A NAVISTAR COMPANY

An Introduction to Diamond Logic™ Electrical System Service

Study Guide
TMT-080604

INTERNATIONAL®

Study Guide An Introduction to Diamond Logic™ Electrical System Service TMT-080604

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AN INTRODUCTION TO DIAMOND LOGIC™ ELECTRICAL SYSTEM SERVICE

After International® launched the industry's first high performance vehicles, customers, body builders, and operators have come to realize the benefits of the Diamond Logic™ electrical system. The system offers end users and equipment manufacturers the opportunity to select factory-installed electrical features that control various types of body equipment. Now we're taking it to the next level. Users can obtain pre-programmed equipment features and parameters to automate and customize truck performance.

"Giving the body builder one central point to connect with the truck electrical system–without the need to cut into the cab or wiring harnesses, and without the need for after market switches, is an International® goal."

Giving the body builder one central point to connect with the truck electrical system–without the need to cut into the cab or wiring harnesses, and without the need for after market switches, is an International® goal.

The Diamond Logic™ electrical system makes it all possible. Along with these enhancements, a completely new software program has been developed. Diamond Logic™ Builder software enables body builders and end users to integrate body equipment and create customized vehicles uniquely in tune with their businesses.

These electrical features and integration options, present a whole new electrical-service challenge for the technician.

This program is designed to help the technician research and identify all factory electrical components, wiring options, electrical parameters, and, any custom logic that may relate to electrical service requirements.

The program is divided into three modules. **Module I** introduces you to the Diamond Logic™ electrical system. A good basic understanding of electrical components and integration technology is necessary to understand electrical features, their parameters, and truck integration ordering options.

Module II introduces you to virtually all electrical feature code options and related electrical parameters. A complete overview is necessary to help the technician provide related electrical service.

Module III provides the skills you need to research and access all features and parameters specific to the vehicle requiring service. Altogether, this DVD program provides all the tools you need to provide quality service within standard repair times to help get the customer down the road with the full benefits of the Diamond Logic™ electrical system.

"This program is designed to help the technician research and identify all factory electrical components, wiring options, electrical parameters, and, any custom logic that may relate to electrical service requirements."

MODULE I MULTIPLEXING 101

Let's go over some basics before we move on to cover the many advantages of International® High Performance trucks.

First, let's define multiplexing. After all, multiplexing, together with the engine controller, transmission controller, ABS controller, electrical system controller, and remote power connection points, is what makes these trucks wired for performance.

"Multiplexing is the ability to send and receive multiple messages over one pair of wires, similar to the land-line telephone system."

Multiplexing is the ability to send and receive multiple messages over one pair of wires, similar to the land-line telephone system. Multiplexing relies on the use of several onboard computers to encode, sort, and decode multiple electrical signals. Everything works together to get the job done.

Before, if we wanted to monitor engine oil pressure and water temperature we needed two wires to run from each sensor to the gauge cluster in the dash. A far more intelligent approach is to use just one pair of wires to connect all engine sensors to the gauges.

The result is a system with at least 40 percent fewer wires for greater

reliability, and lower repair time and cost. In addition, a smaller harness is easier to route and clip, making for a cleaner installation.

Almost everything is multiplexed on the Industry's First High Performance Trucks: the engine, transmission, anti-lock brakes, body control modules and the major components of the instrument panel.

Multiplexed components include rocker switch packs, the gauge cluster, the electrical system control module, remote power modules, and air solenoid modules. These are smart modules developed by International® that communicate and share information with each other, and the power train control modules.

"Multiplexed components include rocker switch packs, the gauge cluster, the electrical system control module, remote power modules, and air solenoid modules."

Now let's take a closer look at the features and benefits of each component in the Diamond Logic™ electrical system

Primary control of the chassis electrical system takes place through one Electronic System Controller or ESC. It's the brain of the electrical system. The ESC communicates and shares information with other major systems like the engine, automatic transmission, ABS brakes, and driver controls in the cab.

"ESC standard features include daytime running lights, solid state turn signal flashers, solid state lighting controls, intermittent wipers, and electrical system diagnostic reporting."

ESC standard features include daytime running lights, solid state turn signal flashers, solid state lighting controls, intermittent wipers, and electrical system diagnostic reporting.

Software programming allows for low cost continuous ESC feature upgrades in the field. It provides a far easier way to modify body control operations.

This is the revolutionary piece of the puzzle—it makes all the other benefits of the International® Diamond Logic™ electrical system possible.

The gauge cluster is another key part of the Diamond Logic™ multiplexed electrical system.

The gauges provide built-in diagnostics which let the driver know if truck functions are out of range. There is a wide-angle gauge display, digital odometer, and warning lights. There are also audible alarms when gauges detect an unsafe operating range, such as low fuel, low voltage, low oil pressure, or high coolant temperature.

Older systems had as many as 90 wires. Now, only seven wires feed the entire gauge cluster.

Stepper motors are used as the gauge mechanism for extreme accuracy

and reliability. A stepper motor is simply an advanced technology that relies on electronics rather than mechanical parts, so they will never jump like the old gauges did when they lost stabilizer oil.

Bottom line, these gauges offer greater reliability. They also do a better job detecting less than optimal vehicle conditions. They are easier to read, more accurate, and require fewer repairs. This minimizes repair cost and maximizes uptime.

Since the odometer now has a digital LCD display, it serves as a numeric fault code reader as well as trip and mile gauge. If you push and hold the selector switch, it even logs kilometers.

"Since the odometer now has a digital LCD display, it serves as a numeric fault code reader as well as trip and mile gauge."

The Diamond Logic™ electrical system allows for factory installed cab switches, custom labels, and customized switch locations, all with integrated ON LEDs and backlighting. Even the switch labels are designed for long life. Labels are molded right into the switches, so the switch name will never rub off like some screen-printed labels. Competitor labels can rub off in just a few years.

