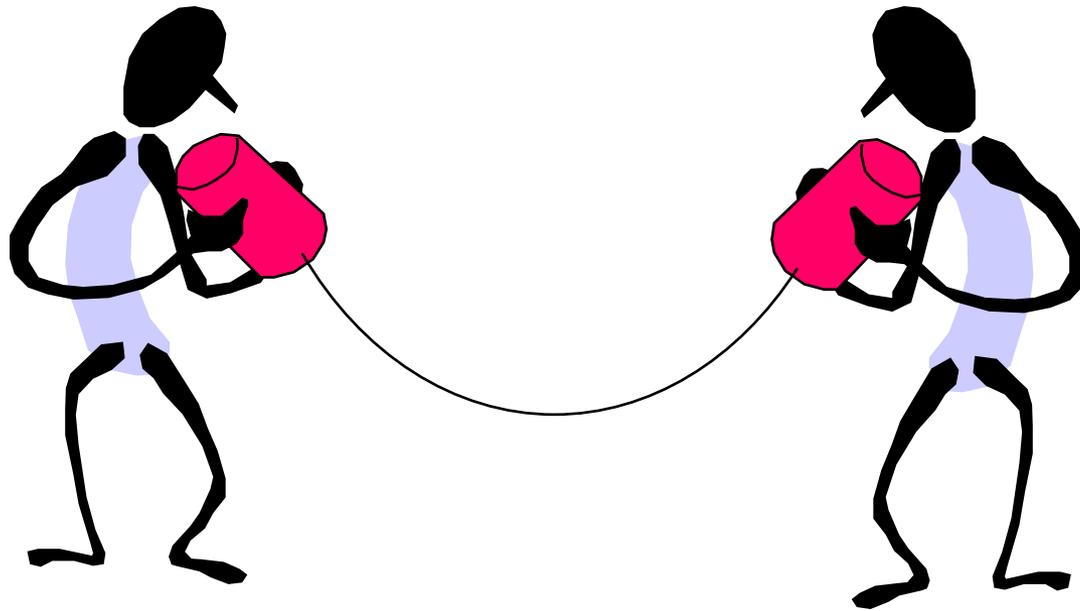
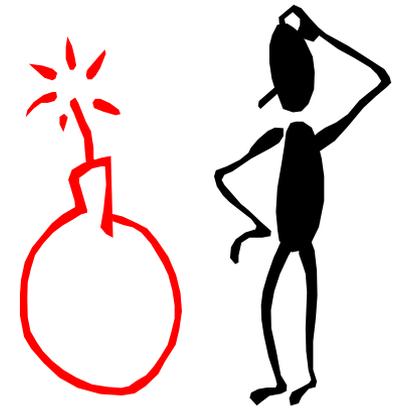


Fundamentals Of PLC



Safety



When performing different types of repairs to a PLC equipped vehicle, special precautions must be taken. Failure to follow these recommendations and procedures could result in injury or severe damage to the vehicle and its components.

Deactivate the electrical system in a manner that removes all electrical power from the vehicle before removing or servicing any components.

Safety

- Practice general safety procedures
- Use care when working around belt driven accessories
- Use test equipment properly
- **Do not use test lights**



Safety Precautions For PLC Coaches

- Caution should be exercised when welding on a coach.
- All electronic system computers must be disconnected before any welding takes place on the vehicle.



What is PLC ?

Programmable **L**ogic **C**ontrol system is a computer based control system that collects information received from input devices such as toggle and pressure switches. The PLC system then combines the input and output information and checks it against the control strategies stored in its memory. The results is information that “tells” the coach how to operate. The information is then sent to remote areas of the coach through the multiplex wiring system.

Multiplex Wiring System

Some of the advantages of the Multiplex wiring system are:

- Short wiring harnesses that are, for the most part, localized to a specific area of the bus.
- Reduced number of connectors and circuit breakers in the system.
- Reduced possibility of voltage drop problems.

Bits, Bytes, and Words

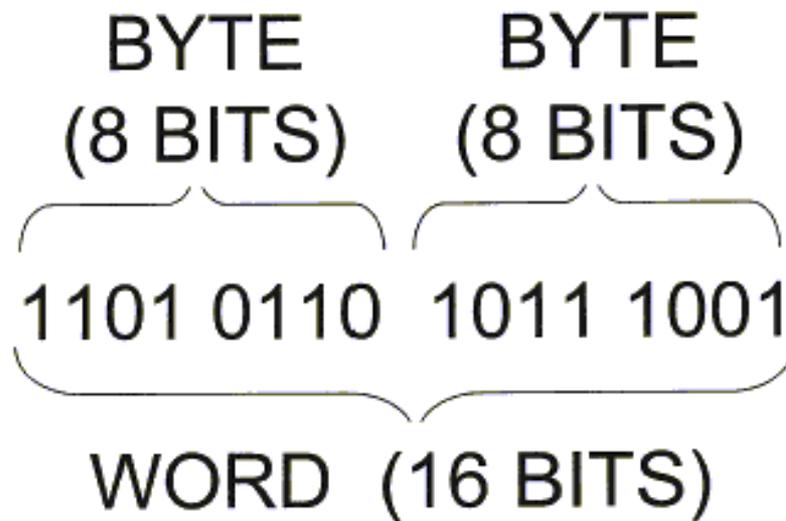
PLC's instructions are formatted in binary. Binary Information is expressed in two different states or digits known as bits.

A bit (binary digit) can assume one of two possible values:

- (1) = a logic high
- (0) = a logic low

Bits, Bytes, and Words

- Bytes strung together form words. Typically, PLC's use words that are 8, 16, 32, 64 bits long.



PLC Terminology

- PLC.....**P**rogrammable **L**ogic **C**ontrol
- IO....Inputs and Outputs
- Inputs....Information supplied from switches, sensors or other bus systems (Engine, Transmission, HVAC etc.) 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.
- Address....The address of an input or output, or the identification of the location where the data is stored.

PLC Terminology

- Bit....Bit is the abbreviation for a binary digit. A single 1 or 0 is a bit
- Byte....A byte is eight bits, or binary digits. An example of a byte would be a series of bits 10101110.
- Word....the bit format that the computer accepts as its standard representation of data or information. The most common PLC word lengths are 8 and 16 bits.
- Digital Signal....A digital signal has only two valid states, either on or off.

PLC Terminology

- Logic Charts (Ladder Logic)....Diagrams that show program requirements for each output. Symbols are used to represent the actual ON or OFF status requirements.
- Memory....a PLC's memory is where data is stored in an orderly manner. Data is typically stored in a file by address.
- Multiplex....Two way communication through the same data port.

PLC Terminology

- Data Bus....The shielded cable of wires providing the multiple Data paths and power supply to link each network.
- Node....An individual input or output point of each module.
- LED....A light emitting diode. A small semiconductor lamp.
- Module....A network functional unit which contains an intelligent co-processor unit. Acts as a vital link between inputs and outputs.

PLC Terminology

- MBC....The Main Bus Controller which directs and regulates all communication between each functional unit on the data bus.
- HCNCHigh-speed Cell Network Controller. Programmable module that may be programmed to control other groups of modules in the system.
- DIO....An intelligent reaction module. Non-programmable. (Except for ID)

PLC Terminology

- PMS....Power Management Module provides Computer Power or “Clean Power”. The isolated power source for modules in the network that helps to avoid data corruption from electrical interference or a common power source such as a battery.
- Data....The information transmitted from module to module through the data cables.
- Ring Loop....Data bus structure in which the modules are connected to form a “ring”.
- Reset....Restart / re-boot the system.

What is Multiplex / DINEX?

- General term for two way communication through the same data port.
- DINEX - Distributed Intelligent Network System.
- Simplifies hook-up of electrical devices.
- Utilizes a two-wire system to turn devices on and off.

Why Multiplex?

- Functional changes made easy.
- To ease troubleshooting.
- To reduce vehicle down-time.
- To save weight by replacing unnecessary wiring harness, flashers, connectors.

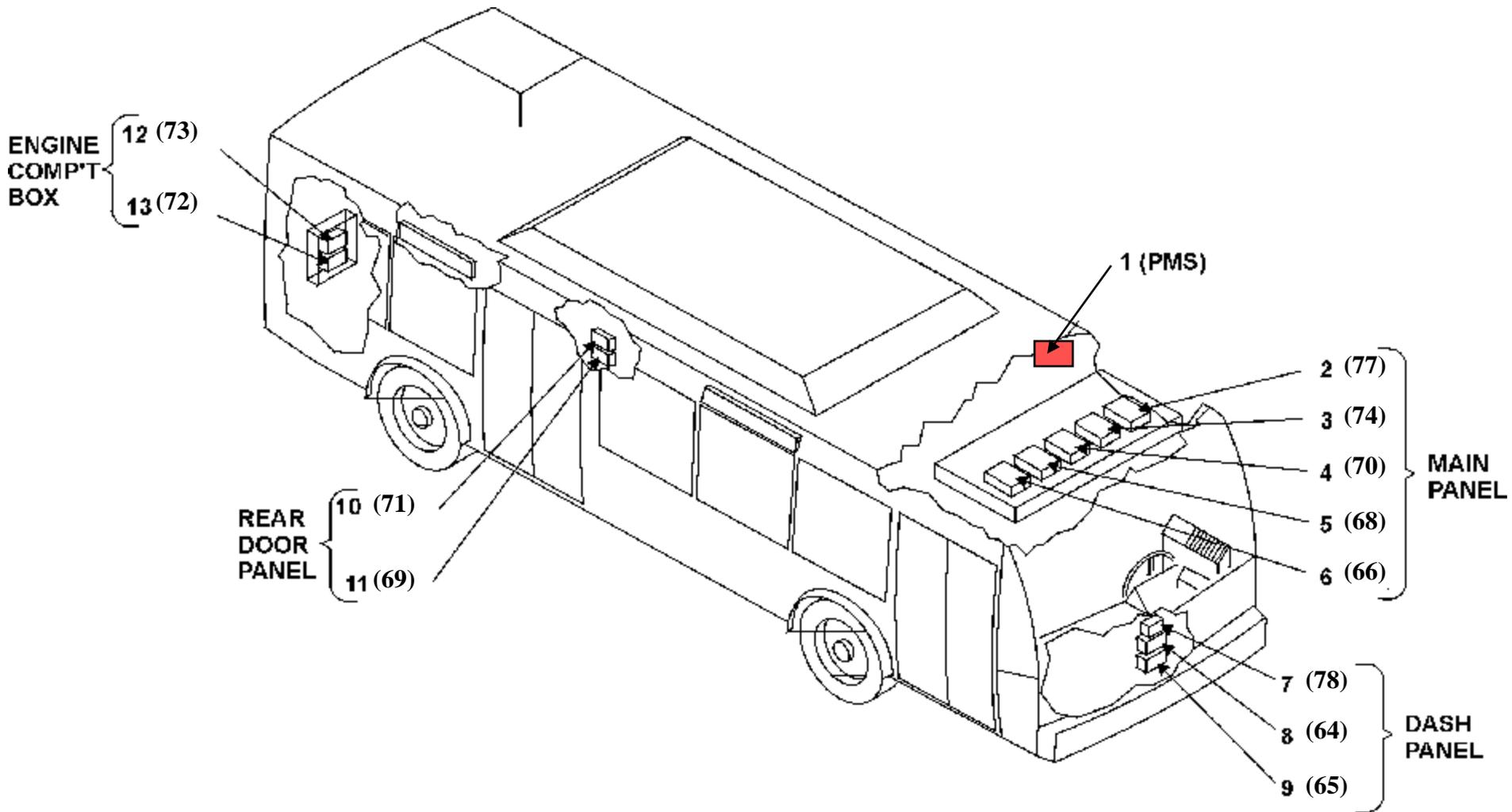
How does Multiplex do this?

- Microprocessor base system.
- Small compact modules.
- Full computer functions.
- One module controls a family of modules.
- Connected together in a unique “loop”.
- Each module controls a zone of **inputs** & **outputs**.

Overview of How DINEX Works

- MBC receives an **input**, either directly from switches in the form of an on/off signal or Indirectly from another multiplex module via the data cable.
- If the **input** completes a output logic. MBC intelligently sends a signal to the proper module to activate an **output**.
- MBC **initiates contact** to all the zone modules utilizing each modules pre-assigned ID (or phone number).
- At each contact all **input** & **output** information is transferred from MBC to the Zone module & from the Zone module back to MBC.

Component Location Chart (6400)



Component Location Chart (6400)

ITEM	DESCRIPTION		LOCATION
	MODULE TYPE	ADDRESS	
1	PMS	---	LH LIGHT PANEL
2	MBC	77	MAIN PANEL
3	HCNC-168	74	MAIN PANEL
4	DIO-808	70	MAIN PANEL
5	DIO-808	68	MAIN PANEL
6	DIO-808	66	MAIN PANEL
7	DIO-240LP	78	UNDER DASH
8	HCNC-808	64	UNDER DASH
9	HCNC-808	65	UNDER DASH
10	HCNC-808	71	REAR DOOR
11	DIO-808	69	REAR DOOR
12	DIO-808	72	ENGINE BOX
13	HCNC-808	73	ENGINE BOX

Why Light Emitting Diodes (LED's)?

- LED's use only 10 to 20 ma to illuminate.
- They generate very little heat.
- Less heat means longer LED life.
- They can operate on either 12 or 24 volts.
- Inexpensive to manufacture.



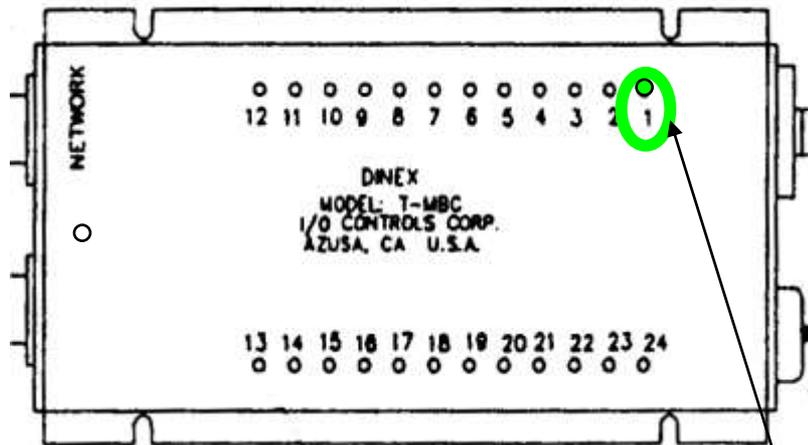
ADDRESSING

- Each module is assigned a unique address for **MBC** to communicate with the module.
- Each module has sub-addresses related to its inputs and outputs.
- **For example: 77-01**

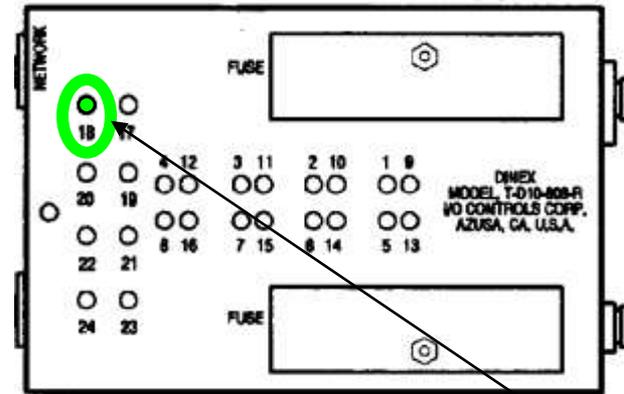
Address **77 = MBC located in the main panel.**

Sub-address **01 = Input from master switch in run position.**

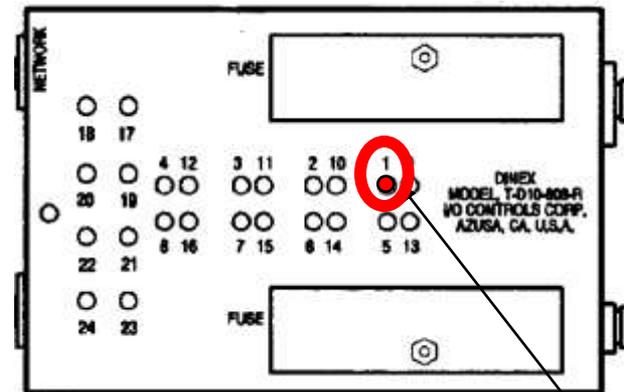
Addressing Example



77-01 = Input from master switch/run position.



64-18 = Input Signal from interlock stop light lamp.



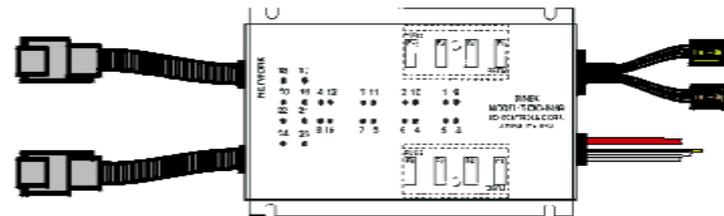
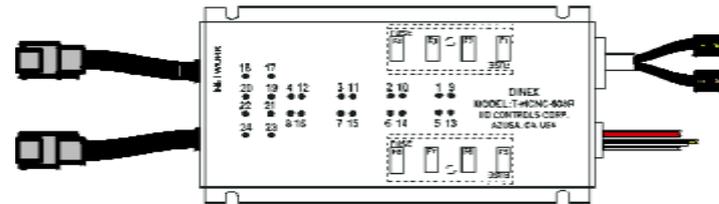
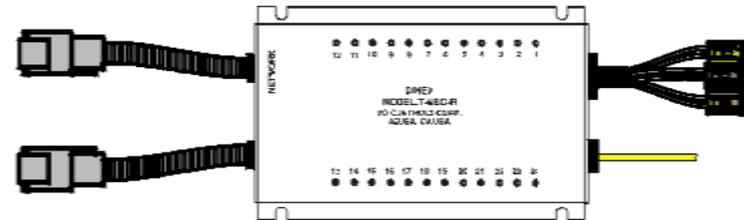
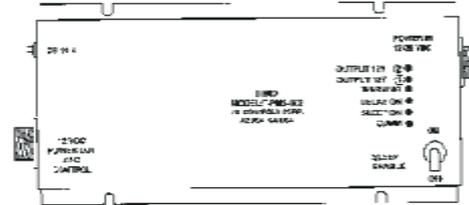
73-01 = Output to stop lamps.

Multiplex Components

- Main Bus Controller (T-MBC)
- High Speed Cell Network Controller (T-HCNC)
- Digital Input/Output Control Module (T-DIO)
- Power Management System (T-PMS)
- LED Driver (240LP DIO)
- Data Cable (DATA BUS)

Multiplexing Components

- Power Management Module (PMS)
- Main Bus Controller (MBC)
- High Speed Cell Net Controller (HCNC)
- Digital Input and Output Controller (DIO)

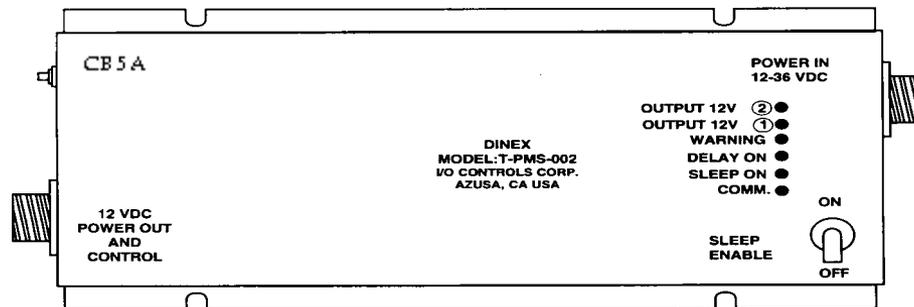


Power Management Module (T-PMS)



Power Management Module

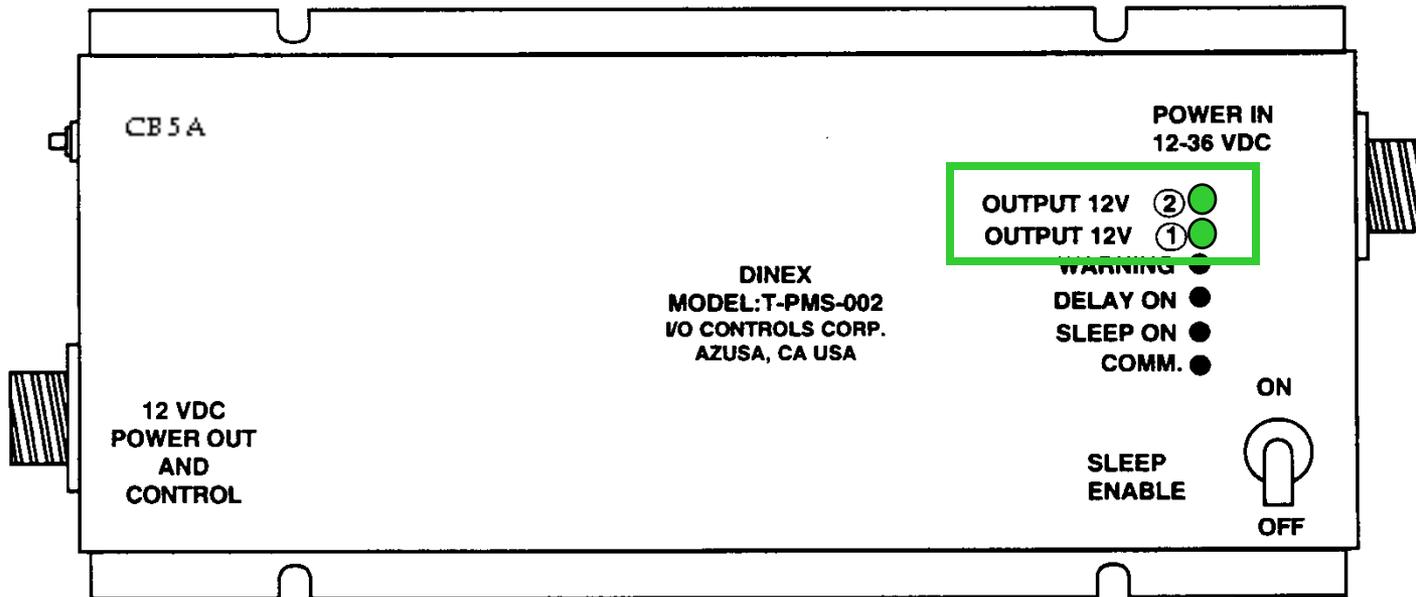
- Provides “clean” 12 VDC power supply to all Dinex system modules.
- Clean power means free from EMI and RFI interference.
- 12-36 VDC to 12 VDC converter.
- 12 VDC is only used to power the computers.
- 5 amp circuit breaker in upper left hand corner provides output circuit protection.
- Has sleeper mode for reduced battery drain.



PMS LED INDICATORS

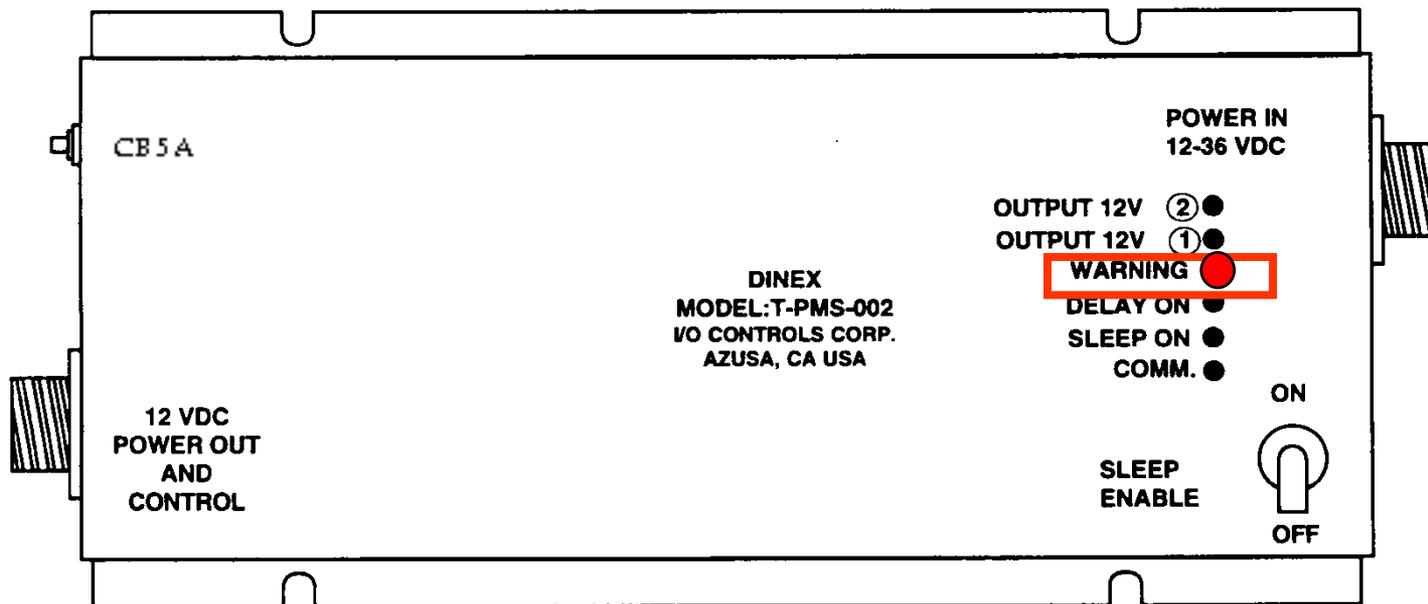
- OUTPUT 12V 2
- OUTPUT 12V 1

- Indicates if one or both of the internal parallel output circuits are operating.
- Two output circuits are provided for back up.
- Both LED's should be lit when the system is active.



