IMPORTANT CUSTOMER NOTE:
Please note that this is preliminary copy of the Express 4500 Owner Manual. Material has not yet been validated for correctness and accuracy.

(ADVANCE RELEASE)

OCT 2 1 2003

NOTE: This information was correct at time of printing. For any vendor changes made to equipment and/or manual after printing date refer to the actual vendor owner manual supplied with coach.

Table of Contents

Introduction

Limited Warranty

WANDERLODGE®
The Ultimate Luxury

Welcome Blue Bird Wanderlodge (Wanderlodge), a division of Blue Bird Body Company, warrants each coach to be free from defects in material and workmanship under normal use and service for two (2) years/150,000 miles/240,000 kilometers, whichever occurs first from date of delivery to the original user. Wanderlodge warrants all components installed by Wanderlodge except engines, automatic transmissions, wheelchair lifts, air conditioners, tires and batteries, which are warranted separately by their manufacturers.

Wanderlodge's obligation covered in this limited warranty is limited to the repair or replacement of such parts as shall, under normal use and service, appear to have been defective in workmanship or material. Without restricting the generality of this limitation, loss of use, commercial loss and maintenance are specifically not covered... This warranty shall not apply to any parts or components which must be repaired or replaced during the warranty period as a result of what is, in the opinion of Wanderlodge, normal wear and/or deterioration in the course of normal operations and use, accident damage, misuse and/or abuse. If distributors, dealers or customers have any vehicle modifications or equipment installations performed without the written approval of Wanderlodge to the extent the modifications or equipment installations adversely affect other vehicle components or performance, Wanderlodge shall not accept any product liability or claims under the terms of the limited warranty. These claims become the sole responsibility of the company performing the modifications and/or installations. Overloading beyond the normal seated and standee capacity voids all warranties.

THIS LIMITED WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED AND ALL OTHER OBLIGATIONS OR LIABILITIES. NO PERSON, INCLUDING SALESMEN, DEALERS, DISTRIBUTORS, OR FACTORY REPRESENTATIVES OF WANDERLODGE, IS AUTHORIZED TO MAKE ANY REPRESENATION OR WARRANTY CONCERNING WANDERLODGE PRODUCTS EXCEPT TO REFER PURCHASERS TO THIS LIMITED WARRANTY. WANDERLODGE MAKES NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. WANDERLODGE SHALL NOT BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

Wanderlodge reserves the right to make changes in design and changes or improvements upon its products without imposing any obligations upon itself to install the same upon products therefore manufactured. Defects shall be repaired promptly after discovery of the defect and within the warranty period as stated herein. All claims for warranty adjustments must be received by Wanderlodge not later than 30 days after the repair date, and shall be channeled through an authorized Wanderlodge dealer or factory representative. Any suit alleging a breach of this limited warranty or any other alleged warranty must be filed within one year of breach.

All rights under this limited warranty shall be governed by the law of Georgia, U.S.A.

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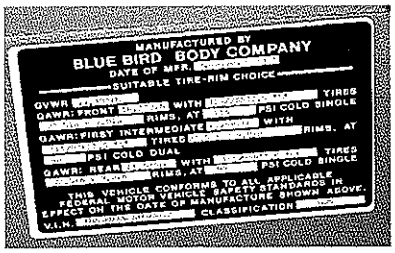
Wanderlodge® / One Wanderlodge Way / Fort Valley, Georgia 31030 / (478) 825-2021

Vehicle Identification



The Vehicle Certification Plate is located on the auxiliary shifter cabinet below dash at front leading edge. This plate provides Gross Vehicle Weight Ratings, specifies tire inflation pressures, and certifies that the vehicle conforms to all applicable Federal Motor Vehicle Safety Standards in effect at the date of manufacture. Do not remove or deface this plate.

The Vehicle Identification Number can also be found on a plate mounted on the front of the driver-side dash, and visible from outside the vehicle.

The Body Serial and Service Number Plate is located on the defrost plenum front flange. Refer to the data on this plate for registration purposes or for replacement part information pertaining to the bus body.

The Axle Record and Chassis Service Number Plate is located on the right upper davenport rear panel. Refer to the data on this plate for registration purposes and for replacement part information pertaining to the bus chassis.

Introduction

This section of your Owner's Manual contains general hints and recommendations for using your bus. Checklists and suggestions are offered which cover just about every phase of bus travel.

The remaining sections of this manual describe the operation and use of the individual items and systems which comprise your bus.

Manufacturer's manuals for components and appliances are included in your owner's kit. Please refer to these for more detailed information.

We hope that this manual will help answer questions that may arise about the use, operation and maintenance of your bus. Any suggestions or recommendations that you might have for including or expanding on material of interest will be carefully considered for incorporation in future publications. We are always interested in providing our bus owners with the most current and comprehensive information about our product.

Citizen's Band Transceiver

You might also bear in mind that your bus is equipped with a CB unit (Citizen's Band receiver-transmitter) In the event of an emergency situation which requires outside assistance; remember to call for help on Channel 9. This channel is restricted to emergency use only and it is monitored 24 hours per day! Don't hesitate to use your CB if you see someone else in need of assistance.

Safety Considerations

Electrical Systems

The bus has been engineered and checked for complete electrical system safety. The bus uses a Dinex G2A Multiplex Wiring System. Multiplex wiring simplifies the way electrical devices are hooked up together. It allows for two or more data transmissions to take place on the same wire. In the world of traditional wiring systems - such as wiring harnesses, and relays - as much as three miles of wires can be used. These harnesses run hundreds of signals, using hundreds of wires, just to keep a single transit vehicle operational. Instead of having three miles of complicated wiring harnesses and a number of failure prone connectors, multiplexing sends multiple signals at the same time through a common pair of wires to turn-on or turn-off various electrical devices. A full, detailed explanation of this system can be found in *Section 9-2 Electrical Systems Specifications*.

Emergency Stops

Always carry road flares and/or reflective triangular highway warning markers for emergency warning display. An emergency warning kit is located in the left hand front driver's compartment. Pull off the roadway as far as possible when changing flats or for other emergency situations. Turn on your hazard warning flashers when parked alongside a roadway, even if only for a short while. Have your bus occupants leave the vehicle and stand clear of the area when parked on the edge of a highway.

In Case of Tire Blowout

Michelin Tire Corporation has tested extensively and recommends the following when a blowout occurs:

1. Quickly step on the gas
2. Adjust steering as needed.
3. Stay off the brakes.
4. Keep driving until you find a safe place to pull over.

Engine Exhaust Gas

Avoid inhaling exhaust gases because they contain carbon monoxide, which by itself is colorless and odorless. Carbon monoxide is a dangerous gas that can cause unconsciousness and is potentially lethal. If at any time you suspect that any exhaust fumes are entering the passenger compartment, have the cause determined and corrected as soon as possible.

The best protection against carbon monoxide entry into the vehicle body is properly maintained engine exhaust system, body and ventilation system. It is a good practice to have the exhaust system and body inspected by a competent mechanic each time the vehicle is raised for lubrication or oil change. It should also be inspected whenever a change is noticed in the sound of the exhaust system, and if the exhaust system, underbody or rear of the vehicle has been damaged.

To allow proper operation of the vehicle's ventilation system, keep ventilation inlets clear of snow, leaves or other obstructions.

Sitting in a parked vehicle with the engine on for extending periods, without proper ventilation, is not recommended!

More Safety Considerations

- Check fire extinguishers periodically for proper charge.
- Ensure that tires are in good condition and properly inflated at all times.
- Under-inflated tires overheat and are prone to blowouts!
- Check and tighten wheel lug nuts; manufacturer recommends after first 50-100 miles and every 1,000 miles thereafter.

Emergency Exits

All passenger windows are emergency egress windows. Operating instructions for opening these windows are located at each seat location.

BUS WEIGHT INFORMATION

Model _____

GVWR _____

UVW _____

NCC _____

GCWR _____

GVWR

(Gross Vehicle Weight Rating) means the maximum permissible weight of this bus. The GVWR is equal to or greater than the sum of the Unloaded Vehicle Weight plus the Net Carrying Capacity.

UVW

(Unloaded Vehicle Weight) means the weight of this bus as built at the factory with full fuel, engine oil, and coolants. The UVW does not include cargo, fresh water, LP gas, occupants, or dealer installed accessories.

NCC

(Net Carrying Capacity) means the maximum weight of all occupants including the driver, personal belongings, food, fresh water, LP gas, tools, tongue weight of towed vehicle, dealer installed accessories, etc., that can be carried by this bus.

(NCC is equal to or less than GVWR minus UVW).

GCWR

(Gross Combination Weight Rating) means the value specified by the bus manufacturer as the maximum allowable loaded weight of this bus with its towed trailer or towed vehicle.

CONSULT WEIGHT DECAL LOCATED IN BUS

FOR ACTUAL WEIGHTS

Vehicle Loading

The Federal Certification Label located inside and above the driver's windshield between the sun visor mounting brackets describes the maximum weight-carrying capacities of your bus and for each axle, respectively abbreviated by "GVWR" and "GAWR".

The Gross Vehicle Weight Rating (GVWR) is the maximum bus weight allowable with all systems filled and with passengers and supplies aboard.

Each axle also has a maximum load-bearing capacity referred to as the Gross Axle Weight Rating (GAWR).

The load capacity is the difference between the GVWR and the actual weight. This means that the total weight of all food, clothing, other supplies and passengers must not permit the load capacity to be exceeded.

To find the actual weight, with the bus fully loaded, drive to a scale and read the weight on the front and rear wheels separately to determine axle loading. The load on each axle should not exceed its GAWR. If weight ratings are exceeded, move or remove items to bring all weights below the ratings.

When loading your bus, store heavy gear first. Be sure to keep heavy gear on or as close to the floor as possible. Heavy items should be stored centrally to distribute the weight evenly between the front and the rear axles. Store only light objects on high shelves. Distribute weight to obtain even side-to-side balance of the loaded unit. Secure loose items to prevent weight shifts that could adversely affect the balance and road ability of the vehicle.

Bus Service – Replacement Parts

A paint color label is located adjacent to the Federal Certification Label above the pilot's sun visor.

Data plates located on the rear of the chassis (raise rear engine compartment door for access) provide information useful for identifying your bus if you are planning on ordering parts. Identification plates provide information such as:

1. Body Serial Number
2. Model Year
3. Body Service Number
4. Chassis Serial Number
5. Chassis Service Number

Economical Driving

How you drive, where you drive and when you drive – these factors all have an effect on determining how many miles you can get from a gallon of fuel. Careful maintenance will also contribute to fuel economy.

An idling engine also consumes fuel. If you are faced with more than a few minutes wait, and you are not in traffic, it may be advisable to shut off the engine and re-start later.

A properly lubricated vehicle means less friction between moving parts. Consult the maintenance schedules for proper lubricants, lubrication intervals and general bus maintenance scheduling.

Fuel economy is also related directly to the amount of work accomplished by the engine. Heavier loads require more power: Keep excess weight to a minimum.

Fog Lights

Clear fog lamps are mounted stationary in the front bumper. The fog lamps illuminate only with low beam headlights provided the dash switch is activated.

Winter Traveling

Certain precautions should be taken when traveling in your bus during the cold winter months. Keep these suggestions in mind:

- Provide heat in the bus at all times.

Remember that low temperatures in combination with high winds will cause an equivalent chill temperature much below that indicated by your thermometer. For instance, with an outside temperature of zero degrees and a wind velocity of 10 miles per hour the equivalent chill temperature would be -20 degrees Fahrenheit!

There is no substitute for common sense when traveling in cold weather.

Reporting Safety Defects

If you believe your vehicle has a safety defect which could cause a crash or could cause injury or death, you should immediately inform the National Highway Traffic Safety Administration (NHTSA) in addition to notifying Blue Bird Wanderlodge.

If NHTSA receives similar complaints, it may open an investigation, and if it finds that a safety defect exists in a group of vehicles it may order a recall and remedy campaign. However, NHTSA cannot become involved in individual problems between you, your dealer, or Blue Bird Wanderlodge.

To contact NHTSA, you may either call the Auto Safety Hotline toll free at 1-800-424-9393 (or 366-0123 in Washington, D.C., area).

Or write to:

NHTSA, U.S. Department of Transportation

Washington, D.C. 20590.

Website: http://www.nhtsa.dot.gov

You can also obtain other information about Motor Vehicle Safety from the hotline.

1-1 Safety Features

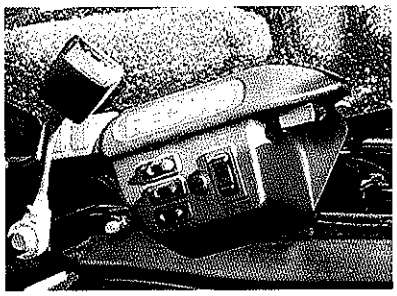
1-1.1 Seat Belts and Restraint Systems

1-1.1.1 Driver's Seat

The Express 4500 is equipped with a fully-adjustable Recaro 2006 Seat. The driver's seat belt is an integral part of the seat assembly. Refer to Recaro documentation for full features, care, and operation information.

▲WARNING: The driver's seat belt should be worn whenever the vehicle is being driven. Remember that the safety of all passengers is directly dependent upon the safety of the driver.

The seat should be adjusted appropriately for the individual operator. Adjustments should be made not only for comfort, but for optimum visibility and full access to bus controls. Control buttons for seat height and tilt, back tilt, and lumbar support are provided on a convenient control panel on the right side of the Recaro seat. These adjustments are air-actuated. Thus, the auxiliary tanks of the bus's air system must be pressurized in order for these seat controls to operate.



Other controls on the seat are mechanical, and therefore require no air pressure for operation. Individual controls for left and right armrest height are adjusted by knobs under the front end of each armrest. Fore and aft adjustment of the seat is also mechanical, and is accomplished by lifting the lock lever at the front underside of the seat cushion. For more information, refer to the Recarro documentation provided with your unit.

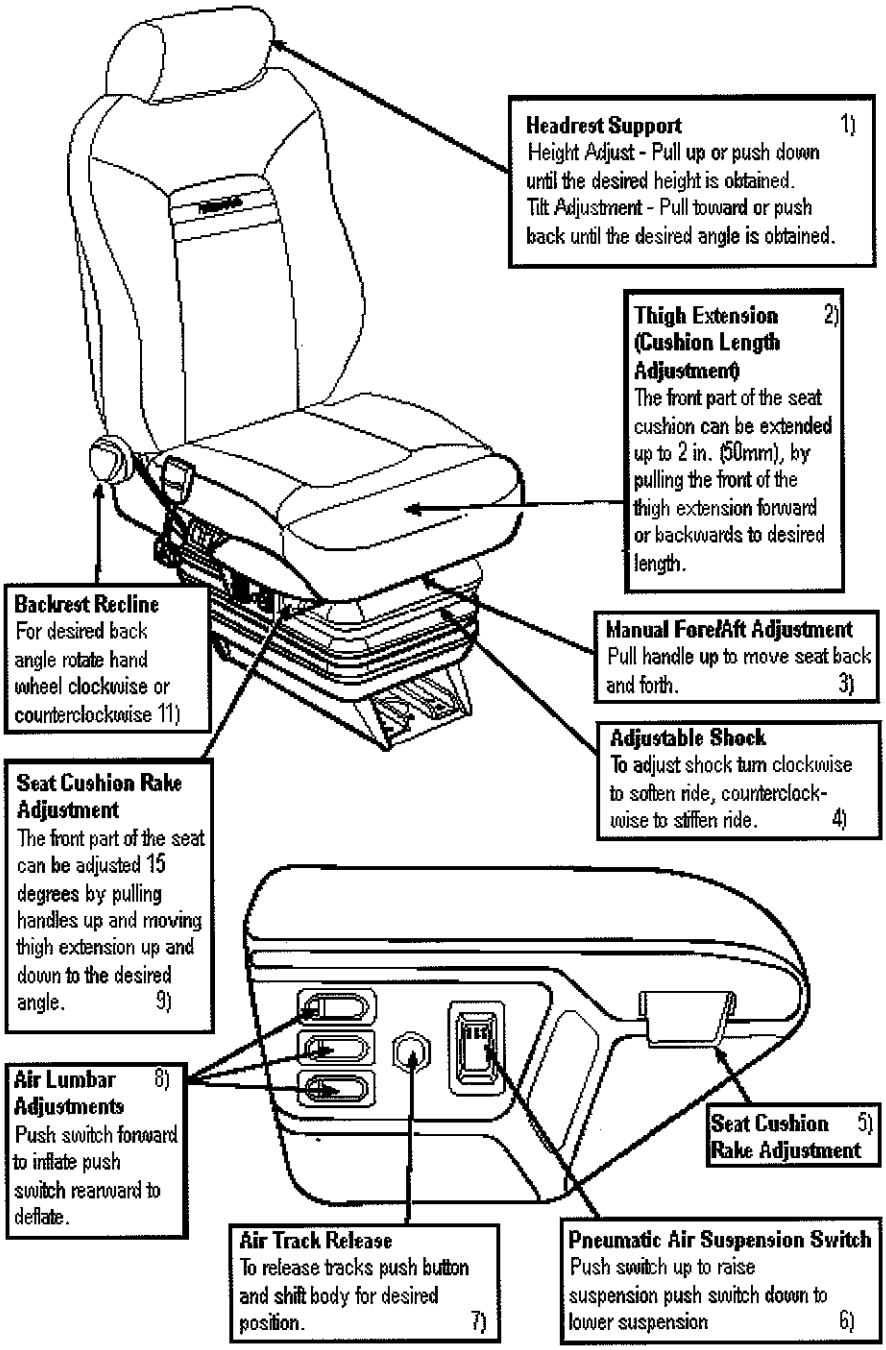
▲WARNING: To avoid accidental momentary loss of control, do not attempt to adjust a driver's seat while the vehicle is in motion. If the engine is running, be sure the parking brake is on before adjusting seat height.

1-1.1.2 Seat Belts

Inspect all seat belts and their attachment points on a weekly basis. Check seat belt buckles and adjustability for proper operation. If necessary, lubricate buckles with a graphite lubricant. Any buckle found to be faulty in any way, must be replaced immediately. If there are any defects in the seat belt strap webbing (i.e., torn or frayed), the seat belt must be replaced immediately. When cleaning seat belts, hand-wash the webbing with only warm water and mild soap. Rinse thoroughly and dry in the shade. Do not bleach or re-dye seat belts, because such processing may severely weaken the strap materials.

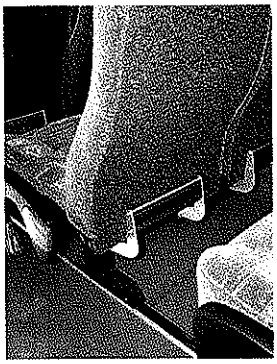
▲WARNING: Be sure the lap belt is fitted snugly around the hips, not the waist. Failure to do so may increase the chance of injury in the event of a collision.

1-1.1.3 Seat Operation



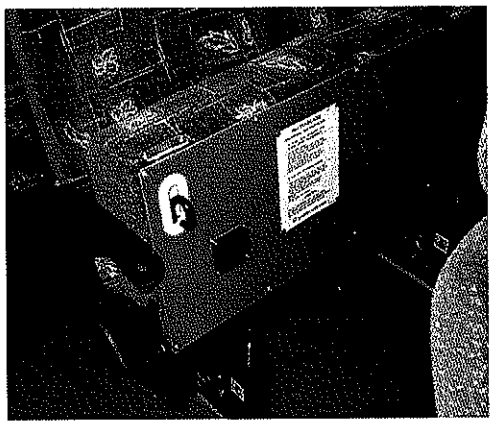
1-1.1.4 Passenger Seats

The Passenger seats in the Express 4500 are American Model 2006 High Back Reclining Seats. These seats are built to meet Federal Motor Vehicle Safety Standards and provide positioning and convenience features for passenger comfort. The seats are mounted on floor and side panel channels which run the length of the bus. This allows some measure of customization of seat arrangements and spacing. However, any such alteration should be performed only by qualified service technicians and in full accordance with any regulations governing seat spacing. Also, if the seat spacing is altered, open sections of the floor tracks must be covered with seat track inserts, available from your Blue Bird parts distributor.

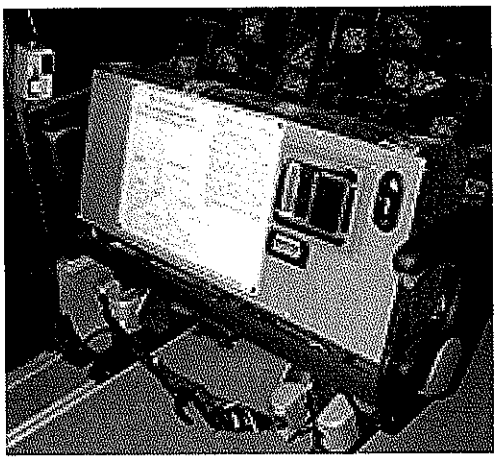


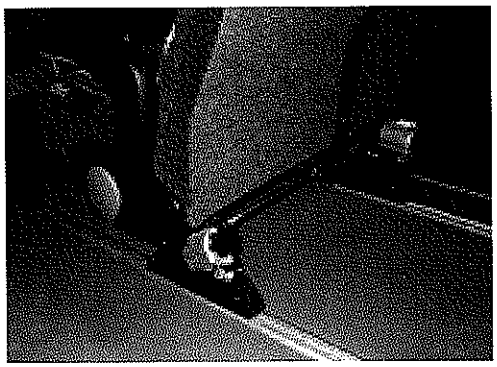
1-1.1.5 Jump Seats

Some of the passenger seats located in proximity to the wheelchair lift door are equipped with flip-up cushions to provide access to the wheelchair constraint system. To lift the seat cushion, grasp the release handle mounted under the aisle-side seat and pull it forward to release the latch. Be sure the seat cushion locks securely in the upright position.



