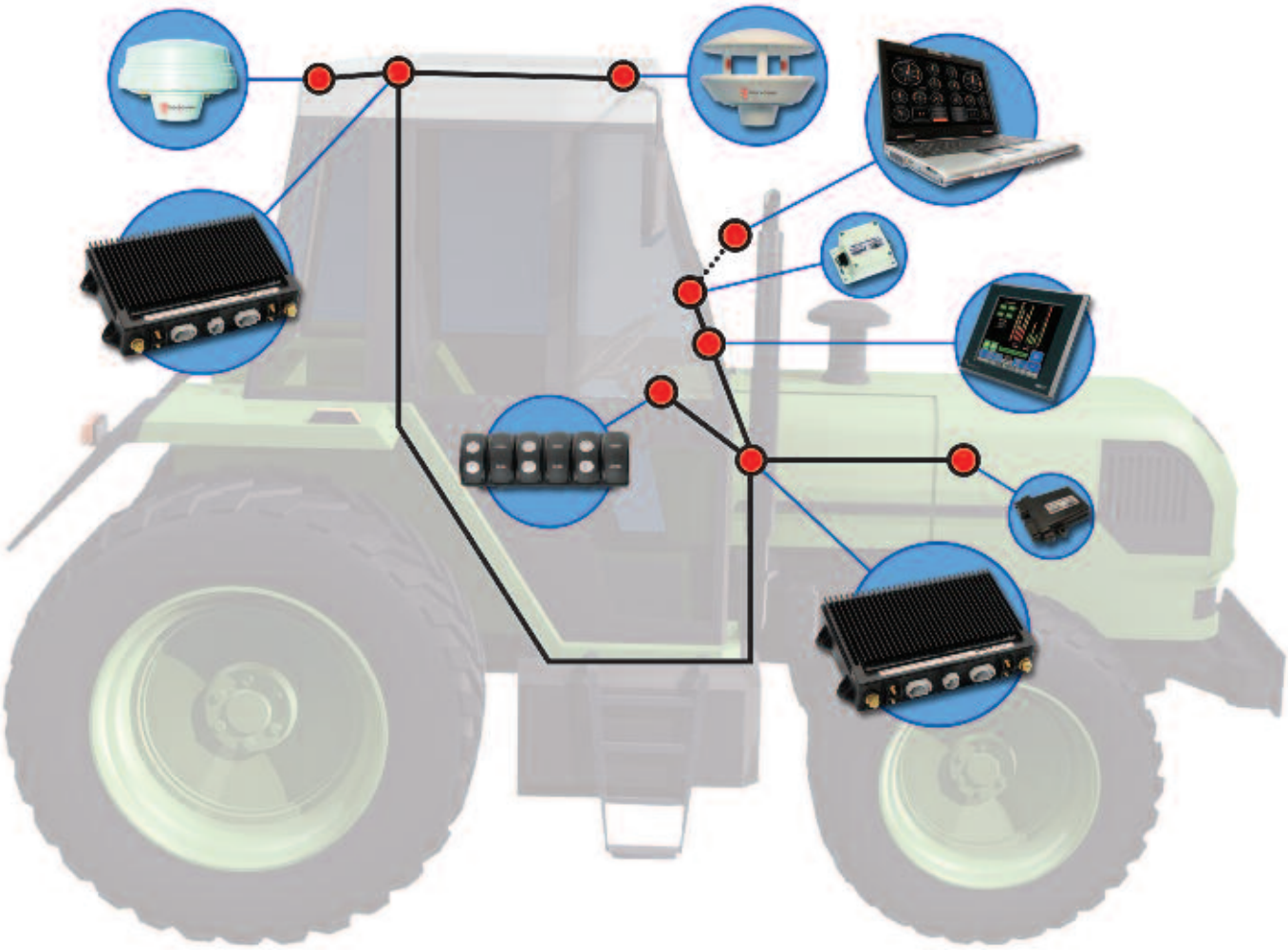
The MPMM includes eight discrete inputs, which can be used as logic level inputs, switch level inputs (up to the supply voltage) analog inputs, or timer/counter inputs for RRM measurements.

Application Examples

- Battery Power Distribution & Control
- Motor Controls
- Flashers
- Dimming
- Horns
- HVAC Controls
- Wiper-Washer Controls
- Exterior Lighting
- Interior Lighting
- Radio

Complete Integrated Solutions

From switches to multifunction touchscreen displays, navigation instruments and multiplexed power management modules, Carling products are available separately or as a complete integrated solution for your vehicle.



Glossary of Terms

Analog Signal
An analog signal is one in which a base carrier's alternating current frequency is modified in some way, such as by amplifying the strength of the signal or varying the frequency, in order to add information to the signal. Broadcast and telephone transmission have conventionally used analog technology.

CAN – Controller Area Network
Controller Area Network (CAN or CAN-bus) is a computer network protocol and bus standard designed to allow microcontrollers and devices to communicate with each other without a host computer.

Digital Transmission
Digital transmission describes electronic technology that generates, stores and processes data in terms of two states: positive and non-positive. Positive is expressed or represented by the number 1 and non-positive by the number 0. Thus, data transmitted or stored with digital technology is expressed as a string of 0's and 1's. Each of these state digits is referred to as a bit (and a string of bits that a computer can address individually as a group is a byte).

ECB
Electronic circuit breaker

Electromagnetic Interference
Electromagnetic interference (or EMI, also called radio frequency interference or RFI) is a (usually undesirable) disturbance that affects an electrical circuit due to electromagnetic radiation emitted from an external source. The disturbance may interrupt, obstruct, or otherwise degrade or limit the effective performance of the circuit. The source may be any object, artificial or natural, that carries rapidly changing electrical currents, such as an electrical circuit, the sun or the northern lights.

FDM (Frequency-Division Multiplexing)
Frequency-division multiplexing (FDM) is a scheme in which numerous signals are combined for transmission on a single communications line or channel. Each signal is assigned a different frequency (sub channel) within the main channel.

Gateway
A gateway is a network point that acts as an entrance to another network.

GPS (Global Positioning System)
The Global Positioning System (GPS) is the only fully functional Global Navigation Satellite System (GNSS). Utilizing a constellation of at least 24 Medium Earth Orbit satellites that transmit precise microwave signals, the system enables a GPS receiver to determine its location, speed, direction, and time.

HVAC
Heating, ventilating, and air conditioning

International Electrotechnical Commission
The International Electrotechnical Commission (IEC) is a not-for-profit, non-governmental international standards organization that prepares and publishes International Standards for all electrical, electronic and related technologies – collectively known as "electrotechnology."

ISO 11783
ISO 11783 (or ISO Bus or ISOBUS) is a communication protocol based on the SAE J1939 protocol (which includes CAN bus) for the agriculture industry. It is managed by the ISOBUS group in VDMA.

LIN-Bus
The LIN-Bus (Local Interconnect Network) is a computer networking bus system used within current automotive network architectures. The LIN bus is a small and slow network system that is used as a low cost sub-network of a CAN bus to integrate intelligent sensor devices or actuators in today's cars. Recently LIN may be used also over the vehicle's battery power-line with a special DC-LIN transceiver.

MPMM
Multiplexed power management module

OCM
Operator control module

SAE J1939
SAE J1939 defines five layers in the seven-layer OSI network model, including the CAN 2.0b specification (using only the 29-bit/"extended" identifier) for the physical and data-link layers. The session and presentation layers are not part of the specification.

VECU
Vehicle electronic control unit

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