Even custom label sheets are made of durable plastic with backside printing for scratch-proof protection. This provides a customized, long-life driver

environment for better job performance and safety.

"The Diamond Logic™ electrical system also includes up to three optional remote power modules."

The Diamond Logic™ electrical system also includes up to three optional remote power modules. Each module contains six switch inputs and six power outputs, each with 20 amps of current carrying capacity. This solid-state, weather-sealed box with heavy-duty battery feeds takes the place of six relays and six circuit breakers and delivers up to 80 amps total.

In combination with the ESC, the customer realizes the benefits of programmable fuse settings for each remote power module output. This means the customer can custom program fuse amperage level settings for each output.

The **Remote Power Module** is the body builder's gateway into the International® electrical system. It's located on the chassis, right where the body builder needs it.

This saves the body builder time, materials, and provides greater warranty protection since the truck warranty applies from the cab up to the point of the power module.

This module can be used to power and control many different types of

added equipment with or without additional software. The base package for integration of one remote power module includes six two-position latched rocker switches in the instrument panel. Momentary-switch options can be added for body functions as we will see later in this program.

But first, a couple of notes on switches to be sure these two types of switches aren't confused.

Two-position latched rocker switches physically stay in the "on" or "off" position when the switch is operated, and you can see that the switch is latched up or down. In addition, these switches have a memory; therefore, if power is lost, they will reengage after the vehicle is restarted.

"Two-position latched rocker switches physically stay in the "on" or "off" position when the switch is operated, and you can see that the switch is latched up or down"

These switches are recommended for applications that will use a remote start/ stop functionality.

Momentary, center-stable, three-position switches don't physically stay in the "on" or "off" position when they are operated. Instead, when the switch is pressed, the software latches on.

In addition to the dash control of six powered output switches, each remote power module provides six inputs.These inputs can be used to read body function

information, like a “boom not stowed” sensor, or a remote mounted switch position.

When a power output is dependent on one or more inputs, the system is said to be Interlocked. Interlocking is a key personnel and equipment protection advantage that will be discussed in detail in the next module.

“In addition to providing power, control and interlocking, remote power modules also provide the ability to use three-way switches.”

In addition to providing power, control and interlocking, remote power modules also provide the ability to use three-way switches. Three-way switching is simply the placement of different switches in different locations that operate the same circuit, such as a switch for a work light in the cab, and a switch for the same light located at the rear of the vehicle.

All of these remote-power module benefits make wiring a body easier, less costly, and more reliable. In other words, remote-power modules are designed to help the body builder integrate the body with our truck

The result is a more professional appearance, more reliable installation, with greater warranty protection, far greater resale value and, because it’s integrated with the Diamond Logic™ electrical system, the truck body benefits from onboard and offboard

diagnostics. Repairs are easier and less costly because diagnostics can be done by computer programs such as INTUNE or the Diamond Logic™ Builder software.

The Air Solenoid Module is an approach to expand system control. It eliminates old flipper valves at the dash to operate air functions, which required two hoses coming into the dash for each feature.

"The Air Solenoid Module is an approach to expand system control."

Now no air hoses are needed in the cab for air controlled accessories. This weather-sealed module "gates" air through electronic control to various components with quality-connect fittings. These gate switches can be normally open or normally closed. There are four and seven pack options available.

Universal air solenoid features are mapped back to dash switches to be turned on or off by the driver. These universal solenoids provide general-purpose control of air-driven body equipment accessories.

This system enhances equipment protection because body operations can be locked out in circumstances in which vehicle components could become damaged. For example, front drive axles cannot be shifted in or out

unless the vehicle is parked. Also, there is less chance of air leaks with the use of quality connect fittings. Another benefit is a savings on installation labor and service time. It also allows the air system to pump up to operational pressures in less time.

"Whether it's the four pack or the seven pack, there are multiple fault codes that help diagnose the air system."

Whether it's the four pack or the seven pack, there are multiple fault codes that help diagnose the air system. For safety reasons, the ESC will shut down the air accessory control system if necessary.

A fully-optioned system can have a total of three remote power modules, up to two air solenoid packs with a total of 14 air solenoids, and up to 24 rocker switches. In other words, the body builder or dealer can make the system as large or as small as necessary to match customer needs.

Optional weather-sealed LED-lighted door pods provide power windows, including express down at all windows and power locks. This means luxury-car-like convenience for the driver. Snap-fit installation and removal makes diagnostics and repair quicker and easier.

Keyless Fob

An optional keyless entry fob adds extra convenience, especially when the vehicle is outfitted with the work light feature. The key fob provides controls for locking and unlocking the doors, a panic button and a switch to remotely control the work light. If the customer wants this feature, it can be turned on by the dealer.

"An optional keyless entry fob adds extra convenience, especially when the vehicle is outfitted with the work light feature."

The electronic system controller software provides a number of features and benefits.

First it provides flexibility and upgradeability after the vehicle is built. That means that the same electrical system can be tailored to perform a broad variety of tasks across many different types of vocations. Changing feature content or obtaining feature upgrades are accomplished through software programming instead of replacing hardware modules.

Another benefit is programmable parameters. The customer can select fuse settings, switch interlocks, parameters for gauges, and many other selections.

Programmable parameters refine feature performance to meet the

"Features can be modified using ICAP or the Diamond Logic™ Builder software."

customer's needs. Features can be modified using ICAP or the Diamond Logic™ Builder software. Parameters may be changed at the dealer level without engineering involvement. This makes truck functions flexible without added service time and cost.

