SECTION 16-601.003
MULTIPLEXING

KEY NOMENCLATURE

ADDRESS
A unique number attributed to each module in the network.

CELLNET CONTROLLER
The unique function of DINEX module. Every CNC module which has the capacity to command another group of modules that might also function as a slave or controller module.

CLEAN POWER
(Computer power) The isolated power source for modules in the network. Isolation avoids data corruption from a common power source, such as a battery or electrical interference.

LOOP
A data bus structure where the modules are linked so as to form a LOOP.

DINEX (DISTRIBUTED INTELLIGENT NETWORK SYSTEM)
A general term for two-way communication by the same data port; simplifies the connection between electrical devices; uses a two-wire system to turn devices ON and OFF.

DATA
The sending of information from module to module over a MULTIPLEX system.

DATA BUS
The multiple pair of common wires providing the multiple DATA path and power supply to link each network element.

DIO (DIGITAL INPUT OUTPUT)
An intelligent (non-programmable) slave module.

HCNC (HIGH CELL NETWORK CONTROLLER)
A high speed cell network controller. A programmable module that controls other module groupings that are part of the system.

ID
The unique identification symbol (a number and a character) that is assigned to each functional unit in the network.

I/O
Inputs and outputs.

INPUTS
Switches and sensors that supply information to the modules to perform an operation.

OUTPUTS
All physical actions that are performed by the modules, such as turning on or off lights, solenoids and other devices.

LADDER CHARTS, LOGIC DIAGRAMS
Ladder charts, circuits or diagrams are logical diagrams. They are not schematics. The primary function of a ladder diagram is to show how devices relate one to another.

LED
A light emitting diode. A small semi-conductor lamp.

MODULE
Each network functional unit, made up of an intelligent co-processor. A vital link between inputs and outputs.

MBC
The master bus controller, or the communication traffic controller, that directs and regulates communication between each functional unit on the data bus.

MULTIPLEX
A way of transmitting several lines of communication simultaneously on the same data link. Two-way communication through a single data port.

NODE
An individual functional module in the network.

PMS
Power Management System; supplies power to the computer, or clean power supply. The isolated power supply, meant for network modules, helps prevent data corruption leading to electrical scrambling or the use of a common power supply, such as a battery.

RESET
Restart the system.
GENERAL DESCRIPTION AND OPERATION

See Figures 1 and 2.

Multiplexing refers to the bidirectional transmission of data through a single data port.

DINEX stands for Distributed Intelligent Network System.

This system has been designed and built so as to simplify the connection between electrical devices. It makes use of a two-wire system to power devices on or off, such that the component control is also simplified. Additionally, troubleshooting becomes easier, reducing the time the bus is out of service.

With the new multiplexing technology all signals are transmitted simultaneously through a common pair of wires, thus reducing the risk of general failures related to connection.

The concept is rather simple. It is a microprocessor-based system. A MAIN DATA BUS CONTROLLER (T-MBC module) controls a family of other modules placed as near as possible to the required functions. Figure 2 shows the component locations on the vehicle.

The inputs to the MAIN BUS CONTROLLER (MBC) are supplied by the driver operated controls and the various switches and sensors linked together in the system. When the Driver turns on a switch, the inputs are activated and a signal goes to the MBC. The MBC is the COMMAND CENTER.

The MBC receives inputs as a signal (on or off) and relays the signal, through the DATA CABLE, to the module that performs the task. The MBC communicates with all the modules in turn, one after the other. Each module executes the command and keeps track of how the system is working. All modules are assigned a unique address which allows the MBC to communicate directly with each specific module.

The DATA CABLE itself is made-up of eight small 20-gauge wires which are shielded. The shielding keeps out all interference, which might distort the data. Data travels through the cable at 36,400 bps. The DATA CABLE talks to all components through a unique “loop” link-up.

Each module has a sub-address that relates to a specific circuit, for example:

77-01 = Input from master switch/run position
64-22 = Input from interlock stop light pressure switch.
73-07 = Output to stop light lamps.

MBC module controls 24 input circuits.
Each 808-type module can control up to eight output circuits and receive eight more inputs.