Wheelchair restraint instructions are mounted on the underside of the Jump Seat located immediately to the rear of the wheelchair lift door.





1-1.1.6 Seat Maintenance

Regular seat inspection and maintenance is an important part of the operation regimen for vehicles used for passenger transport. At least every 90 days, inspect and retighten all bolts, and inspect upholstery for cuts and tears. Repair or replace as needed. Express 4500 seats are equipped with a special foam back pad. If the pad becomes damaged, it should be replaced with an approved replacement part. Any aftermarket replacements should be checked for compliance with Federal standards.

1-1.1.7 Seat Cleaning

Regular cleaning and care will prolong the life of the seats and improve the general appearance of the entire bus.

Everyday dirt and soil. may be removed with a soap and water solution. If the stain is persistent, a stiff bristle brush may be used. Fabric-covered seats should be rinsed with clean water after the stain is removed.

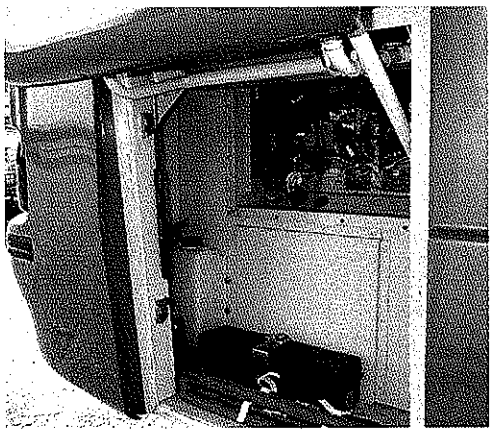
Paint, tar, and asphalt. Stains should be removed immediately using a damp cloth and kerosene. Rub gently, using small strokes. Rinse thoroughly. This type of stain may become permanent if not cleaned immediately.

Nail polish and lacquer-based stains. Soak up as much as possible with dry cloth immediately. Any remaining stain may be removed with a nonflammable cleaning fluid such as "Tuff Stuff" or "Armor All" cleanser. Rinse thoroughly with clean water.

Gum, grease, and shoe polish. Remove as much as possible immediately. If left for any length of time, shoe polish will stain permanently. Clean any remaining stain with "Tuff Stuff" or "Armor All" cleanser.

Ink. Remove stain immediately using a damp cloth and alcohol.

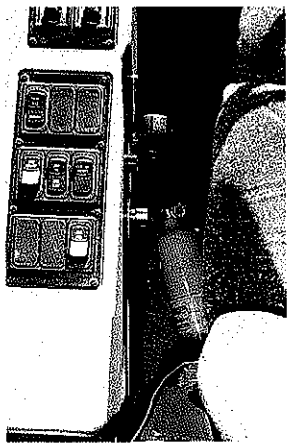
1-1.1.8 Emergency Equipment



Many individual states or provinces have specific laws governing emergency equipment. Your unit may have some or all of the items listed below. Because of variations in option packages, the placement of this equipment inside the bus may vary from the standard installations shown. It is important for you to know the locations of all the emergency equipment on your bus, and to be sure your units always conform to the regulations of the regions in which it is operated. Furthermore, it is important for you to read all literature, labels, and any other written materials supplied by the equipment manufacturers. Be sure you familiarize yourself with all aspects of the emergency equipment before operating the Express-4500.

1-1.1.9 Fire Extinguishers

The fire extinguisher is mounted on the floor to the left of the driver's seat. Your unit may be equipped with a 2.75, 4.5, 5, or 6-pound extinguisher. Inspect the pressure gauge every 30 days or as required by individual state fire laws to make sure the unit is fully charged. Inspect mounting fasteners periodically to be sure they are tight, and be sure you are familiar with their release operation.

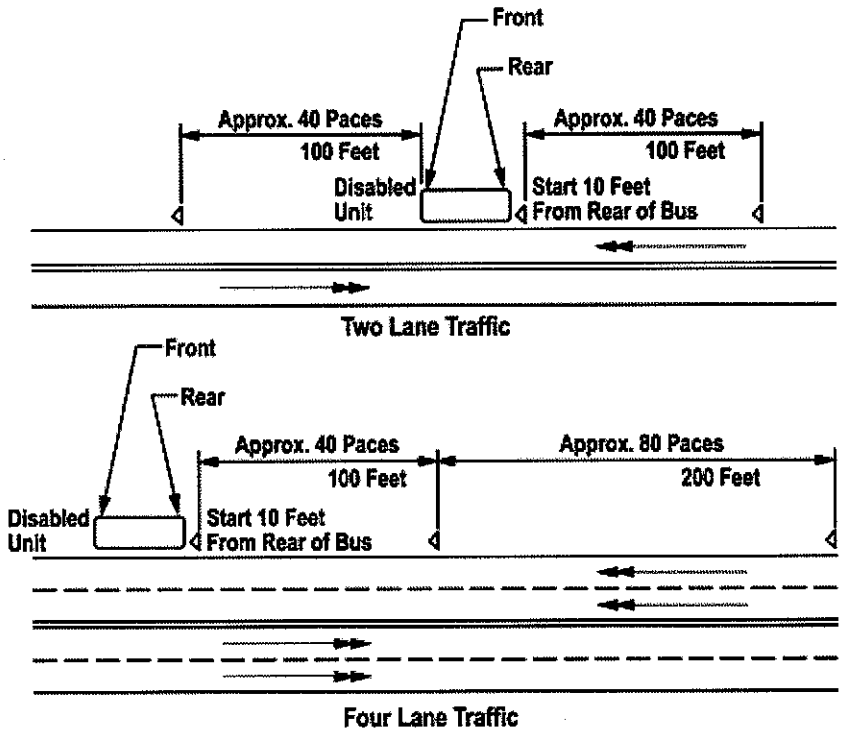


1-1.1.10 First Aid Kit

The first aid kit is attached to the left wall panel just behind the driver's seat. Size and contents of first aid kits vary by option package or differing state specifications. The contents of the kit should be inspected weekly. Check expiration dates on any medications contained. Replace any contents which have been opened or otherwise had their sanitary packaging compromised.

1-1.1.11 Triangular Warning Devices

For states in which they are required, triangular warning devices are located in the driver's luggage compartment. Inspect contents of the kit (as well as the mounting fasteners) every 30 days, or as required by local code.



1-1.1.12 Lug Wrench

The lug wrench is located in the driver's luggage compartment. Inspect the installation-mounting fasteners every 30 days to ensure that the installation is accessible, unobstructed, and tight.

1-1.1.13 Spare Tire Carrier

The Express 4500 is equipped with a front overhang spare tire carrier. The tire is mounted on a slide out tray behind the front bumper. To gain access, first remove the center bumper panel.
Open the luggage compartment door located below the driver's side window and locate the spare tire crank assembly. Place the lug wrench socket on the hex headed shaft, then, turn clockwise, and disengage the ratchet angle. Then slowly lower the tire by turning counterclockwise.

▲WARNING: To help avoid personal injury and/or property damage if a blowout or other tire damage occurs, obtain expert tire service help if you can. An inflated tire and rim can be very dangerous when misused or worn out. Many accidents, some fatal, have resulted from improper handling and operation of bus rims and wheels. Therefore, it is of the utmost importance that all precautions be carefully followed by all persons servicing bus rims and wheels to avoid personal injuries and costly damage.

If you must remove the wheel to change a tire, the following precautions must be followed:

- At all times, keep away from beneath tire and vehicle.
- If the tire looks as if it may contain air under pressure, stand to the side and check whether the wheel assembly appears normal by comparing it to another wheel assembly on the vehicle.
- If you are not fully expert on wheel replacement procedures, or do not have the proper tools and equipment, again, do not attempt to raise the vehicle, or remove or install the tire and wheel assembly. Obtain expert tire service help.

1-1.1.14 Tow Eyes

A set of two tow eyes are contained in the Driver's Luggage Compartment. When used, these are inserted into receiver sockets at the front or rear of the bus.

- Remove the front center bumper panel and locate the two receiver sockets.
- Remove the cotter pin and the hitch pin which are in the sockets.
- Insert Tow Eyes into both of the receiver sockets.
- Replace the hitch pins and cotter pins.

⚠ **CAUTION: Never tow or push a vehicle equipped with an Allison automatic transmission, until the rear drive shaft has been removed, or unless the rear wheels have been raised off the ground. Do not tow by front axle. Do not tow by front or rear bumpers. Tow eyes are designed to tow with both tow eyes simultaneously. Do not attempt to tow with only one tow eye.**

▲WARNING: Extreme caution should be exercised when the drive shaft is removed on a unit equipped with air brakes. The parking brake becomes inoperative when the drive shaft is disconnected. Do not leave the bus unattended until appropriate measures have been taken to prevent vehicle movement. Use only appropriate jack stands supporting frame rails when under bus.

1-1.2 Entrance Door Lock

The entrance door has an air-operated lock installed at the top of the entrance door. The lock engages automatically when the coach reaches 3 mph and disengages when coach is slowed below 3 mph. Rubber assist handles are provided at the entrance door area. Stepwell lights are provided to illuminate the stepwell area. Thermopane entrance door window with tinted gray glass 72% light transmissibility.

1-1.3 Keyless Entry

The Express 4500 is equipped with a KE-1602 Keyless Entry system. Please read this entire section for instructions on operating this system.

1-1.3.1 How To Use the Keyless Entry System

To lock/unlock your vehicle simply enter your personal three to eight digit code on the keypad and the door will unlock. To lock the vehicle from the keypad, enter Lock Code 559. The code can easily be changed to a number that is meaningful to the user, such as a phone number, etc. Instructions for doing so can be found later in this section.

1-1.3.2 How the System Works

The Keyless Entry Keypad system is designed to provide a convenient method to safely and securely enter the vehicle without using keys or keyfobs. If coach has an alarm system it will be disarmed when a valid entry code is entered and when Lock Code 559 or 557 is used. If the coach has a keyfob system as well, this can be used or the keypad, whichever is preferred, or whichever is more convenient at the moment.

1-1.3.3 Using Codes

There are two types of Codes available in the KE-1602: The Master User Code (1) and Optional User Code (5). The Master User Code operates all functions available in the system plus allows user to add, change and delete Optional User Codes as needed.

Entering Master User Code
To unlock the coach enter the 3 to 8 digit Master User Code.

NOTE: The Factory Default Master User Code is 1 3 5 7 9. It is advised to change this code immediately to a 3-8 digit code. Try using a 7 digit phone number for the new Master User Code.

NOTE: The keypad on the KE-1602 has 5 keys. Each key represents two digits. The first key can be used as either or both the numeral 1 and the numeral 2 when entering a code. Example: The Factory default Master User Code can be described as 1 3 5 7 9 or as 2 4 6 8 0. To the system they re the same 5 digit code. It you want a 1 or a 2 in your Master User Code or in an Optional User Code use the first key to represent both numbers.

Changing the Master User Code

a. Locate and press the System Programming Switch
   4 Rapid Beeps will sound and you will have 2 minutes to complete programming the system.

b. Enter 1 1 1 9 on the keypad
   3 Rapid Beeps will sound
   Within 5 seconds of the 3rd Rapid Beep enter the new 3 to 8 digit Master User Code. User Code and the door will unlock. If it doesn't, please read the following paragraph to see where an error may have been made or a step skipped during programming.

NOTE: When using or programming the system make each keystroke within 5 seconds of the previous keystroke or the system will timeout and reset to normal operation. 2 Rapid Beeps signal system reset. If the system resets before changing of the master code has been completed, start over by pressing the System Programming Switch. 1 Long Beep signals an error has been made during the programming sequence. Don't worry, allow the system to reset with 2 Rapid Beeps and then start over by pressing the System Programming Switch.

Code Padding
If you feel you are being observed when you enter your code on the keypad you can "pad" the code by entering several random digits before entering the actual code and still have the door unlock. For instance, if the code is 1 3 9 1 entering 5 7 1 3 9 1 will still unlock the door.

What Code Combinations Are Restricted
Codes 559 and 555 are prep-assigned as Lock Codes. There is no harm if everybody knows the Lock Code. However, the lock code can't be changed so 559 or 555 cannot be used as a Master or Optional User Code.

Furthermore, you may not program a new Master User Code or Optional User Code that starts with the digits 5 or 6 (Key 5/6). If a 5 or 6 is needed at the beginning of the code start with 05 or 06. Example: 05 05 68 (a birth date).

⚠CAUTION: Never use the same sequence of digits for the Master User Code as the first part of an Optional User Code. If this is done, the System Programming Switch will have to be pressed and a new Master User Code selected.

What Code Combinations Are Not Recommended
- Using ATM Pin numbers or computer passcodes
- Short codes using the same digit - example: 111
- Simple codes - example: 123 or 911
- The numbers on your car's license plate

How to Add Optional User Codes and What They Are For
It is possible to add up to 5 Optional User Codes in the Keyless Entry Keypad System. This gives the owner the capability to assign family members their own User Code, or a parking attendant, mechanic, etc. There might be other times when you need to give someone else access to the vehicle when you re away and are not comfortable leaving a set of keys behind (after all, anyone can get a key copied at the local hardware store). Remember, don't give out the personal Master User Code instead of an Optional User Code. This way there is no need to change the Personal Master Code.

How to Enter a Lock Code
After entering a valid Unlock Code wait until the keypad beeps twice or the lights go out before entering either 559 or 555 Lock Codes. See the Convenience Code Mode section at the end of this Guide to understand the differences between using Lock Code 555 instead of Lock Code 559.

1-1.3.4 Using Standard Outputs

Unlocking and Locking
The system has several standard outputs. One output relay is used to unlock the power door locks and another one is used to lock the door locks.

1-1.3.5 Using Auxiliary Outputs

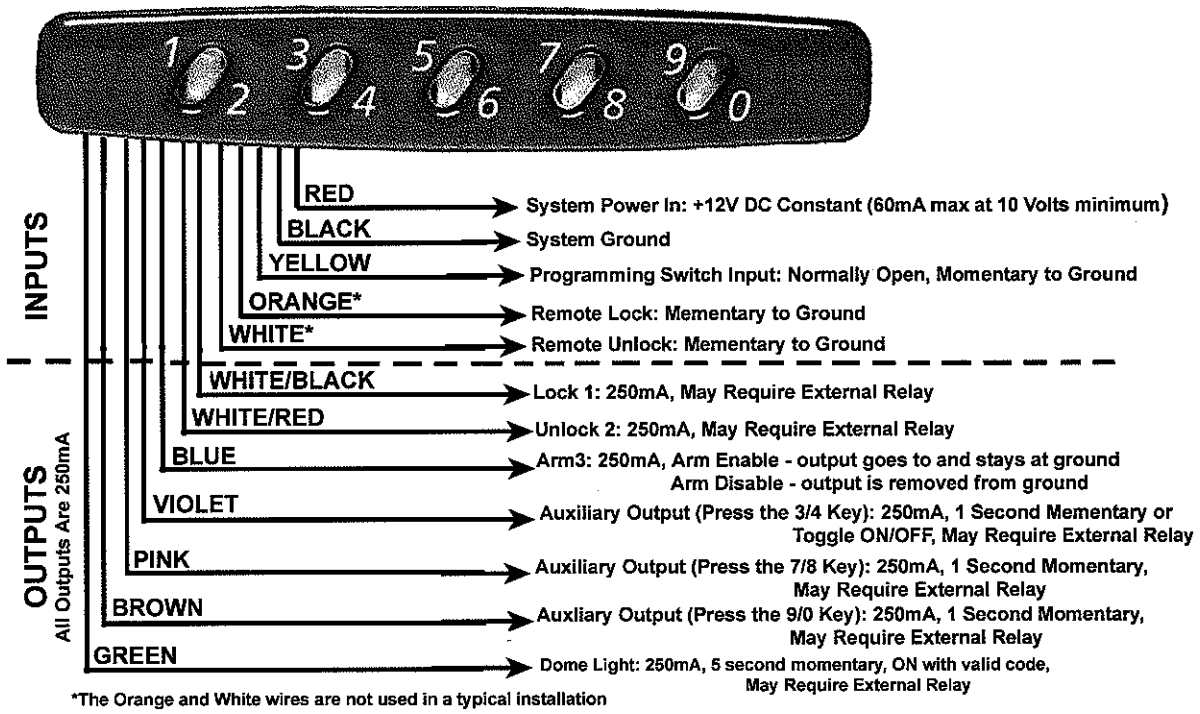
- Auxiliary Output ¾ - Press the ¾ Key within 5 seconds of the last key press of a valid user code.

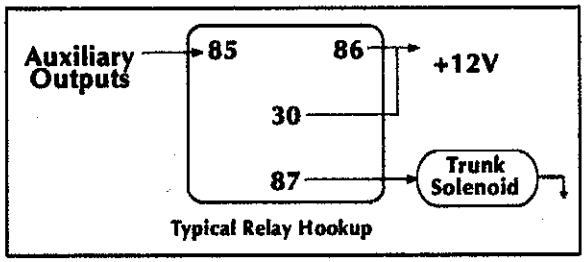
NOTE: This output may be setup to toggle ON/OFF through a programming command for special control applications.

- Auxiliary Output 7/8 - Press the 7/8 Key within 5 seconds of the last key press of a valid user code.
- Auxiliary Output 9/0 - Press the 9/0 Key within 5 seconds of the last key press of a valid user code.

1-1.3.6 Using Convenience Code Mode

The system has a special 3-Digit Convenience Code Mode which can be enabled by the system installer or by following commands listed in the Installer Guide. When the convenience code mode is enabled and the vehicle is locked by using Lock Code 555, every code in the system will not work by entering only the first 3 digits of the code. If you have used 7 or 8 digit codes this can be a handy way to allow a friend or service person to have temporary access by using 3 digits only, and without taking the time to add a new Optional User Code, and without giving away your personal Master User Code. To cancel convenience code mode lock the vehicle with Lock Code 559 and you will be returned to the standard operating mode requiring full length codes. Don't forget, you can always add 3-Digits Optional User Codes for use all the time without activating the Convenience Code Mode if you wish.



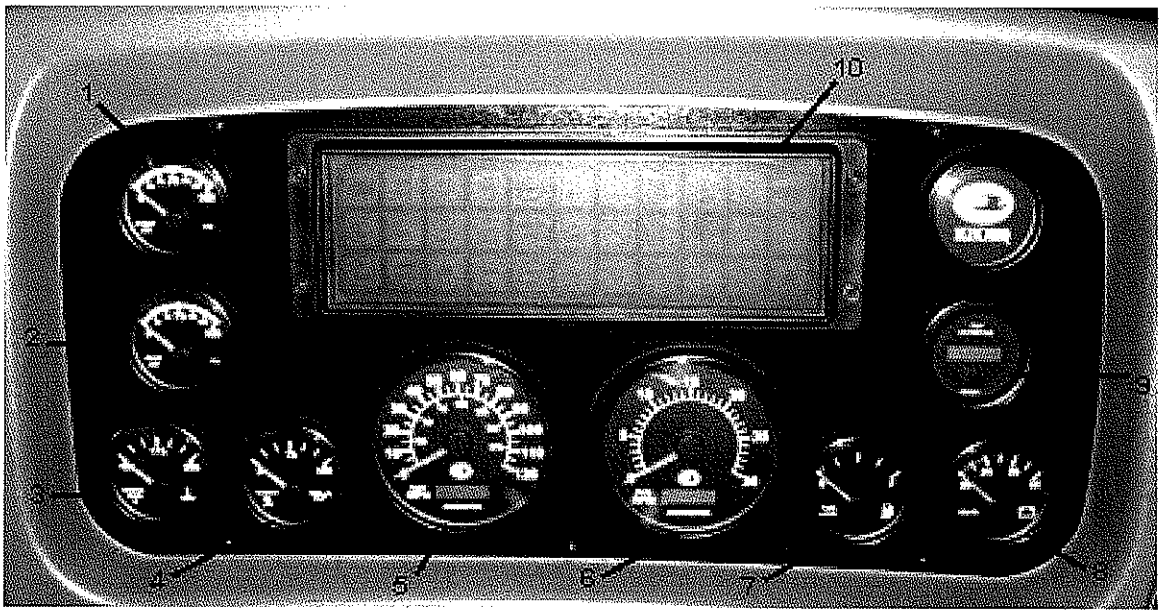


- **Lock Code 559**: Locks the Door, Arm Enabled, Arms the Keypad
- **Lock Code 557**: Locks the Door and Arms the Alarm
- **Lock Code 553**: Locks the Door and Activates 3 Digit Convenience Codes (if enabled)
- Any Valid User Code Unlocks the Door and Arm Disabled.
- Arm Enabled by Lock Codes 559 and 557 Arm Disabled by any valid User Code

2-1 Dash and Monitor Panels

2-1.1 Main Instrument Panel

The main instrument panel supplied with the coach is pictured below. See corresponding numbers and definitions for explanation of what each dial represents.