The Diamond Logic™ electrical system also provides task automation. Here are some examples:

- Headlights turn on with wiper activation to meet over-the-road regulations.
- Keyless entry and work light operation for convenience.
- Power door lock activation above 5 mph for occupant protection.
- Daytime running light shut off with parking brake operation for longer bulb life.
- The dome lights stays on for 20 seconds after door is closed for added convenience in locating the ignition switch.
- The dome light shuts off after 10 minutes with door open and key off to protect the battery.
- The work light turns off after two hours with the key off to protect the battery.

The Diamond Logic™ electrical system also provides equipment protection. Here are some examples:

The **Power Take Off** or PTO can be programmed with up to 42 rules of engagement, disengagement, re-engagement, warnings and alarms.

The **Driver Controlled Differential** Locks release above 25 mph. This used to cost several hundred dollars with a manual transmission, but now it's built in.

"The Driver Controlled Differential Locks release above 25 mph. This used to cost several hundred dollars with a manual transmission, but now it's built in."

The air suspension cannot be dumped above 10 mph to protect the vehicle. Potentially, this can save $1000 in repair costs considering replacement airbag parts, service labor, and service downtime.

Air solenoid accessories shut off with certain faults for truck and driver protection.

For truck and operator protection, transfer case gears cannot be changed unless the vehicle is parked.

Switches, with selectable interlock to the remote-power module outputs, protect against equipment damage and the effects of operator error.

Utility and refuse indicator lights and audible alarm systems notify the driver of unsafe equipment operations.

Infrastructure and support is also provided.

"The Diamond Logic™ electrical system provides centralized vehicle configuration data storage through a link up to International®."

The Diamond Logic™ electrical system provides centralized vehicle configuration data storage through a link up to International®. Features can be added or deleted, switches can be relocated and programmable parameters can be changed. The vehicle's new file will be stored in the International® Centralized Vehicle Configuration Data Storage.

If needed, the stored version of the software can be downloaded at any International® dealer across the nation. Also, any time it comes in for service, the truck can get the latest version of ESC programming for the most up-to-date feature performance.

Another benefit of the vehicle configuration storage service is that a record is kept of how the truck was ordered and, how the truck configuration has been changed to facilitate accurate service and support. Therefore, any International® dealer can service or upgrade a vehicle anywhere in the country.

"The Diamond Logic™ electrical system also provides onboard diagnostics. It continuously monitors electrical system modules for failures."

The Diamond Logic™ electrical system also provides onboard diagnostics. It continuously monitors electrical system modules for failures.

The LCD screen in the instrument cluster serves as a diagnostic display

to read out fault codes without hooking up a computer. This is done by pressing the CRUISE ON and RESUME buttons simultaneously.

These numeric codes can be decoded using the Diagnostic Trouble Code Manual.

These features provide immediate and accurate diagnostic information.

The diagnostics even indicate whether a fault is currently active or inactive.

The Diamond Logic™ electrical system also provides offboard diagnostics.

INTUNE or the Diamond Logic™ Builder software can be used to monitor the gauge cluster and the ESC for fault codes.

Full text descriptions of fault codes are provided for complete diagnostic information.

The software allows the technician to read the status of electrical inputs and outputs, and allows a technician to override the signal to run diagnostic tests. For example, the right front turn signal can be forced on to verify that the output is operational, independent of all other components in the system.

"The software allows the technician to read the status of electrical inputs and outputs and allows a technician to override the signal to run diagnostic tests."

In addition, gauges can be tested, individually.

All electrical modules transmitting on the data link are listed.

Exact vehicle hardware and software vehicle configuration information is provided.

This powerful tool simply provides a way to quickly pinpoint the cause of any operational malfunction within the electrical system.

Please note that INTUNE or the Diamond Logic™ Builder software does not replace the engine diagnostic program called MasterDiagnostics®.

Feature Overview

In addition to the high reliability, increased uptime, and diagnostic benefits of the Diamond Logic™ electrical system, it also offers factory-installed electrical options and integration features for many types of body equipment.

"Commonly, body equipment includes power take offs or PTOs, body lighting and indicator lighting systems."

Commonly, body equipment includes power take offs or PTOs, body lighting and indicator lighting systems. Body equipment might also involve remote engine speed control or even remote

engine start/stop. Almost all require additional stop, turn, tail, and body lighting connections. Many require trailer connections.

International® offers a variety of electrical code options that provide the body builder a turn-key solution for all body equipment control functions. A solution that delivers more functionality at less cost than the traditional methods used to connect a body to a vehicle chassis.

As we have already mentioned, connection points can be prewired and computer logic pre-installed from the factory, dealer or body builder, and tailor made to the needs of the customer. International® offers body builder connection point packages or piece-by-piece integration for a completely customized solution.

In the past, body builders had to use a third party switch-pack module to operate key functions. They had to pull out the dash to route wires, mount the add-on switches and indicator lights, route wiring in and out of the cab–and, then, they had to splice into the chassis circuits. In the process, if anything went wrong, the body builder was totally on their own.

Well, not any more. International® takes care of the in-cab wiring, switch pack installation and provides a centralized wiring connection outside the cab. International® covers these components under warranty, and provides continuous on-board diagnostics for add-on equipment.

"The process also saves money. The installed price from International® is less than the cost of some third party parts."

The process also saves money. The installed price from International® is less than the cost of some third party parts. Then consider the added value of dramatically faster installation time for the body builder. Also consider the reduction in problems and potential truck damage that customers can avoid during the body building process. It all translates to faster body installation and increased uptime for the customer.

Electrical Options

The following section addresses virtually all International® Truck electrical options and body integration features. First, areas not related to remote power modules are covered. They include:

- Cab interior
- Stop, turn, tail, marker, and back up lights
- Trailer lighting
- Wiring extensions
- External lights (without a remote power module)
- Engine speed control (without a remote power module)
- Remote start/stop
- And air accessories

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Body Integration Options

Features related to remote power modules are covered together, since an inventory of outputs and inputs must be kept for all remote power module related options.