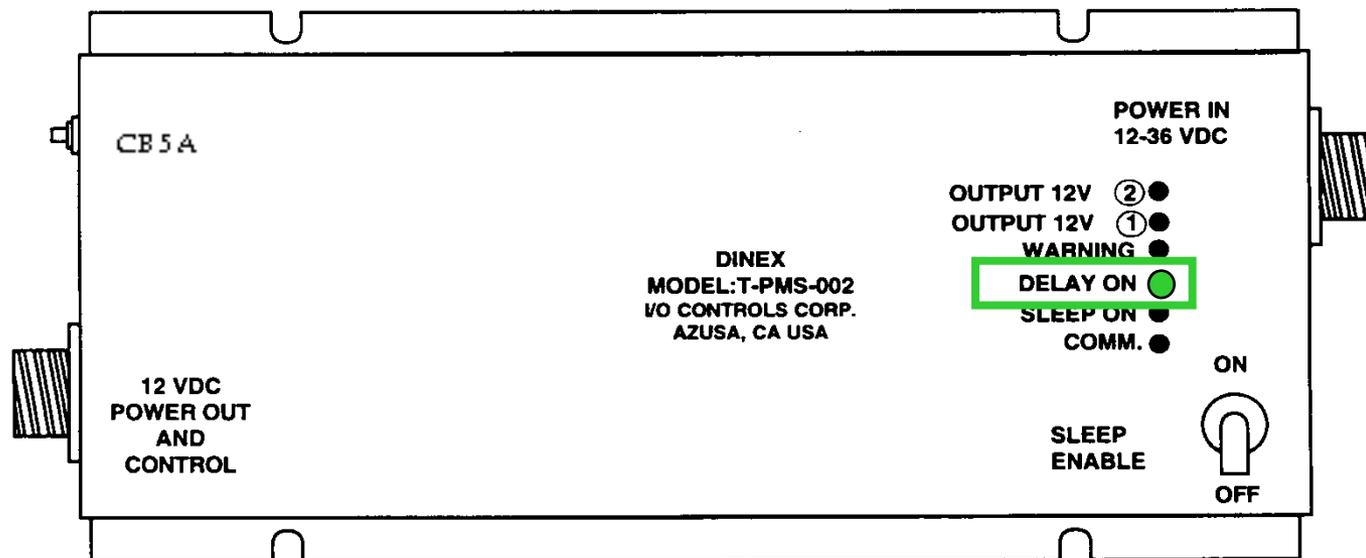
PMS LED INDICATORS

- **WARNING** Indicates if less than 20volts is **supplied to PMS**. If on, check vehicle charging system.



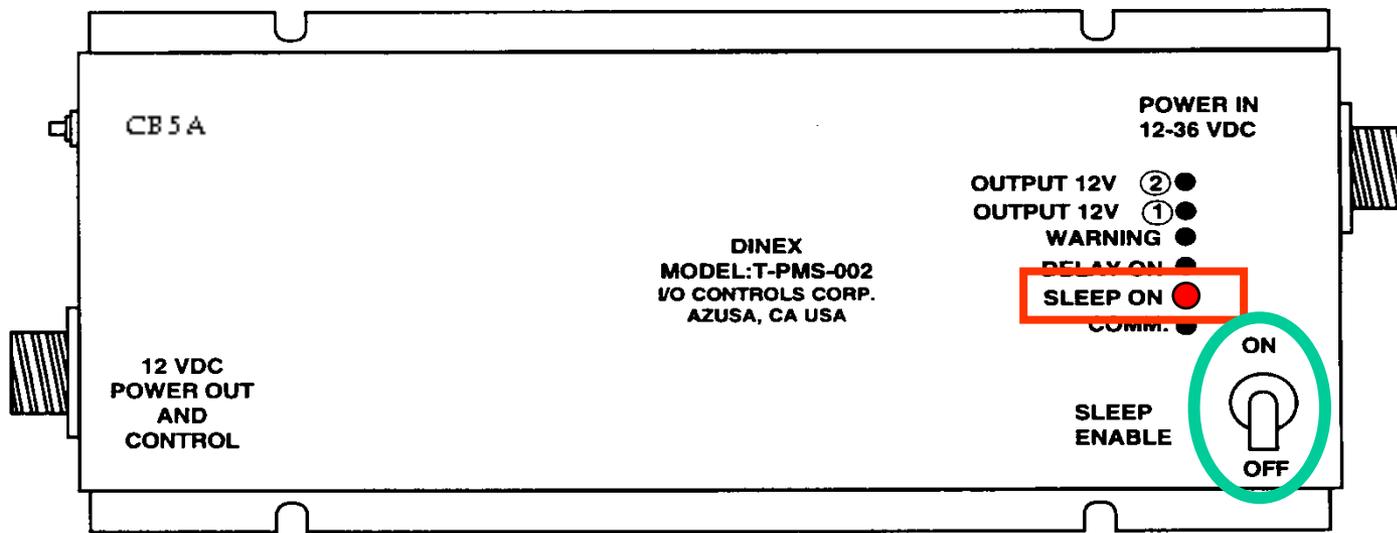
PMS LED INDICATORS

- **DELAY “ON”** Indicates when lit, the pre-programmed Sleep delay (70 minutes) has been activated. It starts the Sleep countdown when the master run switch is turned OFF.



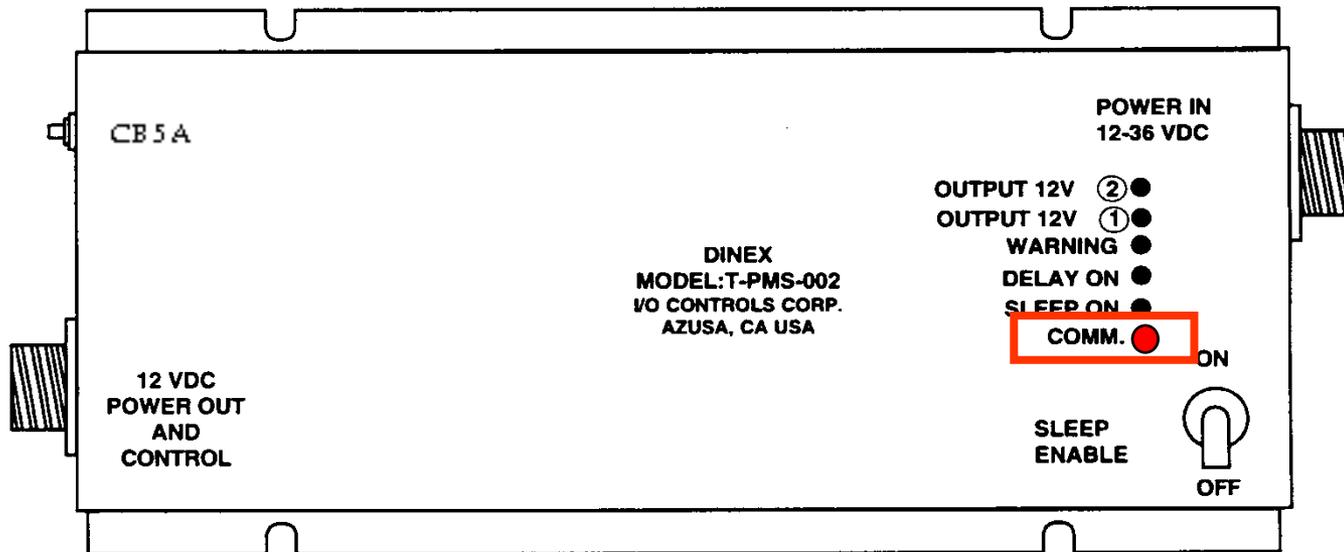
PMS LED INDICATORS

- **SLEEP “ON”** Indicates the Sleep delay timer (70 min.) has run out, power to all the I/O modules will be turned off if the Sleep Enable switch is ON.
- The sleep mode is designed for battery power conservation.
- If the Sleep Enable switch is “OFF”, the sleep timer will be ignored, and I/O module power will remain on.

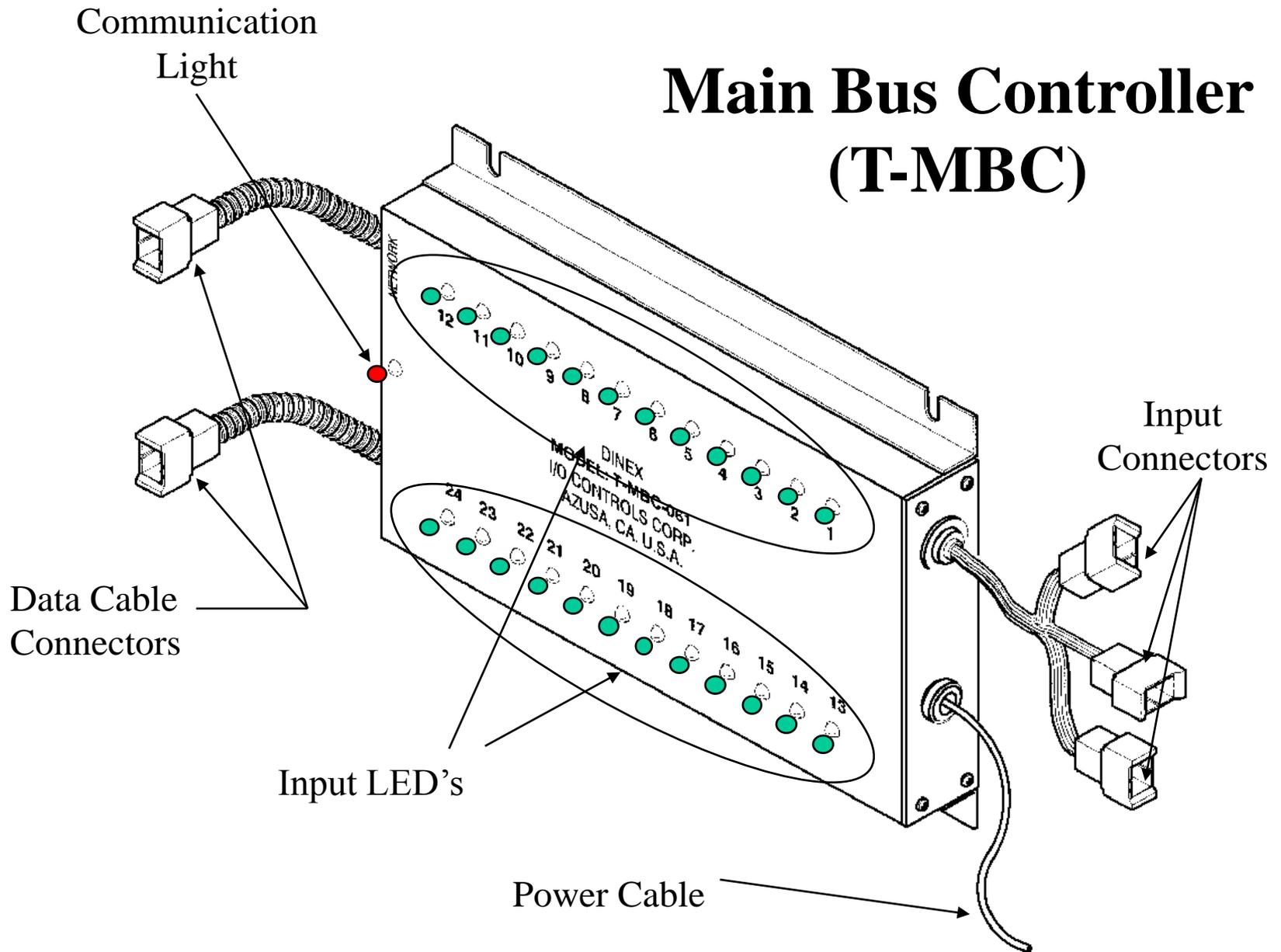


PMS LED INDICATORS

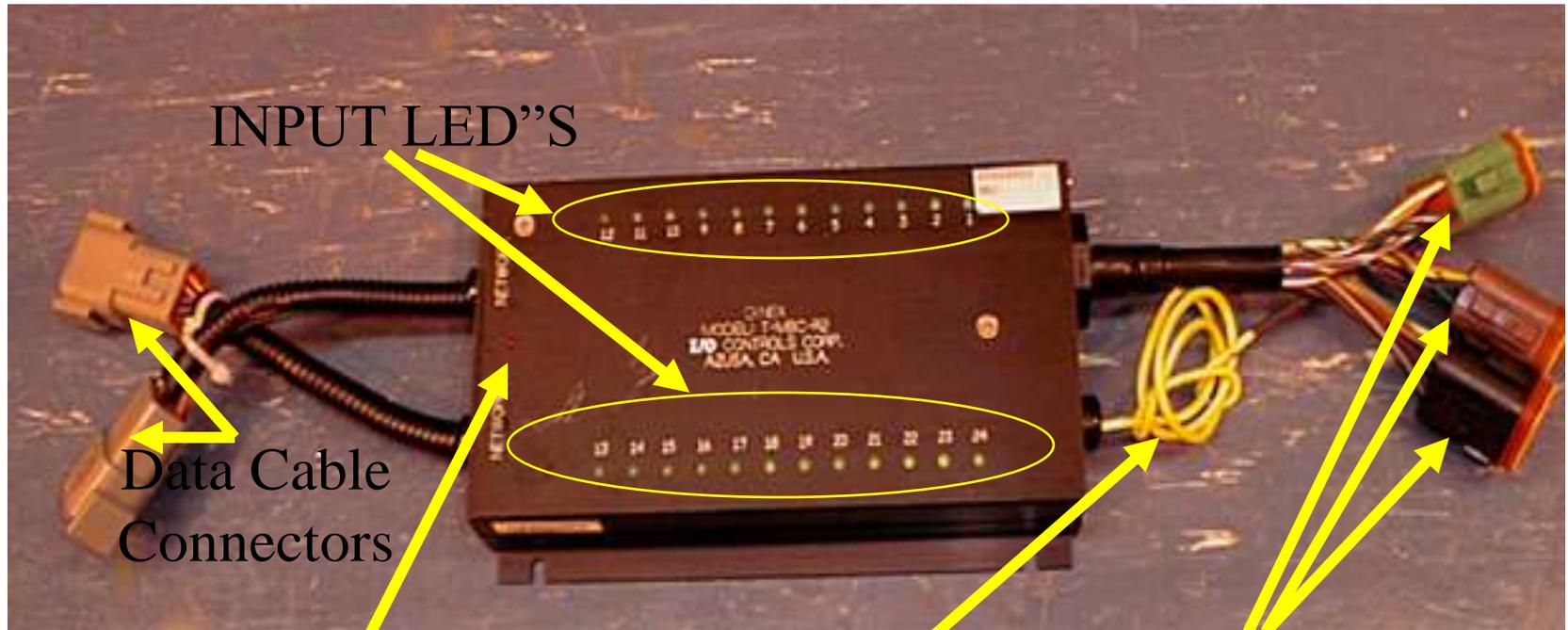
- **COMM.** This LED should only be flashing when PMS is being programmed. If on at any other time indicates a malfunction and the PMS should be replaced.



Main Bus Controller (T-MBC)



MAIN BUS CONTROLER (T-MBC)



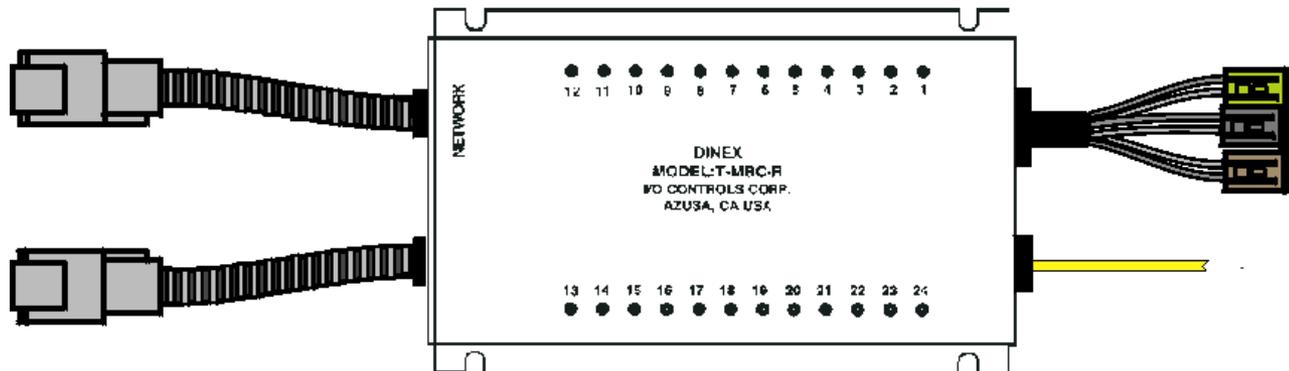
Communication Light

Power Cable

Input Connectors

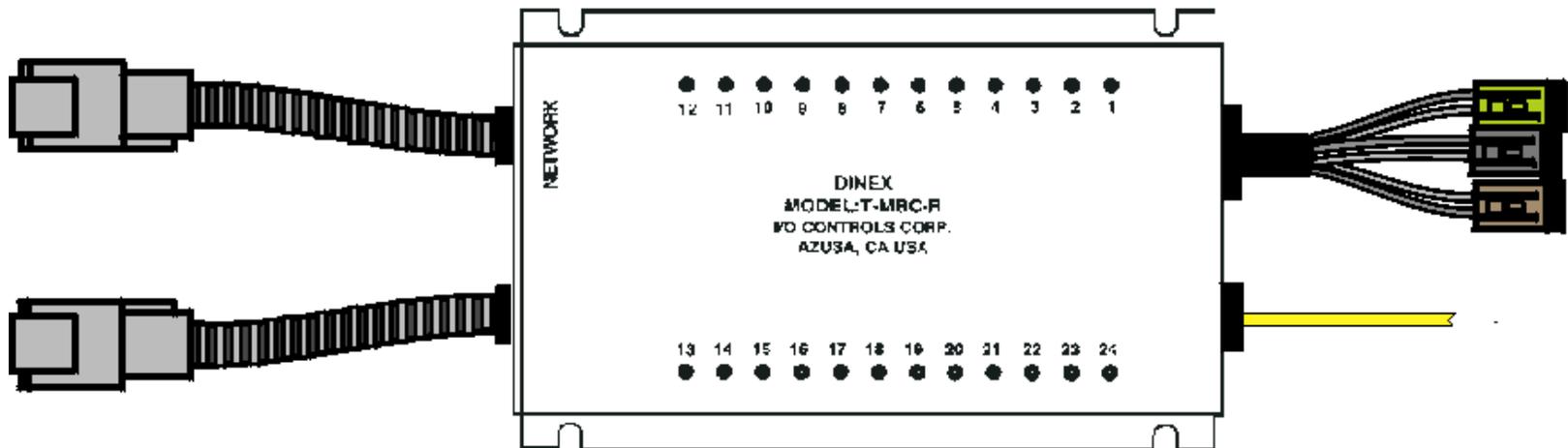
Main Bus Controller (MBC)

- Is the command post, NO control decisions are made without MBC.
- Interfaces with up to 24 **inputs**.
- Interfaces with switches: such as toggle, pressure, and limit switches.



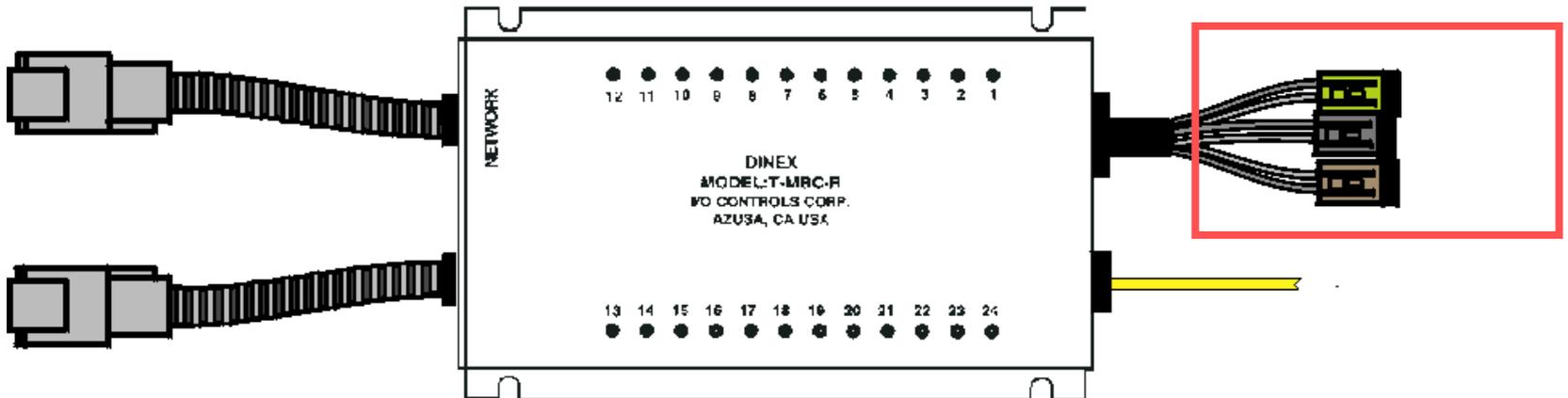
Main Bus Controller (MBC)

- Top level device in the Dinex system, it contains the control program.
- Makes all decisions for control.
- Can directly communicate with up to 16 modules.
- Strictly an input device. The **inputs** are in the form of ground from switches and sensors.
- Inputs are LED monitored. If a green LED is lit, MBC is receiving a ground input on that circuit.



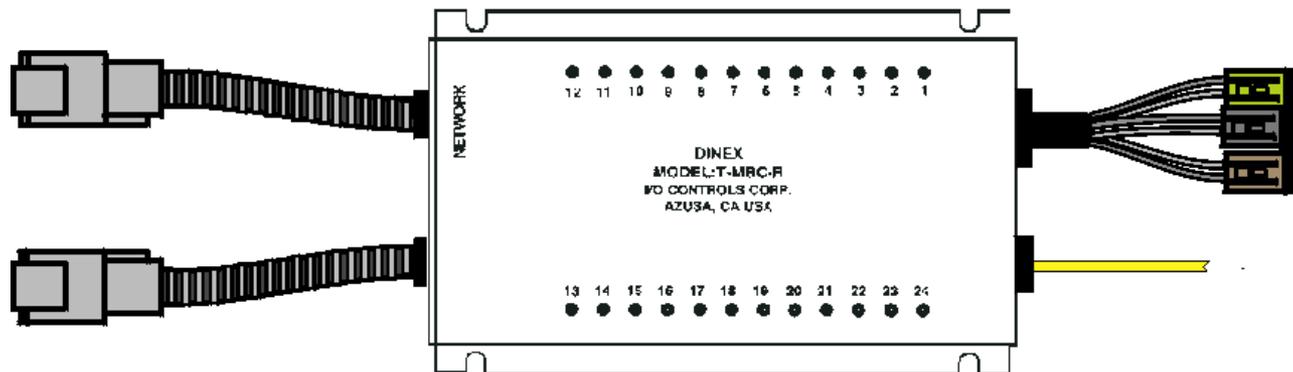
Main Bus Controller (MBC)

- There are three Deutsch style connectors in the top right hand corner of the MBC.
- These connectors interface MBC with vehicle **input** circuits.
- There are three Eight (8) pin connectors, one pin for each input LED.