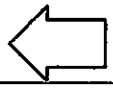
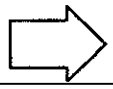
1. **and 2. FRONT/REAR BRAKE AIR GAUGE** – Normal: 110 to 135 psi. The Dual Air Service Brake Pressure systems are engine-operated and supply independent brake system air pressure for front and rear service brakes and the parking brake. During normal operation, each air pressure gauge reading will build up to 110 psi to 135 psi shortly after the engine is started.
3. **ENGINE TEMPERATURE GAUGE** – Monitors the temperature of the engine.
4. **ENGINE OIL PRESSURE GAUGE** – A standard gauge used to display engine oil pressure. The oil pressure is driven by the oil pressure sender analog input.
5. **SPEEDOMETER WITH ODOMOTOR IN MPH** – Measures miles per hour coach is traveling.
6. **TACHOMETER WITH HOURMETER IN RPM** – Keeps track of how many actual hours engine has been used.
7. **FUEL GAUGE** – Indicates the amount of diesel fuel remaining in the tank.
8. **VOLTAGE GAUGE** – Measures voltage at engine ECU.
9. **TRIP ODOMETER** – This is a resettable gauge that measures how many miles driven.
10. **MESSAGE CENTER** – Multiplexed 32 LED Tel Tale Cluster.

2-1.1.1 Message Center

The Message Center shall contain the electronics necessary to interface to the vehicle system indicator inputs. The message center shall have a maximum of 34 indicators, which shall be arranged with two rows of eleven indicators located on the top and bottom separated by a single center row of twelve indicators. The turn signals shall be housed in the center row, outer indicator locations. Refer to the following tables for indicator source information. When the Message Center is first powered on and sees the ignition signal, it shall run a lamp check on all lamps for a two second sound delay.

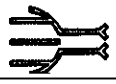
See Table 1 for details on signal source, audible alarm requirements, symbol or nomenclature, color function, and location on message center.

Table 1 - Indicator Definitions

LOCATION	INDICATOR LIGHTS	SIGNAL SOURCE	AUDIBLE ALARM	SYMBOL OR LETTERS	COLOR	FUNCTION
1	Spare	N/A	-	SPARE	RED	SPARE
2	Spare	N/A	-	SPARE	RED	SPARE
3	Low Fuel	INSTR. ECU	-		AMBER	TURNS ON IF < 1/8 TANK
4	Traction Control (ATC)	ABS	-	ATC	RED	TURNS ON FOR DIAGNOSTICS, AND WHEN IN TRACTION CONTROL MODE
5	Park Brake	VEH	-		RED	TURNS ON IF HI BEAM HEADLIGHTS ARE ON
6	Hi Beam	VEH	-		BLUE	~~TURNS ON IF ENGINE FAULT~~
7	Stop Engine	ENGINE	BUZZER (See note 4)	STOP ENGINE	RED	TURNS ON IF ENGINE FAULT
8	WAIT TO START (GRID HEATER)	ENGINE	-	WAIT TO START	RED	TURNS ON WHEN ENGINE IS TURNING ON THE GRID HEATERS
9	ENGINE MAINTENANCE	ENGINE	-	ENGINE MAINT	AMBER	TURNS ON IF ENGINE NEEDS MAINTENANCE
10	LOW COOLANT	VEH	BUZZER		AMBER	TURNS ON IF COOLANT IS LOW
11	Spare	N/A	-	SPARE	RED	SPARE
12	LH TURN INDICATOR ARROW	VEH	CLICK		GRN	TURNS ON IF LEFT TURN SIGNAL HAS BEEN ACTIVATED
13	Spare	N/A	-	SPARE	RED	SPARE
14	WATER IN FILTER (RACOR)	VEH	See Note 1	WATER IN FILTER	AMBER	TURNS ON IF WATER IN FUEL SENSOR DETECTS WATER
15	ABS	ABS	-		AMBER	TURNS ON IF ABS SYSTEM HAS A FAULT OR DIAGNOSTIC INFORMATION
16	LOW AIR	PRX1	See Note 2	LOW AIR	RED	TURNS ON IF AIR PRESSURE IS LESS THAN 62 PSI
17	ENGINE BRAKE	VEH	-	ENGINE BRAKE	RED	TURNS ON IF ENGINE BRAKE DASH SWITCH IS ON
18	ENGINE COMPARTMENT (Fire) ALARM	VEH	See Note 3		RED	TURNS ON IF ENGINE COMPT. FIRE SENSORS DETECT A FIRE
19	TRANSTEMP	TRANS	-	TRANS TEMP	RED	TURNS ON IF TRANSMISSION FAULT
20	CHECK ENGINE	ENGINE	BUZZER (See Note 4)	CHECK ENGINE	AMBER	TURNS ON IF ENGINE DETECTS A PROBLEM
21	HYDRAULIC OIL TEMP WARNING	VEH	BUZZER		AMBER	TURNS ON IF HYDRAULIC OIL TEMPERATURE IS EXCESSIVE (.200°F)
22	Spare	N/A	-	SPARE	RED	SPARE
23	RH TURN INDICATOR ARROW	VEH	CLICK		GRN	TURNS ON IF RIGHT TURN SIGNAL HAS BEEN ACTIVATED
24	DRL	VEH	-	DRL	GRN	TURNS ON IF DAYTIME RUNNING LIGHTS ARE ON
25	Spare	N/A	-	SPARE	RED	SPARE
26	Spare	N/A	-	SPARE	AMBER	SPARE
27	HEADLIGHT ALERT	VEH	BUZZER		AMBER	NOT ON 38 FOOT VEHICLES
28	LEVEL WARNING	VEH	BUZZER	LEVEL WARNING	RED	NOT ON 38 FOOT VEHICLES

TURNS ON WITH PARK BRAKE SET

CALLED KATHY ON THIS ON 12/5/03 ERC

29	SUSPENSION DUMP	VEH	BUZZER	SUSP DUMP	RED	TURNS ON AFTER SUSP IS DUMPED (2 SEC. ON DELAY) TURNS BACK OFF (AFTER 1 MINUTE) AFTER SUSP. PRESSURE BACK UP
30	TAG DUMP	VEH	-		RED	NOT ON 38 FOOT VEHICLES
31	CHECK TRANS	TRANS	-	CHECK TRANS	AMBER	TURNS ON IF TRANSMISSION FAULT
32	TV ANT/SAFELINE	VEH	BUZZER See Note 5		FLASHING AMBER	TURNS ON IF
33	Spare	N/A	-	SPARE	RED	SPARE
34	Spare	N/A	-	SPARE	GREEN	SPARE

Audible Outputs: The Message Center shall have two audio transducers to produce the sounds listed in the table above. These sounds are identified as being a buzzer, a click, and a chime.

Click: The click output is used to indicate that the turn signals are flashing. Every time a turn signal indicator is turned on, the Buzzer output will be turned on for 10 ms.

Single Chime: The single chime output is used to indicate a Next Stop Request. The Message Center will output 1.0 kHz for 1000 ms (including 800 ms of decay) when the Next Stop Request function is first activated, with a minimum sound pressure level of 85dB at 10cm.

Double Chime: The double chime output is used to indicate a Wheel Chair Next Stop Request. The Message Center will output 1.0 kHz for 1000 ms (including 800ms of decay), then output 1.0 kHz for 1000 ms (including 800 ms of decay) when the Wheel Chair Next Stop Request function is first activated, with a minimum sound pressure level of 85dB at 10cm.

Buzzer: The buzzer output is the primary audible output. The Message Center output 3.6 kHz +/- 0.5 kHz for as long as a buzzer function is activated, with a minimum sound pressure level of 90 dB at 10cm with 12 Volts applied.

Buzzer Notes:
Note 1: Water in Filter Buzzer. The H4RE Water in Filter (L14) input will activate the Buzzer during initial startup for a duration of 30 seconds, if the corresponding input was at ground when power was first applied.

Note 2: Low Air Buzzer. The buzzer and Low Air Indicator shall come on if the air pressure in EITHER front OR rear system has decreased to ≤ 62 +2/-0 PSI. Once the air pressure in EITHER front OR rear system falls below 62 +2/-0 PSI, the buzzer and indicator light shall remain on until the air pressure in BOTH front AND rear systems has reached a minimum of 70 + 1/-1 PSI.

Note 3: Engine Compartment Fire Alarm Buzzer. The Engine Compartment (Fire) Alarm (L18) input will activate the Buzzer at the rate of 2.0 Hz with a 50% duty cycle when the corresponding input is at +12 Volts.

Note 4: Stop and Check Engine (engine warning) Buzzer. The buzzer shall be continuously energized when either the stop engine OR check engine lamps are commanded by the engine AND critical limits are exceeded on EITHER the oil pressure data OR the coolant temperature data received off the data link. These limits shall be programmable. Default values for Cummins are tabled below:

Table 2

ENGINE	COOLANT TEMP	OIL PRESSURE
Deleted	Deleted	Deleted
ISL	220	10

Note 5: TV/Safeline Buzzer. The TV/Safeline input will activate its indicator and the Buzzer at the rate of 1.0 Hz with a 50% duty cycle when the corresponding input is at ground.

Priority Buzzer: Priority shall be as follows with a priority 1 as the highest.

Table 3

BUZZER APPLICATION	PRIORITY
ENG COMPARTMENT FIRE ALARM	1
LOW AIR	2
ENGINE WARNING	3
TV / SAFELINE	4
WATER IN FILTER	5
TURN SIGNALS	7

Indicator Signal Source: See Table 4 for details on source for indicator light.

Table 4: H4RE Message Center Signal Sources

FUNCTION	CUM	WT	BENDIX	PRX1	VEHICLE
LOW OIL PRES ALARM				GND	
HIGH COOL TEMP ALARM				GND	
TRANS TEMP		GND			
CHECK TRANS		GND			
STOP ENGINE	GND				
CHECK ENGINE	GND				
ENGINE MAINTENANCE	GND				
WAIT TO START	GND				
LOW AIR				GND	
ABS			GND		
TRACT CONTROL (ATC)			GND		
PARK BRAKE					GND
RH TURN IND ARROW					+12V
LH TURN IND ARROW					+12V
HIGH BEAM					+12V
HYD OIL TEMP WARNING					GND
LOW COOLANT					GND
DRL					GND
ENG COMP FIRE ALARM					+12V
ENGINE BRAKE					GND
LOW FUEL				GND	
WATER IN FUEL					GND
WATER IN FILTER					GND
SUSPENSION DUMP					+12V
TAG DUMP					GND
LEVEL WARNING					+12V
HEADLIGHT ALERT					+12V
SPARE					GND
SPARE					GND
TV/ANT SAFELINE					GND

Indicators that need to come on without Ignition On: RH indicator, LH indicator, High Beam indicator, Level Warning indicator, Headlight Alert indicator, and Engine Compartment (fire) alarm indicator.

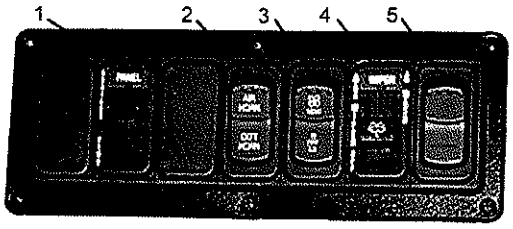
Low Fuel Indicator: This indicator input shall come from the PRX1 module, which will have special requirements. See the section on the PRX module.

Power Up and Power Down Requirements: Upon start up the indicator lights will turn on for a two second delay.

Message Center Pin Assignments

H4RE	
SIGNAL NAME	**Pin #**
Spare Indicator	B1
Spare Indicator	B4
Low Fuel SIGNAL	A1
Tract. Control (ATC)	A3
Park Brake	C4
High Beam	C15
Stop Engine	C7
Wait To Start	A8
Engine Maintenance	C16
Low Coolant	C9
Spare Indicator	B2
LH Turn Indicator	A18
Spare Indicator	B3
Water in Filter	B5
ABS	A2
Low Air	C1
Engine Brake	C3
Eng. Compartment (Fire) Alarm	C6
Trans Temp	C8
Check Engine	C17
Hydraulic Oil Temp Warning	C13
Spare Indicator	B9
RH Turn Indicator	C20
DRL	B8
Spare Indicator	C18
Spare Indicator	C19
Headlight Alert (not used)	B12
Level Warning (not used)	C2
Suspension Dump	C5
Tag Dump (not used)	C10
Check Trans	C11
TV Ant/Safeline	A4
Spare Indicator	C12
Spare Indicator	C14
Coolant Temp SIGNAL	A5
Oil Pressure SIGNAL	A6
Spare Buzzer 4	A16
Spare Buzzer 5	A17
Spare Buzzer 6	A15
Spare Buzzer 1	A14
Spare Buzzer 2	A12
Spare Buzzer 3	A13
Switched +12V	B6
Ground	B7
Spare Indicator	B10

2-1.2 Right Dash Panel Controls and Indicators

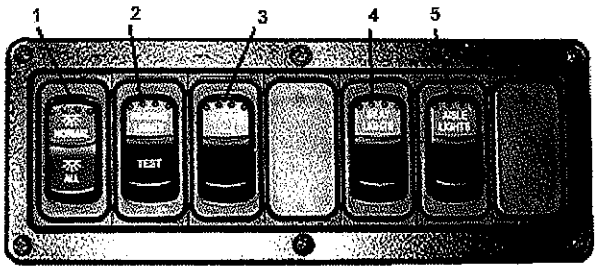


The Right Dash Panel Controls and Indicators are the controls found on the right hand side of the instrument panel on the main dash.

1. DIMMER SWITCH – Controls brightness of switches and gauges at night.

2. AIR/CITY HORN – Allows user to toggle between the air and city horns. It is recommended the air horn be used for highway travel, and the city horn be used in residential areas.

3. **VENT** – Allows user to switch from Hi, Off and Low vent settings for roof hatch.
4. **WIPER** – Controls intermittent feature of wiper system with windshield washer.
5. **HAZARD FLASHERS** – Turns on emergency flashers. When the switch is used, both left and right turn signals will flash in unison.

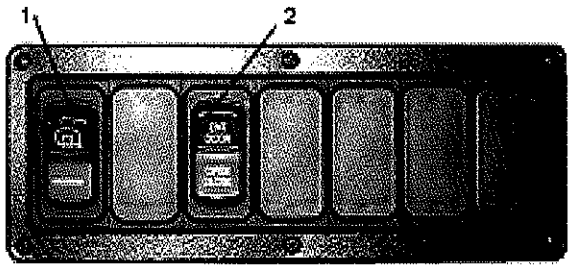


1. **INTERIOR FLUORESCENT LIGHTS SWITCH** – Norm – 1st two lights are controlled with door open/close. All others on. Helps with drivers glare on windshield during night. Off – All Fluorescent lights are off. All – All fluorescent lights are on.

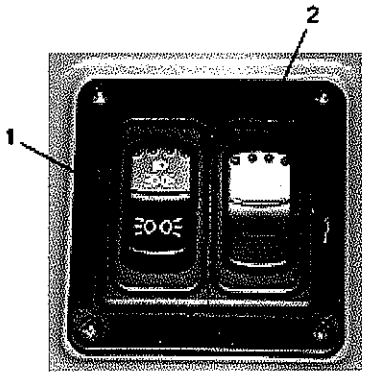
2. **READING LIGHTS SWITCH** – Reading Light - Allows passenger control of reading lights. Test – Used by maintenance personnel to check reading lights.
3. **DRIVERS LIGHT**
4. **SEAT LIGHTS** – Blue under seat lights that illuminate floor during night run.
5. **AISLE LIGHTS** – This switch allows you to turn the aisle lights on or off from the pilot's chair.

1. **MIRROR HEAT** – Momentary switch allows 5 minutes of mirror defrost.

2. **ENT. DOOR OPEN/CLOSE** – Opens and closes the entrance door.



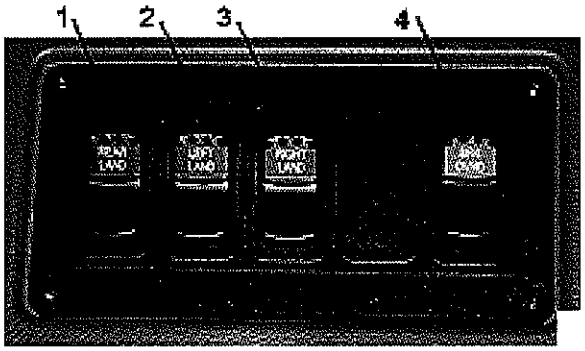
2-1.3 Left Dash Panel Controls and Indicators



1. PARK AND CLEARANCE LIGHTS – Use this switch to select your park and clearance lights only. (top position)

1. HEADLIGHTS, PARK AND CLEARANCE LIGHTS – Use this switch to select headlights, park and clearance lights. (bottom position)

2. FOG LAMPS – Switches fog lamps on and off.



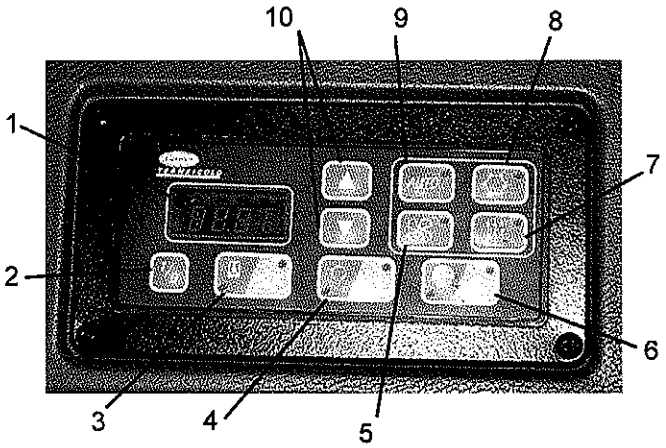
1. REAR LAND – Turns rear landing lights on/off.

2. LEFT LAND – Turns left landing lights on/off.

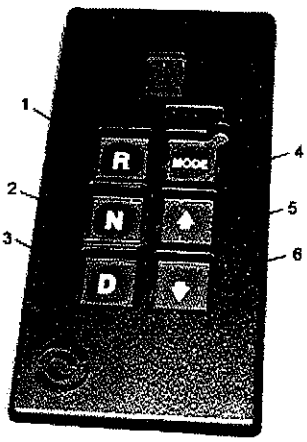
3. RIGHT LAND – Turns right landing lights on/off.

4. BRK OVRD – Allows user to override the brake.

1. **Temperature Display**
2. **HVAC on/off switch**
3. **Inside/outside temperature selector switch**
4. **Air recirculation/fresh switch**
5. **Fan only mode switch**
6. **Fan high/low selector switch**
7. **Heat only mode switch**
8. **A/C only mode switch**
9. **HVAC auto mode switch**
10. **Temperature set switches**



2-1.4 Left Side Driver's Armrest Panel Controls and Indicators



This panel allows you to select the gears in your transmission.

1. REVERSE – Selects reverse gear.

2. NEUTRAL – Puts transmission in neutral.

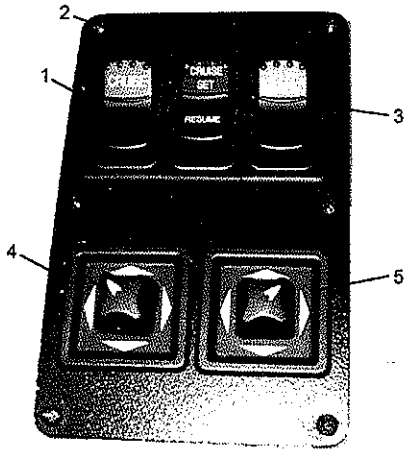
3. DRIVE – Selects drive gear.

4. MODE – Puts transmission in economy mode. This shifts transmission from 2000 to 1800 rpm which will save on fuel.

5. ARROW UP – Allows driver to shift up one gear at a time, for instance from 4th to 5th gear.

6. ARROW DOWN – Allows driver to shift down one gear at a time. For instance shifts from 5th to 4th.

ARROW UP AND ARROW DOWN PUSHED TOGETHER – When these are pushed at the same time allows transmission to go into diagnostic mode. To use this feature the bus has to have the engine running, transmission in normal operating temperature. This mode will check the transmission fluid level, transmission defect codes. If this mode is selected and you have not met the conditions stated the system will let you know.



1. CRUISE – Turns cruise control on and off.

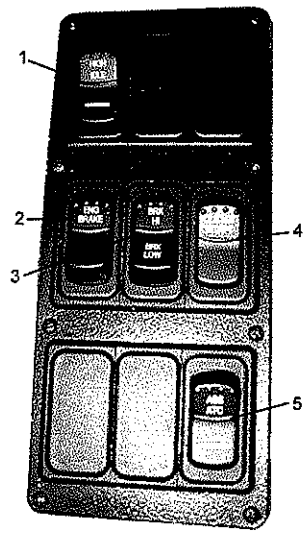
NOTE: The coach must be traveling at least 35 mph before the cruise control will operate properly.

2. CRUISE SET/RESUME – Locks the cruise control on the desired cruising speed. Press Resume when bus was taken out of cruise momentarily, for example, to speed up to pass a vehicle, etc. This will restore cruise to what was originally set.

NOTE: The coach should be at or above 35 mph before attempting the RESUME function. In addition, if the ignition switch has been turned off, the previous cruise speed will be erased from memory and the new cruise speed will be that speed when the RESUME switch was depressed.

3. CLEARANCE LIGHTS – Turns clearance lights on and off.

4. and 5. LEFT and RIGHT OUTSIDE MIRRORS – Use these controls to adjust outside mirrors as needed.



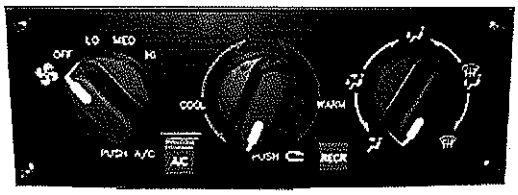
1. **HIGH IDLE** – When a higher idle speed is needed, the engine can be placed in the **high idle** by:
   1) Place coach in neutral
   2) Apply parking brake.
   3) Turn on **high idle** switch on left-hand auxiliary cabinet.