- General/exterior light power packages
- PTO accommodation
- High amperage power outputs
- Indicator light systems
- And engine speed control with a remote power module.

Before we review code options, keep in mind that the electrical feature codes are broken down into three main categories: 595 codes, 08 codes, and 60 codes. Features from other sales code groups, such as 12, 13 and 16, are also discussed when appropriate.

"The 595 codes are software part numbers for International® designed electrical features."

The 595 codes are software part numbers for International® designed electrical features. These 595 codes contain the necessary software to implement the control of features such as headlights, wipers, air conditioning, fog lights, turn signals, dome lights, mirror heat, electric horn, fuel gauge, etc. 595 codes are used to manage the software for both the 08 Electrical codes and the 60 Body Integration codes.

The 08 Electrical codes provide a means to order electrical options that may contain both custom wiring and software 595 codes to perform a specific vehicle function. These add-on 08 features are generally not specific to any vehicle application and are usually open to many vehicle models.

The 60 Body Integration code features provide a means to order options for very specific body equipment control functions. Features such as indicator light systems, switches with user selectable interlocks, PTO controls, three-way switch control, and multiple engine speed control options. Each of these options were designed to make installation of the body on an International® chassis easier with improved functionality and performance.

Keep in mind that the electrical component body builder book, CT-471 lists all 08, and 60 codes pertinent to body integration, including connector locations and wiring information. The electrical component body builder book, also includes a technical description of each code, and the 595 software required for each feature. Any or all programmable parameters with default settings are included.

"Keep in mind that the electrical component body builder book, CT-471 lists all 08, and 60 codes pertinent to body integration, including connector locations and wiring information."

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MODULE II ELECTRICAL FEATURES OVERVIEW

Cab Electrical Features

These are the in-cab power accessories:

- 08518 provides a plug-in cigar lighter
- 08718 provides a power source with a cigar type receptacle.
- 08WCK gives the customer a cab power source with two-post type terminals for portable powered electrical equipment that goes in the cab.

"08WCK gives the customer a cab power source with two post type terminals for portable powered electrical equipment that goes in the cab."

All of these options are battery fed with power at all times.

CB Radio Accommodation Package

Code 08RCB gives the customer a header mounted CB radio accommodation package. Power is accessory fed. 08RCB provides a power source and two antenna bases. It also includes power, ground, and antenna wiring to the overhead console.

The 08RBK option provides two CB antennas. These antennas provide full bandwidth transmission and reception

of CB frequencies, and are 4.0 feet in length

Option 08REA provides a two-way radio battery feed connection with 20 amp fuse protection, and a switched ignition feed with 5 amp fuse protection. The wire ends are heat-shrinked in rubber tubing for protection and a 10 foot coil is taped to the base harness. The wiring is routed to the lower passenger side instrument panel by the engine cover. It includes a two-way wiring harness.

"Option 08REA provides a two-way radio battery feed connection with 20 amp fuse protection and a switched ignition feed with 5 amp fuse protection."

Code 08RGA two-way wiring effects provide the same features as 08REA, except that the wires are routed to the center of the header console in the cab for a header mounted two-way radio.

Power Windows, Power Locks, or Keyless Entry Options

Code 16WJU in the cab component group, provides two power windows and two power locks for a standard cab.

"16WJU in the cab component group, provides 2 power windows and 2 power locks for a standard cab."

Code 16WJV in the cab component group provides four power windows and locks for crew cabs.

Code 16WKZ adds a keyless entry system with lock, unlock, panic and auxiliary buttons. It includes one key fob.

This feature is available on both two door and four door cabs.

In-Cab Lighting Options

Code 08WPJ provides two courtesy lights mounted under the instrument panel for standard cabs.

Code 08WPK provides four courtesy lights. Two are mounted under the instrument panel and two are for rear doors on crew cabs.

Stop, Turn, Tail, Back Up Light

"Standard rear lighting combines stop and turn lights in a single lamp assembly on each side at the rear of the vehicle."

Standard rear lighting combines stop and turn lights in a single lamp assembly on each side at the rear of the vehicle. This standard configuration is appropriate for applications that require only one combined stop-turn-taillight per side when no additional marker or back-up lights are needed.

However, if the customer needs additional separate or combined stop and turn lights, up to four lights per side, or additional marker, or backup lights 08HAB or O8HAE stop-turn-taillights are appropriate feature codes.

Code 08HAB refers to a back of cab wiring and 08HAE provides end of frame wiring. These features also

include a 20 amp accessory feed. The 20 amp feed can be used for anything you want, gated on or off with an ignition key, such as spot lights with integral switches or for continuous equipment power when the key is in the ignition position.

These features provide individual weather sealed connectors for both separate stop/turn and combined stop/turn lights. The choice for either lighting configuration is available with both of these features.

Be aware that if LED stop/turn lights will be used, more than four lights can be added per side.

"Be aware that if LED stop/turn lights will be used, more than four lights can be added per side."

Another option for stop, turn, and tail lighting is 08HAA. It provides the wires to drive up to seven stop and seven turn lights per side for heavy lighting requirements. This feature provides only separate turn and stop lights and tail lights, and the ability to drive additional marker lights. It also provides a 30 amp accessory controlled feed that can be used for added lights with integral switches or equipment power.

Code 08HAA is only required by less than 10 percent of customers. Typical applications that require this feature include those that will add several turn lights along the side of the vehicle and

upper and lower stop lights and turn lights.

Unlike 08HAB and 08HAE, this option code does not provide a connector, but provides a bundle of blunt cut wires located at the end of the frame on the driver's side.

Trailer Lighting Options

"For towing a trailer, additional lighting and brake codes are required."

For towing a trailer, additional lighting and brake codes are required.

You must first be aware that there are separate codes for straight trucks and tractors.

Code 08TME provides a seven-way socket at the end of the frame on the driver's side for separated stop and turn lights. The center pin provides power to the ABS module.