Figure 1 - Input and Output Circuits LED indicators
<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PMS</td>
<td>LIGHTING PANEL</td>
</tr>
<tr>
<td>2</td>
<td>MBC</td>
<td>MAIN PANEL</td>
</tr>
<tr>
<td>3</td>
<td>HCNC-168</td>
<td>MAIN PANEL</td>
</tr>
<tr>
<td>4</td>
<td>DIO-808</td>
<td>MAIN PANEL</td>
</tr>
<tr>
<td>5</td>
<td>DIO-808</td>
<td>MAIN PANEL</td>
</tr>
<tr>
<td>6</td>
<td>DIO-808</td>
<td>MAIN PANEL</td>
</tr>
<tr>
<td>7</td>
<td>DIO-240LP</td>
<td>DASH COMPARTMENT</td>
</tr>
<tr>
<td>8</td>
<td>HCNC-808</td>
<td>DASH COMPARTMENT</td>
</tr>
<tr>
<td>9</td>
<td>HCNC-808</td>
<td>DASH COMPARTMENT</td>
</tr>
<tr>
<td>10</td>
<td>HCNC-808</td>
<td>REAR DOOR</td>
</tr>
<tr>
<td>11</td>
<td>DIO-808</td>
<td>REAR DOOR</td>
</tr>
<tr>
<td>12</td>
<td>DIO-808</td>
<td>ENGINE COMPARTMENT</td>
</tr>
<tr>
<td>13</td>
<td>HCNC-808</td>
<td>ENGINE COMPARTMENT</td>
</tr>
</tbody>
</table>

Figure 2 - Multiplexing Components Location
MULTIPLEXING COMPONENTS

The following components are part of the multiplexing system (number of units in brackets below; see vehicle wiring diagram):

- T-MBC (1)
- T-HCNC-808 (4)
- T-HCNC-168 (1)
- T-DIO-808 (4) [+1 OPTIONAL, SEE FIG.2]
- T-PMS-002 (1)
- T-DIO-240LP (1)

POWER MANAGEMENT MODULE: T-PMS-002

See Figure 3.

The power management module T-PMS-002 is a switchable power circuit. It converts voltage from 12-36 V c.c. to 12 V c.c. and oversees the conditions for voltage switching On and Off.

- It provides a stable source of power to the communication system of the multiplex;
- It provides clean power for isolated voltage regulation, which reduces electromagnetic and radio frequency interference during computer use;
- Two internal parallel output circuits are provided for back-up provisions;
- It ensures the detection of low voltage;
- Has a sleeper mode designed for battery power conservation. The DELAY ON, when lit, indicates if the pre-programmed Sleep delay has been activated. It should start the Sleep countdown when the master run switch is turned off. The SLEEP ON LED shows the Sleep delay timer has run out; when the Sleep Enable switch is ON, power to all the I/O modules will be turned off. If it is OFF, the sleep timer will be ignored and I/O module power will remain on.

CAUTION:

The WARNING on the PMS shows that the power provided is less than 20 V and that the charging system on the vehicle should be checked. At less than 12 V, the system becomes deactivated.

WELDING PRECAUTIONS:

The I/O Control Modules are designed with optical isolation and should not be affected by minor welding on the vehicle.

As a precaution before any minor welding, the PMS module should be completely disconnected. Before any MAJOR welding, all modules should be completely disconnected.

THE MAIN BUS CONTROLLER — T-MBC

The Main Bus Controller is the top-level device. It is the command post for all activity throughout the operating system (see Figure 4).

- The Main Bus Controller controls and monitors up to 16 modules in a single level of data bus;
- It interfaces with up to 24 inputs;
- It interfaces with switches, such as limit switches, temperature and pressure switches, and can directly control other modules;
- Stores instructions for control and monitoring;
- High level device in the DINEX system, containing one of the controlling programs;
- Supports Automatic Test Equipment;
- All I/O points are optically isolated;
- LED status indicators provided on all I/O points;
- Is strictly an INPUT device.
INPUTS consist of a grouping of switches and sensors. INPUTS are controlled by LEDs. If a green LED is turned ON, the MBC receives an INPUT from the ground on this circuit. There is a yellow wire which closes the circuit loop at the INPUT level. There are three Deutsch-type connectors in the upper right corner of the MBC. Thanks to these connectors, the MBC interfaces with the INPUT circuits of the vehicle.