   Safety features of high idle:
   - Releasing parking brake disengages the **high idle** feature.
   - Placing transmission in gear disengages the high idle feature.

NOTE: Programming built into the I/O Control's multi-plexing system. When the coach's transmission is engaged the high idle is disengaged and engine rpm's returns to normal and the shift selection is placed in stand-by until the parking brake is released.

2. **ENG BRAKE** – Enables the engine brake.
3. **BRK HI/LOW** – Selects HI or LOW if engine brake is engaged.
4. **CLR LGT INTRPT** – Trucker's salute
5. **ABS ATC** – Auto traction control. Helps prevent wheel slippage during acceleration on wet or icy roads.

2-1.5 Heat and AC Controls



The first dial on this panel lets the user select between Fan, Off, Lo, Med, and Hi speed for either the heater or the air conditioner. The second button chooses between cool and warm air. The third button controls where the air or heat will be directed. These are much like the standard controls that come with any vehicle. To select air conditioning, push the blue AC button at the bottom of the panel. To choose recirculating air push the green RECR button located on the bottom of this panel.

2-2 Driver and Co-Pilots Area

2-2.1 Mirrors

2-2.1.1 Mirrors Exterior

Two remote controlled and heated mirrors (flat portion) are provided. The convex portion of the mirrors are manually adjusted. The controls for the mirrors are located in the driver's area.

2-2.1.2 Mirror Interior

4 x 8 compound convex mirror, located on left-hand windshield pillar.

2-2.2 Entrance Door Electric Lock

The entrance door electric lock is operated by the remote that controls entry door lock.

2-2.3 Entrance Door Air Lock

An air-operated lock is installed at the top of the entrance door. The lock engages automatically when the coach reaches 3 mph and disengages when coach is slowed below 3 mph. Stainless steel assist handrails are provided at the entrance door area. Stepwell lights are provided to illuminate the stepwell area. Thermopane entrance door window with tinted gray glass 72% light transmissibility.

2-2.4 Entry Door Operation

2-2.4.1 Door Open

By momentarily depressing the upper half of door switch, upper door lock disengages from door and door open/close cylinder extends, pushing door to full open position. Switch does not need to be held to open door.

2-2.4.2 Door Close

By momentarily depressing lower half of door switch, door open/close cylinder retracts, pulling door to full closed position. Once door is closed, upper door lock extends into pocket at top of door.

NOTE: Switch does not need to be held to close door.

2-2.4.3 Driving

Once coach has reached 3 mph road speed, door operation circuit is disabled, maintaining door in closed position, regardless of whether door switch is actuated.

After dropping below 3 mph, door will resume normal operation.

2-2.4.4 Emergency Release

In the event that the door will not operate using the dash-mounted switch, an emergency release valve is located on top of the dash forward of the entry door. Depressing the knob will cause all air pressure to be exhausted from the door lock cylinder and the door open/close cylinder, allowing the door to be opened manually. Constant pressure against the door will be necessary to hold the door open to overcome the internal speed restrictors. To resume normal door operation, pull knob up to re-pressurize cylinders.

⚠CAUTION: Stand clear of door when re-pressurizing.

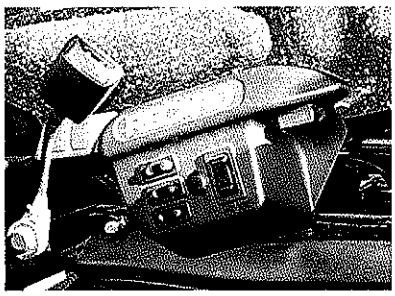
2-2.5 Six-Way Power Seats and Seat Belts

2-2.5.1 Driver's Seat

The Express 4500 is equipped with a fully-adjustable Recaro Metro Seat. The driver's seat belt is an integral part of the seat assembly. Refer to Recaro documentation for full features, care, and operation information.

▲WARNING: The driver's seat belt should be worn whenever the vehicle is being driven. Remember that the safety of all passengers is directly dependent upon the safety of the driver.

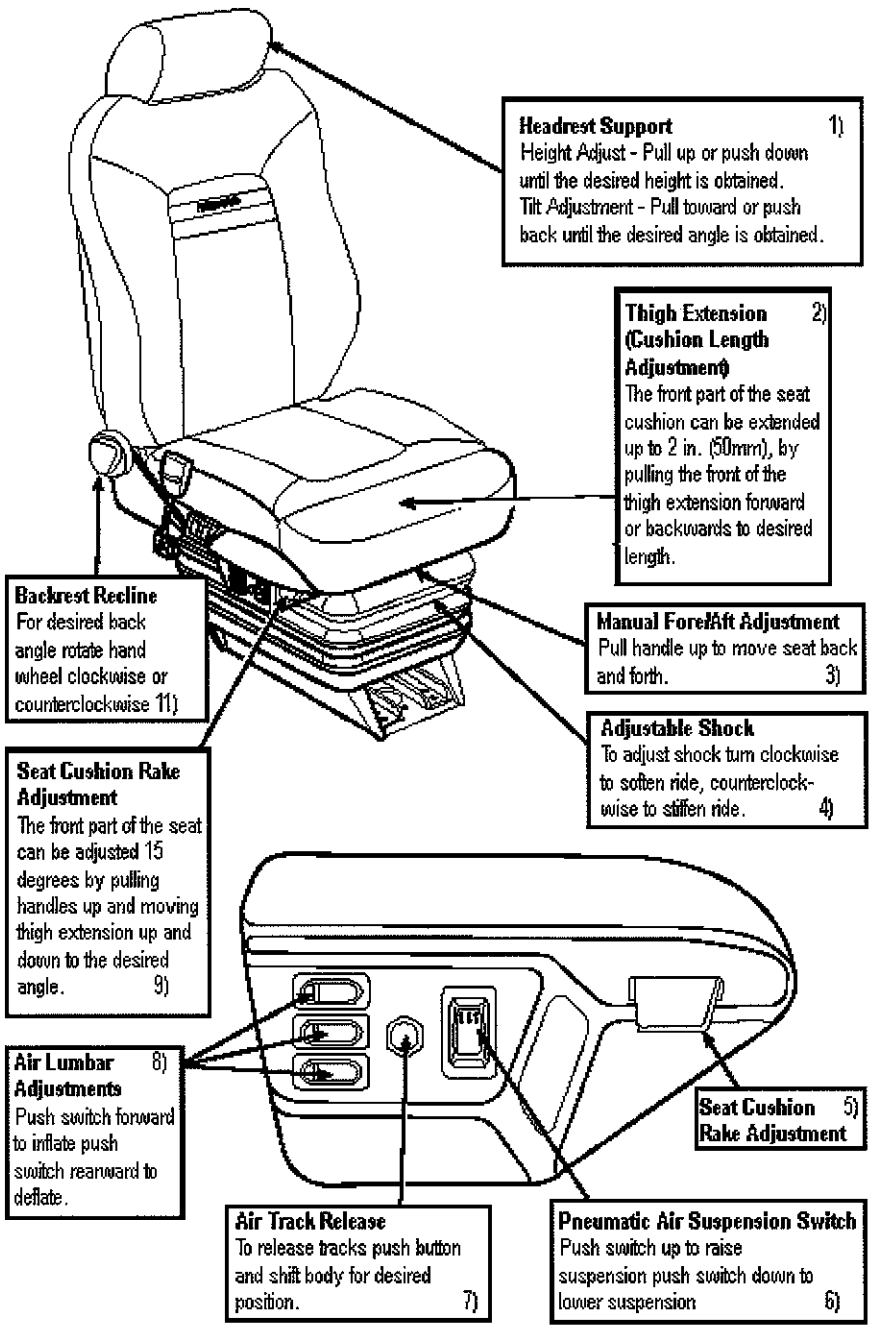
The seat should be adjusted appropriately for the individual operator. Adjustments should be made not only for comfort, but for optimum visibility and full access to bus controls. Control buttons for seat height and tilt, back tilt, and lumbar support are provided on a convenient control panel on the right side of the Recaro seat. These adjustments are air-actuated. Thus, the auxiliary tanks of the bus's air system must be pressurized in order for these seat controls to operate.



Other controls on the seat are mechanical, and therefore require no air pressure for operation. Individual controls for left and right armrest height are adjusted by knobs under the front end of each armrest. Fore and aft adjustment of the seat is also mechanical, and is accomplished by lifting the lock lever at the front underside of the seat cushion. For more information, refer to the Recarro documentation provided with your unit.

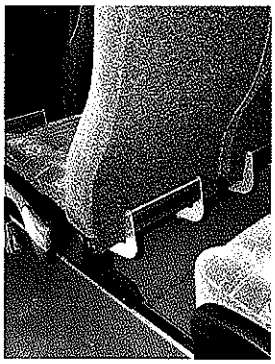
▲WARNING: To avoid accidental momentary loss of control, do not attempt to adjust a driver's seat while the vehicle is in motion. If the engine is running, be sure the parking brake is on before adjusting seat height.

2-2.5.2 Seat Operation



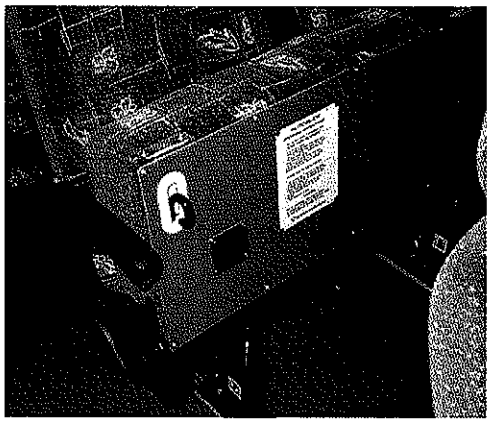
2-2.5.3 Passenger Seats

The Passenger seats in the Express 4500 are American Model 2006 High Back Reclining Seats. These seats are built to provide positioning and convenience features for passenger comfort. The seats are mounted on floor and side panel channels which run the length of the bus. This allows some measure of customization of seat arrangements and spacing. However, any such alteration should be performed only by qualified service technicians and in full accordance with any regulations governing seat spacing. Also, if the seat spacing is altered, open sections of the floor tracks must be covered with seat track inserts, available from your Blue Bird parts distributor.



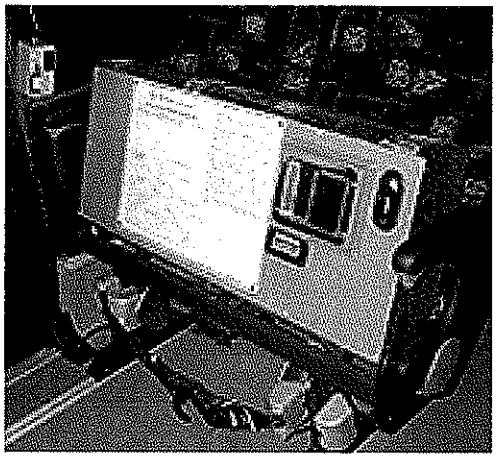
2-2.5.4 Slide Guide Seats

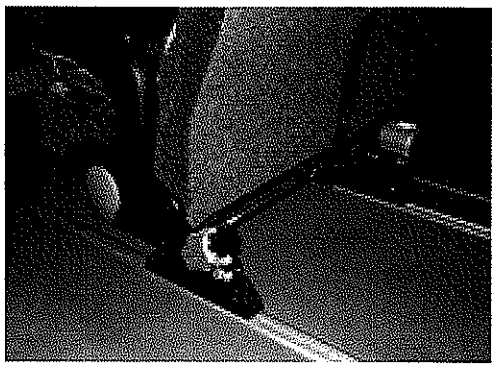
Some of the passenger seats located in proximity to the wheelchair lift door are equipped with flip-up cushions to provide access to the wheelchair constraint system. To lift the seat cushion, grasp the release handle mounted under the aisle-side seat and pull it forward to release the latch. Be sure the seat cushion locks securely in the upright position.



Wheelchair restraint instructions are mounted on the underside of the Flip Seat located immediately to the rear of the wheelchair lift door.

Basically two seats slide forward and the other flips up allowing enough room for securing the wheelchair.





2-2.5.5 Seat Maintenance

Regular seat inspection and maintenance is an important part of the operation regimen for vehicles used for passenger transport. At least every 90 days, inspect and retighten all bolts, and inspect upholstery for cuts and tears. Repair or replace as needed. Express 4500 seats are equipped with a special foam back pad. If the pad becomes damaged, it should be replaced with an approved replacement part. Any aftermarket replacements should be checked for compliance with Federal standards.

2-2.5.6 Seat Cleaning

Regular cleaning and care will prolong the life of the seats and improve the general appearance of the entire bus.

Everyday dirt and soil. may be removed with a soap and water solution. If the stain is persistent, a stiff bristle brush may be used. Fabric-covered seats should be rinsed with clean water after the stain is removed.

Paint, tar, and asphalt. Stains should be removed immediately using a damp cloth and kerosene. Rub gently, using small strokes. Rinse thoroughly. This type of stain may become permanent if not cleaned immediately.

Nail polish and lacquer-based stains. Soak up as much as possible with dry cloth immediately. Any remaining stain may be removed with a nonflammable cleaning fluid such as "Tuff Stuff" or "Armor All" cleanser. Rinse thoroughly with clean water.

Gum, grease, and shoe polish. Remove as much as possible immediately. If left for any length of time, shoe polish will stain permanently. Clean any remaining stain with "Tuff Stuff" or "Armor All" cleanser.

Ink. Remove stain immediately using a damp cloth and alcohol.

2-2.6 Optional Equipment Available

2-2.6.1 CB Receiver Transmitter

A forty channel, CB receiver/transmitter is available installed in your coach.

2-2.6.2 Closed Circuit Rear-Vision Camera

A color LCD rear view monitor is standard on the coach. This allows you to see behind coach. This is especially helpful when towing a vehicle, it allows driver to see behind and keep an eye on what is in tow.

1. **Power/Standby Button** – There are two possible modes of operation for turning the unit on/off. In manual mode, the power button is used to turn the unit on/off. In standby mode, the unit automatically turns on only when 12V is applied to the stand-by trigger wire. The power button features dual-illumination (bright and dim). In installations where the unit is not wired for standby operation and power is applied to the unit, the Power Button will dimly glow when the unit is off, allowing the user to easily find the control in low light. Illumination switches to full intensity when the unit is turned on.

2. **A/B Input Select Switch** – This control toggles the active display image back and forth between AV1 and AV2 inputs.

3. **Day/Night Mode Button** – This allows the unit to be switched between "Day" and "Night" LCD illumination modes. In the "Day" mode, the LCD backlight intensity is at maximum. In "Night" mode, the LCD backlight is dimmed to a preset level that is more suitable for low light operation.

4. **Picture Adjustment Menu Button** – Accesses the On-Screen Display (OSD) menu for four LCD picture adjustments (Brightness, Contrast, Color, and Tint). The first depress of the button accesses the "Brightness" adjustment. The Volume +/- controls adjusts the level, which is indicated by a bar graph at the bottom of the screen. Each consecutive depress of the Picture button accesses the adjustment screen for each picture adjustment. If no buttons are pressed within 6 seconds or controls other than the Picture and Volume buttons are pressed, the unit will exit the Picture Adjustment mode.

5. **Volume +** - Increases volume output.
6. **Volume –** - Decreases volume output.

2-2.6.3 Troubleshooting

SYMPTOM	CAUSE	SOLUTION
No power	No +12V accessory, no ground, mis-wired/reversed.	Replace circuit fuse, monitor has protection device built-in/reset, check ground connection, verify power is being supplied.
Video/No audio	Blue/white audio trigger wire not powered, volume adjust down	Connect to +12V ACC or reverse light circuit, turn volume adjustment up
Monitor does not activate in reverse	Blue standby wire not powered	Connect to reverse circuit +12V
Negative/dark video image	Low voltage, brightness adjustment down	Check voltage power and ground connections, turn brightness adjustment up
No video/no audio	Camera connection	Check camera input selection, connection to camera and junction bow, correct camera connection/plugged incorrectly
Vehicle battery drained	+12V ACC (red wire) connected to vehicle battery	Provide +12V ACC (red wire) power from switched circuit

Safety Summary

General Safety Notices

The following general safety notices supplement the specific warnings and cautions appearing elsewhere in this manual. They are recommended precautions that must be understood and applied during operation and maintenance of the equipment covered herein. A listing of the specific warnings and cautions appearing elsewhere in the manual follows the general safety notices.

FIRST AID

An injury, no matter how slight, should never go unattended. Always obtain first aid or medical attention immediately.

OPERATING PRECAUTIONS

Always wear safety glasses.

Keep hands, clothing and tools clear of the evaporator and condenser fans.

No work should be performed on the unit until all circuit breakers and start-stop switches are placed in the OFF position, and power supply is disconnected.

Always work in pairs. Never work on the equipment alone.

In case of severe vibration or unusual noise, stop the unit and investigate.

MAINTENANCE PRECAUTIONS

Beware of unannounced starting of the evaporator and condenser fans. Do not open the unit cover before turning power off.

Be sure power is turned off before working on motors, controllers, solenoid valves and electrical controls. Tag circuit breaker and power supply to prevent accidental energizing of circuit.

Do not bypass any electrical safety devices, e.g. bridging an overload, or using any sort of jumper wires. Problems with the system should be diagnosed, and any necessary repairs performed, by qualified service personnel.

When performing any arc welding on the unit, disconnect all wire harness connectors from the modules in the control box. Do not remove wire harness from the modules unless you are grounded to the unit frame with a static-safe wrist strap.

In case of electrical fire, open circuit switch and extinguish with CO_2 (never use water).

SPECIFIC WARNINGS AND CAUTIONS

▲WARNING: Be sure to observe warnings listed in the safety summary in the front of this manual before performing maintenance on the hvac system.

▲WARNING: Read the entire procedure before beginning work. Park the coach on a level surface, with parking brake applied. Turn main electrical disconnect switch to the off position.

▲WARNING: Do not use a nitrogen cylinder without a pressure regulator.

▲WARNING: Do not use oxygen in or near a refrigeration system as an explosion may occur.

▲WARNING: The filter-drier may contain liquid refrigerant. Slowly loosen the flare nuts to avoid refrigerant contact with exposed skin or eyes.

▲WARNING: Extreme care must be taken to ensure that all the refrigerant has been removed from the compressor crankcase or the resultant pressure will forcibly discharge compressor oil.

⚠CAUTION: Do not under any circumstances attempt to service the microprocessor. Should a problem develop with the microprocessor, replace it.

⚠CAUTION: To prevent trapping liquid refrigerant in the manifold gauge set be sure set is brought to suction pressure before disconnecting.

2-3 Bus Air Conditioning Unit

2-3.1 Introduction

This manual contains Operating Instructions and Electrical Data for the Model 68RF353 Air Conditioning and Heating equipment furnished by Carrier Transport Air Conditioning as shown in Tables 1-1 and Table 1-2.

Table 1-1 Option Legend

Evaporator Frame	
1	0 or 20% Air Exchange or Blankoff
2	0 to 100% Air Exchange
3	Customer Preset
Refrigeration Kit	
1	Road Side with Heat
2	Curb Side with Heat

Air Exchange	
1	None
2	0 & 20%
3	0 & 100%
4	Customer Preset
Controller	
1	Standard
2	Variable Air Exchange

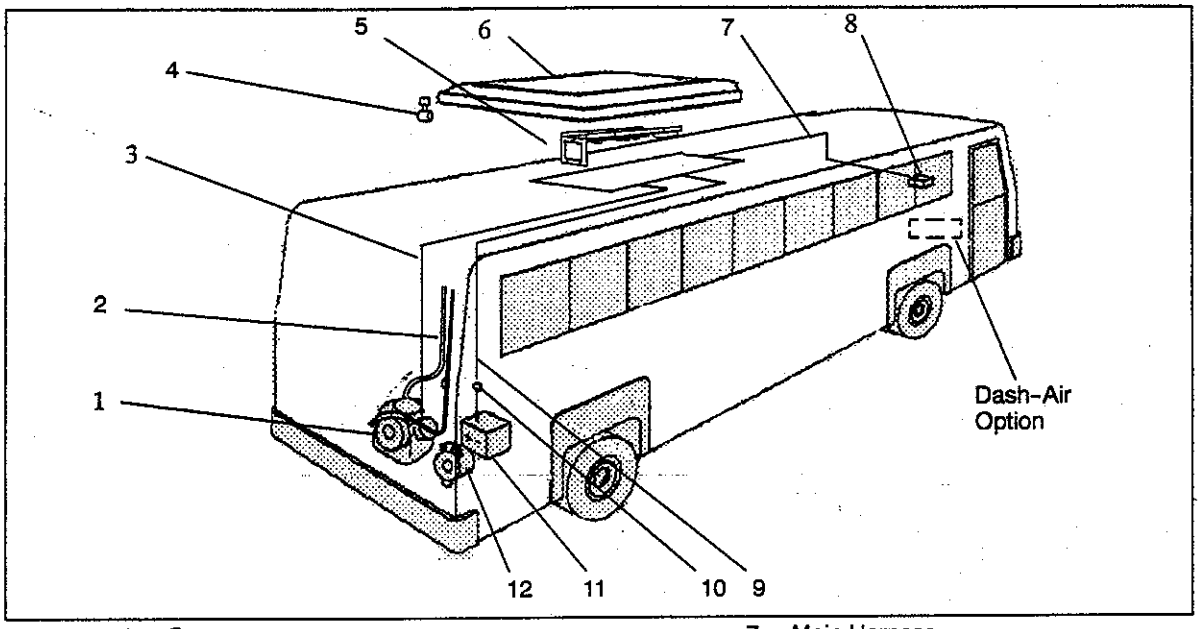
Table 1-2 Option Table

MODEL 68RF353	PID Condenser RF353C	PID Evaporator RF353E	Evaporator Frame	Refrigeration Kit	Air Exchange	Controller
-100	Refer to Model 68RF353-7					
-100-1	Refer to Model 68RF353-6					
-100-2	00006	00007	2	1	3	3
-100-3	00008	00009	1	1	2	1
-100-4	00010	00011	1	1	1	1
-100-5	00012	00013	2	2	3	1
-100-6	00014	00015	1	2	2	1
-100-7	00016	00017	1	2	1	1
-100-8	00018	00019	2	1	3	1
-100-9	00020	00021	1	1	2	1
-100-10	00022	00023	1	1	1	1
-100-11	00024	00025	2	2	3	1
-100-12	00026	00027	1	2	2	1
-100-13	00028	00029	1	2	1	1
-100-14	00038	00039	3	2	4	2

The Carrier Transicold model 68RF series units are of lightweight frame construction, designed to be installed on the vehicle roof.