To add this option with air brakes or no brakes with combined stop turn taillights code 08TMG, Trailer Connection Socket for Combined Lights, is appropriate.

For trailers equipped with electric brakes, use codes 08HAG or 08HAH: Accommodation Package for electric trailer brake. 08HAG provides separate stop/turn lighting while 08HAH provides

combined stop/turn lighting. This option includes blunt cut wires at the end of the frame for electric trailer brakes and connections in the cab for the customer supplied electric trailer brake controller. The body builder can use the wires located at the end of the frame with one or more trailer sockets of their choice, which are also customer supplied.

For tractors, a seven-way socket at the back of the cab is standard. Optional codes 08THG and 08THH provide a second seven-way trailer socket configuration for the purpose of providing vehicle battery power to the trailer. This feature is used to accommodate accessories such as cargo lights. With 08THG, the 30 amp auxiliary power source is directly fed from the battery through a switch in the instrument panel. With 08THH, the ignition key must be on to enable the auxiliary power.

"For tractors, a seven-way socket at the back of the cab is standard."

Code 08NAA – Tail Light Wiring Modified, adds 8 feet to taillight wiring. The harness is bundled and tie wrapped to the frame rail. International® supplied taillights may be remounted on the vehicle body, up to a distance of 8 feet from the pre-option factory location.

Specifically appropriate for beverage body applications that modify and drop the frame, 08WEB adds six additional

feet of chassis wiring, including ABS sensors, stop, turn, tail, and back up lights. This option allows the electrical system to be quickly and safely modified to accommodate frame-rail modifications.

Exterior Lights

Now we'll look at the external lighting options on the chassis:

Code 08WLL provides a pedestal mounted work light at the back of the cab with a switch on the instrument panel. This option is only available on 4000, 7000, and 8000 series tractors.

Code 08WMA provides a toggle switch for a work light on the instrument panel and wiring for a customer furnished light installed at a location of their choice.

"By default, both the work light and the work light accommodation will time out two hours after the key is removed, although this time can be adjusted with programming."

By default, both the work light and the work light accommodation will time out two hours after the key is removed, although this time can be adjusted with programming. In addition, these features can be turned on from the auxiliary button of the key fob if the keyless entry feature is purchased.

This accommodation package can be used for any added switched lighting that requires less than 10 amps. For

example, cabinet lights, cargo lights, work light, strobe light, or van body dome light. Please note that this feature will operate with the key removed.

For lighting that requires extra power, option 08XBK provides a two-position backlit latched rocker switch delivering 40 amps of power. Power is available only in ACCESSORY or RUN. This option places one blunt-cut wire strapped near the fuse box in the engine compartment. Be aware that this option is only available on a 4000 and 7000 series chassis.

This option works well for lights or other equipment requiring more than 20 amps but less than 40 amps. For example, lights bars.

On the 8000 model, code 08XBJ provides 30 amps of power through an auxiliary switch that includes a fuse and relay. Power is available in ACCESSORY or RUN again, since this is a 08 code option, this code is not driven through a remote power module. This option places one blunt-cut wire strapped near the fuse box in the engine compartment.

"On the 8000 model, code 08XBJ provides 30 amps of power through an auxiliary switch that includes a fuse and relay."

This option is appropriate for a load light used to illuminate the hook up.

Code 08585 provides a toggle

switch and wiring for driving lights or fog lights mounted by the customer.

Codes 08WPL, 08WPM, 08WLM, & 08WLN provide two fog lights mounted in the bumper, plus a switch in the instrument panel.

Code 08WPL provides two amber, oval fog lights, with H355W halogen bulbs.

Code 08WPM provides two clear, oval fog lights, with H355W halogen bulbs.

Code 08WLM provides two Peterson amber rectangular halogen fog lights.

Code 08WLN provides two Peterson clear rectangular halogen fog lights.

"Code 08THJ provides 3.0 feet of wiring for auxiliary front head lights and turn signals for front plow applications."

Code 08THJ provides 3 feet of wiring for auxiliary front head lights and turn signals for front plow applications. A seven-pin connector is provided to supply high beam, low beam, park lights and turn signals for the plow lights.

This feature is only available on 7000 series models, though a kit may be purchased through Service Parts for other models.

Code 08THV provides a front harness for guide post lights. This

option provides connectors at the headlights for customer supplied guide post lights.

Code 08TMH provides wiring in the roof with a 20-amp maximum load and switch in the instrument panel for customer supplied roof lighting.

Code 08TMK accommodates a lighted-roof air shield. Hookup is at the right rear side of the cab roof. The maximum load is 10 amps with the parking lights and accessory/ignition on.

"Code 08TMK accommodates a lighted-roof air shield."

Lights On With Wipers is available only after the vehicle is built using the ICAP or the Diamond Logic™ Builder program. It is enabled by turning on a programmable parameter in the ESC.

When Lights On With Wipers is enabled, the park lights and headlights turn on automatically with the wipers. If the wipers are turned off, the headlights remain on until the head light switch is cycled on then off.

"When Lights On With Wipers is enabled, the park lights and headlights turn on automatically with the wipers."

Hazard Override Stop

Another safety related feature is stop light override. The following is the standard function when hazard lights are activated and the brake pedal is depressed:

- First, on a truck or tractor without a trailer, the hazards stop flashing and the rear lights burn steadily on the chassis.
- With separate stop, tail, turn, and hazard lights, the hazard lights continue to flash.
- Standard front and side turn and hazard lights continue to flash.

Many fuel haulers and other hazardous chemical carriers require option 08THN, Hazard Override Stop, to make legal stops at railroad crossings.

When this feature is ordered, the hazards will continue flashing when the service brakes are applied. It is for vehicles with combination stop and turn lamps.