There are three eight-pin connectors, one pin for every INPUT LED.
- BROWN CONNECTOR - ground input LEDs, numbered 1 to 8.
- BLACK CONNECTOR  - ground input LEDs, numbered 9 to 16.
- GREEN CONNECTOR  - ground input LEDs, numbered 17 to 24.
- YELLOW WIRE  - Voltage for the module's green LEDs (24V).

HIGH SPEED CELL NET Controller with POWER CONTROL (T-HCNC-808)

The HIGH SPEED CELL NET Controller is a network controller with a power driver which provides all the functions of a full-size, on-board computer. It can be a Bus Controller and control other modules in the network. The HCNC can provide direct interface for the equipment, including switches, LED indicators and digital displays (see figure 5). Other features include,
- Cell Controller for Electrical System and subsystems, such as door control, engine, driver console and displays;
- Used for turning on and off electrical power to control devices, such as solenoid valves, lights, electrical clutches, heaters and motor starter;
- Interfaces limit switches, temperature and pressure switches, pushbutton and selector switches;
- Commands from the MBC are carried out by the HCNC for on/off devices;
- Every individual circuit is fuse-protected (10 A) and self-monitoring.
- Yellow/amber LEDs allow for individual surveillance of each circuit in its entirety;
- In order to function correctly, the units must be programmed for time delay, flashers, sequencing, etc.
- Can process up to eight INPUTS and eight OUTPUTS (808);
- In order to function correctly, the units must be programmed and be provided with an address;
- Used for tasks requiring multiple conditions;
- Comprises colored LEDs for diagnostics and problem detection.

DIGITAL INPUT AND OUTPUT CONTROL MODULE: T-DIO-808

See Figures 5, 6, 7, 8.
- A DIO unit can only handle eight inputs and eight outputs;
- DIO units are placed in the network for on/off work only;
- DIOs are slave units and cannot be programmed, with the exception of the address;
**CAUTION:**
The DIO and HCNC look alike.
Read labels carefully.
**HCNC** must be programmed.
**DIO units** are strictly start-stop devices and cannot be programmed.

**NOTICE REGARDING SAFETY:**
Follow all general safety guidelines.
Use safety equipment adequately.
Always use safety equipment properly whenever performing trials/tests or work on the multiplexing system.

**DIGITAL CONTROLLER OF INPUTS AND OUTPUTS (DIO-808)**
- The digital input and output controller (DIO-808):
  - is interchangeable with other DIO-808 modules if the address for zone placement was installed;

**HCNC/DIO LED INDICATORS**
The HCNC/DIO LED indicators (see Figure 7) are:

a) Red communication LED for Data Communication Status (SCD) blinks rapidly when an I/O module is contacted by a command module. A blinking SCD means that the specific module is in contact with the command module. If it is not blinking, the module is not in communication, therefore the LED is out of order. Check the ladder diagram for more information. Except for the MBC.

b) Red LEDs 1 to 8 on the modules show that the module detected a digital command signal and should apply a voltage to the load. The voltage sent to the load may either be 12 V DC or 24 V DC.

c) Green LEDs, when turned on, number 17 to 24, show that a ground input has occurred through a switch, sensor, etc., related to that specific input. When a green LED lights up, the module is contacted, a digital signal is generated, encoded and sent. These digital signals are used for any control type in the system.

d) Yellow/amber LEDs. LEDs 9 to 16 are used to determine the continuity of the circuit, from the module via the output circuit (circuit check). When a red LED is activated, the yellow LED should turn itself off. If both red and yellow LEDs are lit, this indicates that a fuse has shorted.

e) Fuses F1 to F8 control the current flux for outputs 1 to 8. For example, fuse F1 at Output 1.
SUPPLY CABLES FOR HCNC/DIO 808

Supply cables for all 808 modules contain four wires. See figure 8. They provide current to the modules, in order to establish load (lights, solenoids, and other functions requiring power). These wires are found on the upper right side of the HCNC and the DIO-808. The last two characters in the model number refer to the way in which these wires are terminated:

R2 = ring terminal or R7 = plug end block. The red wire supplies outlets 1 to 6 (green LED indicator lights 1-6). The yellow wire supplies outlets 7 and 8 (Red LEDs). The red and yellow wires may be supplied by either 12 V DC or 24 V DC. Their location determines the voltage at the specific outlet.