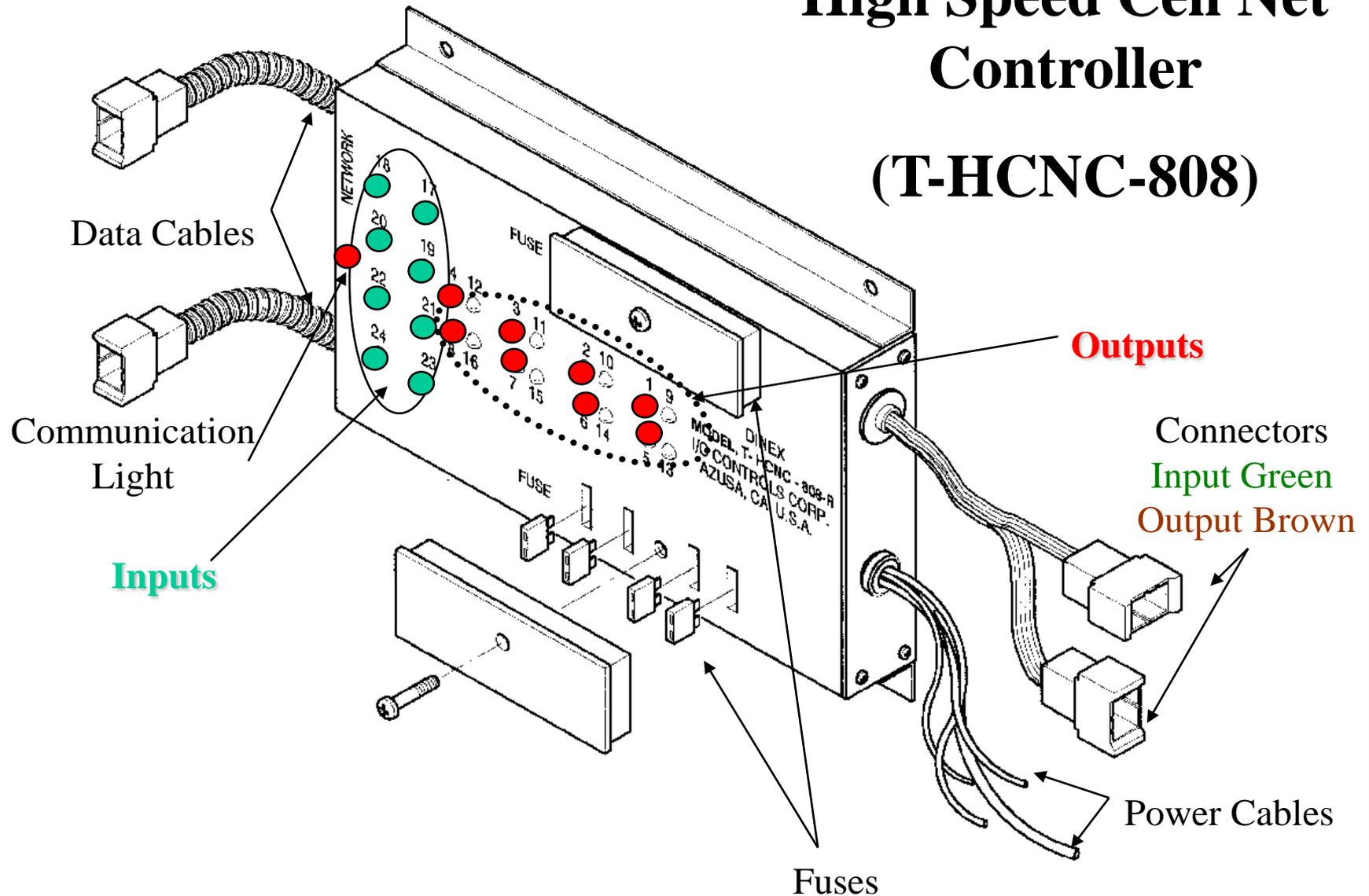


Main Bus Controller (MBC)

- **BROWN CONNECTOR**-Ground inputs to LED's number 1 through 8. (Pin 1 to LED 1, 2 to 2)
- **BLACK CONNECTOR**- Ground inputs to LED's number 9 through 16. (Pin 1 to Led 9, 2 to 10)
- **GREEN CONNECTOR**- Ground inputs to LED's number 17 through 24. (Pin 1 to LED 17, 2to18)
- **YELLOW WIRE**- Voltage for the module **GREEN LED's (24V)**.



High Speed Cell Net Controller (T-HCNC-808)

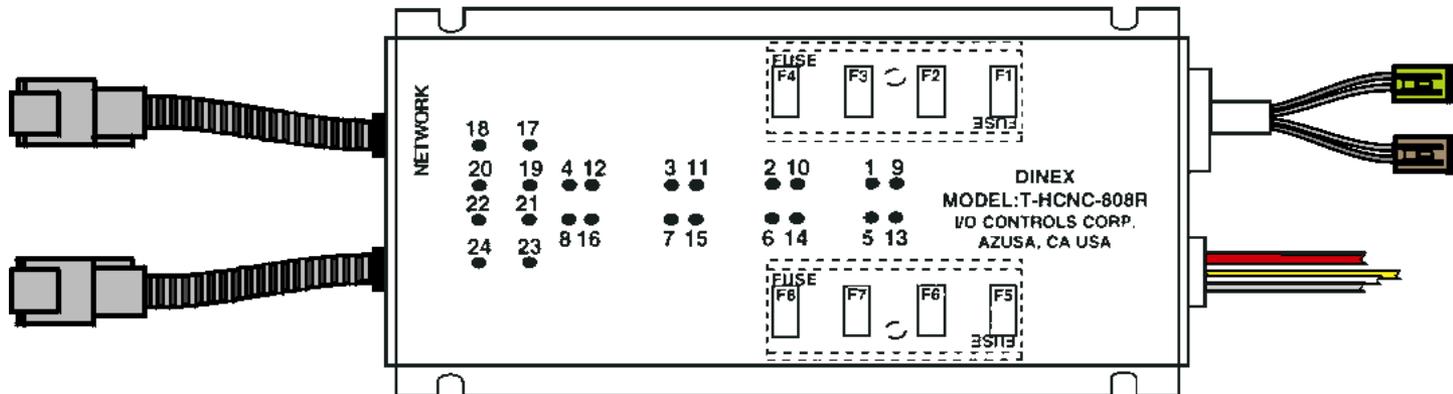


High Speed Cell Net Controller/HCNC-808

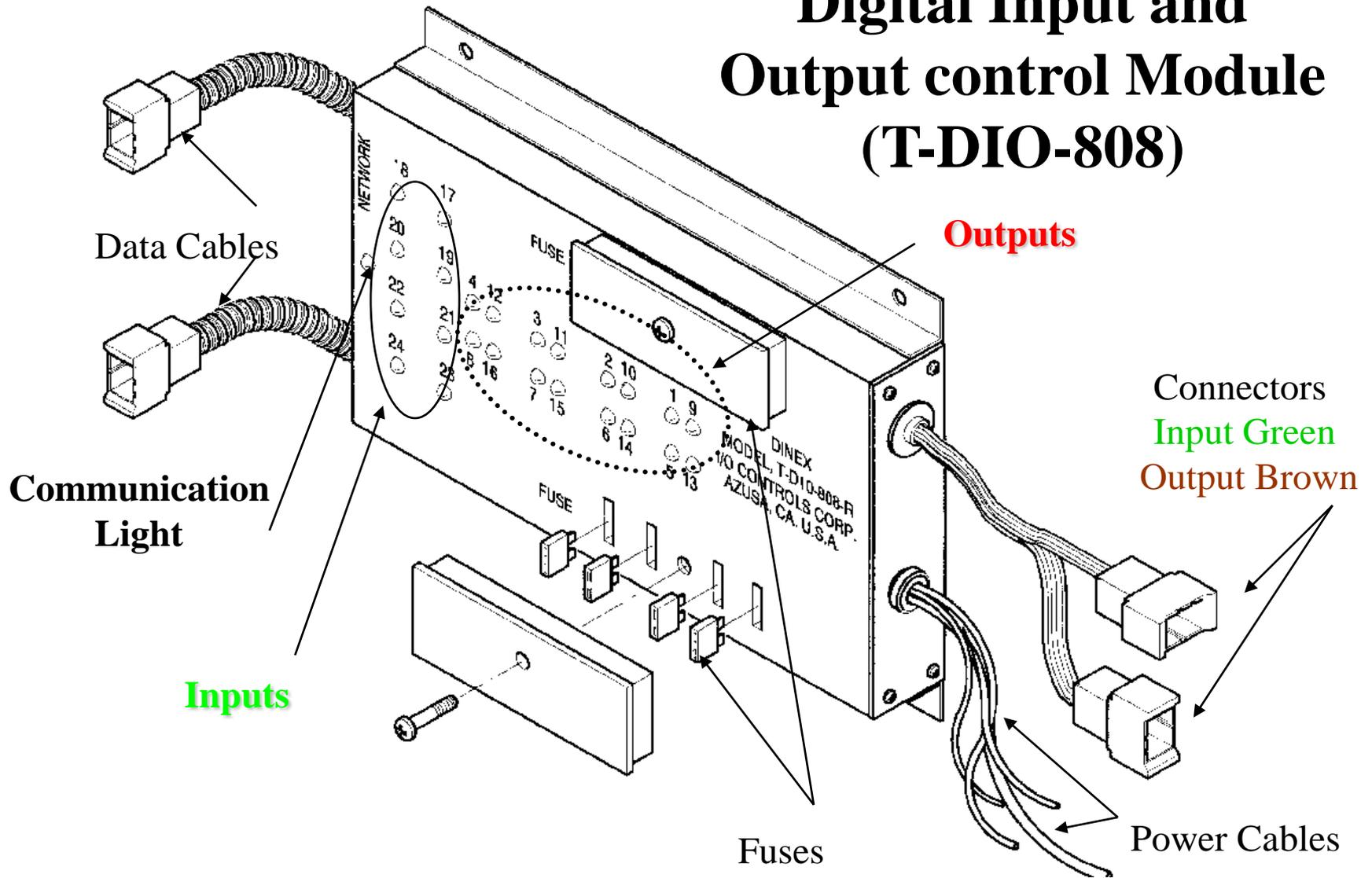
- **Programmable outputs** for time delay, flashers, sequencing, etc.
- Carries out commands from MBC for on/off devices.
- Interfaces with **inputs** from switches: such as toggle, limit and pressure switches. Also interfaces with other electronic devices.
- Can handle up to 8 **inputs** and 8 **outputs** (808).

High Speed Cell Net Controller/HCNC-808

- Must be **addressed** and **programmed** to function correctly.
- Used for tasks requiring multiple conditions.
- Has different colored LED's for diagnosis, and troubleshooting.

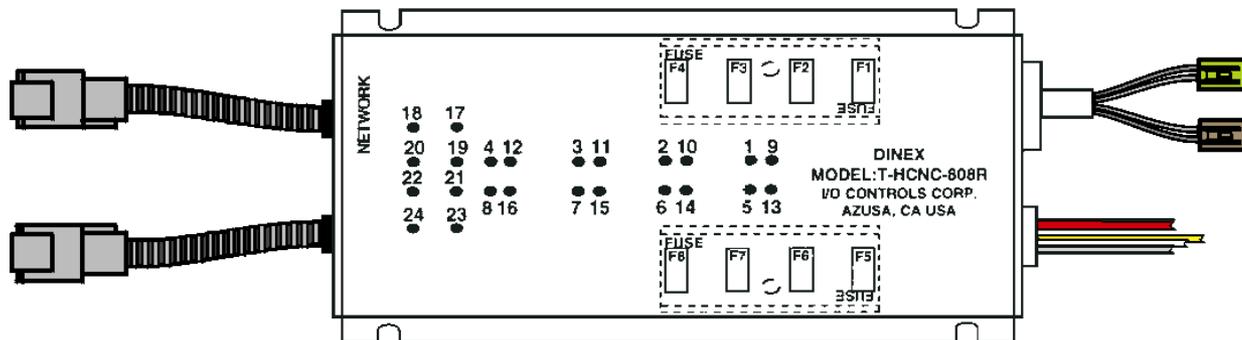


Digital Input and Output control Module (T-DIO-808)



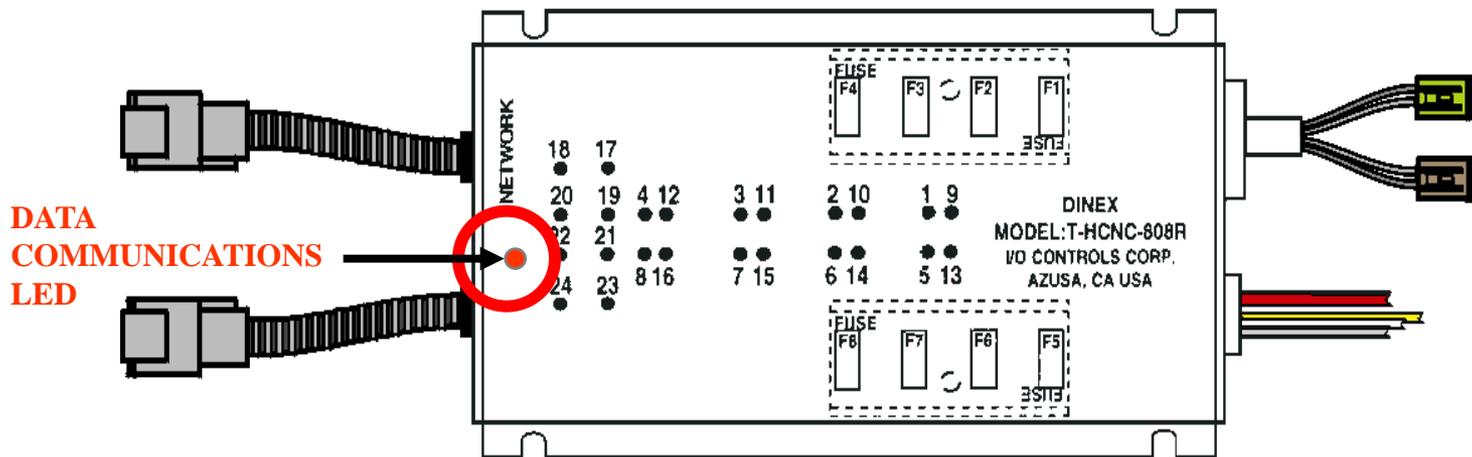
Digital Inputs and Output Controller/DIO-808

- Reaction module, **non-programmable** (except address)
- Interchangeable with other DIO-808 modules, if the address for the Zone location is installed.
- Handles 8 **INPUTS** and 8 **OUTPUTS** (808).
- Used for ON/OFF work only.
- LED indicators on DIO-808 modules operate and indicate the same information as HCNC-808 modules.
- Caution HCNC-808 and DIO-808 modules look alike replace like modules with like modules.



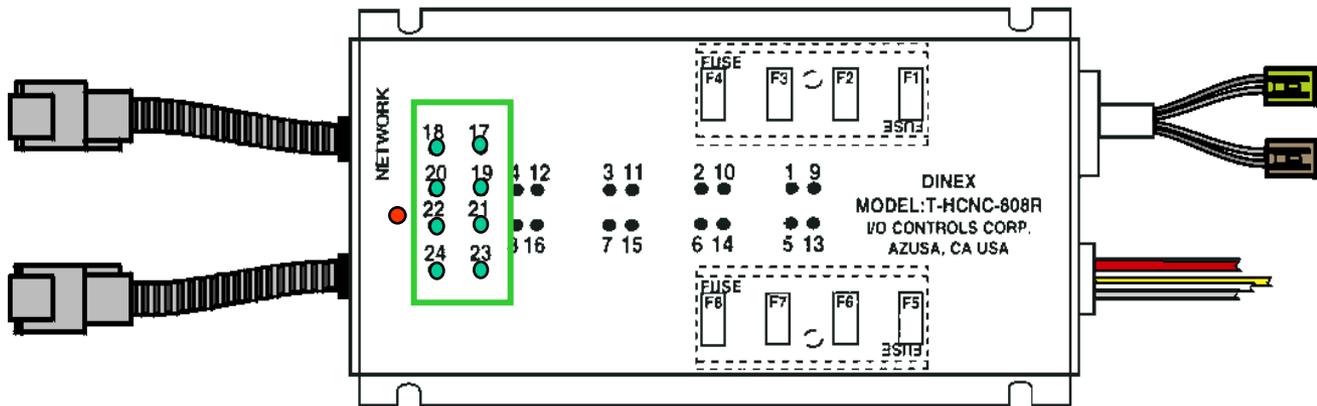
HCNC/DIO LED INDICATORS

- The “**RED**” Data Communications Status LED will flash rapidly whenever that I/O module is contacted by a control module.
- A flashing DCS indicates, that particular module is communicating with a control module.
- If not flashing, that module is not communicating/or LED failure. Check the Data communication loop sheet for additional information.



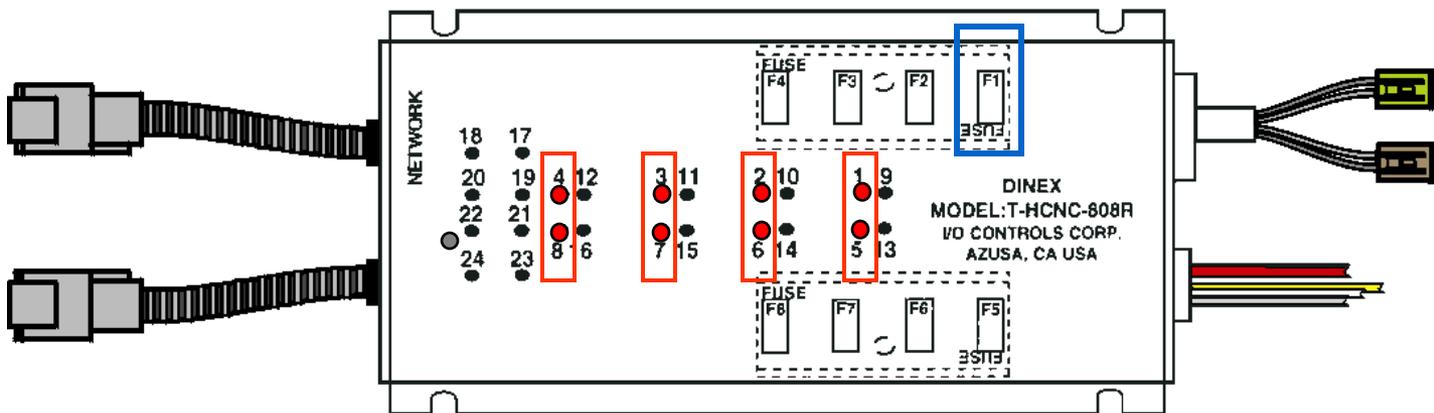
HCNC/DIO 808 LED INDICATORS

- A lit “**GREEN**” LED numbered 17 through 24 indicates a ground input has been made through a switch, sensor (etc.), attached to that particular **input**.
- When any of these “**GREEN**” LED’s light, and the module is contacted, a digital signal is generated, encoded, and transmitted. These digital signals are used for some type of control in the system.



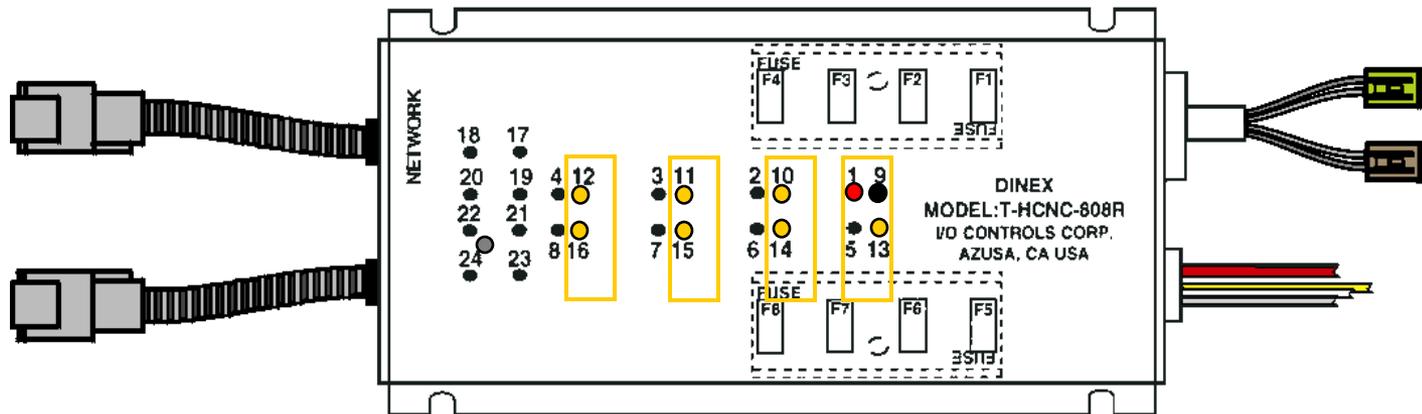
HCNC/DIO 808 LED INDICATORS

- “RED” LED’s 1 through 8 on the modules indicate that the module has decoded a digital command signal and should be applying voltage to the load device.
- Voltage sent to the loads can be either 12 VDC or 24 VDC.
- Fuses F1 through F8, control current flow for outputs 1 through 8. Fuse F1 to output 1 for example.



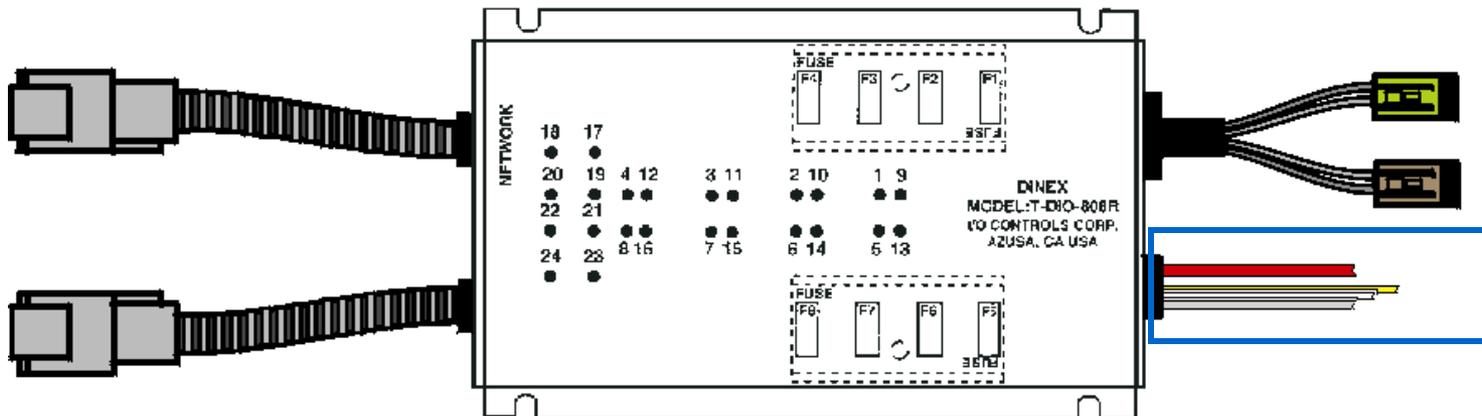
HCNC/DIO 808 LED INDICATORS

- “YELLOW OR AMBER” LED’s 9 through 16 are used to determine circuit continuity from the module through the **output** load circuit to ground (Circuit Check).
- When the “RED” LED is activated, the “YELLOW” LED should go **OFF**. Both the Red and Yellow lights **ON** indicate a blown fuse.



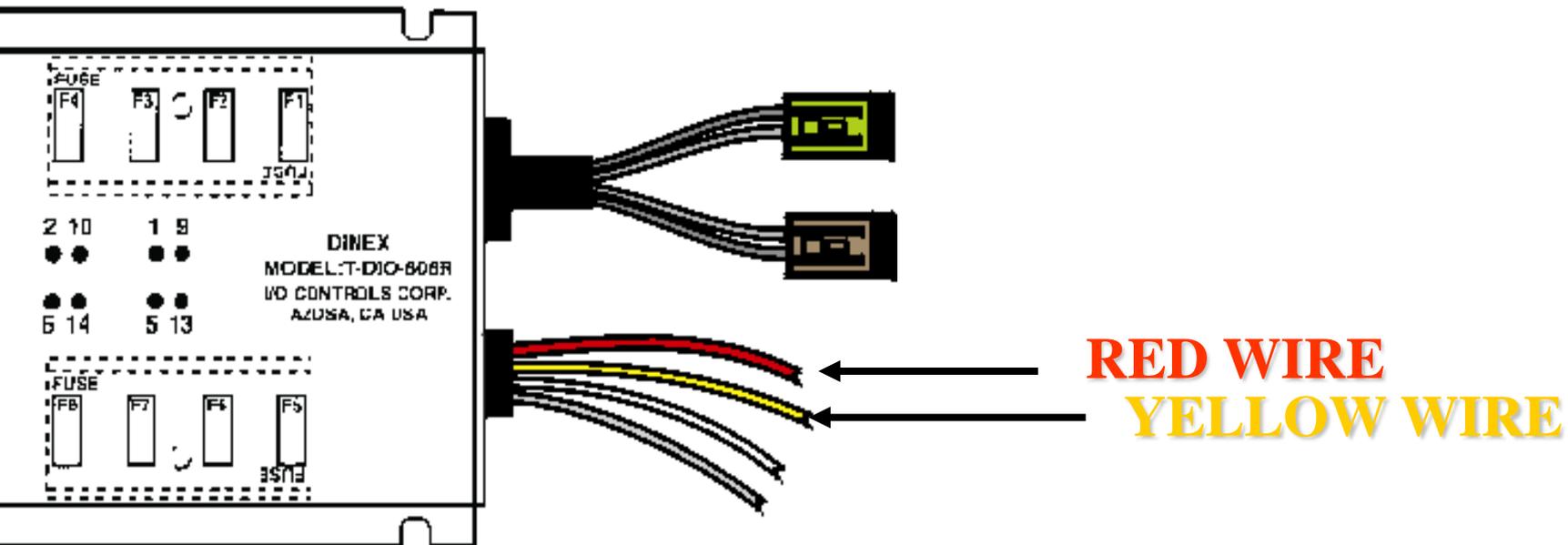
HCNC/DIO 808 POWER CABLES

- The Power Cables for all **808** modules consists of 4 wires.
- Power Cables supply current to the modules to run loads (Lights, Solenoids and all functions requiring power).
- These wires are located on the bottom right side of the HCNC's and DIO-808's.