This feature may also be enabled after the vehicle is built using the ICAP or Diamond Logic™ Builder program.

"Code 08WHZ provides an 8 position MAXI Fuse Block, pre-wired to the battery and mounted in the engine compartment fuse and relay box."

Options for 12-Volt Fused Power Outside The Cab.

Code 08WHZ provides an eight-position MAXI fuse block, pre-wired to the battery and mounted in the engine compartment fuse and relay box. This option provides eight MAXI fuse-protected connection points to supply

unswitched battery power for high-current body electrical loads. Each fuse position can accept up to a 60-amp MAXI fuse or circuit breaker.

This feature provides high-current power and it protects the electrical wire harness in the event of a short circuit. Code 08WHZ is great for applications that require continuous power, such as light bars, electric motors or pumps.

The customer supplies the fuses, the output fuse terminal, and wiring to the load device.

Engine Control

International® has a wide variety of ways to provide remote engine speed control, speedometer, and tachometer signals for remote mounted gauges.

"International® has a wide variety of ways to provide remote engine speed control, speedometer, and tachometer signals for remote mounted gauges."

The first ones are engine ordering options rather than electrical options. Since these options don't include a remote power module, programmable operation, or interlocking, is limited with these choices. Programmable speed control options will be discussed in the next section.

Engine option 12VYC provides wiring for connection to customer-supplied switches to perform preset or variable remote engine speed control.

The 12VYC feature provides a bundle of blunt cut wires along the engine valve cover. Control modes include two preset speeds, variable speed control, a vehicle speed signal, and a tachometer signal.

Examples of applications that commonly mount a remote mounted switch to control engine speed while the vehicle is stationary, include refuse, rear packers, recovery, roll back, and utility.

"One example of the use of the speedometer signal is for salt spreader equipment"

One example of the use of the speedometer signal is for salt spreader equipment. The signal is used to control the amount of salt dispensed as a function of vehicle speed.

Option 12VXY provides a remotely mounted module that provides all of the signal interfaces of 12VVW. This feature must be installed if remote pedal or engine warning lights are required with a VT-365 or I-6 engine.

Engine option code 12VXT provides variable engine speed control with steering wheel mounted switches.

Engine option code 12VXU provides two presets controlled by steering wheel switches.

Engine option code 12VXV provides mobile variable engine speed control with steering wheel switches.

There are additional engine speed control options in the 60 Series Body Integration Features. These 60 Series features use the remote power module.

“There are additional engine speed control options in the 60 Series Body Integration Features”

These features increase the engine speed to the first preset in the stationary mode using various activation options. There are codes for utility, recovery, refuse, and other applications.

Refer to the next module of this program and the CT-471 electrical component book for more information on these features.

Remote Engine Start/Stop Options

This option provides remote start, stop, and restart of the engine from a single switch control.

For example, this gives the utility truck driver the ability to stop the engine once the bucket is in position to perform work, and then restart the engine from the bucket once all work is completed.

Code 60ABD provides the same remote start/stop function of 60ABC with the addition of an emergency pump motor control. This feature is applicable to vehicles that will control both remote start/stop and emergency pump trigger from the same input circuit. Code 60ABD also includes programmable time intervals.

"Both 60ABC and 60ABD provide one weather sealed connector located on the center chassis."

Both 60ABC and 60ABD provide one weather-sealed connector located on the center chassis. One wire is a connection for a customer supplied switch for starting or stopping the engine. The second wire is an output for controlling the customer supplied emergency pump relay. Both wires are ground active.

Feature code 08WJA provides a power source for a customer installed lift gate with loads up to 200 amps. The accommodation package includes a power cable to the end of the frame and switch in the instrument panel located to the left of the gauge cluster. Additional benefits include:

- Automatic Lift Gate Disable: The lift gate is only enabled for a programmable time period when it is activated with the in-cab switch. The default is 1 hour.

- Road Speed Interlock:
  This feature prevents operation while the vehicle is in motion.

- Dead Battery Protection:
  This feature includes battery level monitoring to shut off the lift gate during low voltage conditions with or without the engine running. Also, the cut-off voltage level is programmable.

- Driver Alarm:
  This feature provides an audible alarm in the cab. It sounds during low voltage conditions. Again, the alarm duration is programmable with a default of 60 seconds.

Pre-Trip Exterior Light Inspection

Code 08 WPZ provides a pre-trip exterior light inspection. When activated, the vehicle lights repeatedly flash in a specific sequence to allow the operator to verify that the exterior lights are functioning. This enhancement provides the driver with the added sense of security that the exterior lights are working properly.

"Code 08 WPZ provides a pre-trip exterior light inspection."

To activate this feature, the driver simply presses the cruise switches simultaneously while depressing and releasing the brake pedal.

The light test sequence tests:

- Plow high beams
- Park lights
- Fog lamps, if installed
- Headlights (low and high beam)
- Right/left front/rear turn lights
- And Brake lights

Air Control

Codes 08WGA, 08WGB, 08WGC, and 08WGD provide one to four normally closed pilot air sources at approximately 4 CFM. They include a switch in the cab for each air source.

With these options, air control is only available when the key is in the accessory or run position. These air solenoids will exhaust when the key is off so safety critical functions that could cause unexpected machine movement should not be used with these options. Air solenoids are commonly appropriate for any kind of water valve application, such as a fire truck or street sweeper.

"Remote power modules are the body builder's gateway into the International® electrical system."

Remote Power Modules and Related Features

Remote power modules are the body builder's gateway into the International® electrical system. These modules can be utilized to power and

control many different types of added equipment. These integration options place six switches in the instrument panel plus the remote power module, which contains six 20-amp outputs, for controlling lights or other loads required for a vehicle's application, up to 80 amps total per module.

Remote power module features are offered from International® in two major categories, one for simple lighting control and the other for controlling multiple types of body equipment.