The grey wire supplies power to green LEDs in the module. It is always supplied by 24 V DC.

The green/yellow wire is grounded and provides the module protection against static (see note on lower corner of the module).

BI-TENSION FUNCTION

- Modules HCNC/DIO are made up of subdivided circuits which allow two different current output voltages (12 V or 24 V) from a single module;
- division 6/2:
  outputs 1 to 6 are supplied through the red wire;
  outputs 7 and 8 are supplied through the yellow wire.

Power supply may be 12/12V, 12/24V, 24/12V or 24/24V, depending on the voltage characteristics of the driven circuits;
- the grey wire provides voltage to the green LED in the module. Always supplied by 24 V DC.
- the green/yellow wire is ground connected and provides static protection (see note on the lower corner of the module).
- the red and yellow wires may be supplied either by 12 V DC or 24 V DC. Their placement determines the voltage at the specific output.
- multiplex system inputs are grounded to a selector/changeover switch.

☞ CAUTION:
When supply wires are removed from the modules, make sure to use the right harness adaptor when reconnecting.

CONTROL CIRCUIT LED (T-DIO-240LP)

See figure 9.

The T-DIO-240LP is a digital output module interfacing with the driver's panel. The module includes 24 output launch circuits which maintain contact with the driver's control panel. When the master switch is On, all LEDs light up for a few seconds to check the LEDs working order. The LED tell-tale lights are grounded and the Master module 240LP supplies 12 V when individual LEDs must light. However, not all tell-tale lamps are digitally controlled. The tell-tale panels may only be replaced as individual assemblies.

- reaction module, not programmable (except for the address)
- processes 24 OUTLETS (240LP)
- does not process INPUTS (240LP)
- used for on/off work only.
- supplies current to a few tell-tale lights.(240)
- located under the dashboard, near the tell-tale panel (240)
- total of 24 outlets (240)
- 25-pin connector (240)
- Pin n° 25 12-V DC-supply (240)

TELL-TALE LIGHTS ON THE DASHBOARD

When the master switch is turned on, all LEDs are lit for a few seconds in order to check LED working order. The tell-tale LEDs are grounded and the command module 240LP supplies 12 V when individual LEDs must be lit. Caution should be taken, not all tell-tale lights are digitally controlled. The tell-tale panels may only be replaced as individual assemblies.

T-HCNC-168 MODULE

The High Speed Network Controller T-HCNC-168 is a replacement for the transmission interface module. This module can receive or process grounded or positive signals from any transmission. See Figure 10.

- Made up of 16 inlets and 8 outlets of 10 A each, for a total output current of not more than 20 A;
- Red LEDs 1 to 8, when lit, show that the module detected a digital command signal and should apply voltage to the load;
- The green LEDs 9 to 24 are inputs;
- The yellow/amber LEDs 9 to 16 are replaced by green LEDs now representing inputs and not continuity;
- The input wiring is spread into four groupings of six wires;

Figure 8 - T-HCNC/DIO 808 modules

Figure 9 - Control panel interface module
- Four wires are shared along with the sixth one, the fifth wire serves as a replacement;
- When the sixth wire is grounded, the inputs have a power source;
- When the sixth wire is connected to a power source, the inputs are grounded, the inputs have a ground source;
- Black input connector: pins 1 - 4: inputs 9 - 12, pin 5: emergency and pin 6: shared (power or ground);
- Black input connector: pins 7 - 10: inputs 13 - 16, pin 11: emergency and pin 12: shared (power or ground);
- Green input connector: pins 1 - 4: inputs 17 - 20, pin 5: emergency and pin 6: shared (power or ground);
- Green input connector: pins 7 - 10: inputs 21 - 24, pin 11: emergency, pin 12: shared (power or ground);
- Brown output connector: pins 1 - 8: individual output pins, pins 9 and 10: power source, pins 11 and 12: ground for outputs;

MULTIPLEXING SYSTEM CONNECTIONS: DATA CABLES
- Six wires are contained in a sheathed cable that protects the multiplexing system from electrical interference.
- These cables provide a voltage control power supply of 12 V positive and 12 V negative to all modules.
- The data cable allows the MBC to communicate bidirectionally with all the network modules.