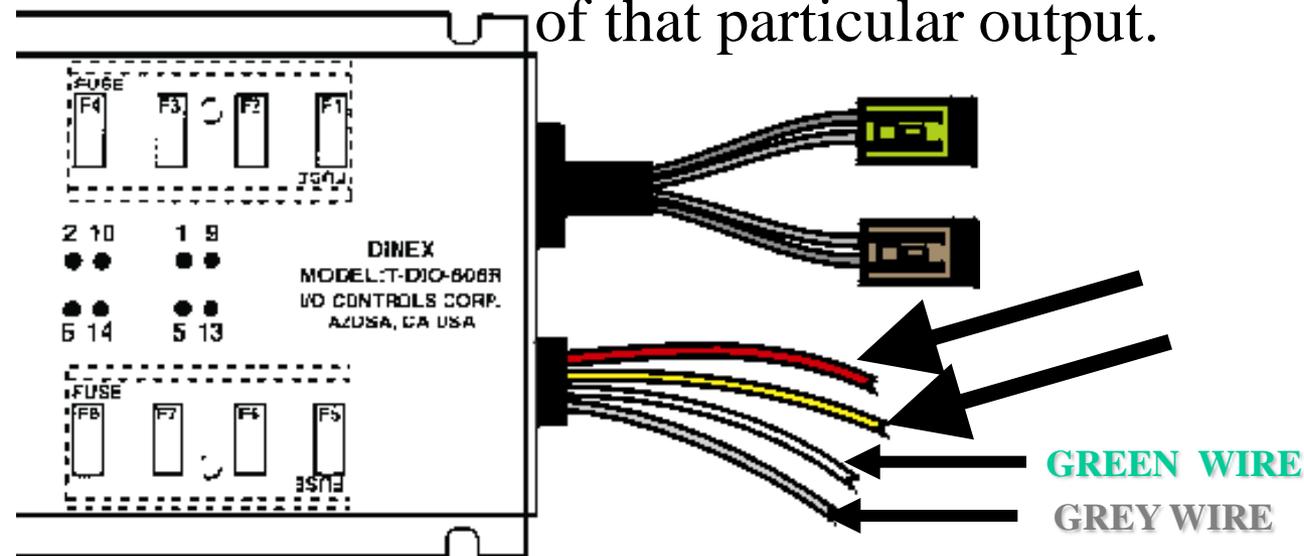
HCNC/DIO 808 POWER CABLES

- The **RED** Wire supplies current to outputs 1 through 6 (RED LED Indicators 1-6)
- The **YELLOW** wire supplies current to outputs 7 & 8 (RED LED Indicators 7-8)



HCNC/DIO 808 POWER CABLES

- The **GREY** wire supplies voltage to the **GREEN** LED's in the module. It is powered by 24 VDC.
- The **Green** w/**Yellow** tracer wire is connected to ground.
- The **RED** and **YELLOW** wires can be powered by either 12 VDC or 24 VDC. Their location will determine the voltage of that particular output.



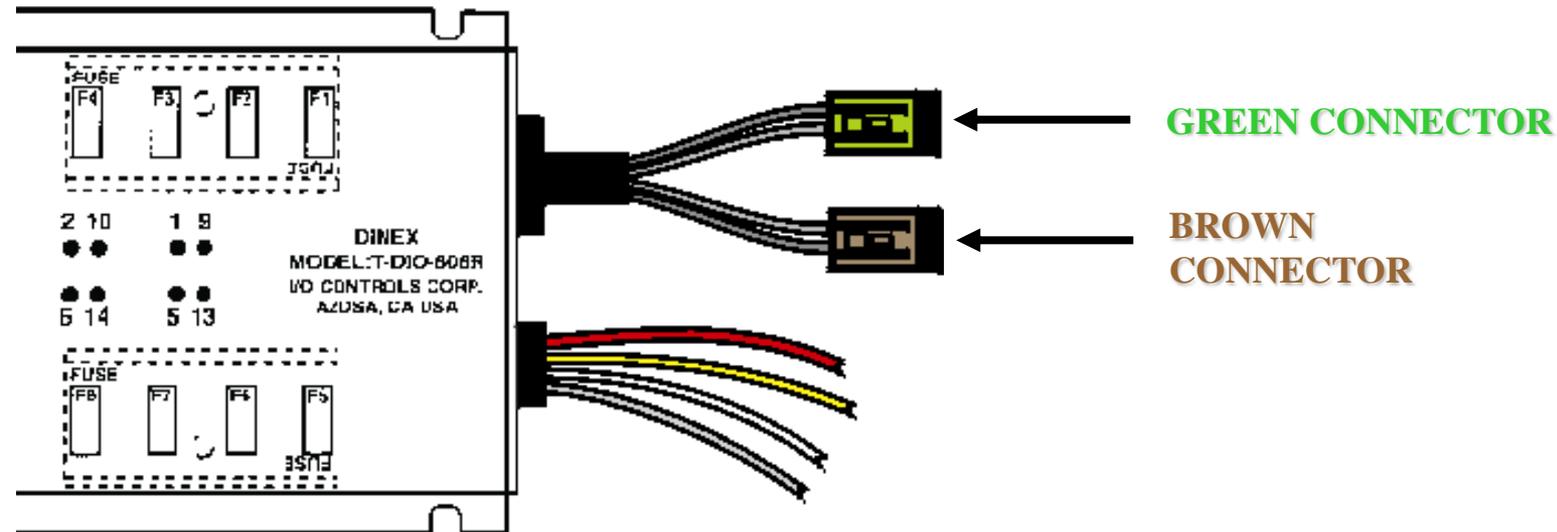
HCNC/DIO 808 GND/LOAD CONNECTORS

- **BROWN CONNECTOR**

Output connector Pin 1 to output LED 1, 2 to 2 etc.

- **GREEN CONNECTOR**

Input connector Pin 1 to input LED 17, 2 to 18, etc.

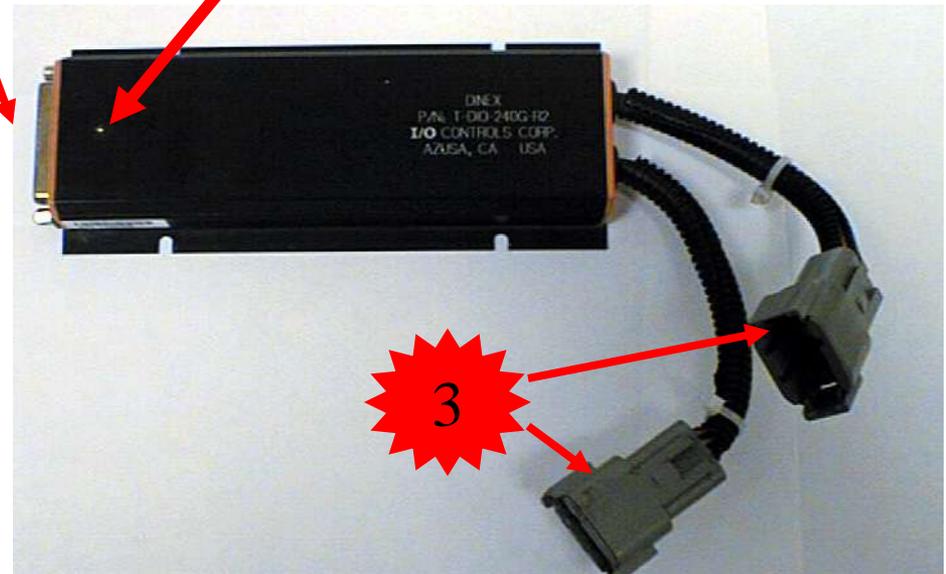


LED DRIVER (T-DIO-240LP)

1. 25 pin connector.

2. Communication light.

3. Data Cable connectors.



LED Driver (T-DIO-240LP)

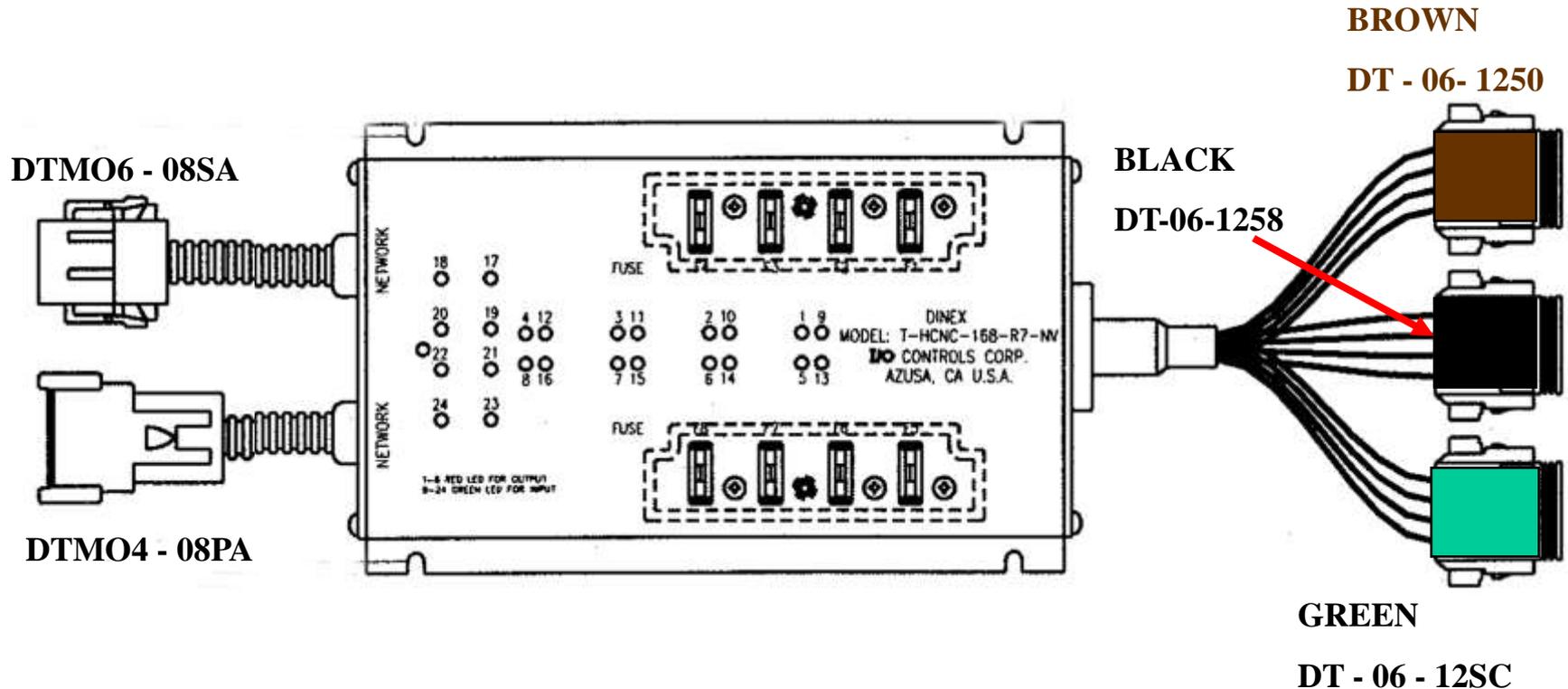
- Interfaces with the Driver's tell tale panel
- Powers the Tell Tale LED's
- Located under dash close to the tell tale panel
- Total of 24 outputs
- 25pin connector



LED Panel

- When master switch is turned “ON” all Tell-Tale LED’s are lit for several seconds to check LED operation.
- LED indicator lights are grounded and the 240LP LED Driver module provides power when the individual LED’s are to be lit.
- All Tell-Tale indicator lamps are digitally controlled.
- Tell-tale panels can only be replaced as individual assemblies.

High-speed Cell Network Controller HCNC-168

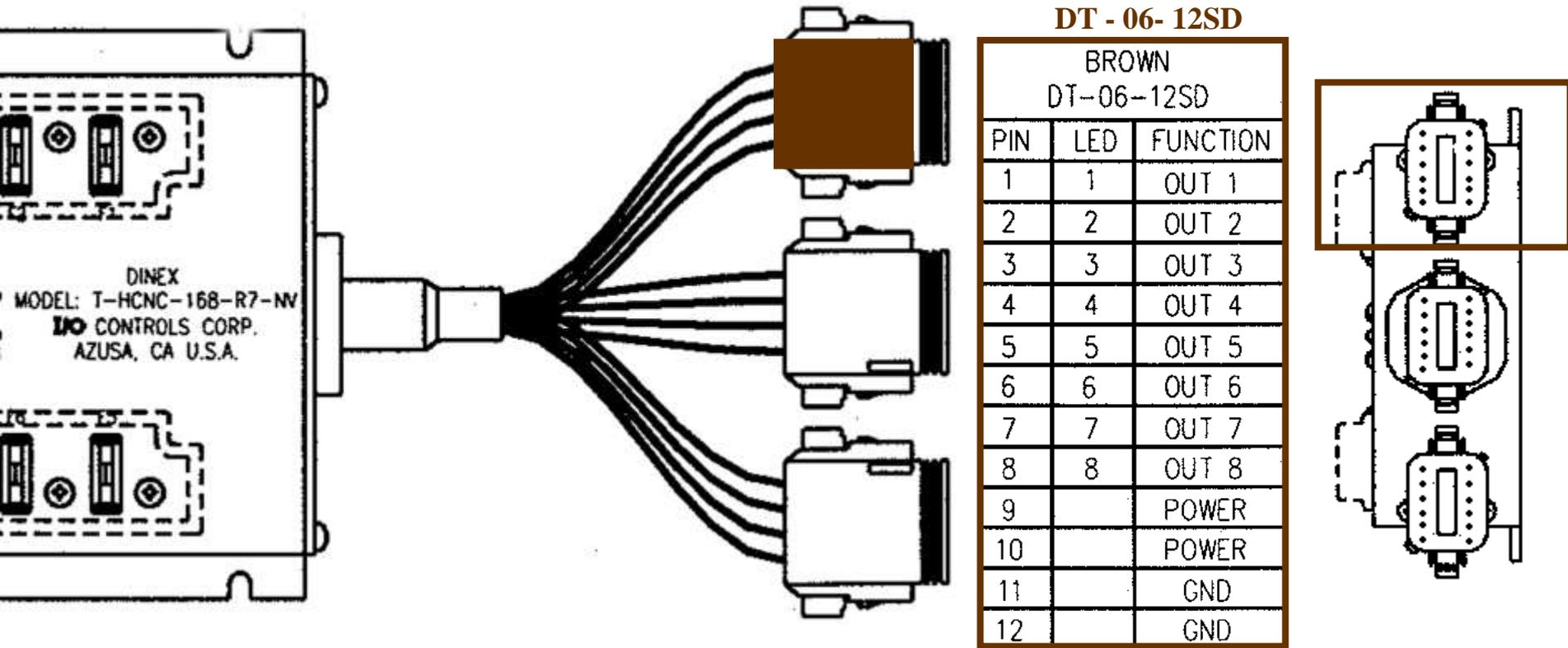


8 Source output with 10/A each output and total current of 8 outputs at less than 20 A.

HCNC 168

- Has **16 INPUTS** and **8 OUTPUTS**.
- Red LED's 1 through 8 when on indicate active **OUTPUTS**.
- Brown **OUTPUT** connector: Pins 1 - 8 individual outputs. Pins 9 & 10 power and Pins 11 & 12 ground.

High-speed Cell Network Controller HCNC-168



HCNC-168

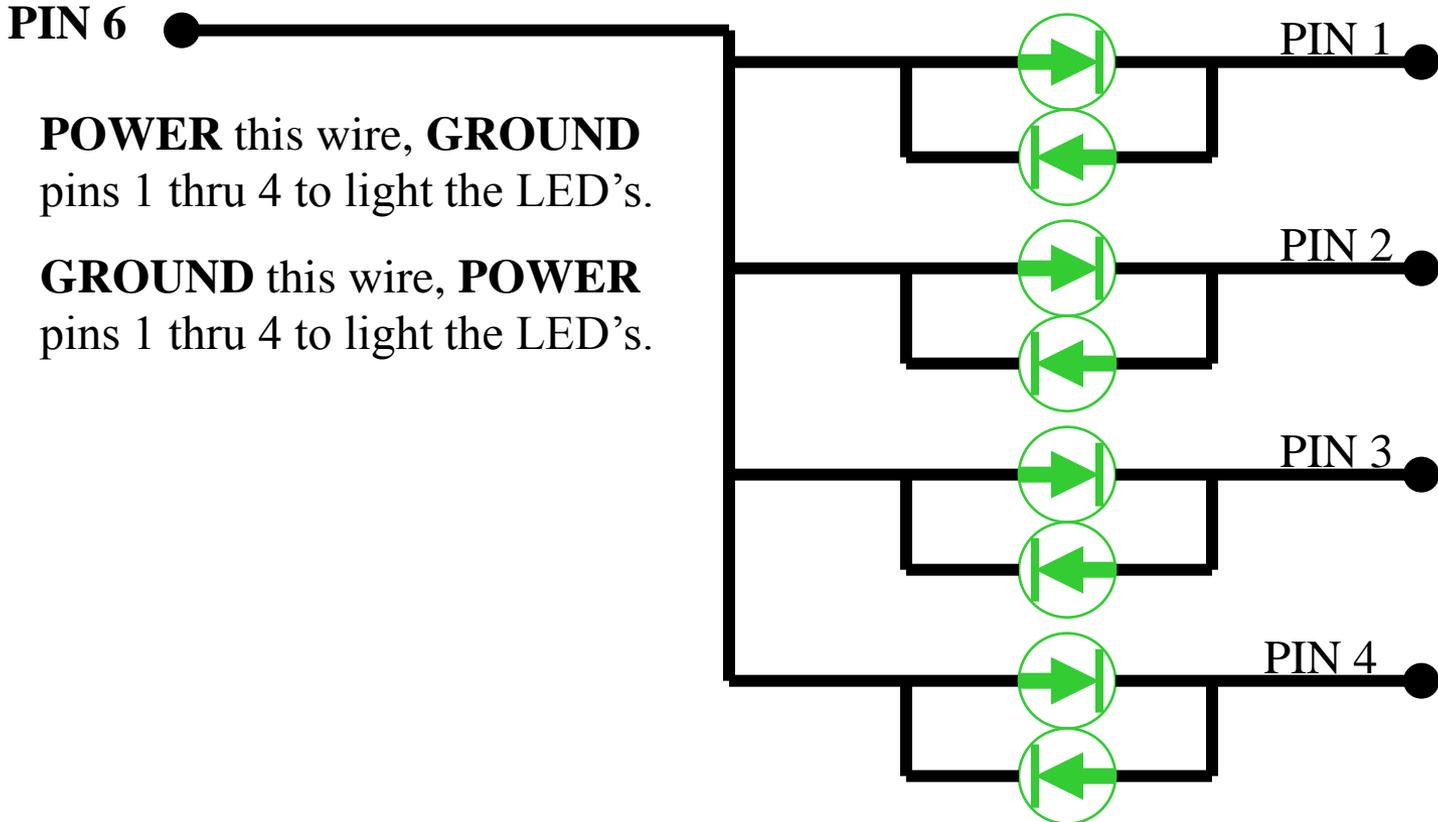
- Green LED's 9 through 24 are **INPUTS**.
- The Yellow / Amber LED's 9 through 16 are replaced with **GREEN** LED's now, representing **INPUTS**, NOT continuity.
- **Input** wiring is broken down into four groups of six wires for the Black and Green Connectors.
- Four wires are common to the sixth with the fifth one spare.

HCNC-168

- When the sixth wire is connected to ground the inputs will have a power source.
- When the sixth wire is connected to power the inputs will have a ground source.

HCNC 168 INPUT LED's BLACK OR GREEN CONNECTOR.

GREEN
LED's

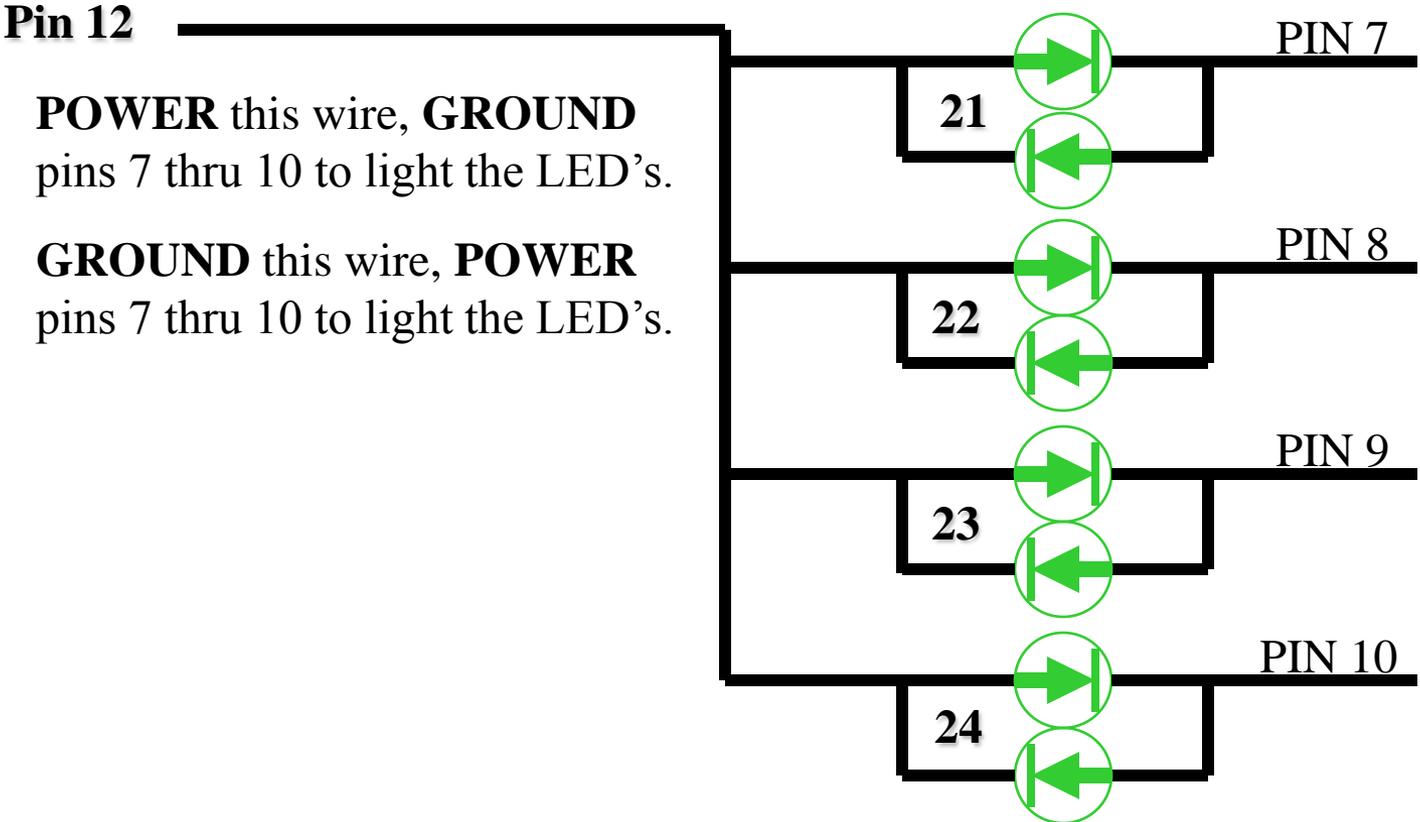


POWER this wire, **GROUND** pins 1 thru 4 to light the LED's.

GROUND this wire, **POWER** pins 1 thru 4 to light the LED's.

HCNC 168 INPUT LED's BLACK OR GREEN CONNECTOR.