Model 68RF353 system consists of a condenser and evaporator and an engine compartment mounted compressor. To complete the system, the air conditioning and heating equipment interfaces with electrical cabling, refrigerant piping, engine coolant piping (for heating), duct work and other components furnished by Wanderlodge. See Figure 1-1.

Operation of the units is controlled automatically by a microprocessor based Micromax Controller which maintains the vehicle's interior temperature at the desired set point.



1. Compressor
2. Refrigerant Lines
3. Compressor Harness
4. Liquid Line Solenoid
5. Electronics Boards
6. RF353
7. Main Harness
8. Driver Control
9. Power Harness
10. Power Relay
11. Battery
12. Alternator

Figure 1-1 A/C Component Identification

2-3.1.2 Configuration Identification

Unit identification information is provided on a plate located inside the condenser and evaporator sections. The plate provides the unit model number, the unit serial number and the unit parts identification number (PID). The model number identifies the overall unit configuration while the PID provides information on specific optional equipment and differences in detailed parts.

This manual provides a description of and a tabular listing of unit model numbers and PID numbers to assist the reader in identifying the equipment supplied and any required service parts.

2-3.1.3 Option Description

Various options may be factory or field equipped to the base unit. These options are listed in the tables and described in the following subparagraphs.

2-3.1.3.1 Evaporator Frame

The evaporator may be fitted with one of three different base assemblies. The assemblies differ dependent on the air exchange equipment supplied.

2-3.1.3.2 Refrigeration Kit

The units are assembled to allow orientation of the connections for different mounting arrangements and may be supplied with various piping layouts for specific applications.

2-3.1.3.3 Air Exchange/Controller

The unit may be fitted with either an air exchange assembly or an air exchange blankoff plate. Air exchange assemblies may be of the 0 & 20% opening, 0 & 100% opening or customer preset type.

The customer preset air exchange uses a special controller.

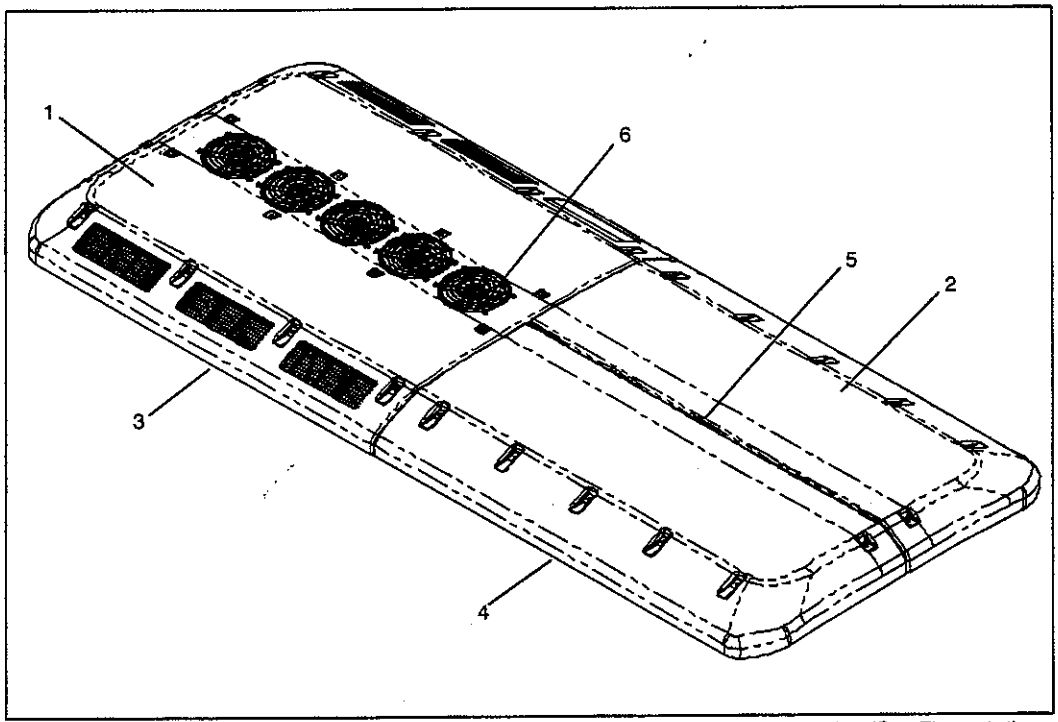
Table 1-3 Additional Support Manuals

MANUAL/FORM NUMBER	EQUIPMENT COVERED	TYPE OF MANUAL
T-304PL	68RF353	Parts List
62-02491	O5K Compressor	Operation and Service
62-02460	O5K Compressor	Parts List
62-02756	O5G Compressor	Operation and Service
T-200	O5G Compressor	Parts List
62-10699	Micromate	Diagnostic Tool (Card)

2-3.1.4 General Description

2-3.1.4.1 Rooftop Unit

The Rooftop unit (see *Figure 1-2*) is comprised of the condensing section, evaporator section, Micromax electronics, and the Fresh Air System. All components are accessible by lifting the condenser and evaporator top covers. Descriptions of the systems are provided in the following sub paragraphs.



1. Top Cover, Condenser
2. Top Cover, Evaporator
3. Condenser Section (See Figure 1-3)
4. Evaporator Section (See Figure 1-4)
5. Hinge, Evaporator Cover
6. Condenser Fan Grille

Figure 1-2 Rooftop Unit Components

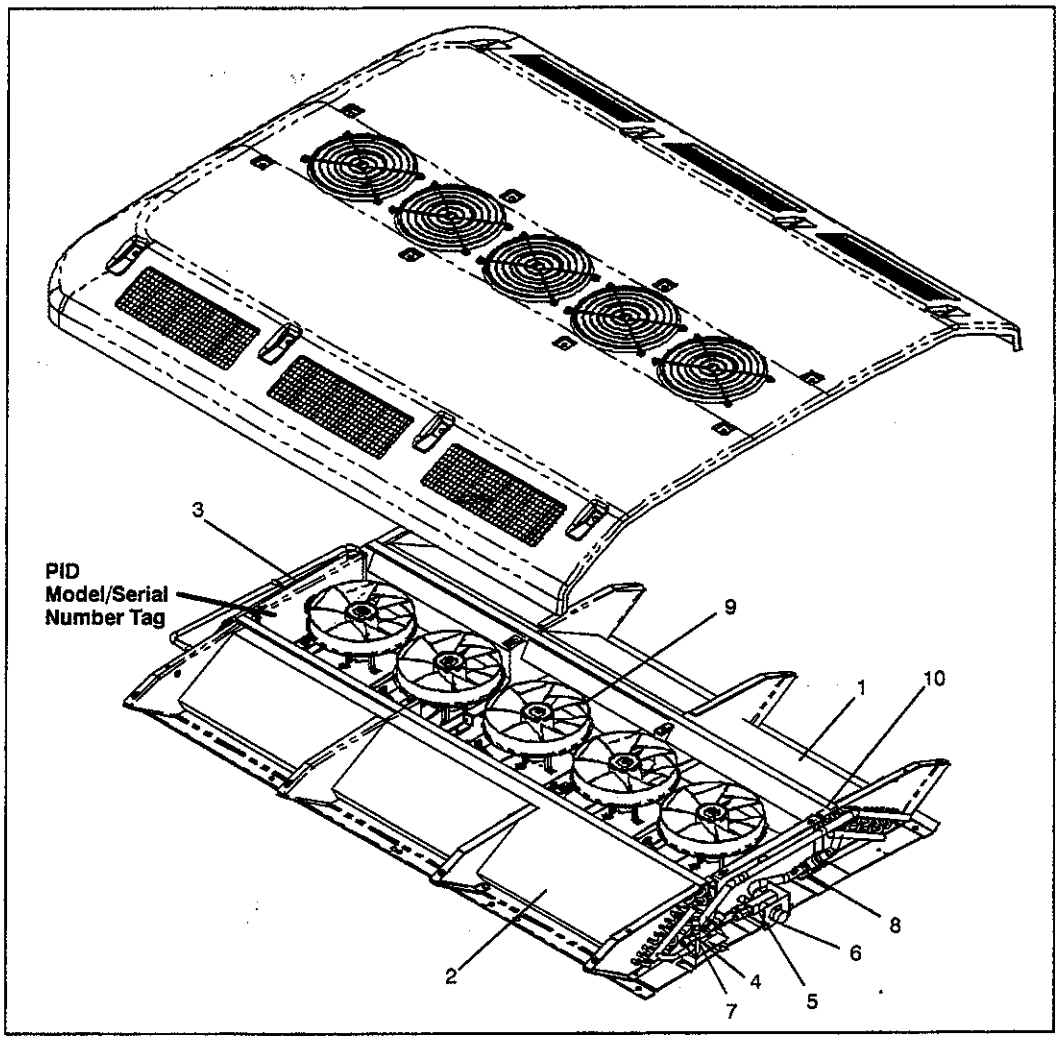
2-3.1.4.2 Condensing Section

The condensing section (*Figure 1-3*) includes the cover, left and right condenser coils, five fan and motor assemblies, receiver, check valve, service valves and an ambient temperature sensor.

The condenser coils provide heat transfer surface for condensing refrigerant gas at a high temperature and pressure into a liquid at high temperature and pressure. The condenser fans circulate ambient air across the outside of the condenser tubes at a temperature lower than refrigerant circulating inside the tubes; this results in condensation of the refrigerant into a liquid.

The receiver collects and stores liquid refrigerant. The receiver is also fitted with a fusible plug which protects the system from unsafe high pressure conditions. An ambient temperature sensor measures ambient temperature and sends an electrical signal to the controller.

A check valve is located in the discharge line. The discharge check valve is a spring loaded, normally closed valve that opens with the flow of refrigerant from the compressor. When the compressor clutch is disengaged, the discharge check valve will close, preventing the flow of high pressure liquid from the condenser back into the compressor.

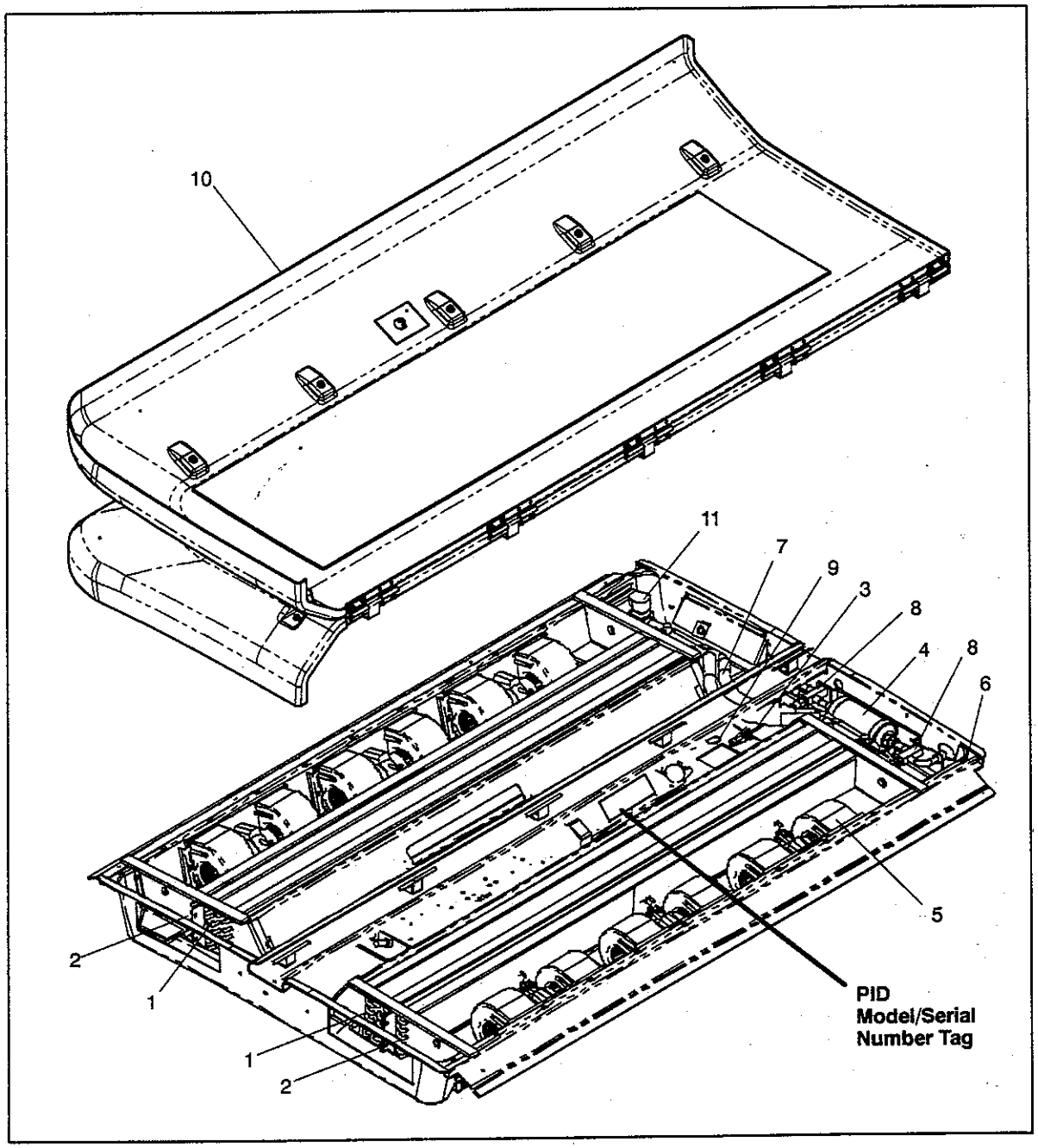


1. Coil Assembly Left
2 Coil Assembly Right
3. Receiver
4. Shut Off Valve (Liquid) &
5 Shut Off Valve (Discharge)
6. Discharge Line.
7. Liquid Line
8. Check Valve
9 Condenser Fan and Motor Assembly
10 Ambient Temperature Switch

Figure 1-3 Condensing Section Components

2-3.1.4.3 Evaporator Section

The evaporator section (*Figure 1-4*) includes the evaporator coils, six blower and motor assemblies, evaporator coil assemblies, heater coil assemblies, filter drier, a thermostatic expansion valve, liquid line solenoid, service valves and condensate drain connections.



1. Evaporator Coil
2. Heat Coil
3. Expansion Valve
4. Filter Drier
5. Blower & Motor Assembly
6. Suction Line
7. Heating Lines
8. Service Valve
9. Liquid Line Solenoid
10. Cover
11. Heat Valve

Figure 1-4 Evaporator Section Components

The evaporator coils provide heat transfer surface for transferring heat from air circulating over the outside coil area to the refrigerant circulating inside the tubes; thus providing cooling. The heating

coils provide heat transfer surface for transferring heat from engine coolant water circulating inside the tubes to air circulating over the outside surface of the tubes, thus providing heating. The fans circulate the air over the coils. The air filters remove dirt particles from the air before it passes over the coils. The filter-drier removes moisture and debris from the liquid refrigerant before it enters the thermostatic expansion valve in the evaporator assembly. Service valves enable isolation of the filter-drier for service. The thermostatic expansion valve meters flow of refrigerant entering the evaporator coils. The liquid line solenoid valve closes when system is shut down to prevent flooding of the evaporator coils with liquid refrigerant.

A heat valve controls the flow of engine coolant water to the heating coils upon receipt of a signal from the controller. The condensate drain connections provide a means for connecting tubing for disposing of condensate collected on the evaporator coils during cooling operation.

2-3.1.4.4 Compressor Assembly

The compressor assembly is mounted in the engine compartment (See *Figure 1-1*) and includes the refrigerant compressor, clutch assembly, suction and discharge service valves, high pressure switch, low pressure switch, suction and discharge servicing (charging) ports and electrical solenoid unloaders.

The compressor raises the pressure and temperature of the refrigerant and forces it into the condenser tubes. The clutch assembly provides a means of belt driving the compressor by the bus engine. The suction and discharge service valves enable servicing of the compressor. Suction and discharge servicing (charging) ports mounted on the service valves enable connection of charging hoses for servicing of the compressor, as well as other parts of the refrigerant circuit. The high pressure switch contacts open on a pressure rise to shut down the system when abnormally high refrigerant pressures occur. The electric unloaders provide a means of controlling compressor capacity, which enables control of temperature inside the bus.

2-3.1.4.5 Fresh Air System

The Fresh Air System consists of a damper and damper operator. The damper operator may be controlled by the driver, if a switch is provided. In the automatic mode, it is controlled by the Micromax to open and close the damper to allow addition of fresh air into the air entering the evaporator coil. For additional information on air flow, refer to *2-3.1.9 Air Flow* section.

2-3.1.4.6 System Operating Controls and Components

The system is operated by a Carrier Transicold Micromax microprocessor controller which consist of a logic board (*Figure 1-8*), relay board (*Figure 1-7*), and manual operator switches. The manual operating switches are located on the drivers control and may consist of a single OEM supplied ON/OFF switch, additional OEM supplied switches or a Carrier Transicold supplied Micromate control panel (*Figure 1-9*). The logic board regulates the operational cycles of the system by energizing or de-energizing relays on the relay board in response to deviations in interior temperature. Modes of operation include Cooling, Heat and Vent. On systems fitted with only an ON/OFF switch and on systems with the Micromate set in the AUTO mode, the logic board will cycle the system between the operating modes as required to maintain desired set point temperature.

In the vent mode the evaporator fans are operated to circulate air in the bus interior.

In the heat mode the heat valve is opened to allow a flow of engine coolant through the heat section of the evaporator coil. The evaporator fans operate to circulate air over the evaporator coil in the same manner as the vent mode.

In the cooling mode the compressor is energized while the evaporator and condenser fans are operated to provide refrigeration as required. The compressor is fitted with cylinder unloaders to match compressor capacity to the bus requirements. Once interior temperature reaches the desired set point, the system may operate in the clutch cycle or reheat mode. A controller programmed for clutch cycle will de-energize the compressor clutch and allow the system to operate in the vent mode

until further cooling is required. A controller programmed for reheat will maintain compressor operation and open the heat valve to allow reheating of the return air. In the reheat mode interior temperature is maintained at the desired set point while additional dehumidification takes place.

Controls may also be provided to allow manual operation of the evaporator fans in low or high speed and manual control of the fresh air damper in the open or closed position.

2-3.1.5 Refrigeration System

2-3.1.5.1 Component Specifications

a. Refrigerant Charge
R-134a 23 Lb (10.4 kg)

b. Compressor

UNIT MODEL	RF353
Compressor	05G
No. of Cylinders	6
Weight - Dry w/Clutch	145 lbs (65.77 kg)
Oil Charge	5.5 pints (2.6 liters)

Oil Level:
Level in sight glass between Min.-Max marks on compressor crankcase (curbside)

Approved Compressor Oils - R-134a:
Castrol: Icematic SW68C
Mobile: EAL Arctic 68
ICI: Emkarate RL68H

c. Thermostatic Expansion Valve:

Superheat Setting: 12 ± 3°F (5 to 8°C)
MOP Setting: 53.9 ± 4 psig (3.67 ± 0.27 bar)

d. High Pressure Switch (HPS):

Opens at: 350 ± 10 psig (23.81 ± 0.68 bar)
Closes at: 250 ± 10 psig (13.61 ± 0.68 bar)

e. Low Pressure Switch (LPS)
Opens at: 6 ± 3 psig (0.41 ± 0.20 bar)
Closes at: 25 ± 3 psig (1.7 ± 0.20 bar)

2-3.1.6 Electrical Specifications - Motors

a. Evaporator Fan Motor

Evaporator Motor	Permanent Magnet 24 VDC
Horsepower (kW)	1/8 (.09)
Full Load Amps (FLA)	9.5
Operating Speed High/Low (RPM)	2900/1700
Bearing Lubrication	Factory Lubricated (additional grease not required)

b. Condenser Fan Motor

Condenser Motor	Permanent Magnet 24 VDC
Horsepower (kW)	1/8 (.09)
Full Load Amps (FLA)	3
Operating Speed High/Low (RPM)	1900/1700
Bearing Lubrication	Factory Lubricated (additional grease not required)

2-3.1.7 Electrical Specifications - Sensors and Transducers

a. Suction and Discharge Pressure Transducer

Supply Voltage: 4.5 to 5.5 vdc (5 vdc nominal)
Supply Current: 8 mA maximum
Output Range: 8K ohms minimum
Input Range: -6.7 to 450 psig (-0.46 to 30.62 bar)
Output Current: -1.5 mA minimum to 1.5mA maximum
Output Voltage: vdc = 0.0098 x psig + 0.4659 (See No Tag for calculations)

b. Temperature Sensors

Input Range: -52.6 to 158°F (-47 to 70°C)
Output: NTC 10K ohms at 77°F (25°C)
(See No Tag for calculations)

2-3.1.8 Safety Devices

System components are protected from damage caused by unsafe operating conditions with safety devices. Safety devices with Carrier Transicold supplied equipment include high pressure switch (HPS), low pressure switch (LPS), circuit breakers and fuses.

a. Pressure Switches

High Pressure Switch (HPS)

During the A/C mode, compressor operation will automatically stop if the HPS switch contacts open due to an unsafe operating condition. Opening HPS contacts de-energizes, through the controller, the compressor clutch shutting down the compressor. The high pressure switch (HPS) is installed in the center head of the compressor.