LOOP DESIGN
- The loop design allows the power supply and the data to be available simultaneously in the circuit, even if the cable and/or the loop are damaged.
- A simple defect located anywhere in the loop cable has no effect on the power supply or on the data circuit.
- The power supply and data are only interrupted when multiple defects occur on both sides of a module or a group of modules, isolating the module from the loop.

Figure 10 - High Speed Cell Net Controller T-HCNC-168; T-HCNC-168 connectors and LEDs
LADDER DIAGRAMS

- The ladder diagrams show the logic behind each action.
- The ladder diagrams make circuit diagnosis easier.
- All conditions must be met for an action to be executed.
- The diagrams indicate any parallel or serial circuits involved in an action.

For example, the ladder diagram in Figure 15 shows all the necessary steps for the headlight, low beam (68-08).

UNLINKED CIRCUIT

- The simplified circuit illustrated in Figure 16 indicates that there is no direct link between the input, the data bus and the output.
- The green LED activates the sensor and switch inputs.

- A phototransistor closes and a CPU sends out a signal through the data bus.
- The receiving CPU lights up the red LED.
- Another phototransistor closes and completes the circuit, from the battery to the load.
- The absence of a direct wire link eliminates the need for external diodes.
- It also eliminates the risk of voltage spikes damaging the data loop or the modules.

ACTIVE AND INACTIVE INPUTS

- The MBC and the HCNC can be programmed to use an open (inactive) or closed (active) switch input to determine actions to be executed.
- Consequently, for the module to execute an action, it may be possible that certain LEDs light up while others do not.

ID VERIFICATION

T-MK-IDWT-R2-01 ID DISPLAY

The ID display (see Figure 17a) is used to verify or change a module's address. Therefore, it is a problem-detecting tool used to isolate and correct a malfunction resulting from incorrect module identification addresses. Some of its features are:

- Sturdy and easy to use
- Writes and checks the identification (ID)
- Compatible with the software
- RS-485 signal – two wires
- Designed with a low power CMOS circuit
- No computer or notebooks computer required
- Small and easy to manipulate

PRECAUTIONS

1. Inside the vehicle, disconnect the data cable from the displayed module (see Figure 17c). The ID display will write to all connected modules. If the display is connected to the loop, it will write the same module identification to all modules, resulting in a malfunction.

   If this is the case, verify and adjust the ID number of each module individually.

2. Take good care of the polarity: If the connections are reversed while the address of a module is being reprogrammed, all network modules will have their ID displays overwritten with the same ID as that of the module being reprogrammed. This situation can be corrected by checking each module individually and reprogramming with the correct ID number, where needed.

MODULE IDENTIFICATION NUMBER

VERIFICATION

Refer to the Pocket User Guide for the procedure.

MODULE IDENTIFICATION NUMBER

MODIFICATION

Refer to the Pocket User Guide for the procedure.

CAUTION:

The ID display allows writing on one module at a time. Before conducting these tests, isolate the module from the data cable.

DIAGNOSIS AND TROUBLESHOOTING

DIAGNOSIS AND TROUBLESHOOTING STEPS

CAUTION:

Before executing the troubleshooting, always refer to the ladder diagram and the vehicle wiring diagram.

In most circumstances, three basic steps allow you to diagnose and troubleshoot the multiplexing system wiring in a relatively simple manner.

STEP 1. VISUAL INSPECTION

Ninety five percent of circuit faults can be identified and eighty five percent of circuit failures can be diagnosed with the LED modules. These failures are usually caused by defects in parts, such as bulbs, switches, etc.

![Figure 17a - ID Verification with T-MK-IDTW](image)

![Figure 17b - Command Information](image)

![Figure 17c - Application Target modules](image)

Target Devices
- T-DIO-24LED
- T-MBC
- T-HCNC-808
- T-HCNC-168
- T-DIO-808

Main Testing Components
- T-MK-IDWT-R2-01
STEP 2. VERIFICATION USING AN INPUT/OUTPUT TEST KIT

The input/output command tester kit allows testing of the modules and of the communication network. The kit also allows the diagnosis of failures that were not found during the visual inspection.