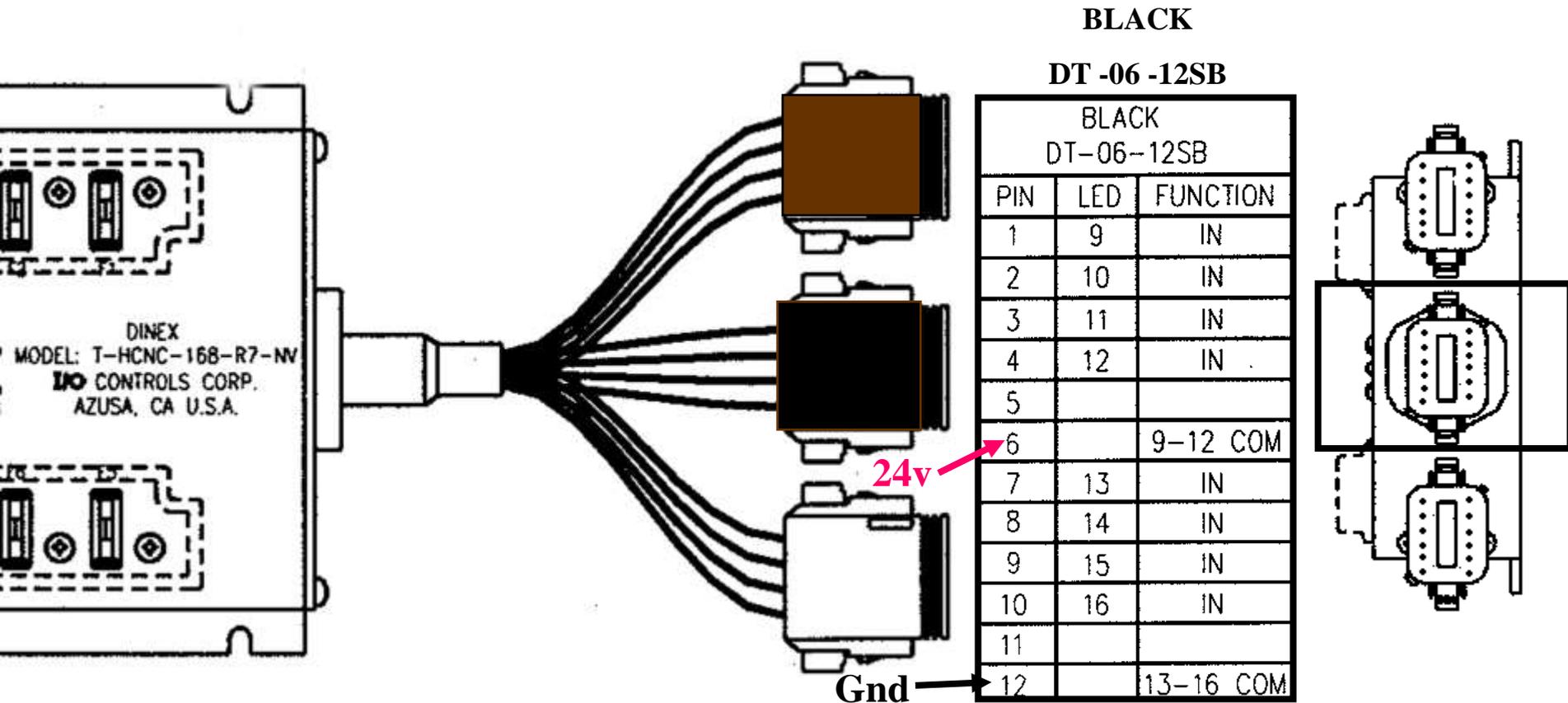
GREEN
LED's



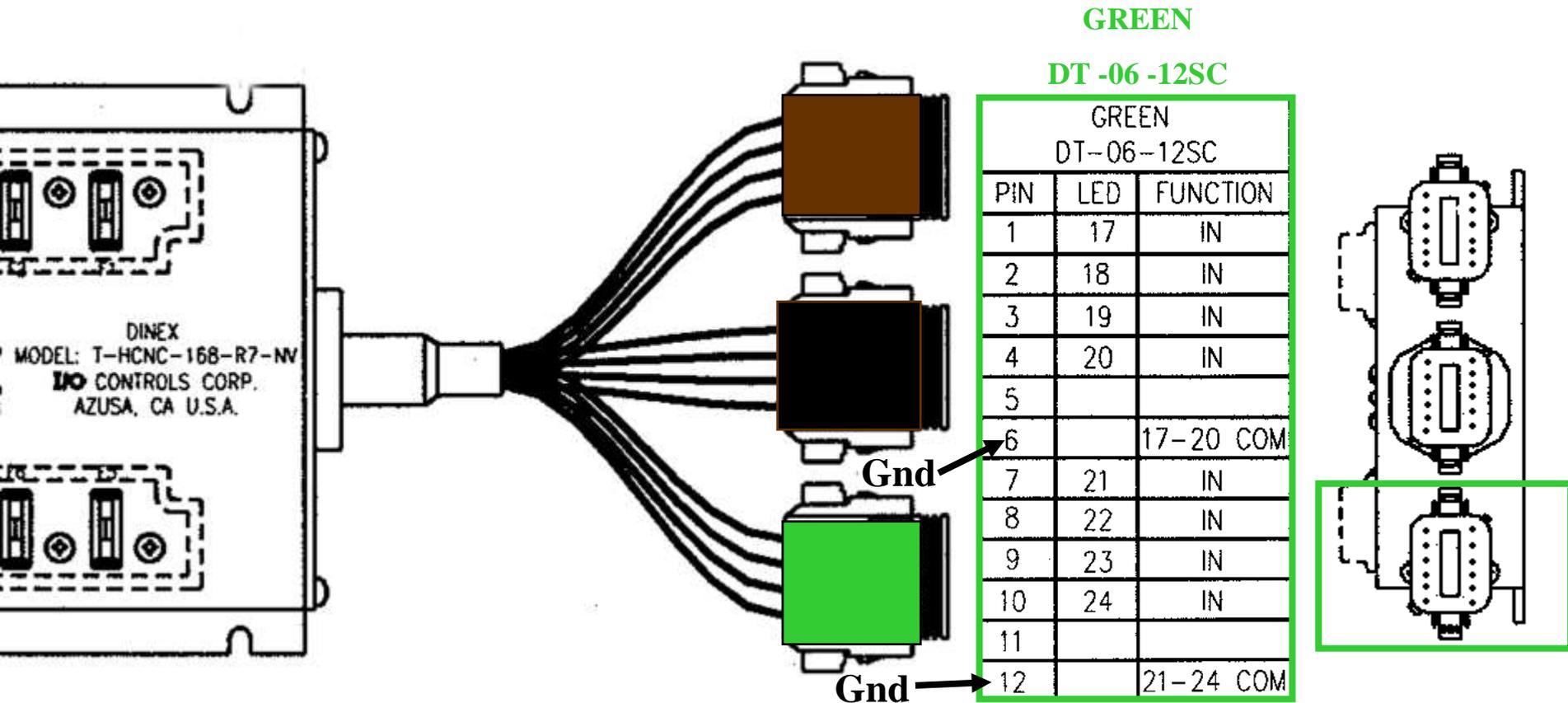
HCNC -168

- Black **INPUT** connector: Pins 1 - 4 = LED's 9 - 12, 5 spare and 6 common (power or ground).
- Black **INPUT** connector: Pins 7 - 10 = LED's 13 -16, 11 spare and 12 common (power or ground).
- Green **INPUT** connector: Pins 1 - 4 = LED's 17 - 20, 5 spare and 6 common (power or ground).
- Green **INPUT** connector: Pins 7 - 10 = LED's 21 -24, 11 spare and 12 common (power or ground).

High-speed Cell Network Controller HCNC-168

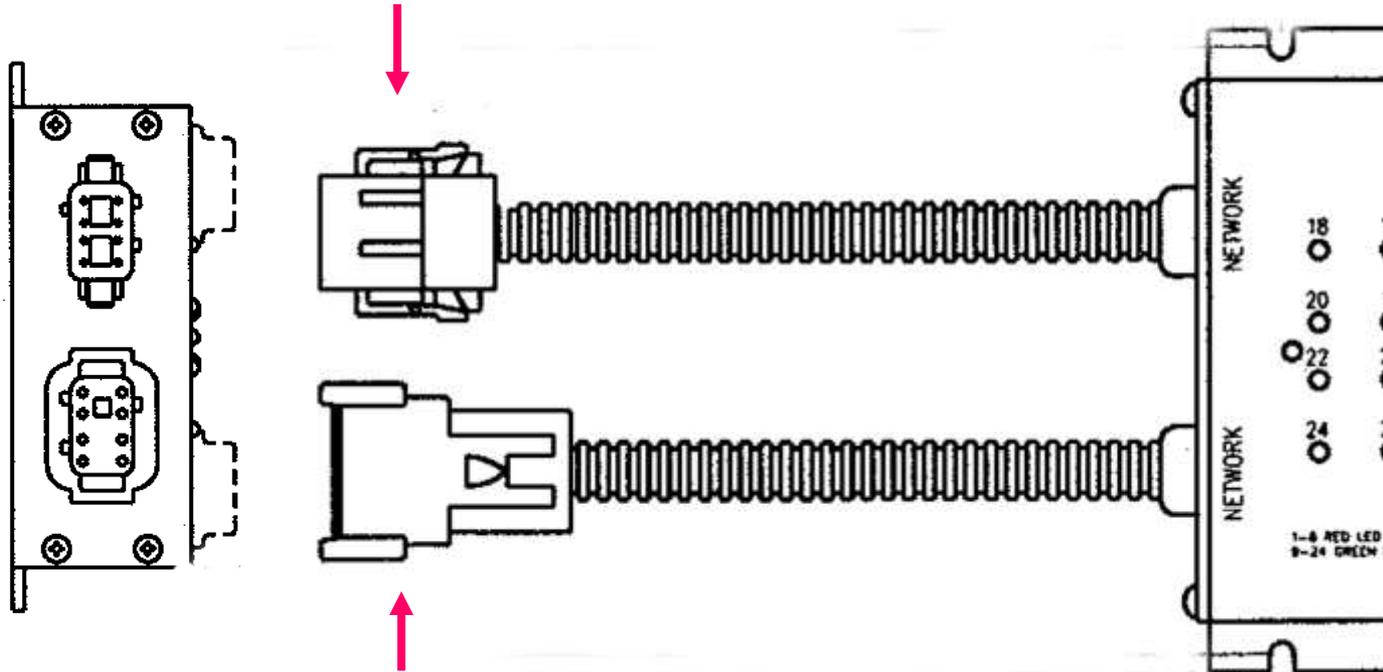


High-speed Cell Network Controller HCNC-168



High-speed Cell Network Controller HCNC-168

CONNECTION TO NEXT MODULE



CONNECTION TO NEXT MODULE

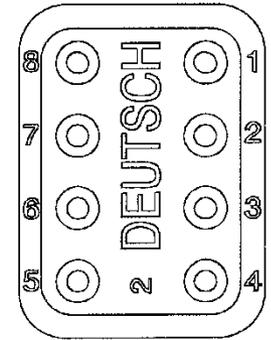
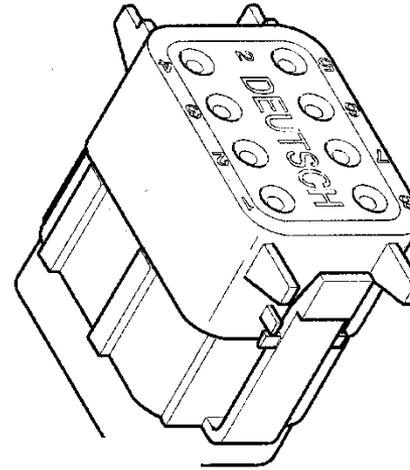
DATA CABLES

- Data cables carry all digital signals back and forth between the MBC and all the other Dinex modules not directly connected together.
- Data cables carry power to all the modules.
- These cables consist of six small gage wires in twisted pairs.
- The remaining wires provide shielding.

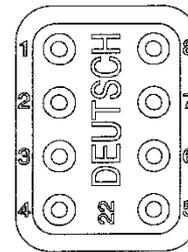
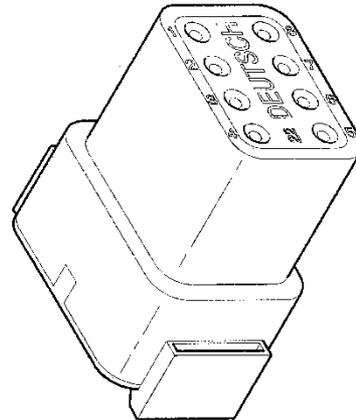
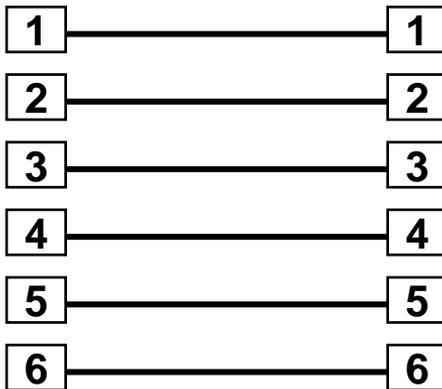
DATA CABLES

- Data cables use Deutsch type terminal ends one male and one female.

MALE



**TYPE
CONNECTION**



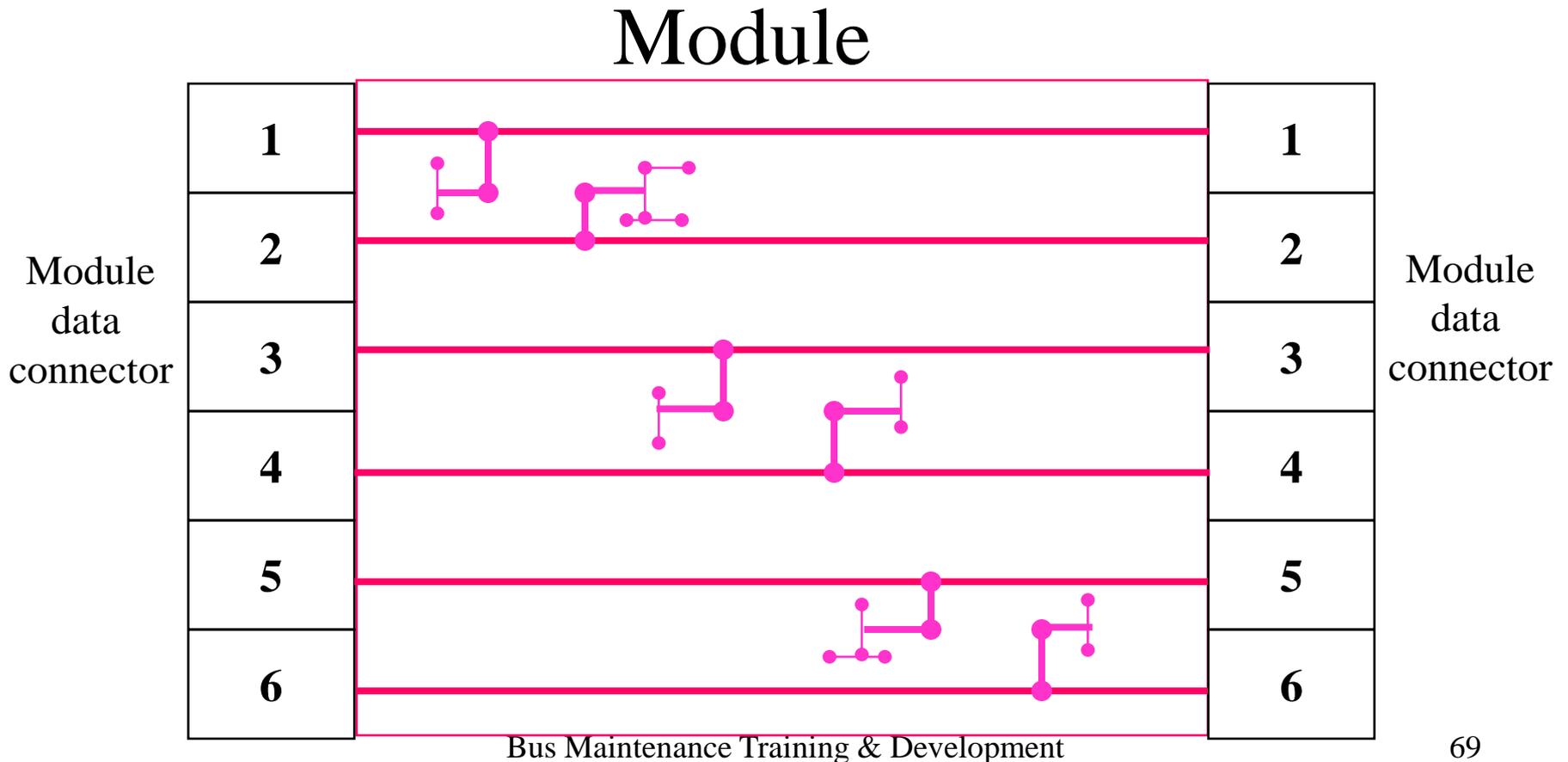
FEMALE

Data Cable Configuration

- The twisted pair configuration is: 3 White 4 Black, 1 Red 2 Black, 5 Green 6 Black.
- Pins 1 and 2, Red + Black = Data.
- Pins 3 and 4, White + Black = Power/Ground.
- Pins 5 and 6, Green + Black = Program.
- Module wire configuration is: Yellow 1, Green 2, Red 3, Black 4 , Orange 5, Gray 6, Purple 7 , Blue 8.
- Data Junction 1 Red, 2 Black, 3 White, 4 Black, 5 Green, 6 Black, 7 shield, 8 ground.

Internal Module Wiring

- The circuits are basically straight through from Pin 1 to Pin 1, 2 to 2, 3 to 3, etc.
- The modules internal data and power circuits connect to these lines passing through.



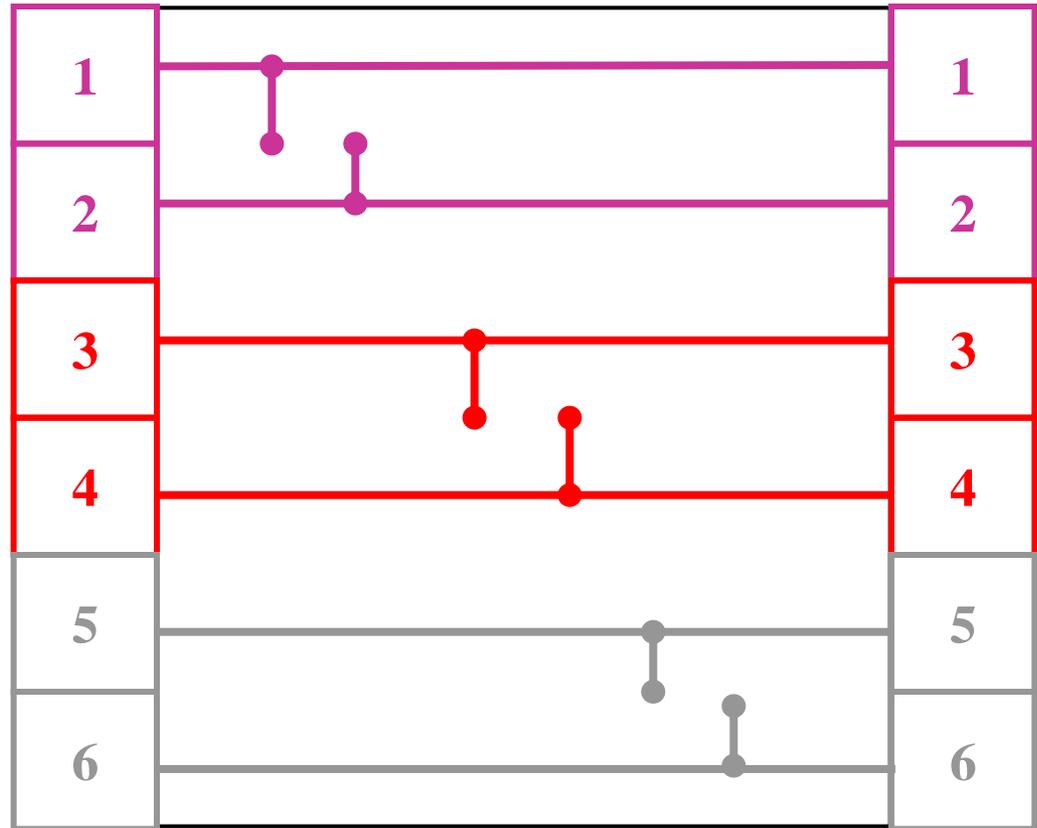
Module Port Configuration

•Pins 1 & 2. Data port where the module listens for its ID # then responds from, back to the Control Module (MBC).

•Pin 3, 12V power from PMS.

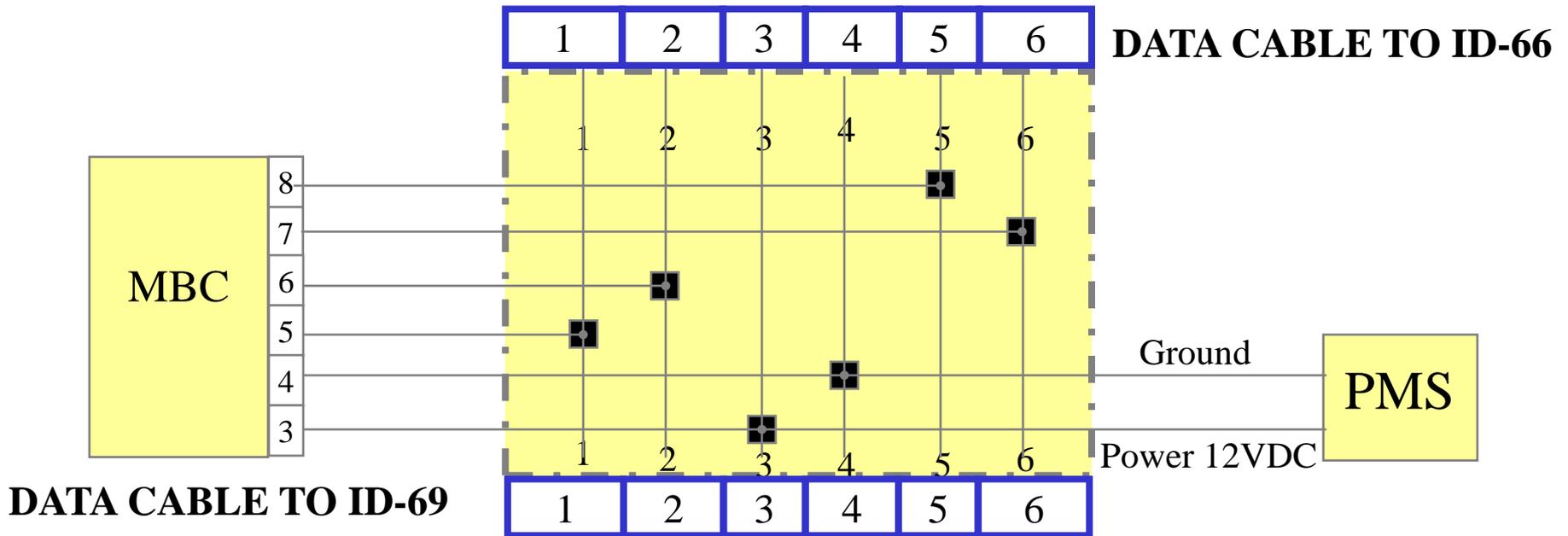
•Pin 4, Ground from PMS.

•Pins 5 & 6. Used for programming.



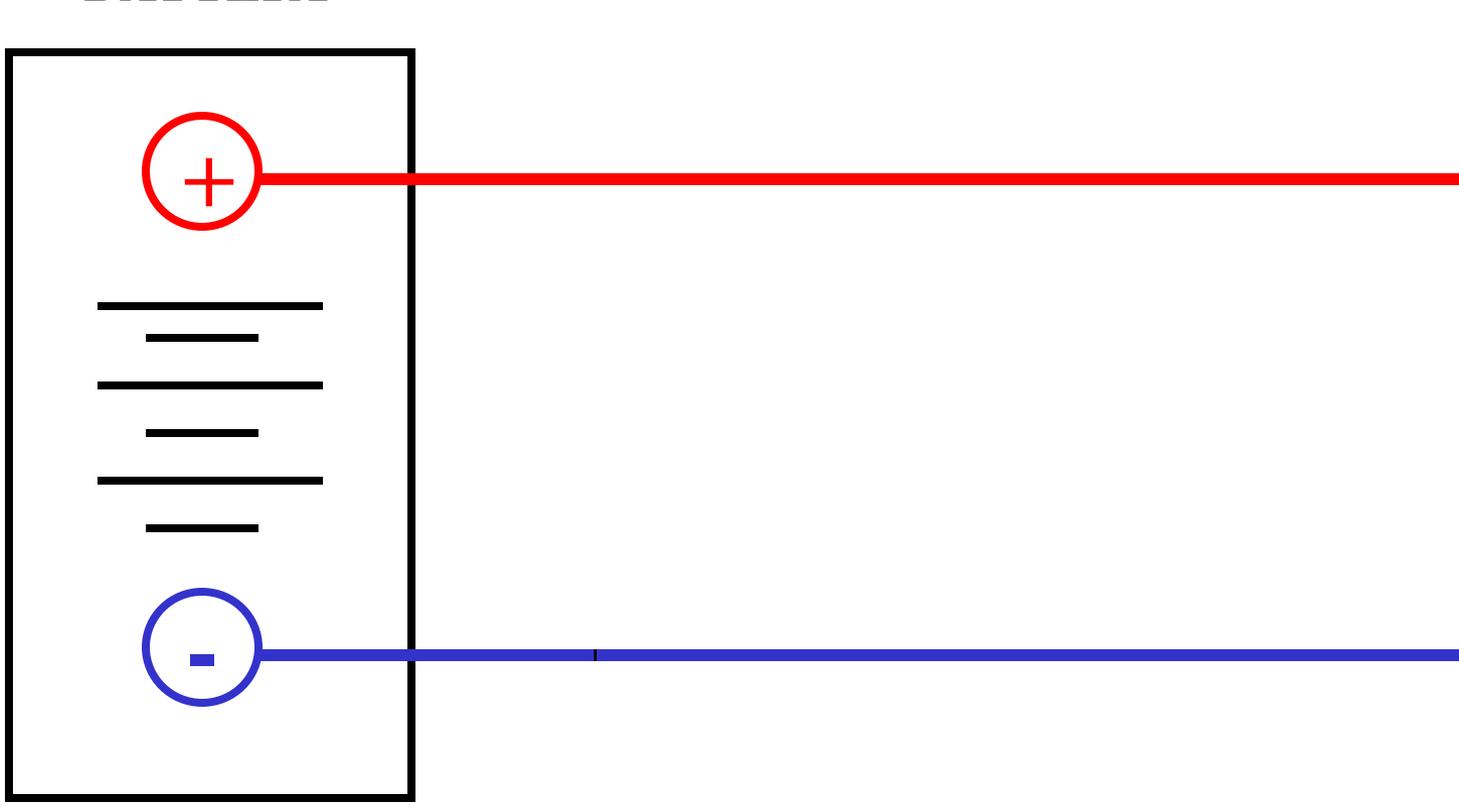
Data Loop Junction

- The data loop junction ties the two ends of the data loop together.
- Allows 12 VDC power and ground from the PMS, to enter the data loop.
- Allows data from the MBC, to enter the data loop.