Low Pressure Switch (LPS)

The low pressure switch is installed in the compressor and opens on a pressure drop to shut down the system when a low pressure condition occurs. In addition, if the control monitors a pressure less than 10 psig (0.68 bar) by the suction pressure transducer mounted in the evaporator section, the system will be shut down for at least one minute.

b. Fuses and Circuit Breakers

The system is protected against high current by an OEM supplied 150 amp fuse. Independent 15 amp fuses protect each evaporator blower motor assembly, while 20 amp fuses protect each condenser motor.

c. Ambient Lockout

The ambient temperature sensor located in the condenser section measures the condenser inlet air temperature. When the temperature is below the cut out set point the compressor is locked out until the temperature rises above the cut in setting. The set points will be programmed to cut out at 45°F (7.2°C) and cut in at 50°F (10°C). This setting protects the compressor from damage caused by operation at low pressures.

2-3.1.9 Air Flow

The paths for ambient air through the condenser and coach air through the evaporator are illustrated in *Figure 1.5*.

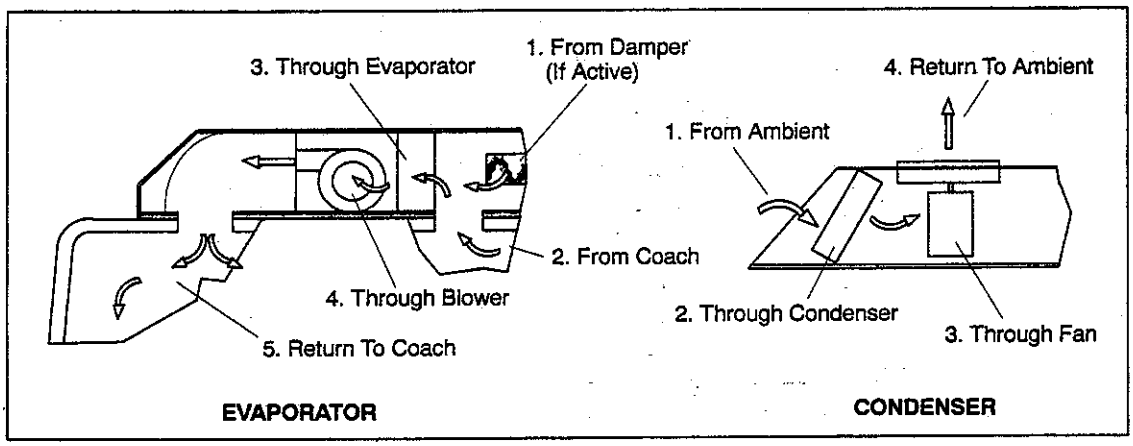


Figure 1-5 Air Flow Paths

2-3.1.10 Air Conditioning Refrigeration Cycle

When air conditioning (cooling) is selected by the controller, the unit operates as a vapor compression system using R-134a as a refrigerant (See *Figure 1-6*). The main components of the system are the reciprocating compressor, air-cooled condenser coils, receiver, filter-drier, thermostatic expansion valve, liquid line solenoid valve and evaporator coils.

The compressor raises the pressure and the temperature of the refrigerant and forces it into the condenser tubes. The condenser fan circulates surrounding air (which is at a temperature lower than the refrigerant) over the outside of the condenser tubes. Heat transfer is established from the refrigerant (inside the tubes) to the condenser air (flowing over the tubes). The condenser tubes have fins designed to improve the transfer of heat from the refrigerant gas to the air; this removal of heat causes the refrigerant to liquefy, thus liquid refrigerant leaves the condenser and flows to the receiver.

The receiver serves as a liquid refrigerant reservoir so that a constant supply of liquid is available to the evaporators as needed, and acts as a storage space when pumping down the system. The liquid line is equipped with a sight glass to observe the refrigerant for restricted flow and the correct charge level.

The refrigerant leaves the receiver and passes through a filter-drier where an absorbent keeps the refrigerant clean and dry.

From the filter-drier, the liquid refrigerant then flows through the liquid line solenoid valve to the thermostatic expansion valve. The thermal expansion valve reduces pressure and temperature of the liquid and meters the flow of liquid refrigerant to the evaporator to obtain maximum use of the evaporator heat transfer surface.

The low pressure, low temperature liquid that flows into the evaporator tubes is colder than the air that is circulated over the evaporator tubes by the evaporator fans. Heat transfer is established from the evaporator air (flowing over the tubes) to the refrigerant (flowing inside the tubes). The evaporator tubes have aluminum fins to increase heat transfer from the air to the refrigerant; therefore the cooler air is circulated to the interior of the bus. Liquid line solenoid valve closes during shutdown to prevent refrigerant flow.

The transfer of heat from the air to the low temperature liquid refrigerant in the evaporator causes the liquid to vaporize. This low temperature, low pressure vapor passes through the suction line and returns to the compressor where the cycle repeats.

2-3.1.11 Heating Cycle

Heating circuit (see *Figure 1-6*) components furnished by Carrier Transicold include the integral evaporator coil heater cores and a solenoid operated heat valve. Components furnished by Wanderlodge include auxiliary heater and boost water pump. The controller automatically controls the heat valve during the heating and reheat modes to maintain required temperatures inside the bus. Engine coolant (glycol solution) is circulated through the heating circuit by the engine and an auxiliary boost water pump. When the heat valve solenoid is energized, the valve will open to allow engine coolant to flow through the heater coil. The valve is normally closed so that if a failure occurs, the system will be able to cool.

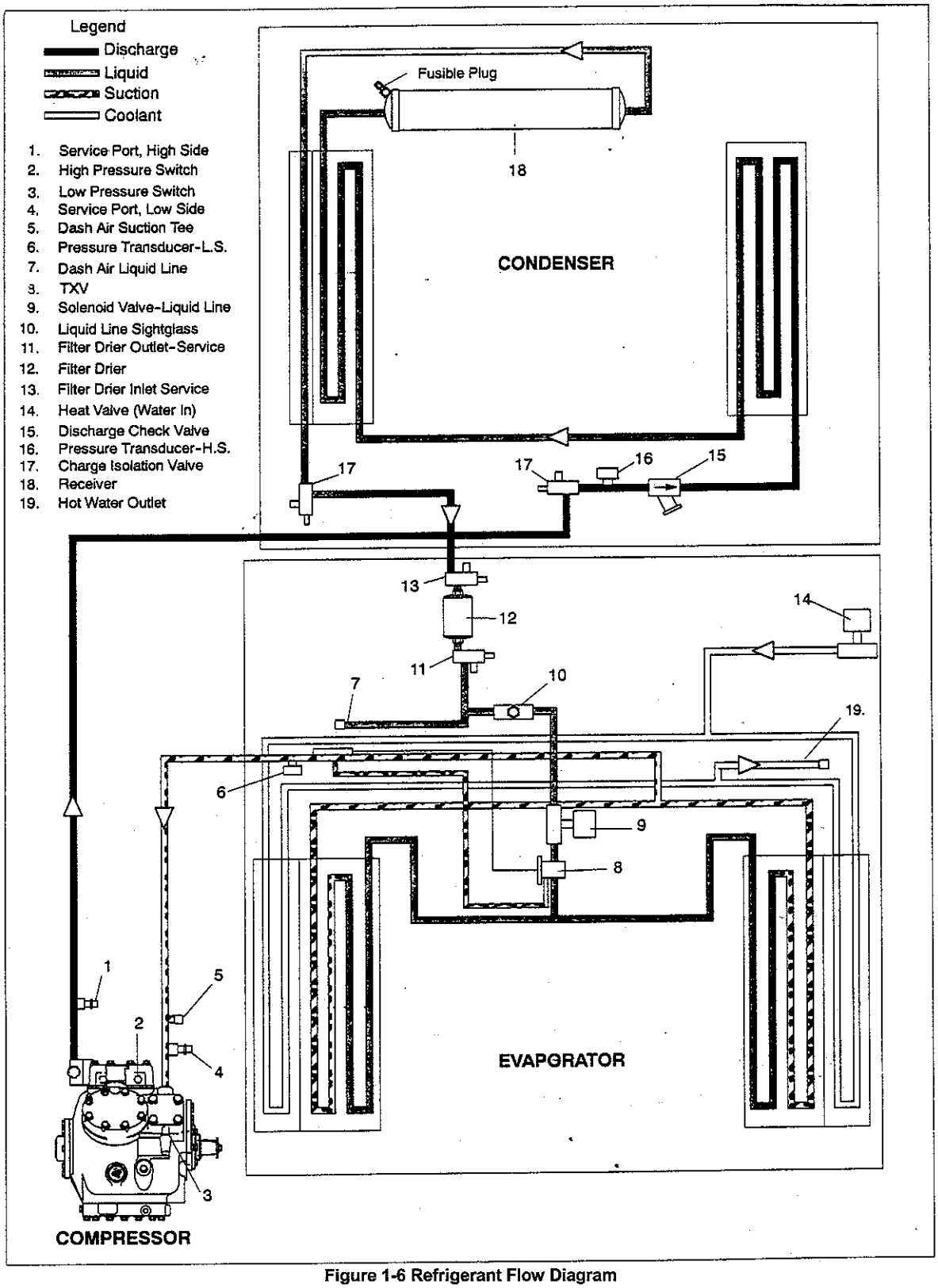


Figure 1-6 Refrigerant Flow Diagram

2-3.1.12 RELAY BOARD, 24VDC

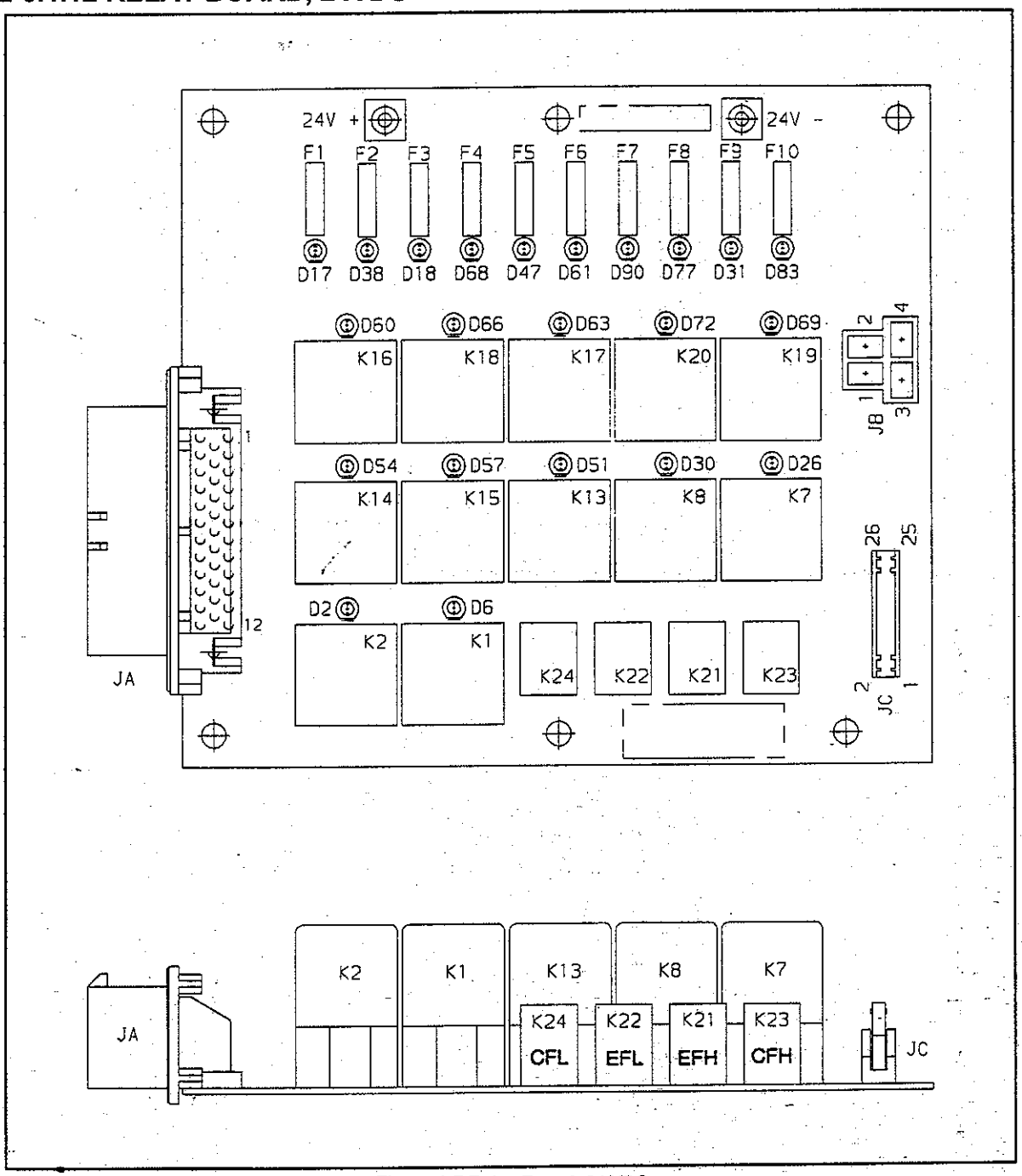
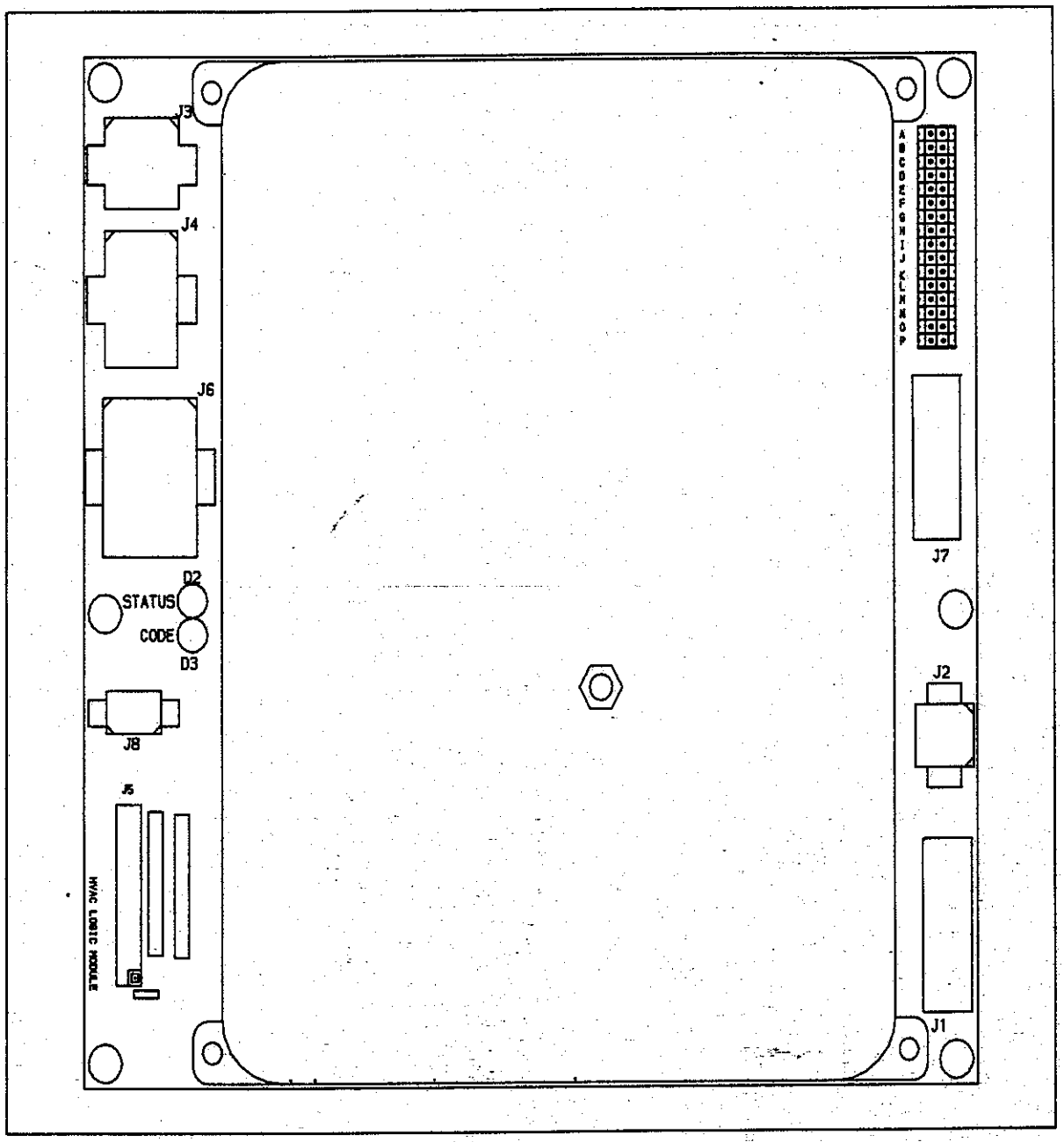


Figure 1-7 Relay Board, 24 VDC

RELAY BOARD 12-00486-00	DEFINITION
POWER STUD +	24V+
POWER STUD -	COMMON
JA-1	K17, HEATER RELAY (N.O.)
JA-2	FAULT LIGHT SOURCE
JA-3	K7, COND FAN ON RELAY (N.O.)
JA-4	COND FAN JUMPER
JA-5	K15, UNLOADER 2 RELAY (N.O.)
JA-6	EVAPORATOR FAN JUMPER
JA-7	K1, EVAP FAN ON RELAY (N.O.)
JA-8	K18, FAULT LIGHT RELAY (N.O.)
JA-9	COMMON FOR RELAY COIL
JA-10	+24V SOURCE FOR FAULT LIGHT
JA-11	+24V SOURCE FOR EVAP FAN JUMPER
JA-12	+24V SOURCE FOR COND FAN JUMPER
JA-13	K20, SPARE RELAY (N.O.)
JA-14	K16, FRESH AIR RELAY (N.O.)
JA-15	K8, COND FAN HIGH SPEED RELAY (N.O.)
JA-16	K14, UNLOADER 1 RELAY (N.O.)
JA-17	K13, CLUTCH RELAY (N.O.)
JA-18	K2, EVAP FAN HIGH SPEED RELAY (N.O.)
JA-19	COMMON FOR HIGH PRESSURE SWITCH
JA-20	K8, COND FAN HIGH SPEED RELAY (N.O.)
JA-21	
JA-22	CIRCUIT BREAKER FAULT INPUT
JA-23	K2, EVAP FAN HIGH SPEED RELAY (N.O.)
JA-24	COMMON FOR HEATER RELAY
JA-25	COMMON FOR FAULT LIGHT RELAY
JA-26	COMMON FOR EVAP FAN ON RELAY
JA-27	COMMON FOR COND FAN ON RELAY
JA-28	COMMON FOR COND FAN HIGH SPEED RELAY
JA-29	COMMON FOR SPARE RELAY
JA-30	COMMON FOR FRESH AIR RELAY
JA-31	COMMON FOR UNLOADER 1 RELAY
JA-32	COMMON FOR UNLOADER 2 RELAY
JA-33	COMMON FOR CLUTCH RELAY
JA-34	COMMON FOR EVAP FAN HIGH SPEED RELAY
JA-35	
JB-1	BOOST PUMP SOURCE
JB-2	+24V SOURCE FOR BOOST PUMP
JB-3	BOOST PUMP OUT
JB-4	COMMON FOR BOOST PUMP