STEP 3. TESTING USING SOFTWARE AND PROGRAMMING

The software allows module programming verification and replacement module programming.

Each of these steps is detailed below.

STEP 1. VISUAL INSPECTION

See figures 6 and 7.

- Use an LEDs located on the modules to diagnose faulty components.
- The tools essential for failure diagnosis are the LEDs located on the modules, the ladder diagrams (logic diagrams) and the electrical diagrams.
- When a LED does not indicate a good circuit performance, an electrical diagram can be used to track the path of the circuit, from the modules to the input or the output.
- The multiplexing system tester kit, described under step 2, should not be necessary, unless the visual inspection failed to detect a problem or to confirm a good operating status.

INPUT LED VERIFICATION

- The MBC and HCNC/DIO have green LEDs to monitor all inputs.
- Each input point has a location or a unique sub-address. When a green LED is on, the input is active (circuit is closed).

OUTPUT LED VERIFICATION

- When a circuit is not operating, a yellow LED lights up (the yellow LED represents the circuit integrity). A circuit may be completed and ready, but it does not mean it is active.
- When the circuit is operating, a red LED lights up (the red LED indicates an active circuit). The yellow LED goes off.

DATA LINK LED

- The MBC and HCNC/DIO units have data linking LEDs, located on the left side of the module.
- The data link LEDs flash rapidly to indicate that the module is undergoing a communication process. If one or more LEDs are not flashing normally, one circuit or more may be affected. Check the communication cables.

TRACKING THE ORIGIN OF A FAILURE USING THE LEDS

The LEDs indicate the system status

- If the load circuit is open, indicating that a bulb or a solenoid has blown, a wire is broken, etc., the yellow LED will not light up.
- If the yellow and red LEDs are both lit while the circuit is active, check the fuse.
- If the red LEDs of a module are all out, verify the data link tell tale, adjacent to the data cable on the side of the case. Also, verify if the cable connections are loose or damaged.
- If two, six or eight yellow LEDs are out, check the circuit breaker or the busbar. It is possible that the input power is missing.
- The internal circuits of the multiplexing units (HCNC and DIO) allow voltage to flow to the output load, even when the load is inactive.
- The voltage originating from the battery busbar will pass through a yellow LED and a resistance to reach grounding at load.
- When the circuit is active, the yellow LED goes off and the red LED lights up.
- A blown fuse still allows voltage to reach the yellow LED, in which case, the red LED lights up because the circuit tries to activate itself.

FAILURe MODE ANALYSIS

1. Operation verification:
   - When a failure of any function occurs, start by finding the affected module and input/output point.
   - Verify the red LED. If it is lit, go to the next step. If not, go to step 4.

2. Circuit integrity:
   - Verify if the red LED is lit.
   - Check the yellow LED. It should be off.
   - When the device is in the Disable mode, the red LED is off and the yellow LED is lit.
   - If the red LED does not light up during the Enable mode, the circuit or the protection device is defective.
   - If the yellow LED is off during the Disable mode, the circuit is open.

3. Circuit protection device:

**NOTE:**

During normal operation, the red and yellow LEDs go on and off alternately.
- Check if a fuse has blown on the module or if the circuit breaker is open.
- Replace the blown fuse or reset the circuit breaker.
- If the system is not functioning, verify the load (bulb, solenoid, etc.)
- Replace the defective unit.
4. Verify the electrical circuit using the coach wiring diagram to be sure that the load is properly connected.
5. Verification of logic preconditions (INPUT):
   - If the red LED does not function properly, verify logic preconditions.
   - Verify related preconditions.
   - Follow the ladder diagrams. Verify switch inputs and adjustments.
6. Operation re-verification:
   - If any precondition was not met, verify the input device. For example, a pressure switch or another type of switch might need repair.
7. System reset:
   - If the problem persists, cut off the power. Wait 10 seconds. Restore the power to reset the computer.
   - Go back to step 1 and perform another verification. If the problem still persists, go back to step 2.