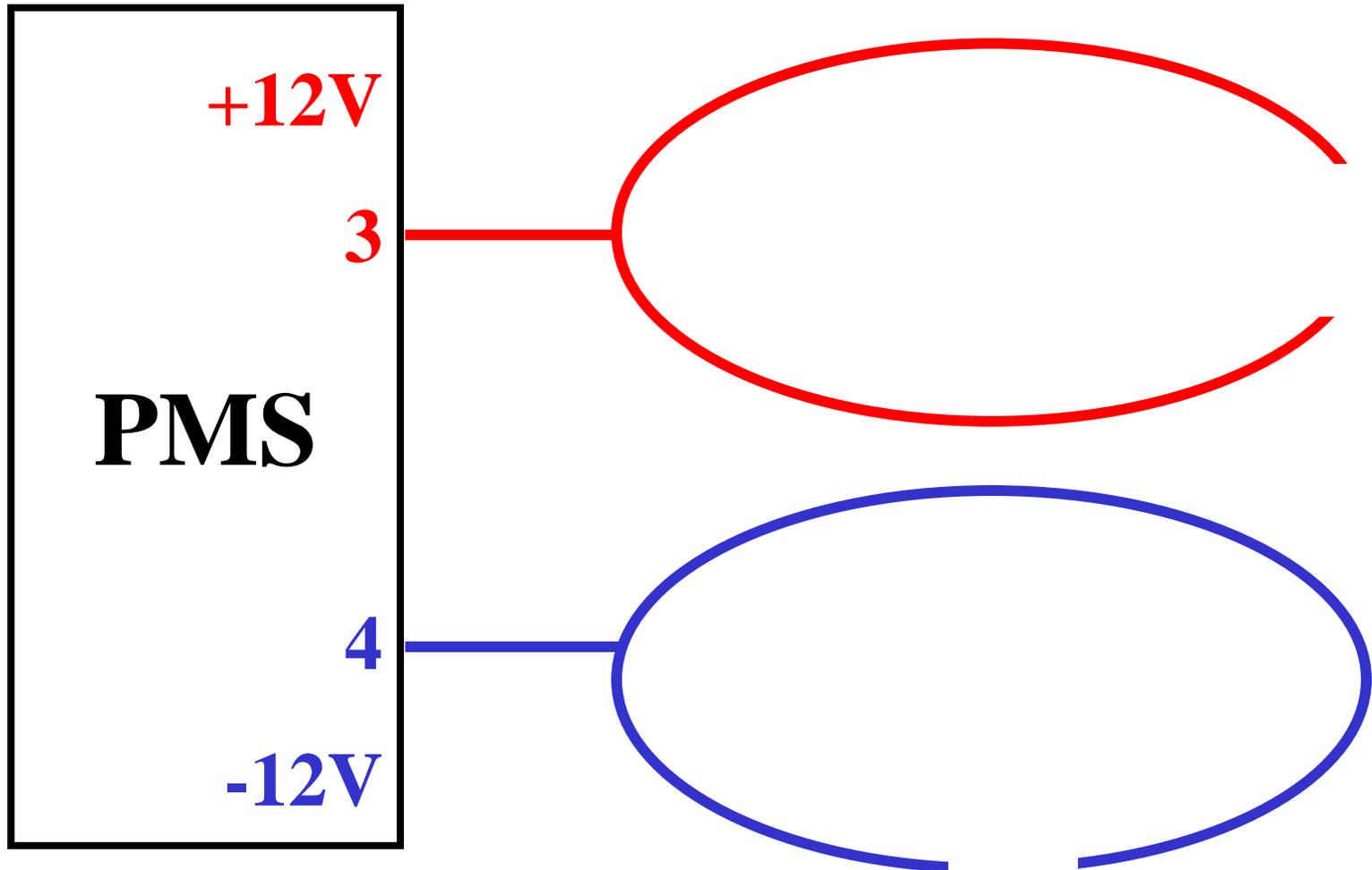


POWER LOOP

BATTERY



POWER LOOP

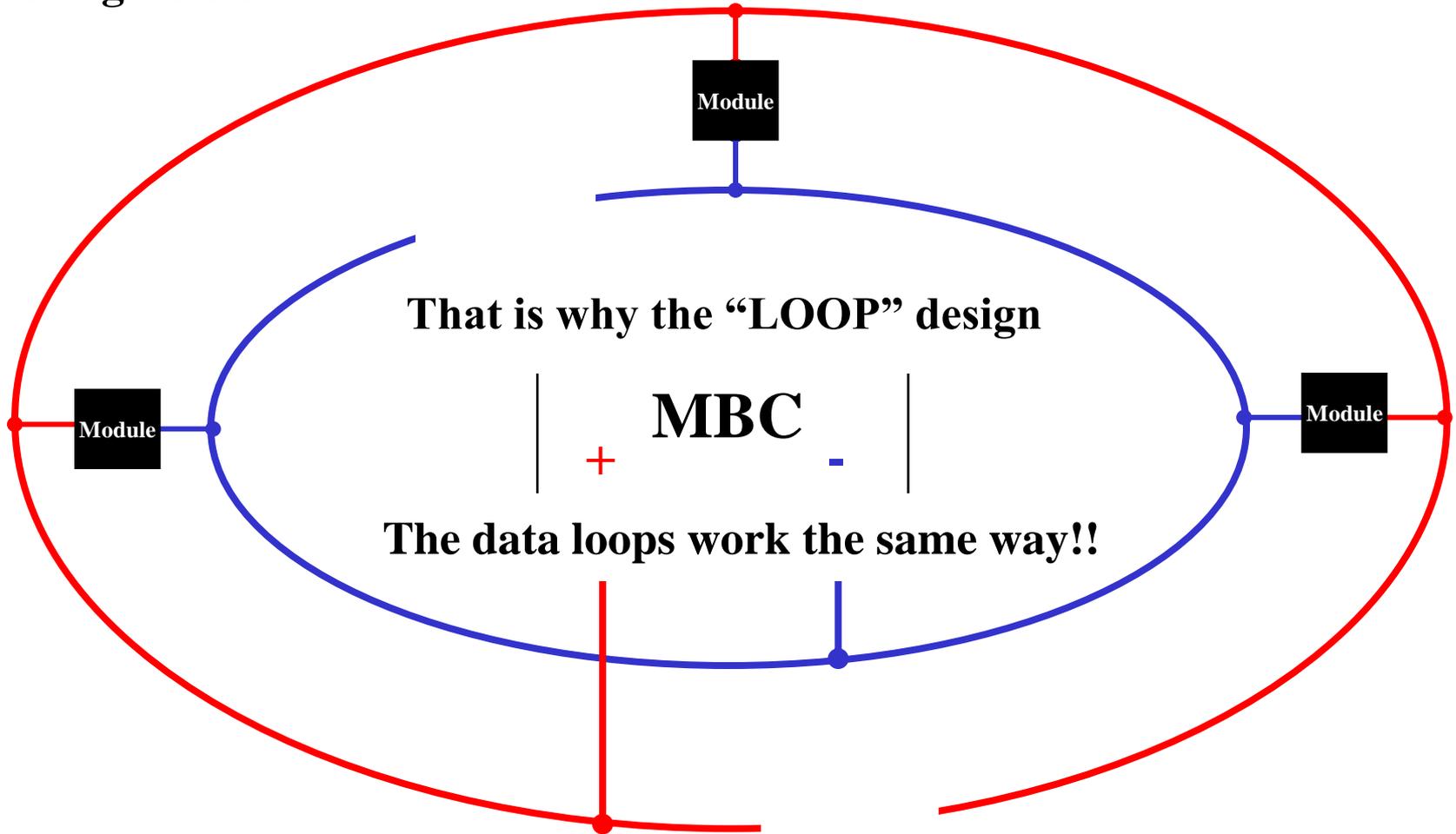


POWER LOOP

Which lights go out?

Which lights are lit?

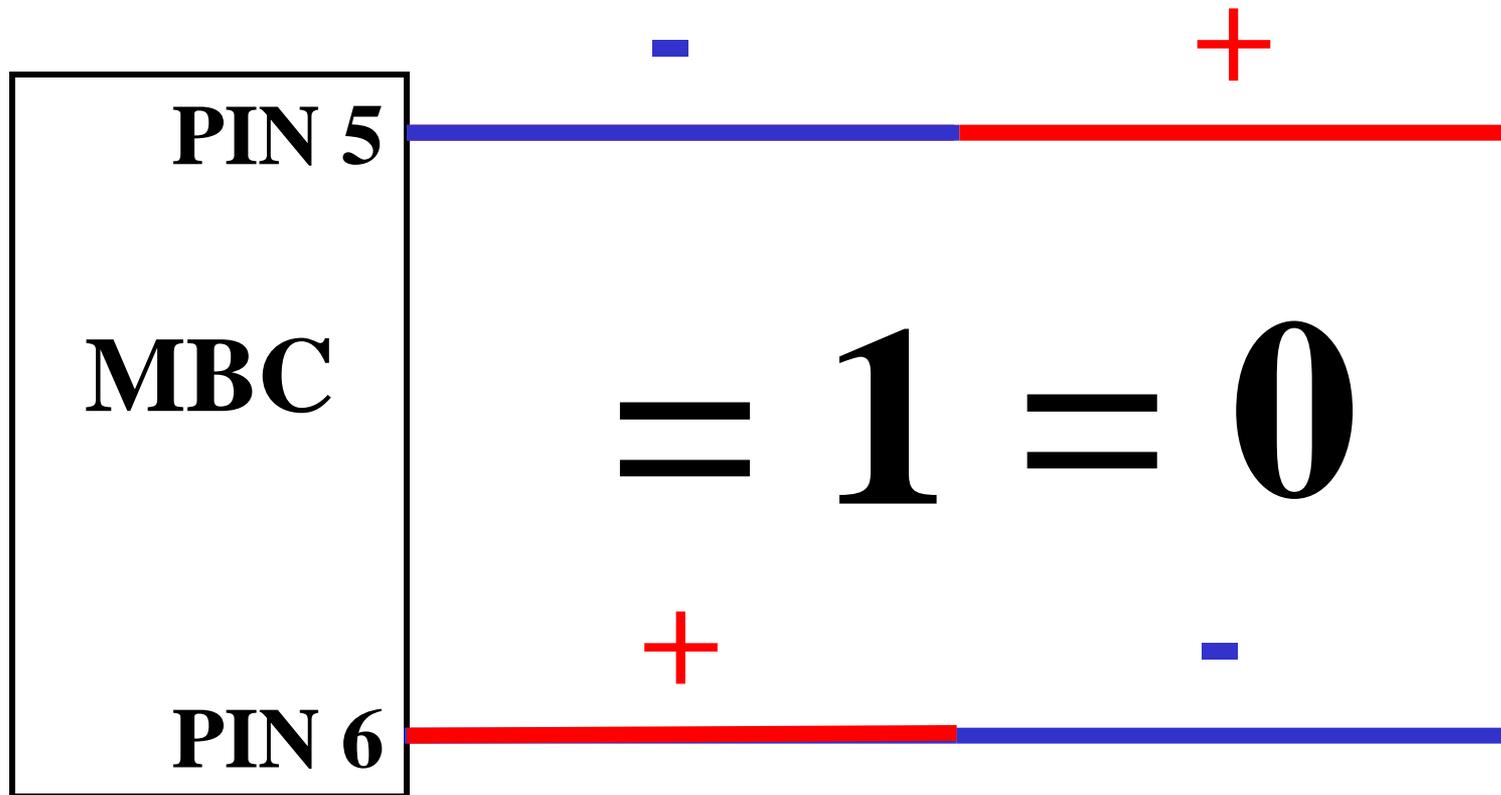
How about now?

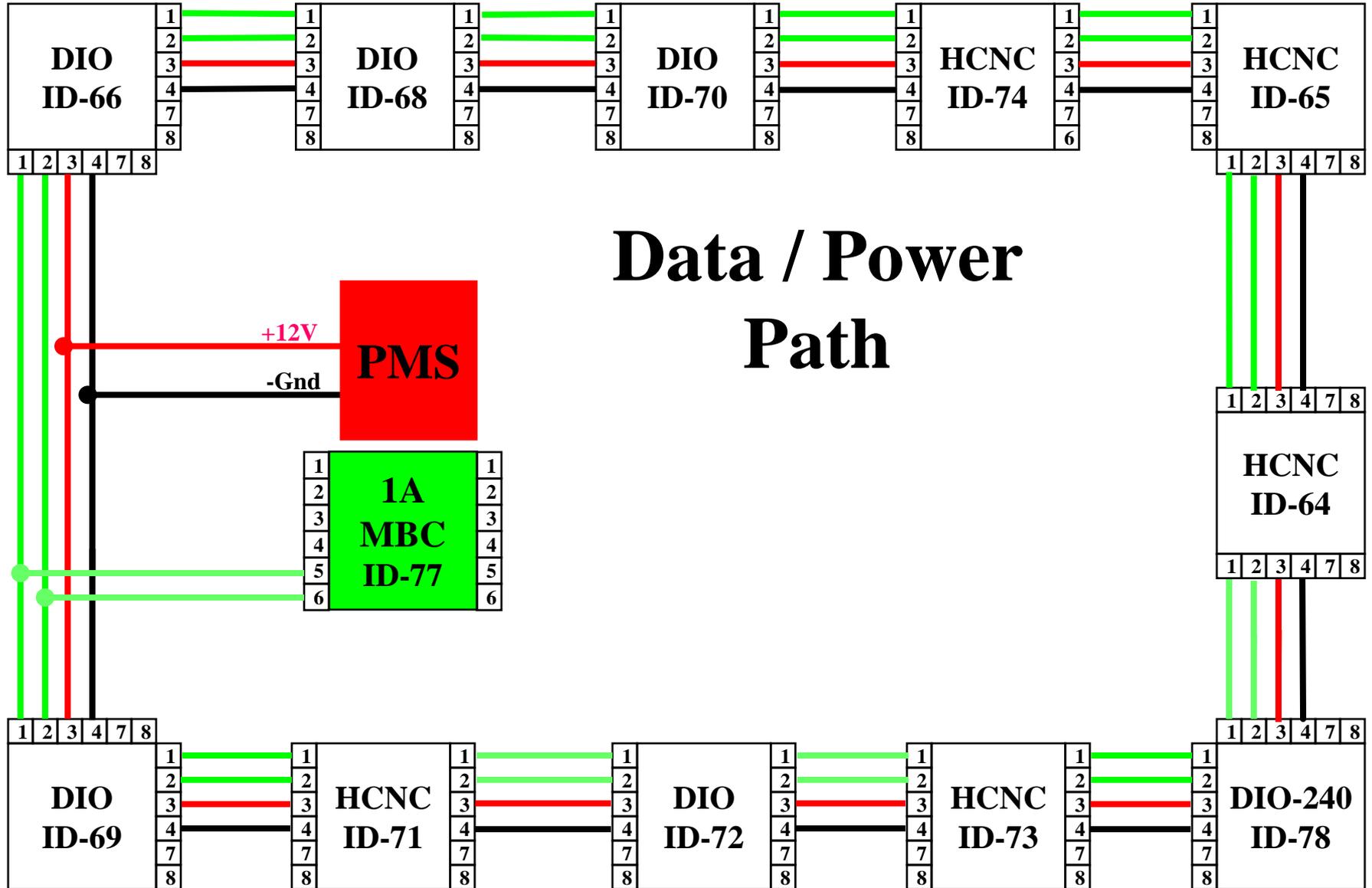


Loop Design

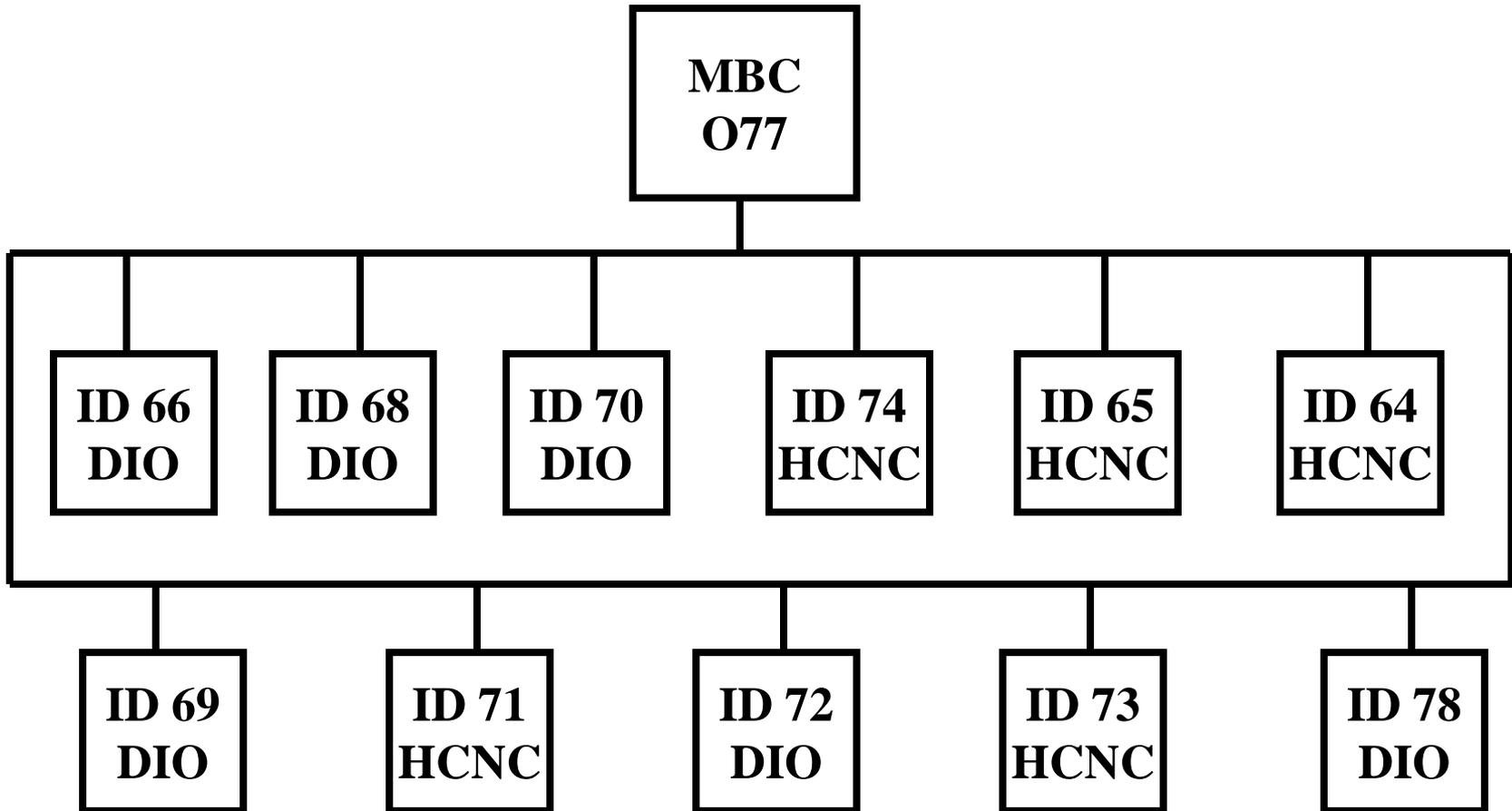
- The “loop” design allows power or data to be available **everywhere** in the circuit **at the same time** even with a break in the cable / loop.
- A single break anywhere **in the loop** cable has no effect on the power or data circuits.
- Power or data is only interrupted when multiple breaks occur on both sides of a module or group of modules, thus **isolating** these modules from the loop.