"Remote power module features are offered from International® in two major categories, one for simple lighting control and the other for controlling multiple types of body equipment."

The first type is offered as 08 type electrical code packages. These packages include six center-stable momentary switches, power modules, and software to run the power module.

These pre-package options include general purpose three-way output control between the switches in the dash, remote power module inputs, and the remote power module outputs.

This means that switch one controls remote power module output one, switch two controls output two and so on.

The 08 remote power module features are commonly used for body lighting and accessories that don't require interlocks with other equipment.

Code 08WSM places the remote power module under the cab while code 08WSK places the remote power module at the end of frame.

Code 08SAJ places two remote power modules under the cab and places 12 momentary switches in the dash.

Control of Multiple Types of Body Equipment

The second type of remote power module options are offered as 60 code Body Integration Features. Rather than remote power module packages, these 60 codes are designed to provide specific features for individual body functions.

"These power modules can be utilized to power and control many different types of added equipment with additional software."

These power modules can be utilized to power and control many different types of added equipment with additional software. The base package for integration includes six two-position latched rocker switches in the instrument panel, plus the remote power module, which contains six 20-amp outputs, for controlling lights or other loads required for a vehicle's application, up to 80 amps total per module.

With this feature option, a remote power module is provided with six

outputs for components such as strobe lights, scene lights, work lights, and equipment power.

By adding more 60 code features, the functionality of the remote power module can expand to include reading inputs from boom sensors and tailgate sensors. Then these signals can be fed to indicator lights on the dash. Or 60 code features can provide remote switching or inter-locks.

"By adding more 60 code features, the functionality of the remote power module can expand to include reading inputs from boom sensors and tailgate sensors."

Code 60AAA, remote power module, provides a remote power module under the cab along with six latched rocker switches in the dash.

Code 60AAB, remote power module, provides two remote power modules under the cab along with 12 latched rocker switches in the dash.

In addition, 060AAA or 0606AAB ordered with other 60 codes offer the following additional features:

- Windowed rocker switches with package of switch labels to accurately apply customized names to the switches for the driver.
- Use ICAP or Diamond Logic™ Builder to determine the assignment of feature names to the rocker switches and the remote power module inputs and outputs.

"Use ICAP or Diamond Logic™ Builder to determine the assignment of feature names to the rocker switches and the remote power module inputs and outputs."

- One to one mapping between the switches and the remote power module outputs if no other 60 codes are ordered beyond 060AAA or 060AAB.
- The ability to mix and match the addition of the 60 codes in a flexible cafeteria menu fashion.
- If any remote power module outputs are not assigned to other 60 codes, the International® data processing system will map all remaining unused outputs to available rocker switches in the dash.
- Switches for body integration features populate in the next available location in the switch pack after other higher priority electrical options that use a latched rocker switch are installed.

Control of a PTO on Body Equipment

The following features provide the optimal control of a PTO. These features provide a switch in the dash for engagement and use portions of Remote Power module inputs and outputs to complete the feature:

- PTO indicator light.
  These features include a switch in

the instrument panel, as well as, a gauge cluster PTO light that is lit only when a feedback switch indicates the PTO is engaged. In other words, it uses a Remote Power Module input.

- PTO Hour Meter.
  This feedback also drives a PTO hour-meter located in the gauge cluster display that keeps track of PTO hours when the engine is running.

- Programmable Parameters.
  Additionally, each PTO accommodation feature includes a series of programmable parameters to customize the control of this equipment. For example, over-speed protection, interlocking, and re-engagement criteria. Refer to the "Electrical Components" section of the CT-471 manual for a complete list of default and optional settings.

"Additionally, each PTO accommodation feature includes a series of programmable parameters to customize the control of this equipment."

The only limit is that only one PTO accommodation package feature may be added per vehicle.

Codes 60/ABA, 60ABB, 60ABE, 60ABK, 60ABL provide PTO Accommodation.

Use the chart within the body builder book to choose the proper PTO

accommodation based on the type of engagement. Whether they are cable or lever actuated, electric driven, hydraulic actuated, air clutch type or, air non-clutch type.

"When the type of engagement isn't available, use the Transmission Type chart as an alternative."

When the type of engagement isn't available, use the Transmission Type chart as an alternative.

The first four PTO accommodation feature options in the chart require one remote power module input and one remote power module output. Feature code 60ABA requires one remote power module input.

Be aware that code 60ABB includes additional wires, due to the high amperage requirement to electrically engage this PTO. Refer to the Electrical Component Body builder book, CT-471, for more information on how to connect this feature.

Another way to achieve PTO accommodation for air shifted PTO's is 13XAA, dash-mounted PTO control.

This option provides a rocker switch in the dash and a frame mounted air solenoid at the back of cab to control the PTO. Software controlled programmable functions may be adjusted with the ICAP or Diamond Logic™ Builder software tool to tailor

multiple interlocks for engagement, disengagement and re-engagement of the PTO.

This feature is delivered with all interlocks turned off. Whether a PTO is controlled by an electric power output of a remote power module or actuated by the air solenoid of 13XAA, all interlocks are established by setting the programmable parameters in the 595 software feature codes that control various aspects of the PTO function. Please refer to the PTO section of the CT-471 body builder book for a complete description of the selections and interlocks available for the PTO features.

By selecting code 16 WLM with 13XAA, a PTO hour meter and a PTO indicator light in the gauge cluster help provide a complete solution.

"By selecting code 16 WLM with 13XAA, a PTO hour meter and a PTO indicator light in the gauge cluster help provide a complete solution."

The basic difference between the 13XAA option and the 60 series option is 13XAA provides a simple and direct control of air shifted PTO's for vehicles that do not require other body integration features.

The PTO features offered with remote power modules:

- Provide an electric drive output that may be used to actuate a PTO

of many different types, including air shifted as long as a customer supplied air solenoid is installed between the remote power module output and the PTO mechanism.