**CAUTION:**
Whenever technical analysis is required it is very important that the proper documentation (Ladder Diagram) be used and that it match the revision of the vehicle in question

**STEP 2: VERIFICATION USING INPUT/OUTPUT TESTER KIT**

The TMK-808 tester kit (see Figure 18) is designed to diagnose and test T-HCNC and T-DIO modules. The kit allows network performance testing, direct output command simulation from an individual output point, and input condition monitoring. The kit is also designed to verify and ensure the network integrity by monitoring and scanning addresses over the entire network.

**WARNING:**
Only authorized personnel having received proper training should use this kit. The T-MK-808 surpasses every security prerequisite. Mishandling may prove hazardous and harmful to the operator or third party. Special care and authorization are required to operate this tool.

The TMK-808:
1. Tests the telecommunication network.
2. Simulates outputs.
3. Monitors inputs.

**DIAGNOSIS PROCEDURE**

**MODULE ID AND INPUT/OUTPUT TEST**

1. Start the vehicle.
2. Connect the Y cable to the target test module (HCNC or T-DIO-808). Follow the cable markings.
3. On the T-MK-808, set the switches at the ID SCAN position.
4. Connect the Y cable to the data bus.
5. Connect the Y cable to the T-MK-808 module. Once the connections are made, the LED corresponding to the connected and tested module should light up.
6. Rotate the testing tool selector (1 to 8).
7. Push the Reset/Active button. The red DEL lights up to indicate the corresponding connection and activates it.
8. Verify the activation status of the target module and of the corresponding output point.
9. Verify the circuit functioning and integrity.
10. Repeat steps 6 and 7 to verify output points (1 to 9), as needed.

**VERIFICATION OF MODULE INPUTS**

The tester kit receives a signal. This signal is sent to the INPUT corresponding to the green LED of the modules. The green LED is turned on the tester kit as a means to validate signal transmission through the data cable.

**NETWORK INTEGRITY TEST**

**MAIN DATA BUS TEST**

1. Disconnect the Y cable.
2. Replace the Y cable by the male to female Identifier Scanning cable. Follow instructions on the cable.
3. Disconnect the MBC data cable.
4. Adjust the selector located on the T-MK-808 to ID SCAN.
5. Connect the T-MK-808 cable to the MBC data bus connector.
6. (a) Verify network integrity to be sure that all module IDs are present.
   (b) On the T-MK-808, read the corresponding LED identifier.
7. Disconnect module 66 network cable, cable #32.
8. All module IDs should appear.
9. If this is not the case, there is a break between the last visible ID and the module next in line within the loop.
STEP 3: SOFTWARE AND PROGRAMMING TEST

NOTE:
When replacing a T-HCNC or T-MBC module, you must apply the same unique system program in the new module.

When making modifications to the control system design, load the update program into the T-HCNC to ensure that the system operates in a proper manner.

Before using this tool for programming, remove the two communication cables of the HCNC or MBC module.

When replacing a DIO module, the module must be addressed correctly. Before addressing, disconnect both communication cables from the DIO module.

LOADING THE PROGRAM IN THE T-HCNC OR T-MBC MODULE

1. Choose the correct programming module for the HCNC or MBC to be programmed.
2. Connect the program to the charger.
3. Place the rocker switch in the OFF position.
4. Attach the data cable to the charger.
5. Attach the other cable to the power supply data channel.
6. Place the rocker switch in the ON position.
7. The green LED (CHARGE) must start flashing (IN CHARGE).
8. The red (COM) and green LEDs (IN CHARGE) then light up continuously (LOADING PROGRAM).
9. When the green LED is off and the red LED is lit, the module is checking the program.
10. When the red LED is off, it indicates that the program was loaded successfully.
11. If the LEDs on the charger do not show any sign of activity, the loading procedure failed or there is no power at this end of the data cable.
12. Ensure the charger is supplied and repeat the procedure.
13. If the procedure fails again, replace the HCNC or MBC.
14. Reconnect the cables as previously.

Figure 18 - T-MK-808 Testing Tool and Testing Cables
CAUTION:
Operation of the T-MK-808 to simulate the outputs will neutralize all integrated safety precautions.

TROUBLESHOOTING

CONCLUSIONS

MODULE REPAIR

If the three inspections tests detailed previously (Visual inspection, Verification using an input/output tester kit and Software and Programming testing) do not allow the identification of a problem, the module must be considered as defective. Unless the manufacturer gives the authorization, no internal component repair is allowed. Return the module to the manufacturer for repair.