HOW DIGITAL MESSAGES ARE GENERATED





HIERARCHY CHART



Visual Inspection

- *Allows identification of 95% of faults.**
- *Used to test 85% of the system.**
- * Use LED's on the modules.**
- * Use logic diagrams.**
- * Use electrical schematics**
- * If visual inspection fails to locate fault, go to step two: Using Test Kits.**

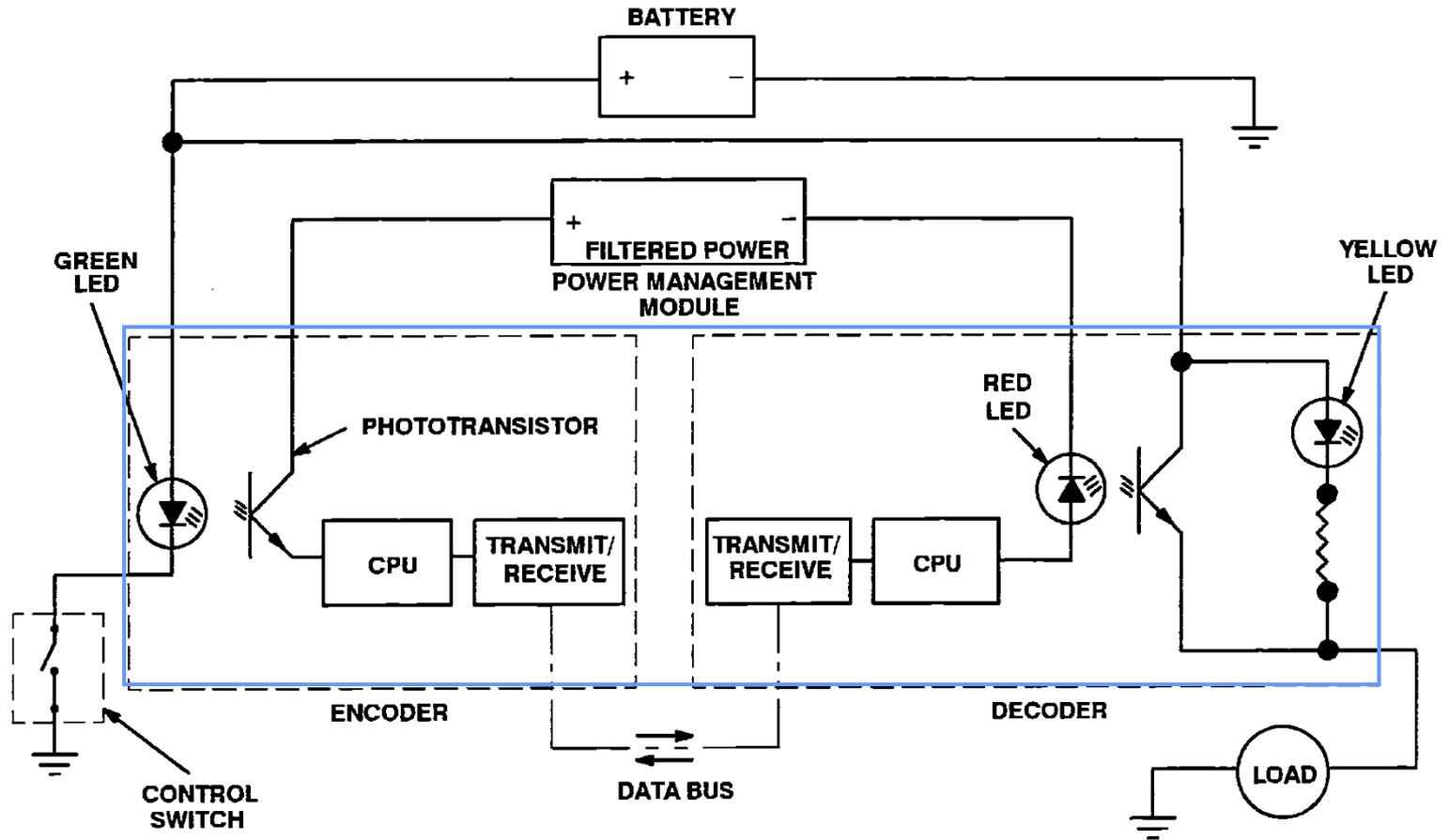
Diagnostics and Troubleshooting

- Use the LED's to trouble shoot the various **inputs**, **outputs**, **power** and **data** going in and out of the modules
- Use the diagnostic troubleshooting tools to determine system integrity

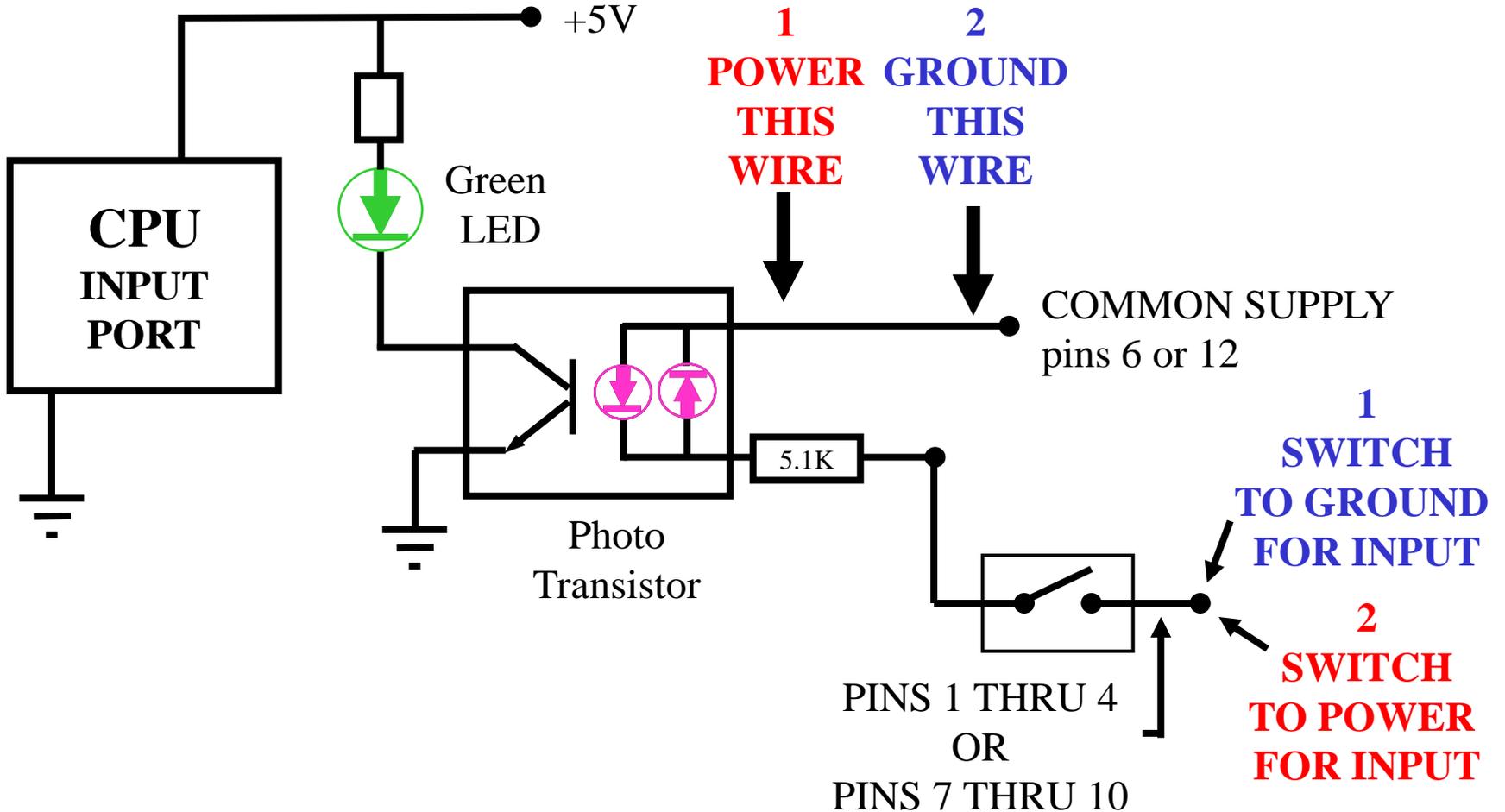
Visual Inspection- No Connection Circuit

- * The simplified circuit shows no direct link between **input**, data bus, and **output**.
- * LED's and light-sensing transistors activate circuits.
- * Lack of direct wire link eliminates need for diodes.
- * No danger of voltage spikes.

Visual Inspection

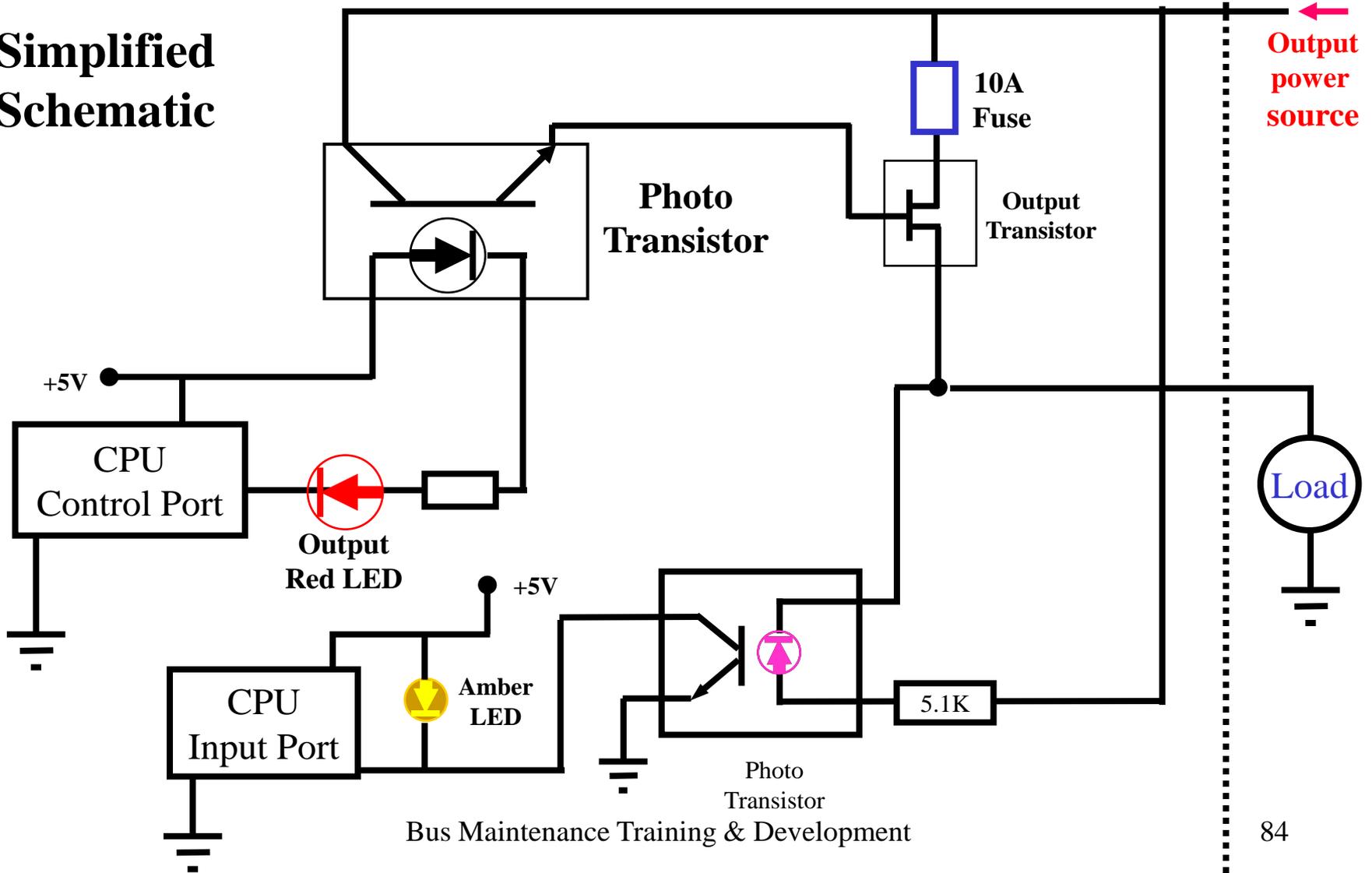


INPUT LED's



Output LED's

Simplified Schematic



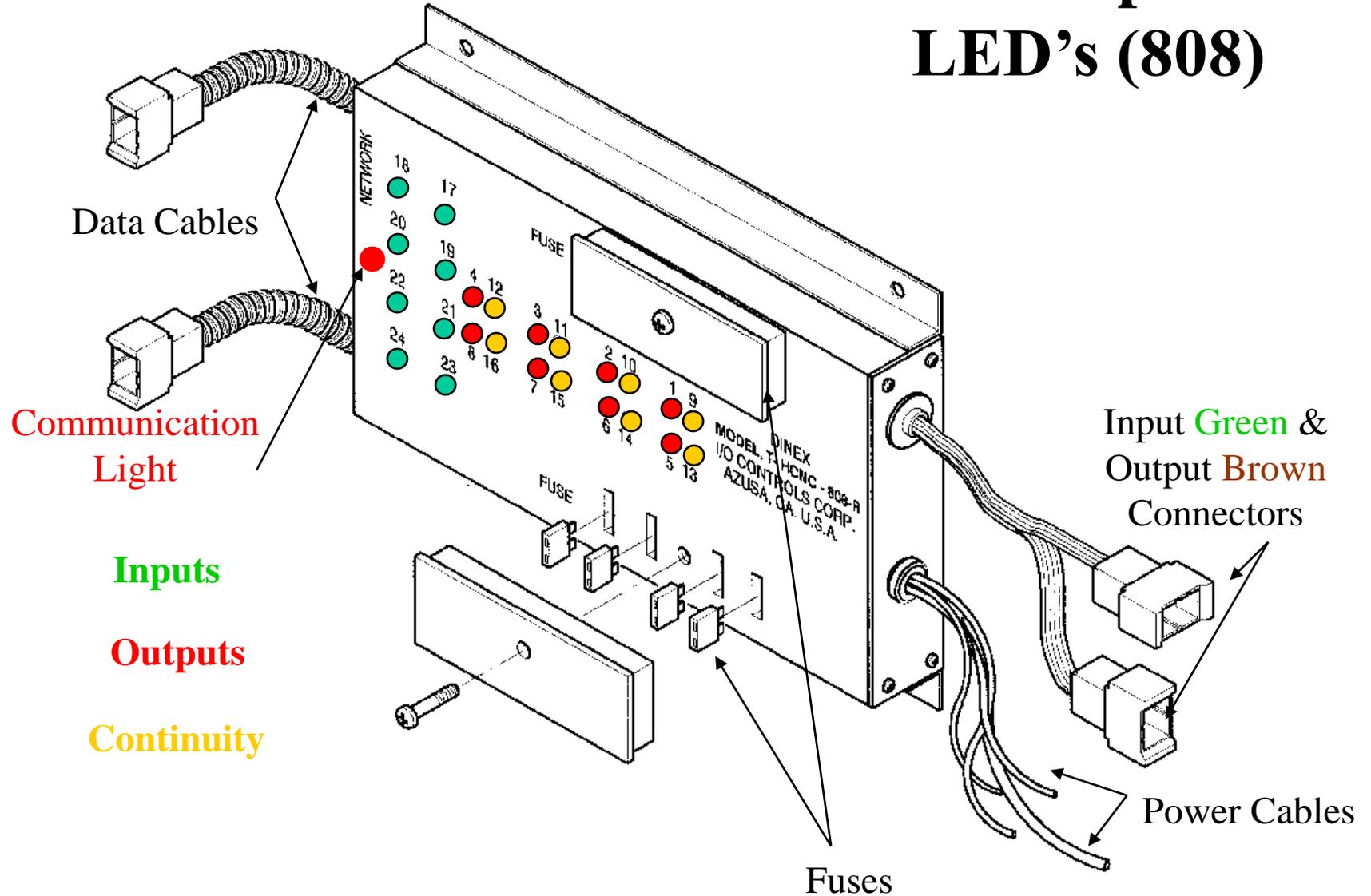
Visual Inspection-Input LED's

- All **input** circuit LED's are **green**
- Lighted **green** LED indicates active input
- **Inputs** are from switches and sensors

Visual Inspection-Output LED's

- HCNC's and DIO-808s **AMBER** LED's and **RED** LED's monitor the output circuit.
- Lighted **AMBER** LED: Output circuit complete, ready, but not active (**RED** LED is off).
- Lighted **RED** LED: Output circuit active (**AMBER** LED is off).

Visual Inspection- LED's (808)



Visual Inspection-Output LED's

- If output circuit “off,” and **AMBER** LED “off”:
Check for load circuit open.
- If output circuit “on,” but both **AMBER** and **RED** LED's “on”: Check fuse.
- If the module's **RED** LED's all “off”: Check data communication status LED.

Visual Inspection

Data Communication Status LED

- **DCS LED** is mounted on left side of MBC, HCNC, and DIO modules.
- **DCS LED** flashes at rapid rate: the module is communicating with a control module.
- **DCS LED** flashing at a slow rate: Indicates a system problem (one or more modules are not communicating).

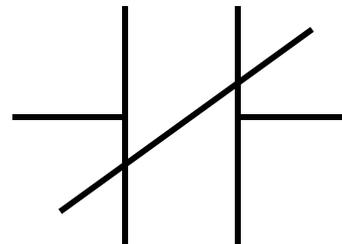
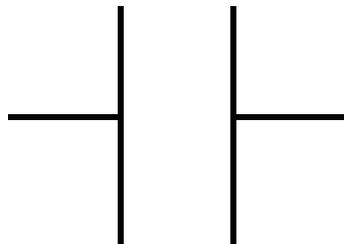
Visual Inspection- Built-In Circuit Monitor

- Internal circuits in HCNC's and DIO's allows current to flow through the output load, even when load is inactive.
- A blown fuse still allows current flow through the **amber** LED to ground, but **red** LED is also “on” due to circuit trying to activate.

Visual Inspection- Logic Diagram

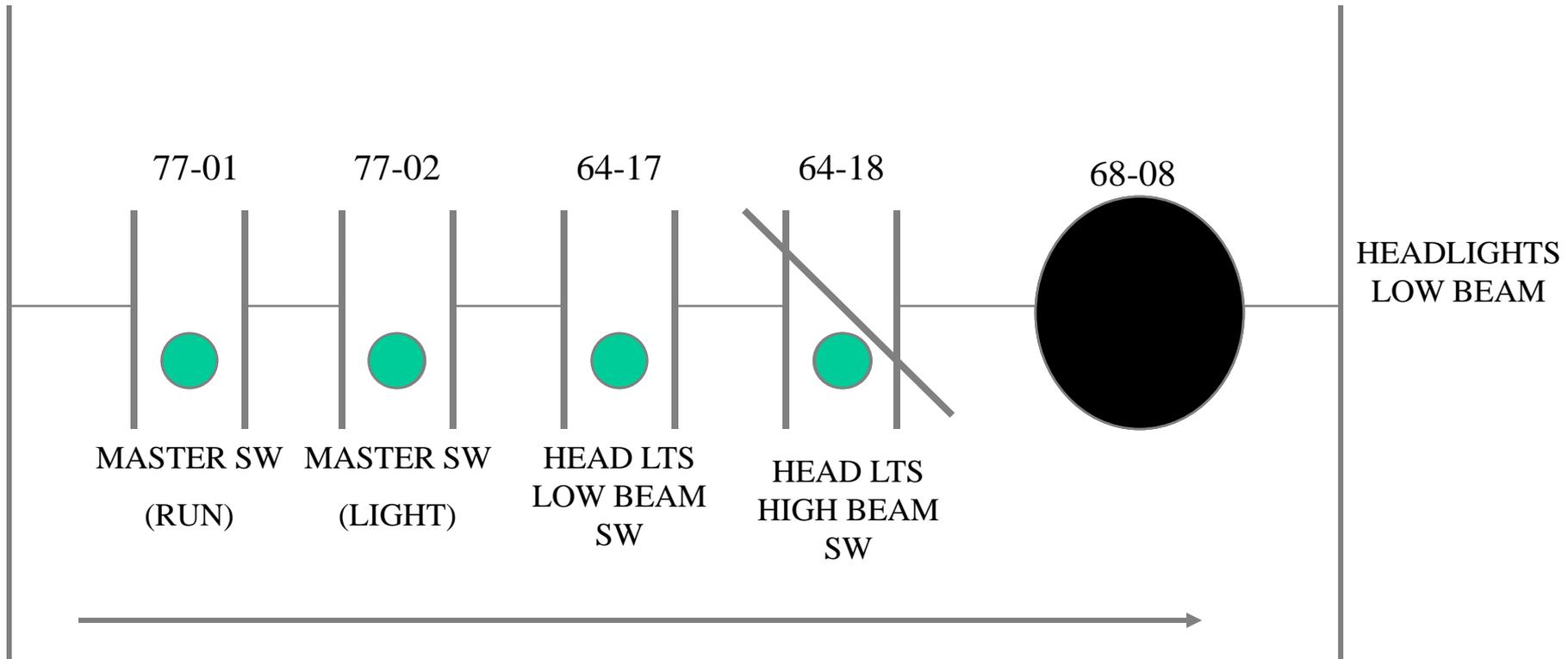
- Logic diagrams will show input name and addresses.
- Symbols below indicate if an input needs to be active or inactive.

Active input
LED
Needs to be
“on” at listed
address



Inactive
input LED
Needs to
“off” at
the listed
address

TYPICAL LOGIC DIAGRAM

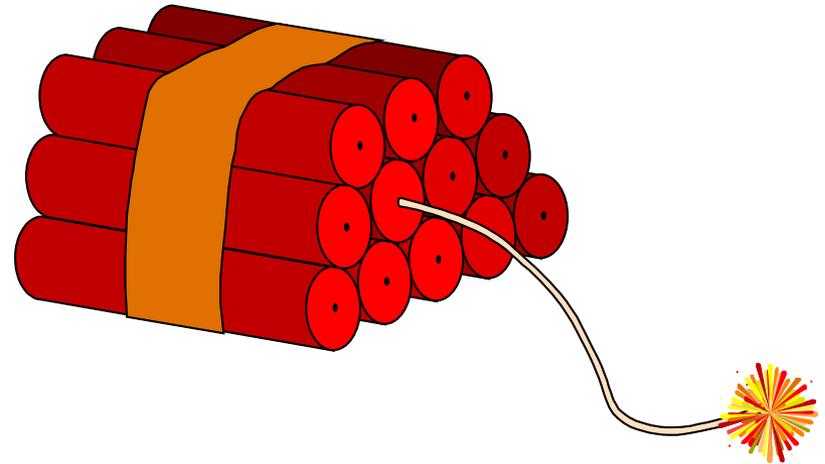


Second and Third Step of Diagnosis and Troubleshooting

- When visual inspection fails to locate fault, test tools are required in the second step.
- When both first step and second step fails, software may be suspect => third step of software testing and programming

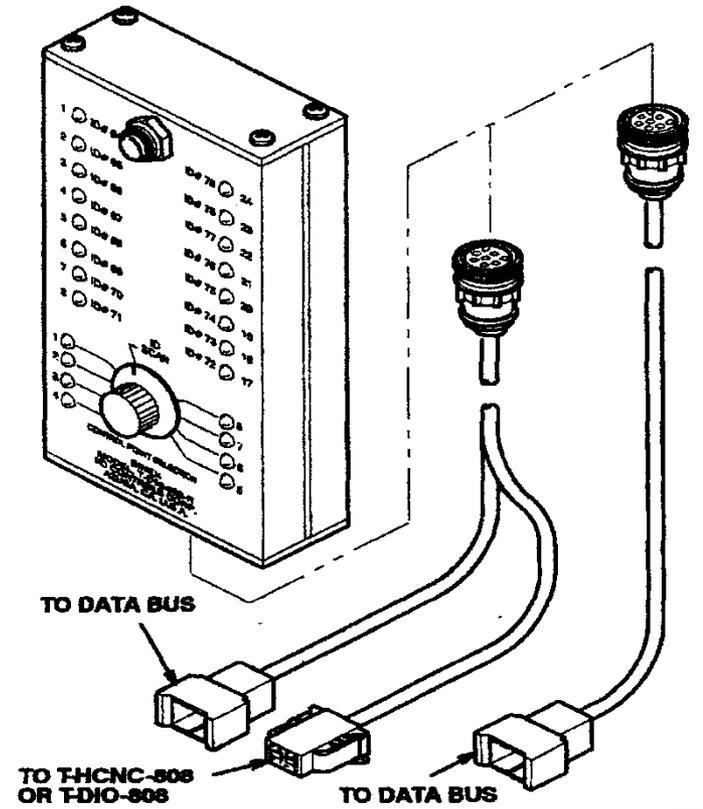
WARNING:

- **NEVER ACTIVATE AN UNIDENTIFIED OUTPUT.**
- **Using the T-MK-808 for simulating the outputs will override all built in safety precautions.**



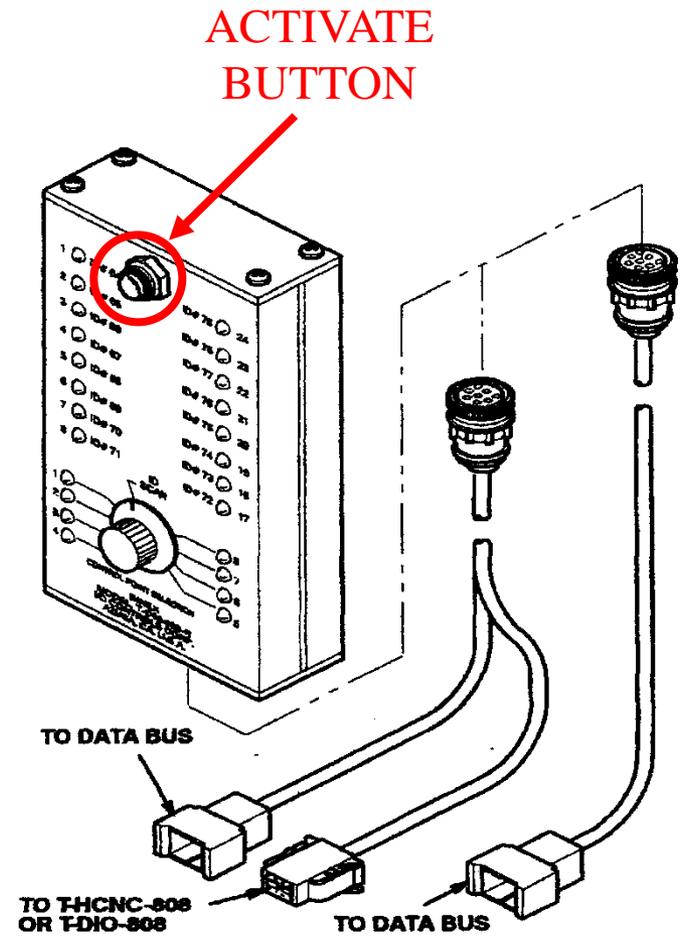
T-MK-808 INPUT/OUTPUT TEST

- **WARNING: Using the T-MK-808 for simulating the outputs will override all built in safety precautions.**
- Power up vehicle.
- Disconnect **BOTH** Data Cables from the target module being tested.
- Connect the end of the “Y” cable marked “T-MK” to the T-MK-808.



T-MK-808 TESTER

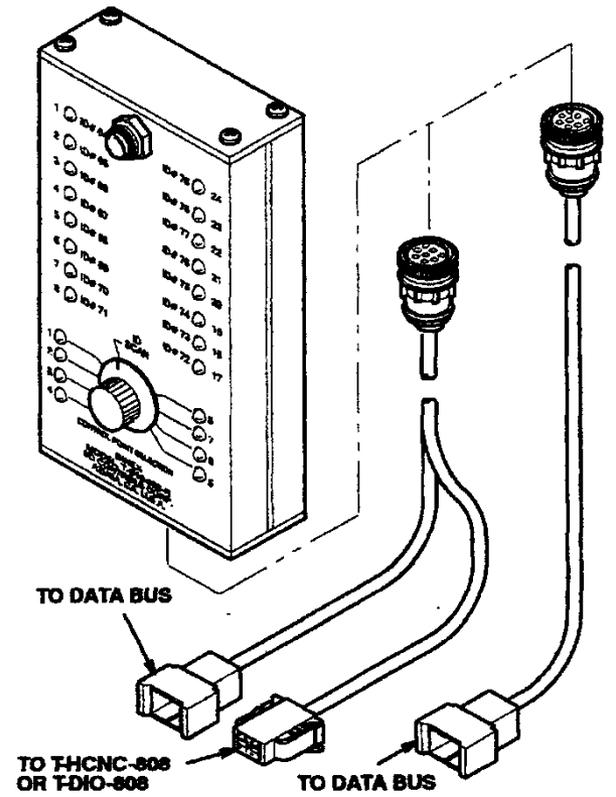
- Connect the lead of the “Y” cable marked “MODULE” to one of the connectors on the module.
- Attach the last cable end marked “DATA BUS” to one of the data cables previously disconnected.
- Rotate the rotary dial to the **identified output** number you want to activate.
- Depress and hold the activate button and the chosen **output** will activate, and the corresponding **output** LED's will light.