- Provide other functions using the same remote power module such as remote engine speed control, general purpose body lighting or indicator light, and alarm systems.

As a base option, six two-position latched rocker switches, are included with each 60 series remote power module.

"Options 60ACS, 60ACT, and 60ACU, provide three-position momentary rocker switches with ON indicator mounted on the dash."

Options 60ACS, 60ACT, and 60ACU, provide three-position momentary rocker switches with ON indicator mounted on the dash. These options modify 60 series remote power module options to provide three-way switching functionality.

60ACS provides one switch, 60ACT provides two switches, and 60ACU provides three switches.

Each in-cab switch controls a remote power module output. In addition, a remote power module input will also control that same output. For example, to turn on a cabinet or bin light from inside the cab with a dash mounted switch, and from outside the cab with

a body mounted switch. The in-cab provided switch is a three-position momentary style switch. The software will latch the output on if either switch is rocked up. Latching the software in lieu of the switch allows control from multiple switches on the vehicle.

Power is only available in the accessory or run position. Each switch requires one remote power module input and one output.

"Power is only available in the accessory or run position."

For example, to turn on a cabinet or bin light from inside the cab with a dash mounted switch, and from outside the cab with a body mounted switch, one of these switches is needed.

These features are defaulted to vehicle road speed but may be altered to operate from other interlock conditions, using ICAP or the Diamond Logic™ Builder software, once the vehicle is delivered.

Options 60ACG and 60ACH, provide two position, latched, rocker switches. Each switch is backlit with an "on" indicator. Load maximum is 20 amps. Output disengages when the vehicle exceeds 30 mph and additional interlocks are programmable.

These features are perfect for rear

shining lights. If the driver accidentally leaves a light on and begins driving down the road, these lights will turn off when the vehicle speed reaches 30 mph.

Option 60ACG requires one output and 60ACH requires two remote power module outputs.

Equipment Control of High Amperage Outputs

"Option 60ACE simply combines the power of two remote power module outputs to provide a maximum of 40 amps of auxiliary power."

Option 60ACE simply combines the power of two remote power module outputs to provide a maximum of 40 amps of auxiliary power.

For example, this option works well with high amperage lights, such as those used in recovery or snow plow operations.

Equipment Warning and Alarm System

Code 60AJC for refuse applications provides two indicator lights in the gauge cluster, one for gate open and one for rear alert. It includes an audible alarm. This option is programmable with various switch positions.

This light/alarm combination can be used to signal the driver to stop or move or it can provide any other required signal.

Code 60AJC uses two remote-power module inputs.

Option 60AJD for utility applications provides two indicator lights in the gauge cluster, one for boom deployed, one for outriggers not stowed. It includes an audible alarm and interlock to the parking brake.

"60AJD for utility applications provides two indicator lights in the gauge cluster, one for boom deployed, one for outriggers not stowed."

This feature includes two functionalities that are common in utility, crane or other applications that will utilize outriggers and/or a boom. The boom-out-of-stow and outriggers-out-of-stow indicator lights in the gauge cluster are triggered by remote power module inputs that can be connected to boom sensors and/or outrigger sensors. There are programmable options that sound the in-cab audible alarm if the vehicle moves from the stationary position and one of these indicator lights is illuminated signaling the driver that the boom or outriggers are not stowed.

Remote Engine Speed Control

There are additional engine speed control features in the 60 series of body-integration features. These features utilize the remote power module inputs.

These features increase the engine speed to the first preset in the stationary mode using various activation options. There are codes available for utility, recovery, refuse, and other applications.

Make sure that the engine programming feature, 12VXU for preset engine speed control, is ordered with the vehicle if any of these 60 codes are used.

Since these codes are detailed and complex, refer to the CT-471 electrical component book, to spec 60 codes for throttle controls.

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MODULE III SERVICING ELECTRICAL OPTIONS AND INTEGRATED FEATURES

Launching Diamond Logic™ Builder ISIS®

"To locate vehicle specific electrical option and parameter information, navigate to the Vehicle Information screen of ISIS® and enter the VIN number."

To locate vehicle specific electrical option and parameter information, navigate to the Vehicle Information screen of ISIS® and enter the VIN number.

Then press the Submit button.

First, if an Integrated Features button appears, this indicates that electrical feature options have been installed by the factory. This button gives you access to a list of all the installed electrical options including all parameters.

Detailed diagrams are provided that explain how the ESC and any remote power modules are wired.

In addition, all switch locations are included in graphic form.

Second, if the Custom Logic™ button appears, this is an indication that there is custom programming for the vehicle.

In this case, the Custom Logic™ button provides detailed and comprehensive ladder graphics that explain the custom logic. All ESC and remote power module customization is included.

Again, customized switches are included in graphic form with an explanation of any customized programming. Diagnostic information is also provided to help the technician in the troubleshooting process.

"Diagnostic information is also provided to help the technician in the troubleshooting process."

Third, if both the Integrated Features and Custom Logic™ buttons appear, this is an indication that there are electrical options as well as custom programming.

In this case, ISIS® provides a summary of the electrical options as well as the ladder graphics. Again, all ESC, Remote Power Module, and Customized Switches are included.

Fourth, if no button appears, this is an immediate indication that the vehicle has no electrical options or customized programming.

As you can see, access to factory installed electrical options, custom logic, parameters, and customized programming is quick and straightforward.

However, a good working knowledge of electrical integration takes careful attention and, initially, an investment of time.

"Please consult ISIS® for help with any other questions you may have about troubleshooting the Diamond Logic™ electrical system."

But once you are able to gain a level of comfort and routine, these tools will become as easy to use as any other.

Please consult ISIS® for help with any other questions you may have about troubleshooting the Diamond Logic™ electrical system.

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