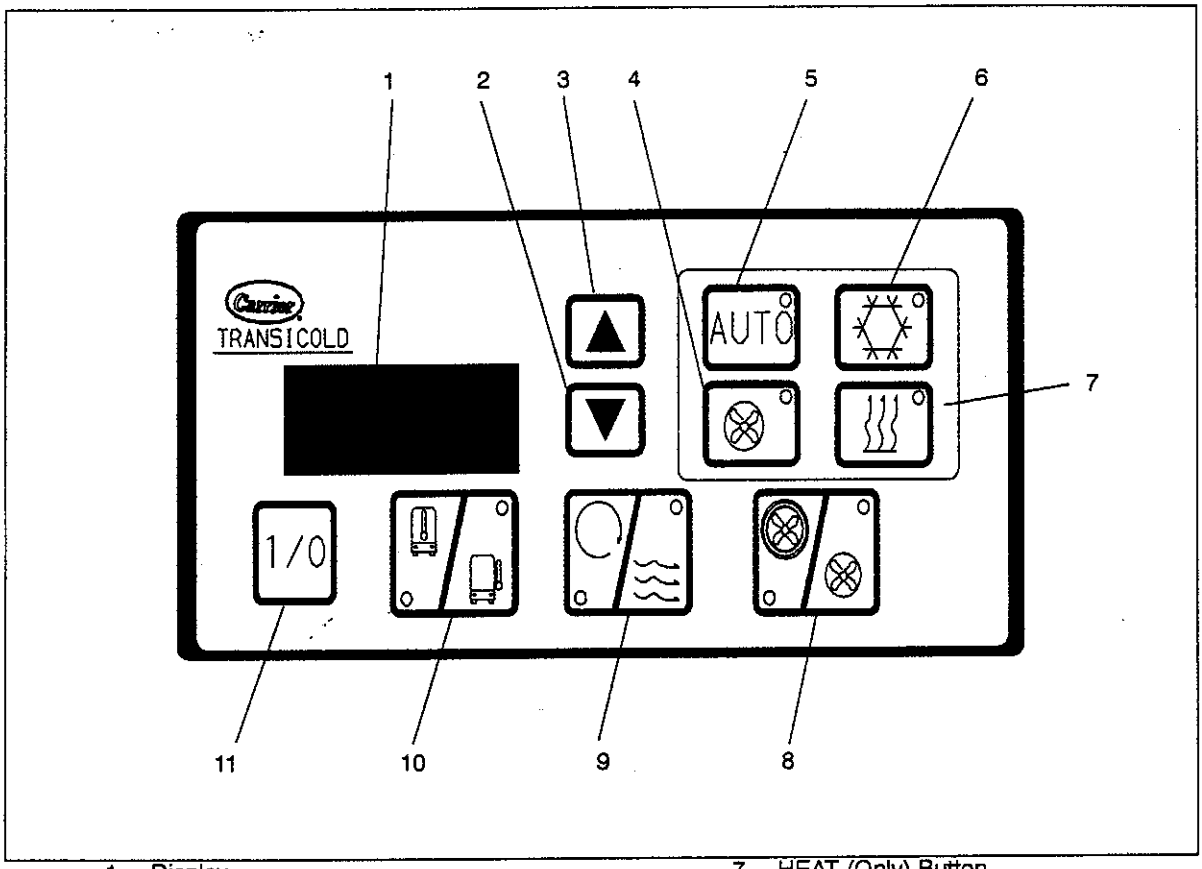
RELAY BOARD 12-00486-00	DEFINITION
JC-1	+24V
JC-2	K21, EVAP FAN HIGH SPEED RELAY
JC-3	K22, EVAP FAN ON RELAY
JC-4	K23, COND FAN HIGH SPEED RELAY
JC-5	K24, COND FAN ON RELAY
JC-6	K13, CLUTCH RELAY
JC-7	K14, UNLOADER 1 RELAY
JC-8	K15, UNLOADER 2 RELAY
JC-9	K16, FRESH AIR RELAY
JC-10	HEATER RELAY
JC-11	K18, FAULT RELAY
JC-12	K19, BOOST PUMP RELAY
JC-13	K20, SPARE
JC-14	EVAP MOTOR OVERLOAD INPUT
JC-15	COND MOTOR OVERLOAD INPUT
JC-16	HIGH PRESSURE SWITCH STATUS LIGHT
JC-17	BREAKER FAULT INPUT
JC-18	COMMON
JC-19	COMMON
JC-20	COMMON
JC-21	COMMON
JC-22	COND FAN BREAKER FAULT INPUT
JC-23	
JC-24	
JC-25	
JC-26	



J1 Logic board power in.
J2 Micromate Display interface.
J3 Manual control inputs.
J4 Interlock Inputs (WTS, low side pressure switch etc.)
J5 Relay board interface.
J6 Sensor inputs (Thermistors, etc.).
J7 Diagnostics interface (RS232, DB9).
D2 Blinks once per second in normal operation. On steady to indicate alarms detected.
D3 Off in normal operation, blinks out alarm codes (2 digits each) when alarms detected.
A-P Configuration Jumpers

Figure 1-8 Logic Board

2-3.1.14 Control Panel (Diagnostic Module)



1. Display
2. DOWN Button - decrease selection
3. UP Button - increase selection
4. VENT (Only) Button
5. AUTO Button (Automatic Control)
6. COOLING (Only) Button
7. HEAT (Only) Button
8. FAN SPEED Button
9. FRESH AIR Button
10. TEMPERATURE (Inside / Outside) Button
11. ON/OFF Button

Figure. 1-9 Micromate Control Panel

2-3.2 Operation

2.3.2.1 Starting, Stopping and Operating Instructions

2.3.2.1.1 Power to Logic Board

Before starting, electrical power must be available from the bus power supply. The system components receive power from two sources:

a. 24 vdc power for the microprocessor electronics is supplied through the bus ignition system.
b. 24 vdc, 125 amp, power from a fuse in the battery compartment supplies power for the clutch, compressor unloader solenoids, evaporator and condenser assemblies; this power is controlled by the Logic Board.

2-3.2.1.2 Starting

a. If the engine is not running, start the engine.
b. OEM SUPPLIED SWITCHES - Actual start sequence depends on the operating controls supplied. If only an ON/OFF switch is supplied, place the switch in the ON position to start the system in the automatic mode. If additional OEM switches are supplied, refer to the following Micromate control description for operating instructions.
c. MICROMATE CONTROL PANEL - It is suggested the system be started in the automatic mode.
    1. The Micromate Control Panel Display (see *Figure 1-9*) may be programmed to display the set point temperature of return air temperature. To determine which display temperature is programmed, press the TEMPERATURE button so that the OUTSIDE AIR indicator is illuminated. If the controller cycles back to the INSIDE AIR indicator, than the controller is programmed to display return air temperature. If the controller does not automatically cycle back to the return air indicator, than the controller is programmed to display set point temperature.
    2. To start the system, press the I/O button to illuminate the indicator light and signal the Logic Board to perform start up. Ensure the AUTO button indicator is illuminated. If not, press the AUTO button to place the system in the automatic mode. After the pre-trip inspection is completed, the switches may be set in accordance with the desired control modes.
    3. If cooling only, heating only or ventilation only is desired, press the corresponding button (refer to *Figure 1-9*) to illuminate the indicator light and place the system in that mode of operation.
    4. If low or high speed evaporator fan speed is desired, press the FAN SPEED button to illuminate the indicator light and bring speed to the desired level.
    5. To open or close the fresh air damper, press the FRESH AIR button to illuminate the indicator light and bring the damper to the desired position.
    6. To read interior or exterior temperature, press the TEMPERATURE button to illuminate the indicator light and bring the display to the desired temperature reading. After a short delay, the display will return to the default set point or return air temperature reading.
    7. Set point may be changed by pressing the UP or DOWN arrow button. The UP button will increase the set point temperature and the DOWN button will decrease the setpoint temperature.
    8. For additional Micromate operating data refer to paragraph *2-3.2.4 Microprocessor Diagnostics*.

2-3.2.1.3 Self-Test and Diagnostics (Check for Errors and/or Alarms)

Self-test of the main Logic Board electrical circuit is automatically initiated when the system is powered up. If there is an error in the circuit, an alarm will be indicated by flashing LED's on the Logic Board. If a Micromate is connected to the Logic Board, the error code can also be read on the display. If there are no errors in the circuit, system will operate normally and flash the status LED at a one second interval. During normal operation, the Logic Board monitors system operating parameters for out of tolerance conditions. If an out of tolerance condition occurs, ALARM will be indicated through the code LED or on the Micromate display. Refer to *Troubleshooting Section* for definition of system errors and alarms and general troubleshooting procedures.

2-3.2.1.4 Stopping

Placing the ON/OFF switch in the OFF position or pressing the Micromate ON/OFF button will stop the system operation by removing power to the Logic Board.

2-3.2.2 Pre-Trip Inspection

After starting system, allow system to stabilize for ten to fifteen minutes and check for the following:

a. Listen for abnormal noises in compressor or fan motors.
b. Check compressor oil level. (Refer to *Removing the Compressor*)
c. Check refrigerant charge. (Refer to *Checking Refrigerant Charge*).
d. Ensure that self-test has been successfully performed and that there are no errors or alarms indicated. (Refer to *Self-Test and Diagnostics (Check for Errors and/or Alarms)*).

2-3.2.3 Modes of Operation

The system is operated by a Carrier Transicold Micromax microprocessor controller which consists of a logic board (*Figure 1-8*), relay board (*Figure 1-7*), and manual operator switches. The logic board regulates operational cycles of the system by energizing or de-energizing Relay Board relays in response to deviations in interior temperature. Modes of operation including Cooling, Heat and Vent. Refer to *Figure 2-1* and the following paragraphs for a description of each mode.

Figure 2-1 shows the Logic Board actions at various temperature deviations from set point. On rising temperature, changes occur when the temperature rises above Logic Board set points,. On falling temperature, changes occur when temperature falls below Logic Board set point. The system will operate in these modes unless pressures override the Logic Board settings.

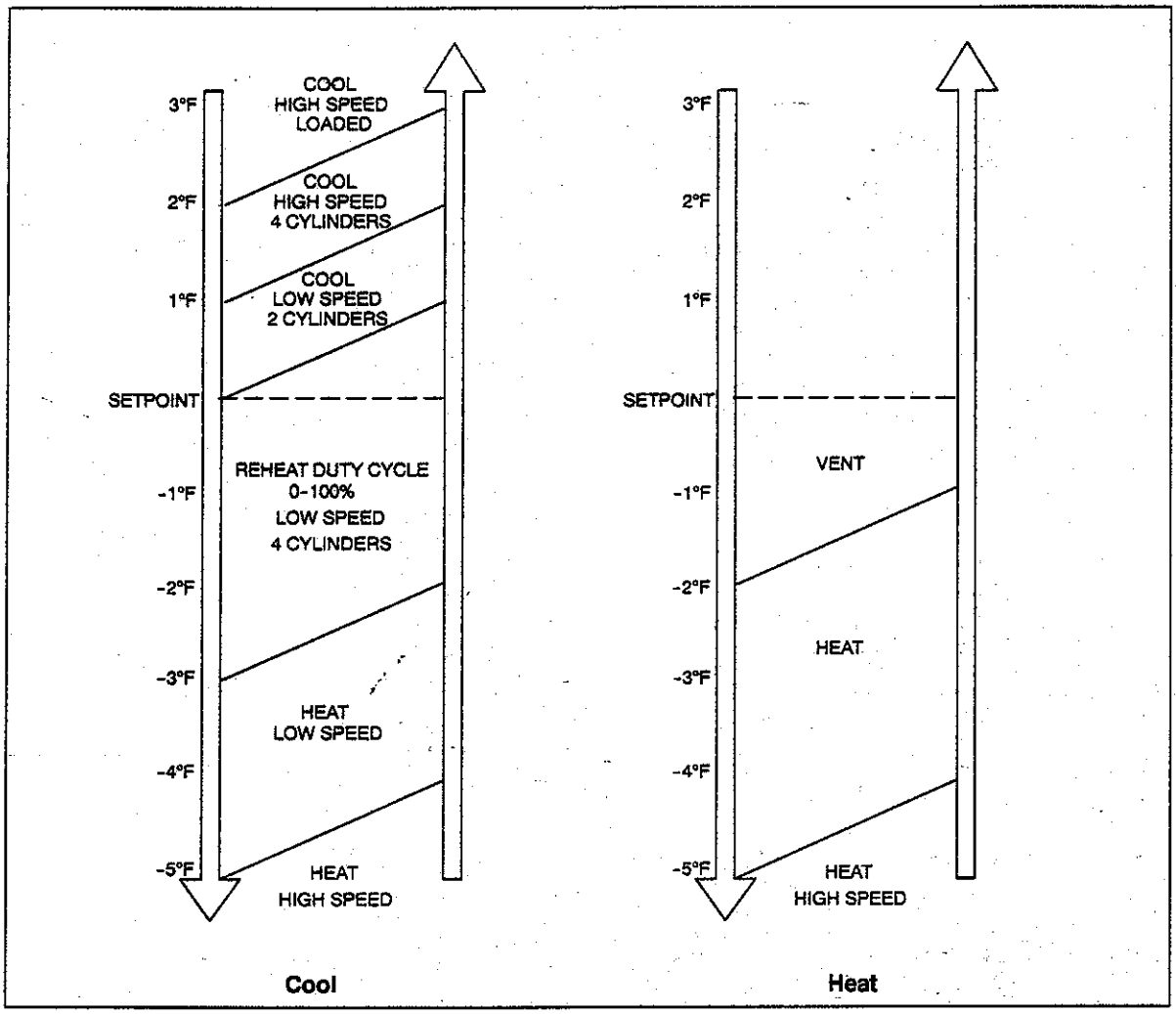


Figure 2-1 Capacity Control Diagram

2-3.2.3.1 Temperature Control

Temperature is controlled by maintaining the return air temperature measured at the return air grille.

2-3.2.3.2 Cooling Mode

Cooling is accomplished by energizing the compressor and condenser fans, opening the liquid line solenoid valve and closing the heating valve. Once interior temperature reaches the desired set point, the system may operate in the clutch cycle or reheat mode. Selection of clutch cycle or reheat is factory programmed in accordance with the bus purchase specification.

A controller programmed for clutch cycle will de-energize the compressor clutch and allow the system to operate in the vent mode until further cooling is required.

A controller programmed for reheat will maintain compressor operation and cycle the heat valve to allow reheating of the return air. In the reheat mode interior temperature is maintained at the desired set point while additional dehumidification takes place.

2-3.2.3.3 Heating Mode

In the heat mode the liquid line solenoid is closed and the compressor and condenser fans are shut down. The heat valve is opened to allow a flow of engine coolant through the heat section of the evaporator coil. The evaporator fans speed is varied as required to circulate air over the evaporator coil based on the temperature difference from set point.

Operation in the heating mode is controlled by the water temperature switch (WTS). The WTS is located on the engine block of the vehicle and is provided by the OEM. It senses the engine coolant temperature and reverses its contacts on temperature rise at 105°F. The switch prevents the circulation of cooler air throughout the vehicle as the engine comes up to temperature.

2-3.2.3.4 Boost Pump (Optional)

When the unit is in heat mode, and if a boost pump is supplied by the coach manufacturer, the boost pump relay is energized, providing 24 VDC to activate the boost pump.

2-3.2.3.5 Vent Mode

In the vent mode the evaporator fans are operated to circulate air in the bus interior.

2-3.2.3.6 Fresh Air System

The fresh air damper is opened to allow entrance of ambient air into the air entering the evaporator coil. The damper is operated by the controller to open when return air temperature is within +/-5°F (+/-2.8°C) of set point.

2-3.2.3.7 Compressor Unloader Control

When operating in cooling, the unloaders are used to reduce system capacity as return air temperature approaches set point. Operation of the unloaders balances system capacity with the load and thereby prevents overshoot from set point.

Relay Board mounted unloader outputs control the capacity of the compressor by energizing or de-energizing unloader solenoid valves. The model 05K has two banks of two cylinders each while the model 05G compressor has three banks of two cylinders each. Energizing a valve de-activates a bank of cylinders. The 05K right cylinder bank (looking at the pump end) and the outboard cylinder banks of the 05G are equipped with unloader valves (UV1 and, for the 05G, UV2), each controlling two cylinders; this allows the 05K to be operated with two or four cylinders and the 05G to be operated with two, four or six cylinders.

Whenever the compressor is started, the unloaders are energized for thirty seconds to reduce starting torque. After thirty seconds, unloaders may be de-energized. Any subsequent changes between energizing and de-energizing the unloaders for temperature control must be staged with a thirty second delay. Once an unloader is energized for pressure control, it remains energized for two seconds to prevent short cycling. Only one unloader may change state at a time when staging is required. Operating parameters for temperature control, suction pressure control and discharge pressure control are as follows.

a. Temperature Control

The unloaders are used to control system capacity by controlling compressor capacity.

1. Compressor Unloader UV1 Relay. When return air temperature falls to less than 2°F (1.1°C) above set point unloader UV1 is energized. If temperature rises to greater than 3°F (1.7°C) above set point, UV-1 will be de-energized to place the compressor at 100% capacity.
2. Compressor Unloader UV2 Relay. When return air temperature falls to less than 1°F (0.6°C) above set point unloader UV2 is energized. If temperature rises to greater than 2°F (1.1°C) above set point, UV-2 will be de-energized to place the compressor at 66% capacity.

b. Suction Pressure

The unloaders are used to control suction pressure and thereby prevent coil frosting:

1. Compressor Unloader UV1 Relay. When the suction pressure decreases below 26 psig (1.77 bar), unloader UV1 is energized unloading a cylinder bank (two cylinders); this output will remain energized until the pressure increases to above 34 psig (2.31 bar).
2. Compressor Unloader UV2 Relay. When suction pressure decreases below 23 psig (1.56 bar) unloader UV2 is energized unloading the second compressor cylinder bank; this output will remain energized until the pressure increases to above 31 psig (2.11 bar)

c. Discharge Pressure

Discharge pressure is also controlled by the unloaders:

1. Compressor Unloader UV1 Relay. When the discharge pressure increases above 275 psig (18.71 bar), unloader UV1 is energized; this output will remain energized until the pressure decreases below 220 psig (14.97 bar). Staging is ignored during discharge pressure override.
2. Compressor Unloader UV2 Relay. When the discharge pressure increases above 285 psig (19.39 bar), unloader UV2 is energized; this output will remain energized until the pressure decreases below 225 psig (15.31 bar).

2-3.2.3.8 Evaporator Fan Speed Selection

Temperature control is the primary method of determining the fan speed selection. The following table indicates relay operational status for the various fan motor states while Table 2-1 provides Logic Board speed selections at various deviations from set point.

Table 2-1 Evaporator Fan Speed Relay Operation

STATE	HIGH SPEED RELAYS	EVAP FAN RELAY
Off	Off	Off
Low	Off	On
High	On	On

2-3.2.3.9 Condenser Fan Control

The condenser fans are energized when the compressor clutch output is energized. The fans are started in low speed and will remain in low speed until the discharge pressure increase to 190 psig (R-134a). The fans will remain in high speed until discharge pressure decreases below 135 psig (R-134a). The fans will also be activated if a high pressure alarm has been activated and operation has not been locked out (refer to *Table 3-2*).

2-3.2.3.10 Compressor Clutch Control

A belt driven electric clutch is employed to transmit engine power to the air conditioning compressor. De-energizing the clutch electric coil disengages the clutch and removes power from the compressor. The clutch will be engaged when in cooling and disengaged when the system is off, in heating or during high and low pressure conditions.

The clutch coil is prevented from engagement when the ambient temperature is below ambient lockout set point.

The clutch coil will be de-energized if the discharge pressure rises to the cutout setting of the compressor mounted high pressure switch. The clutch coil will energize when the discharge pressure falls to the reset point of the compressor mounted high pressure switch.

The clutch coil will be de-energized if the suction pressure decrease below 10 psig (R-134a).

2-3.2.3.11 Liquid Line Solenoid Control

The liquid line solenoid is energized (open) when the compressor clutch is energized and de-energized (closed) when the clutch is not.

2-3.2.3.12 Alarm Description

Alarm descriptions and troubleshooting procedures are provided in the *Troubleshooting* section.

2-3.2.3.13 Hour Meters

Hour meter readings are available in the parameter code list of the Micromate. The hour meters record the compressor run time and the total time the evaporator fans are on. The maximum hours is 999,999. Refer to paragraph *2-3.2.4.2 Diagnostic Mode* for instructions on reading parameter codes.

2-3.2.4 Microprocessor Diagnostics

The Micromate allows the user to interface with the microprocessor based control. This allows system parameters, alarms and settings to be viewed and modified.

2-3.2.4.1 Control

NOTE: 1. This procedure should be performed by an HVAC technician who has been trained on Carrier Model RM or RF system design. Control configuration is preset by the manufacturer and resetting of the parameters should not be required. It is recommended that Carrier Transport Air Conditioning service be contacted before any control configuration is changed. Carrier TAC cannot be responsible for failures or damage resulting from unauthorized changes.

2. If a replacement Logic Module is installed, it is necessary to match the configuration jumpers (see Figure 1-8) to the original board. Refer to paragraph Logic Board Replacement.

a. Turn the A/C main power switch (located in the drivers area) to OFF.
b. Connect the Micromate to the service port (J2) located in the return air section.
c. Unplug the logic board connector J3.
d. Turn the A/C main power switch back to the ON position.
e. Activate the system by pressing the 1/0 key on the Micromate panel.

NOTE: Be sure to reconnect J3 when testing is completed or the system will fail to operate when the Micromate is disconnected.

NOTE: When modifying the set point temperature for diagnostic purposes, be sure to reset the set point when testing is complete.

2-3.2.4.2 Diagnostic Mode

Diagnostic Mode can be entered by pressing the up and down arrow keys simultaneously for 5 seconds. Diagnostic mode allows alarms and system parameters to be viewed. If there are any alarms stored, the most recent alarm will be shown. To view additional alarm information, refer to *Troubleshooting* section. Press the up and down arrow keys to view parameters.

2-3.2.4.3 System Parameters

Pressing the up/down arrow keys will allow the user to scroll up or down through the parameters. If no key is pressed for 30 seconds this mode is exited and the display will revert back to the default display. Pressing the on/off key any time will exit this mode and the display will again indicate the default. The parameters are shown in *Table 2-3*. When scrolling through the parameters, the current parameter will be displayed for two seconds. After two seconds, the display will show the data for the current parameter. When the last parameter is reached, the list will wrap back to P1.