NETWORK INTEGRITY TEST

TESTING DATA BUS

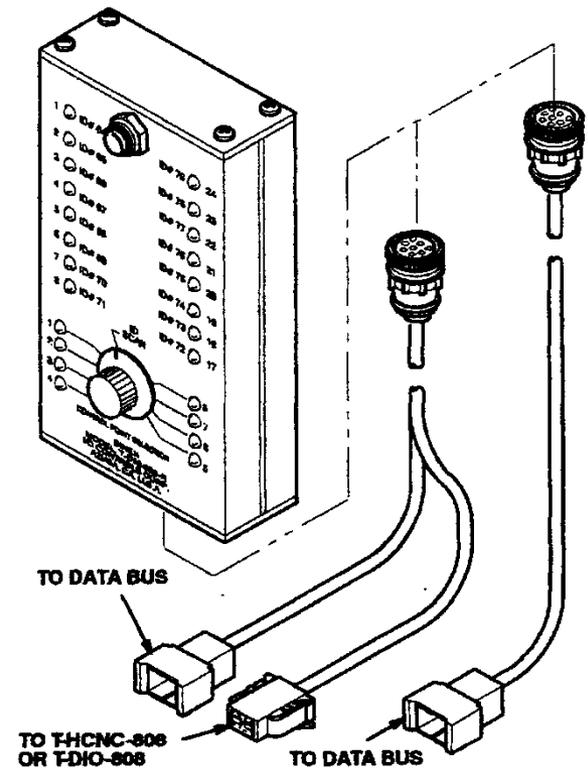
- Disconnect data cable from **MBC**.
- Set the select switch on the T-MK-808 to ID scan.
- Attach the single cable to the T-MK-808.
- Attach the other end of the cable to the previously unplugged **MBC** data cable.

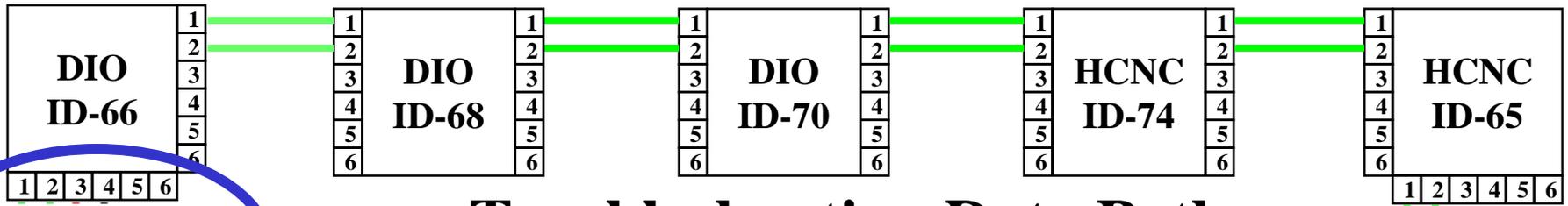


NETWORK INTEGRITY TEST

TESTING DATA BUS

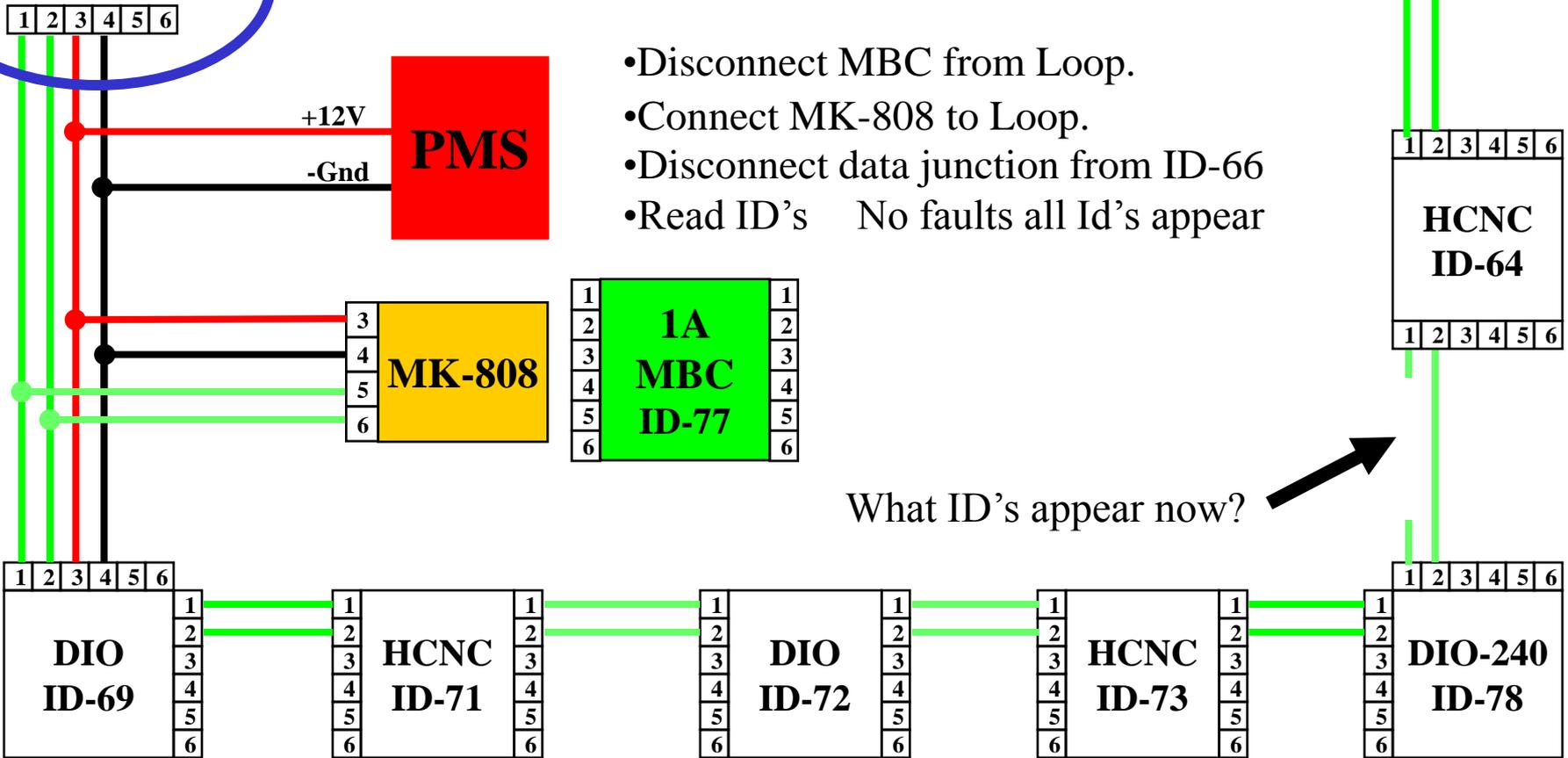
- Next disconnect the data cable between module 66 and the data bus junction.
- Read the corresponding ID LED's on the T-MK-808.
- Check the hierarchy chart to ensure all modules ID's are present.
- If not, use the Ring chart, to determine where the disruption in data is occurring.





Troubleshooting Data Path

- Disconnect MBC from Loop.
- Connect MK-808 to Loop.
- Disconnect data junction from ID-66
- Read ID's No faults all Id's appear

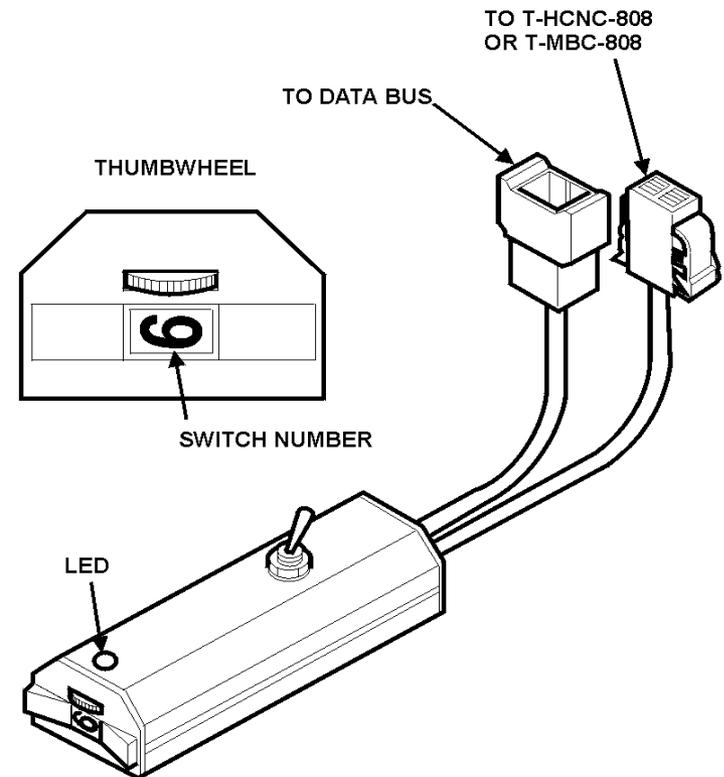


What ID's appear now?

T-MK-IDWT ID CHECK

- **WARNING: Before any testing or programming with this tool, both DATA CABLES must be removed from the target module.**
- Turn on power to coach.
- Remove **BOTH** DATA cables from the module to be checked.
- Set toggle switch on the writer to “CHECK ID”.
- Connect the ID write connector (male) to the module to be tested.
- Connect the remaining connector to one of the previously removed Data cables.

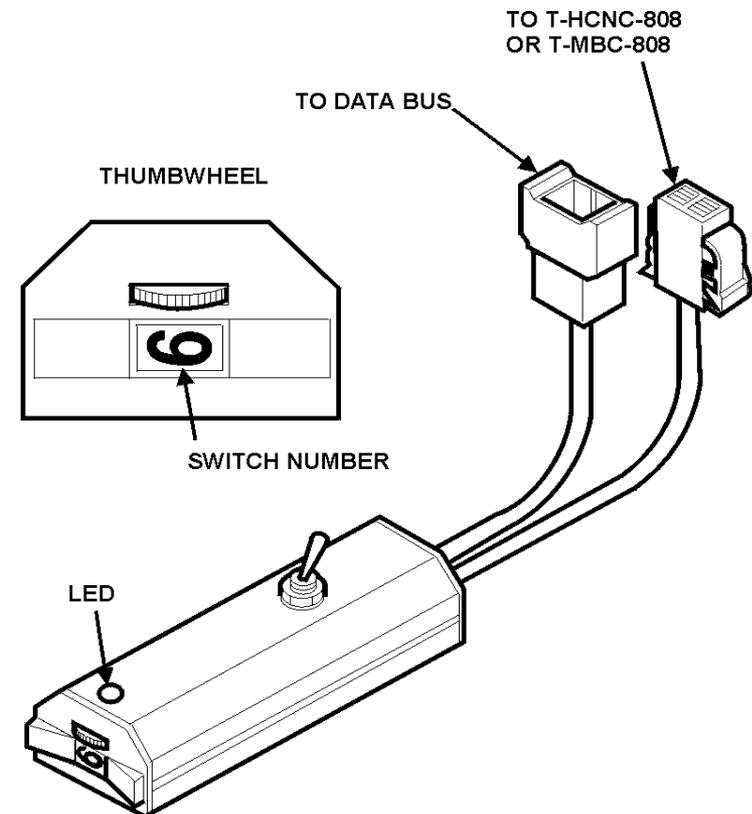
SWITCH NUMBER													
0	1	2	3	4	5	6	7	8	9	10	11	12	13
MODULE ID NUMBER													
64	65	66	67	68	69	70	71	72	73	74	75	76	77



T-MK-IDWT ID CHECK

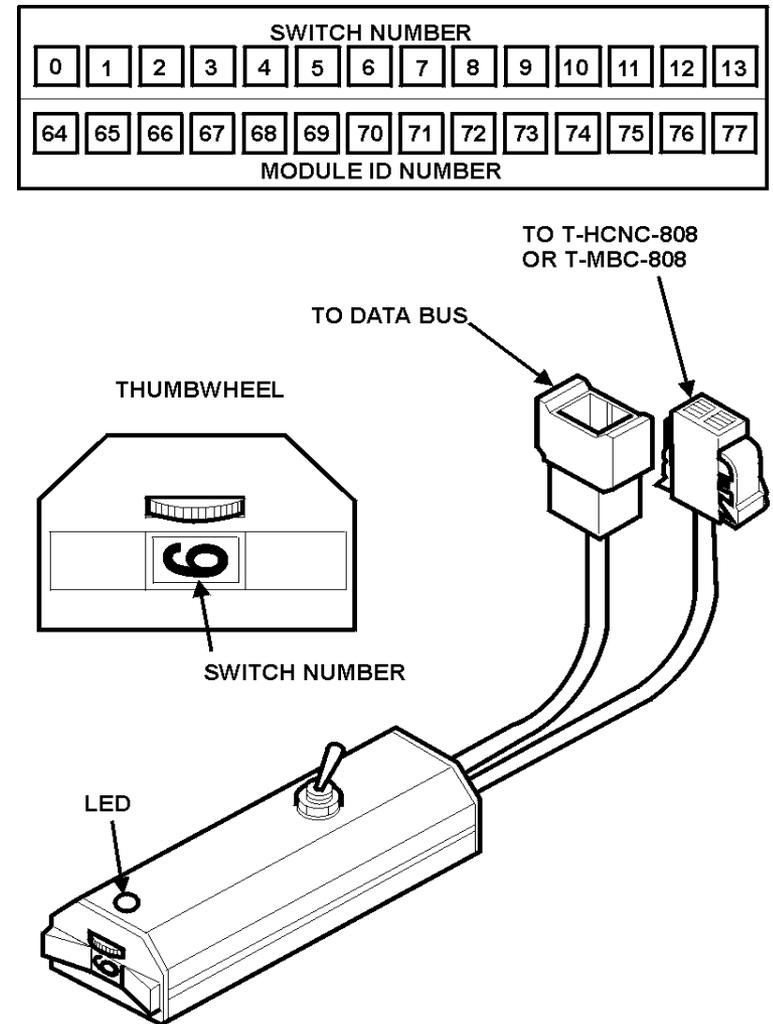
- If the thumb wheel position matches the ID of the target module the “RED LED” will flash for approx. 1 sec. then go out.
- If the thumb wheel position does not match the ID the “RED LED” will flash rapidly until the thumb wheel is moved to the corresponding position then the “RED LED” will go out.
- Match the thumb switch position to the corresponding ID using the chart on the face of the writer.
- If “RED LED” fails to light check connections for PMS power and retry.
- Identify the module using the supplied chart.

SWITCH NUMBER													
0	1	2	3	4	5	6	7	8	9	10	11	12	13
64	65	66	67	68	69	70	71	72	73	74	75	76	77
MODULE ID NUMBER													



T-MK-IDWT ID WRITE

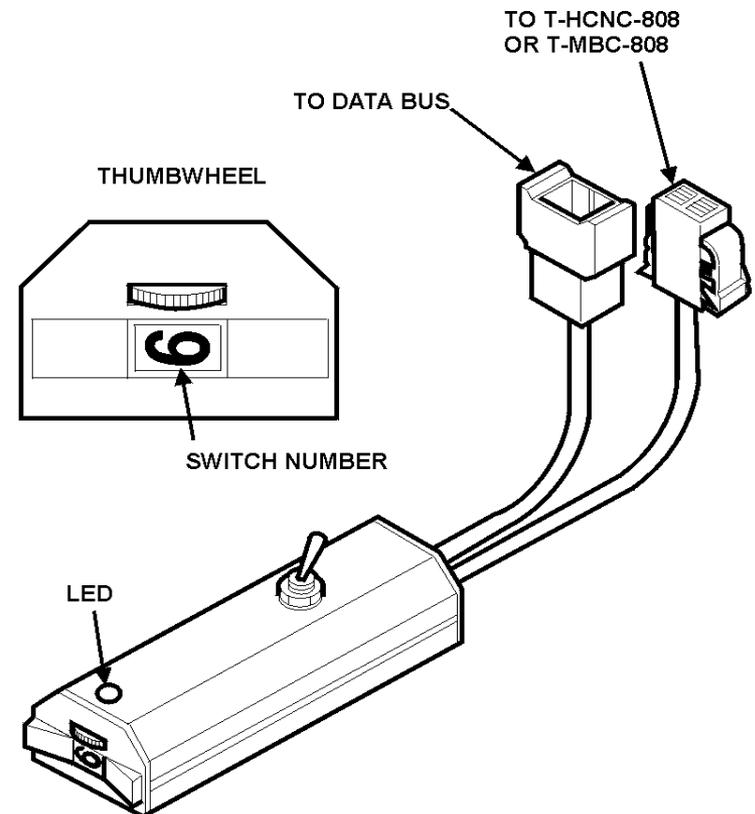
- **WARNING: Before attempting to write an ID, BOTH Data cables must be removed from the target module.**
- Turn on power to the coach.
- Insure that the **Check / Write** switch is in the **Write ID** position.
- Select the proper ID switch position for the ID to be written.
- Connect ID Writer to the target module, then to the data cable for power.



T-MK-IDWT ID WRITE

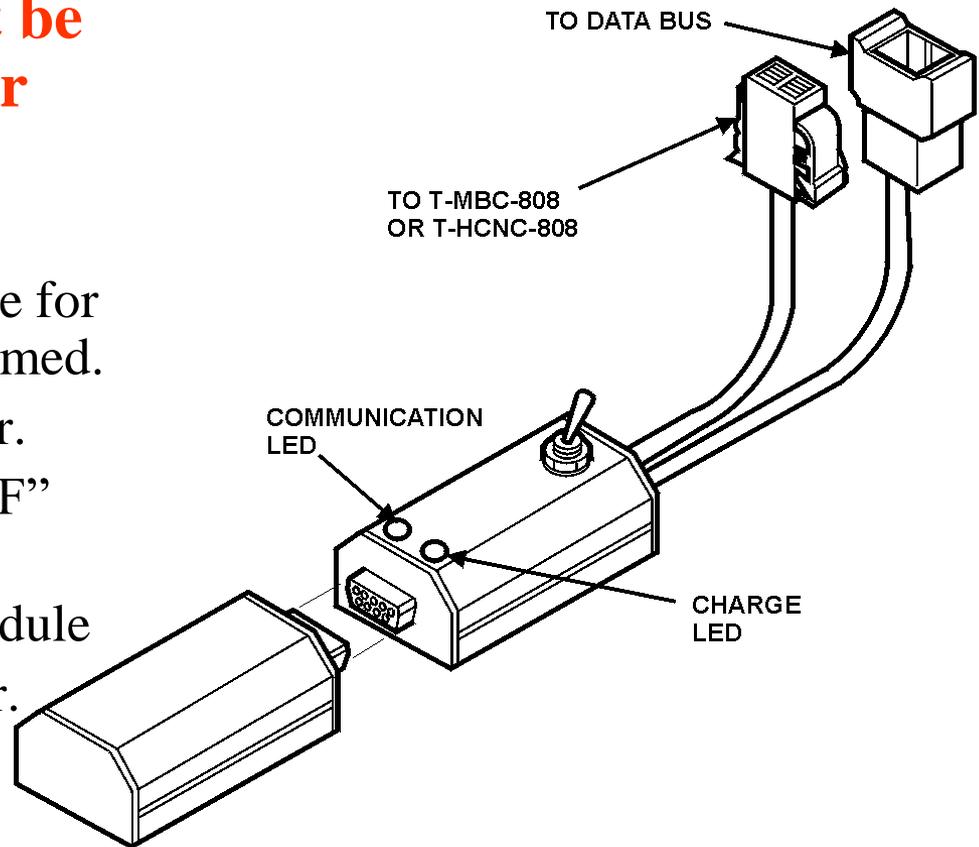
- The red led should flash for approx. 1 sec.
- To check for proper ID transfer, unplug the ID writer from power and move the thumb wheel one position.
- Place the check/write switch into the the check position then reconnect to power.
- The red led should flash until the thumb wheel is moved back to the correct number.
- Replacement modules or modules that are moved to other zone locations require the proper ID number for that zone.

SWITCH NUMBER													
0	1	2	3	4	5	6	7	8	9	10	11	12	13
MODULE ID NUMBER													
64	65	66	67	68	69	70	71	72	73	74	75	76	77



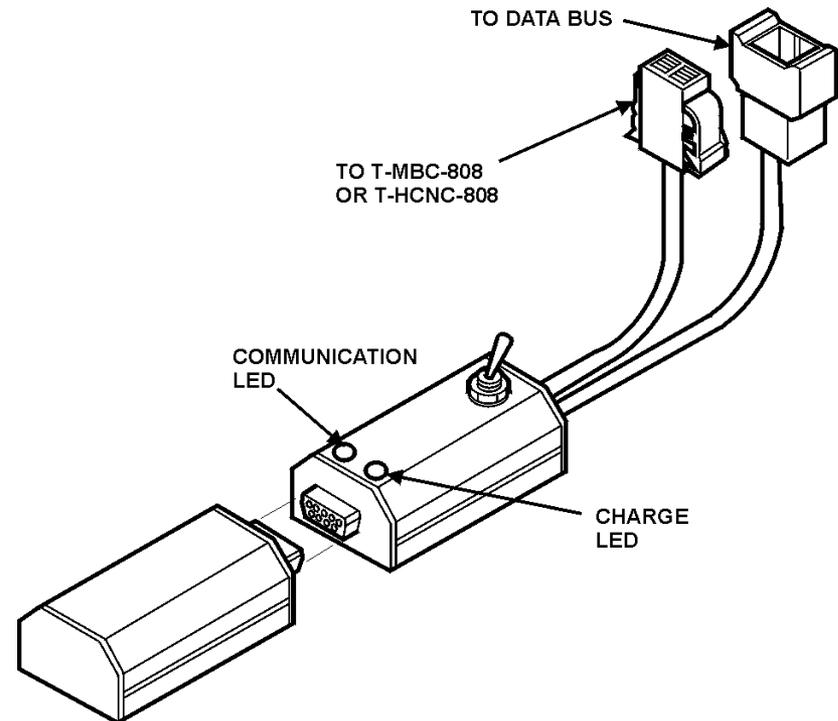
T-MK-CHARGER/PROGRAM MODULES

- **WARNING: Before any programming with this tool, both DATA CABLES must be removed from the HCNC or MBC module.**
- Turn on power to the coach.
- Choose the correct program module for the HCNC or MBC being programmed.
- Connect the program to the charger.
- Move the toggle switch to the “OFF” position.
- Attach the charger to the target module
- The other to the data bus for power.
- Move the toggle switch to “ON”.



T-MK-CHARGER/PROGRAM MODULES

- The Green Charge LED should begin blinking (charging).
- Then both red (com) & green (charging) LED's will light steadily (loading program).
- Green off, red on (checking program).
- Red off, this indicates the program has been successfully loaded.
- If the CHARGER LED shows no activity, the loading process was not successful or there is no power in that end of the data cable.
- Insure there is power to charger, repeat the procedure. If unsuccessful again, replace the HCNC or MBC.
- Reconnect cables as previously connected.



Program Loading Means

- * Using IBM PC Compatible
- * Loading in the Vehicle

MODULE REPAIR

- If all three steps fail to locate fault, module is suspect.
- Must be returned to manufacturer for repair.
- Unless authorized by factory, no internal component repairs are allowed.

I/O FAILURE

- For limited number of malfunctioning I/O points in each module.
- Visual check
 - Fuse
 - Amber and red LED's
- Use of tools: T-MK-808.
- Corrective action:
 - Replace fuse
 - Check possible short circuit
 - Check for open circuit if amber LED is off
 - Replace module

MODULE FAILURE

- For when a full bank of functions is not working.
- Visual check:
 - Connection and communication LED.
 - All LED's
- Use of tools: T-MK-808
- Corrective action:
 - Check data bus cable integrity
 - Replace module

SYSTEM FAILURE

- For when system is abnormal, dead, or lost control.
- Reset system and shut down/restart battery.
- Visual check:
 - Module LED's
 - MBC data bus connection
 - T-PMS +12V green LED
- Use of tools: T-MK-808 ID checking.
- Corrective action:
 - Replace MBC if problem persists.