CAUTION:
Never activate a non-identified output.

MODULE FAILURE

When a complete series of functions has failed, use the T-MK-808 to verify the connection and communication LED, the identifier LEDs and the data bus cable. If there is no correction, replace the module.

If a module indicates failures at some entry/exit points, use the T-MK-808 to check the fuses, to replace the burnt out fuses, to check the yellow and red LEDs. Then, if the yellow LED is off, check for the possibility of a short-circuit or an open circuit. If not the case, replace the module.

SYSTEM FAILURE

If the system breaks down or functions abnormally, or if the system stops working, reset, stop and restart the system. Then, make a visual verification of the LEDs on the module, and check the MBC data bus connection, the T-PMS and the 12-volt green LED. Use the T-MK-808 identifier verification tool. If there are no corrections, the MBC module must be replaced.

POWER SHEDDING SYSTEM

OPERATION

The buses are equipped with a power control system allowing activation and deactivation of the electric power from different areas of the bus. This system replaces both the manual battery disconnecting switch and the circuit breaker that were in place on the earlier models.

This system has several advantages compared to the earlier systems, in that;

- It makes it possible for the driver to stop the power supply, without having to go to the battery compartment.
- It allows the power supply to stop automatically after 30 minutes of inactivity, which prevents discharging the batteries.
- It also makes it possible to re-engage the power supply without having to reach the main circuit breaker, directly from the driver’s compartment.

WARNING:
Before diagnosing a shedding problem, it is recommended to disconnect the shedding coil and the resetting coil of the main circuit breaker. See the wiring diagram.

NORMAL STARTING

Under normal conditions, starting the electric power supply of the vehicle is performed simply by the adjustment of the driver’s master switch to the RUN, RUN/LTS or ACC. position. The circuit breaker will automatically engage and the 24 and 12-volt circuits will be supplied with power.

To cut off the power supply, the driver must simply place the master switch to the OFF position. The circuit breaker will disengage itself automatically after 30 minutes.

NOTE:
To know the sequence and the conditions of the automatic circuit deactivation, refer to the ladder diagram of the vehicle.

The system may also be re-engaged using either the emergency light switch (HAZARD SW), or the 911 emergency switch located near the driver, or the power assistance emergency release command (DOOR MASTER SWITCH). As long as one of these applications is in function, the automatic 30 minutes of inactivity shutdown will remain inactive.

Figure 19 - T-MK-Charger et T-MK-Program Modules
VEHICLE MAINTENANCE

During vehicle maintenance, it may be necessary to deactivate the electric circuits of the vehicle. To deactivate them, place the battery switch, located in the battery compartment, in the **DEACTIVATE** position. See Figure D2. The power supply will stop immediately, as confirmed by the extinction of the power tell tale.

This interruption has complete precedence over all other commands. It is impossible, for safety reasons, to restart the power supply without replacing this switch in the **NORMAL** position (neutral position in the center).

Placing the switch in the **NORMAL** position allows activation of control at other areas throughout the bus.

The temporary positioning of the switch in the **ACTIVATE** position (see Figure D2) engages the power supply. However, it will stop automatically after 30 minutes if the control logic of the ladder diagram is applied.

**CAUTION:**

Some circuits, such as the optional fire detector and the voltage equalizing module, will remain supplied at all times, if necessary.

FORCED INTERLOCK

Certain emergency conditions, such as the detection of a fire (in the vehicles equipped with an optional fire detector), can cause the power supply to stop automatically, which makes normal re-interlocking impossible. It is possible to bypass this emergency condition by activating the power assistance emergency release command (“door master switch”). All interlocks are bypassed in the same manner and the circuit breaker is re-engaged.

However, to return to the normal situation, deactivate the power assistance emergency release command. This eliminates the condition that caused the fire detection and resets the system by temporarily placing the battery switch in the **DEACTIVATE** position. See Figure D3.

AUTOMATIC DEACTIVATION

Automatic deactivation of the vehicle is performed through the T-HCNC-808 “65-07” of the multiplexing system. See Figure D4. The **SLEEP** mode (**SLEEP ENABLE**) of the T-PMS module and its countdown switch are not used with the power shedding system.