Table 2-2 Controller Test List

TEST	OUTPUT	STATE	TEST	OUTPUT	STATE
T00	All Relays De-Energized	Off	T07	Unloader Valve 2	On
T01	Evaporator Fans High Speed	On	T08	Fresh Air Damper	On
T02	Evaporator Fans Low Speed	On	T09	Heat Valve	On
T03	Condenser Fans High Speed	On	T10	Fault Light	On
T04	Condenser Fans Low Speed	On	T11	Boost Pump	On
T05	Compressor Clutch & LLS	On	T12	Spare, Motor Fault or Floor Blower Circuit	On
T06	Unloader Valve 1	On			

2-3.2.4.4 Test Mode

With the system in normal operation, the controller may be placed in the test mode, by doing the following:

a. Enter the diagnostic mode by pressing the up and down arrow keys simultaneously for 5 seconds. Enter the test mode by pressing the COOL key five times.

b. In the test mode, the display will read "T##" where "##" is shown, this indicates the test number that is currently running.

c. The initial indication will be "T00". This indicates the controller is in the test mode and all relays are de-energized. Press the arrow keys to scroll through and perform each test. When the highest test number is reached, the display will increment back to the lowest test number. A listing of tests is provided in *Table 2-2.*

d. To terminate testing, press the I/0 key.

Table 2-3 Parameter Codes

Code	Code Name	Description
P1	Return Air Temperature	This value is the temperature measured by the return air sensor. If the sensor is shorted it will display *CL*. If it is open circuited it will display *OP*.
P2	Coil Temperature	This value is the coil temperature measured by the evaporator temperature sensor. If the sensor is shorted it will display *CL*. If it is open circuited it will display *OP*.
P3	Ambient Temperature	This value is the outside temperature measured by the ambient temperature sensor. If the sensor is shorted it will display *CL*. If it is open circuited it will display *OP*.
P4	Suction Line Temperature	Not used.
P5	Suction Pressure	This value is the suction pressure measured by the suction pressure transducer. If the sensor is shorted it will display *CL*. If it is open circuited it will display *OP*.
P6	Discharge Pressure	This value is the discharge pressure measured by the discharge pressure transducer. If the sensor is shorted it will display *CL* and if it is open circuited it will display *OP*.
P7	Superheat	Not used.
P8	Analog Set Point Temperature	Not used.
P9	A/C Control Window #1	This is the number of degrees F above set point at which the unloaders will be both energized. This value can be modifed between 0 and 10 degrees F. The default value is 1 degree F.
P10	A/C Control Window #2	This is the number of degrees F above AC control window one at which the first unloader will be energized. This value can be modified between 0 and 10 degrees F. The default value is 1 degree F.
P11	A/C Control Window #3	This is the number of degrees F and above AC control window two at which the first evaporator fan speed will be set to low. This value can be modified between 0 and 10 degrees F. The default value is 1 degree F.

Table 2-3 Parameter Codes Continued

Code	Code Name	Description
P12	Heat Control Window	This is the number of degrees F below set point before the heat valve is energized. This value can be modifed between 0 and 10 degrees F. The default value is 2 degrees F for heat and 4 degrees F for reheat.
P13	Compressor Safety Off Delay	This number is the minimum time in minutes that the compressor must be off after a high or low pressure alarm before it can be restarted. This value can be modified between one and five minutes. The default value is 1.
P14	Fan Delay	This is the minimum time (in seconds) that the fans must run at a particular speed before changing to another speed. This value can be modified between one and 60 seconds. The default value is two seconds.
P15	Unloader/Heat Valve Delay	This is the minimum time (in seconds) that the heat valve must be in a particular state (open/closed) before changing to another state. This value can be modified between 1 and 60 seconds. The default value is 2 seconds.
P16	Compressor High Pressure Switch	This is the current state of the compressor high pressure switch input. *CL* will be displayed if it is closed and *OP* will be displayed if it is open.
P17	Condenser Fan Speed Switch	Not used.
P18	Maximum Set Point	This is the maximum value that the operator will be allowed to set the set point temperature. The value can be modified in degrees with the up and down keys to a value between 60°F and 80°F.
P19	Minimum Set Point	This is the minimum value that the operator will be allowed to set the set point temperature. The value can be modifed in degrees with the up and down keys to a value between 60°F and 80°F.
P20	Compressor Hours High	This is the number of hours of operation that the compressor has run with the clutch energized in thousands.
P21	Compressor Hours Low	This is the number of hours of operation that the compressor has run with the clutch energized in hundreds, tens and ones.
P22	Evaporator Hours High	This is the number (in thousands) of hours of operation with the evaporator fans energized.
P23	Evaporator Hours Low	This is the number (in hundreds, tens and ones) of hours of operation with the evaporator fans energized.
P24	Maintenance 1 Hour High	This is the value of compressor hours high (P20) at which maintenance alarm #1 will be activated. This value can be modified by the up and down arrow keys. If both high and low values are zero the alarm is disabled.
P25	Maintenance 1 Hour Low	This is the value of compressor hours low (P21) at which maintenance alarm #1 will be activated. This value can be modified by the up and down arrow keys. If both high and low values are zero the alarm is disabled.
P26	Maintenance 2 Hours High	This is the value of evaporator fan hours high (P22) at which maintenance alarm #2 will be activated. This value can be modified by the up and down arrow keys. If both high and low values are zero the alarm is disabled.
P27	Maintenance 2 Hours Low	This is the value of evaporator fan hours low (P23) at which maintenance alarm #2 will be activated. This value can be modified by the up and down arrow keys. If both high and low values are zero the alarm is disabled.
P28	Freeze Alarm Setting	This is the value at which the freeze alarm will be activated. The default value is 32°F. This value can be modified between 20°F and 40°F in one degree increments by using the arrow keys.
P29	Relay Module Voltage	This is the voltage being supplied to the relay module.

Table 2-3 Parameter Codes Continued

Code	Code Name	Description
P30	Main Board Software Version	This is the software version of the logic board.
P31	Display Software Version	This is the software version of the display module.
P32	Ki	Not used
P33	Kp	Not used
P34	Heat Set Point Offset	This value is the offset that can be used to change the points at which the unit switches between heat and vent in the heat mode. A positive value will raise the critical temperatures (winter use) and a negative value will decrease the critical temperatures (summer use).
P35	Default Display Temperature	This value determines what temperature driver's display will show as a default. When the value is OFF, set-point temperature is displayed. When the value is ON, return air temperature is displayed. This option is only available in logic module software revisions 1.9 and newer, and drivers display software revision 1.3 and newer. Otherwise P35 will not be active and set point temperature will only be displayed as default.

2-3.3 Troubleshooting

⚠CAUTION: Do not under any circumstances attempt to service the microprocessor, should a problem develop with the microprocessor, replace it.

2-3.3.1 Self Diagnostics

A self test is performed by the Micromax Logic Board each time the board is powered up. Errors, if any, will be indicated and the unit will not be allowed to start. The error codes can be read by counting the number of times that the Logic Board STATUS and CODE LED's (see *Figure 1-8*) flash simultaneously. The Micromate display will indicate errors with the code ER-#, where "ER" is the error prefix and # is the error number.

Table 3-1 Error Codes

CODE	NAME	DESCRIPTION
ER1	Data Memory	Logic board data memory failure.
ER2	Program Memory	Logic board program memory failure.
ER3	A/D	A/D and multiplexer failure.
ER4	Communication Failure	Failure in communication between the logic board and MDST.
ER 5	Program Memory	Display program memory failure.

2-3.3.2 System Alarms

2-3.3.2.1 Alarm Codes

The Micromax Logic Board continuously monitors system parameters and will generate an ALARM if a parameter exceeds preset limits. Alarms are indicated and the controller will respond in accordance with the information provided in *Table 3-2*. The alarm codes can be read by counting the number of times that the Logic Board CODE LED (see *Figure 1-8*) flashes. Each alarm code is a two digit number. The first set of flashes is the first digit and (after a slight pause) the second set of flashes is the second digit.

The Micromate Display will indicate alarms with the code A-## or i-##, where "A" is an active alarm prefix, "i" is an inactive alarm prefix and ## is the error number. If no alarms are present, the display will show "---". To access the alarm codes, press the UP and DOWN arrow keys at the same time and

hold for three seconds. If multiple alarms are present the user can scroll through each alarm by pressing the AUTO key. When the end of the alarm list is reached the display will show "---". Press VENT to scroll backward from the latest alarm to the earliest alarm in the queue. When using the VENT key to scroll back, only the alarm code will be shown, the alarm time will not be shown. If the AUTO key is held down for five seconds while "---" is displayed, all inactive alarms are cleared. A listing of alarm codes is provided in *Table 3-2.*

2-3.3.2.2 Activation

When alarms are detected, they are placed in an alarm queue in the order at which they initiated unless the alarm is already present. Each alarm recorded will also capture an evaporator hour meter reading corresponding to the activation time. If the AUTO key is pressed while an alarm is displayed, the activation time capture will be shown.

2-3.3.2.3 Alarm Queue

The alarm queue consist of 10 alarm locations. When the alarm queue is full the Logic Board will take the required action, but the alarm will not be recorded. When this situation occurs, an "Alarm Queue Full" alarm will be generated. When the alarms are viewed this will be the first alarm to be shown.

2-3.3.2.4 Alarm Clear

The user may clear inactive alarms using the Micromate keypad. Refer to *2-3.3.2.1 Alarm Codes* paragraph.

2-3.3.3 Troubleshooting

General procedures for system troubleshooting are provided in *Table 3-3.*

Table 3-2 Alarm Codes

ALARM NO.	TITLE	CAUSE	REMEDY	CONTROLLER RESPONSE
A11	Coil Freeze	Coil temperature is less than 32°F and the compressor is operating.	Check causes of coil freezing. (Refer to *No Evaporator Air Flow or Restricted Air Flow in Table 3-3.*)	An alarm will be generated and the system will shut down. The evaporator fans will remain running while the compressor is off.
A12	High Voltage	The battery voltage is greater than 32 volts.	Check, repair or replace alternator.	The system is shut down until the voltage returns to normal levels.
A13	Low Voltage	The battery voltage is less than 17 volts.	Check, repair or replace wiring or alternator.	The system is shut down until the voltage returns to normal levels.
A14	Return Air Probe Failure	Return air temperture sensor failure or wiring defective.	Ensure all connectors are plugged in. Check sensor resistance or wiring. Refer to paragraph NO TAG. Replace sensor or repair wiring.	All outputs except the evaporator fans will be de-energized.
A15	Suction Pressure Transducer Failure	Suction pressure transducer failure or wiring defective.	Ensure all connectors are plugged in. Check sensor voltage or wiring. Replace sensor or repair wiring.	Both unloaders are energized.
A16	Discharge Pressure Transducer Failure	Discharge pressure transducer failure or wiring defective.	Ensure all connectors are plugged in. Check sensor voltage or wiring. Replace sensor or repair wiring.	One unloader is energized.

Table 3-2 Alarm Codes continued

ALARM NO.	TITLE	CAUSE	REMEDY	CONTROLLER RESPONSE
A17	Low Pressure Shutdown	Low suction pressure switch open or wiring defective.	Check cause of low suction pressure.	The clutch is de-energized for the minimum off time. The evaporator fans will remain running during this period. After the compressor cycles off three times in 30 minutse all outputs will be de-energized and the system is locked out until the power is cycled or the alarm is reset.
A21	High Discharge Pressure	High discharge pressure switch open or wiring defective.	Check discharge pressure transducer reading, wiring or cause of high discharge pressure. (Refer to **Abnormal Pressure in Table 3-3.**)	The clutch is de-energized for the minimum off time. The condenser and evaporator fans will remain running during this period. After the compressor cycles off three times in 30 minutes all outputs will be de-energized and the system is locked out until the power is cycled or the alarm is reset.
A22	Breaker Trip Alarm	A breaker on the relay board has tripped or a fan relay has failed.	Check breakers for tripped device. Repair short and reset breaker.	Alarm will be generated.
A23	Evaporator Fan Overload	Evaporator fan overload jumper is open.	Ensure connector is plugged in or repair wiring.	Alarm will be generated.
A24	Condenser Fan Overload	Condenser fan overload jumper is open.	Ensure connector is plugged in or repair wiring.	Alarm will be generated.
A25	Motor Failure	A brushless motor has not reached full operating speed or a motor failure.	Replace motor, or correct pressure shutdown.	Alarm displayed and the motor fail output is energized.
A26	Not used			
A31	Maintenance Alarm 1	The compressor hour meter is greater than the value in Maintenance Hour Meter 1.	Reset the maintenance hour meter.	Alarm will be generated.
A32	Maintenance Alarm 2	The evaporator hour meter is greater than the value in Maintenance Hour Meter 2.	Reset the maintenance hour meter.	Alarm will be generated.
A99	Alarm Queue Full	All locations of the alarm queue are currently full and no more alarms can be saved.	Record and clear alarm queue.	Alarm will be generated.

Table 3-3 General System Troubleshooting Procedures

INDICATION/ TROUBLE	POSSIBLE CAUSES	REFERENCE SECTION
3.3.1 System Will Not Cool		
Compressor will not run	Active system alarm	3.2
	V-Belt loose or defective	Check
	Clutch coil defective	Check/Replace
	Clutch malfunction	Check/Replace
	Compressor malfunction	See Table 1-1
Electrical malfunction	Coach power source defective	Check/Repair
	Circuit Breaker/safety device open	Check/Reset
3.3.2 System Runs But Has Insufficient Cooling		
Compressor	V-Belt loose or defective	Check
	Compressor valves defective	See Table 1-1
Refrigeration System	Abnormal pressures	3.3.3
	No or restricted evaporator air flow	3.3.6
	Expansion valve malfunction	3.3.7
	Restricted refrigerant flow	4.11
	Low refrigerant charge	4.8
	Service valves partially closed	Open
	Safety device open	1.8
	Liquid solenoid valve stuck closed	Check
Restricted Air Flow	No evaporator air flow or restriction	3.3.6
Heating System	Heat valve stuck open	3.3.8
3.3.3 Abnormal Pressures		
High Discharge Pressure	Discharge transducer failure	Replace
	Refrigerant overcharge	4.8.1
	Noncondensable in system	Check
	Condenser motor failure	Check
	Condenser coil dirty	Clean
Low Discharge Pressure	Discharge transducer failure	See Note
	Compressor valve(s) worn or broken	See Table 1-1
	Low refrigerant charge	4.8
High Suction Pressure	Compressor valve(s) worn or broken	See Table 1-1
Low Suction Pressure	Suction service valve partially closed	Open
	Filter-drier inlet valve partially closed	Check/Open
	Filter-drier partially plugged	4.11
	Low refrigerant charge	4.8
	Expansion valve malfunction	3.3.7
	Restricted air flow	3.3.6
	Suction transducer failure	Replace
Suction and discharge pressures tend to equalize when system is operating	Compressor valve defective	See Table 1-1

Table 3-3 General System Troubleshooting Procedures - Continued

INDICATION/ TROUBLE	POSSIBLE CAUSES	REFERENCE SECTION
3.3.4 Abnormal Noise or Vibrations		
Compressor	Loose mounting hardware	Check/Tighten
	Worn bearings	See Table 1-1
	Worn or broken valves	See Table 1-1
	Liquid slugging	3.3.7
	Insufficient oil	4.15.3
	Clutch loose, rubbing or is defective	Check
	V-belt cracked, worn or loose	Check/Adjust
	Dirt or debris on fan blades	Clean
Condenser or evaporator fans	Loose mounting hardware Defective bearings	Check/Tighten Replace
	Blade interference	Check
	Blade missing or broken	Check/Replace
3.3.5 Control System Malfunction		
Will not control	Sensor or transducer defective	4.17 or 4.18
	Relay(s) defective	Check
	Microprocessor controller malfunction	Check
	Logic Board J3 connector unplugged	
3.3.6 No Evaporator Air Flow or Restricted Air Flow		
Air flow through coil blocked	Coil frosted over	Defrost coil
	Dirty coil	Clean
	Dirty filter	Clean/Replace
No or partial evaporator air flow	Motor(s) defective	Repair/Replace
	Motor brushes defective	Replace
	Evaporator fan loose or defective	Repair/Replace
	Fan damaged	Repair/Replace
	Return air filter dirty	Clean/Replace
	Icing of coil	Clean/Defrost
	Fan relay(s) defective	Check/Replace
	Safety device open	1.8
	Fan rotation incorrect	Check
3.3.7 Expansion Valve Malfunction		
Low suction pressure with high superheat	Low refrigerant charge	4.8
	Wax, oil or dirt plugging valve orifice	Check
	Ice formation at valve seat	4.7
	Power assembly failure	Replace
	Loss of bulb charge	Replace
	Broken capillary tube	4.13.2
Low superheat and liquid slugging in the compressor	Bulb is loose or not installed	4.13.2
	Superheat setting too low	4.13.2
	Ice or other foreign material holding valve open	

Table 3-3 General System Troubleshooting Procedures - Continued

INDICATION/ TROUBLE	POSSIBLE CAUSES	REFERENCE SECTION
3.3.7 Expansion Valve Malfunction continued		
Side to side temperature difference (Warm Coil)	Wax, oil or dirt plugging valve orifice	Check
	Ice formation at valve seat	4.7
	Power assembly failure	Replace
	Loss of bulb charge	Replace
	Broken capillary	4.13
3.3.8 Heating Malfunction		
Insufficient Heating	Dirty or plugged heater core	Clean
	Coolant solenoid valve(s) malfunctioning or plugged	Check/Replace
	Low coolant level	Check
	Strainer(s) plugged	Clean
	Hand valve(s) closed	Open
	Water pumps defective	Repair/Replace
	Auxiliary Heater malfunctioning	Repair/Replace
No Heating	Coolant solenoid valve(s) malfunctioning or plugged	Check/Replace
	Controller malfunction	Replace
	Pump(s) malfunctioning	Repair/Replace
	Safety device open	1.8
Continuous Heating	Coolant solenoid valve stuck open	Replace

2-3.4 Service

▲WARNING: Be sure to observe warnings listed in the safety summary in the front of 2-3 Air Conditioning Section before performing maintenance on the hvac system.

▲WARNING: Read the entire procedure before beginning work. Park the coach on a level surface, with parking brake applied. Turn main electrical disconnect switch to the off position.

NOTE: Following completion of all maintenance or service activities, the alarm queue should be cleared of any original alarms and any alarms generated during service. Refer to Alarm Codes section.

NOTE: To avoid damage to the earth's ozone layer, use a refrigerant recovery system whenever removing refrigerant. When working with refrigerants you must comply with all local government environmental laws.

2-3.4.1 Maintenance Schedule

SYSTEM ON	SYSTEM OFF	SYSTEM	REFERENCE SECTION
A. Daily Maintenance			
X		Pre-trip Inspection - after starting	2.2
	X	Check tension and condition of V-belt	None
B. Weekly Inspection			
	X	Perform daily inspection	See above
	X	Check condenser, evaporator coils and air filters for cleanliness	None
	X	Check refrigerant hoses and compressor shaft seal for leaks	4.6
X		Feel filter-drier for excessive temperature drop across drier	4.11
C. Monthly Inspection and Maintenance			
	X	Perform weekly inspection and maintenance	See above
	X	Clean evaportor drain pans and hoses	None
	X	Check wire harnesses for chafing and loose terminals	Replace/Tighten
	X	Check fan motor bearings	None
	X	Check compressor mounting bolts for tightness	None
	X	Check fan motor brushes	None

2-3.4.2 Opening Top Cover (Evaporator)

To open either side of the evaporator assembly cover do the following: (See *Figure 4-1*)

a. Twist all 6 of the ¼ turn cam locks counterclockwise.
b. Grasp the cover section under the bottom edge and lift up.
c. Locate metal rod (prop) secured behind the evaporator motor assemblies.
d. Lift end of metal rod (prop) and place in plate on cover assembly.

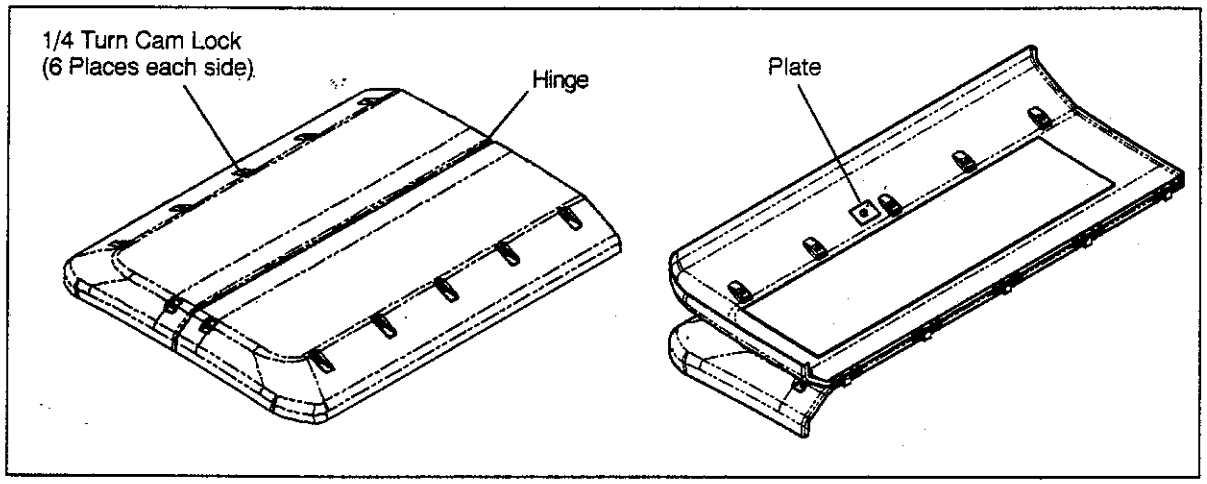


Figure 4-1 Opening Top Cover (Evaporator)

2-3.4.3 Removing Top Cover (Condenser)

The condenser cover assembly is of one piece construction. To remove the cover from the condenser assembly do the following:

a. Twist all (10) of the ¼ turn cam locks counterclockwise.

b. Using two people, grasp the condenser cover section under the bottom edge and lift up evenly from both sides.

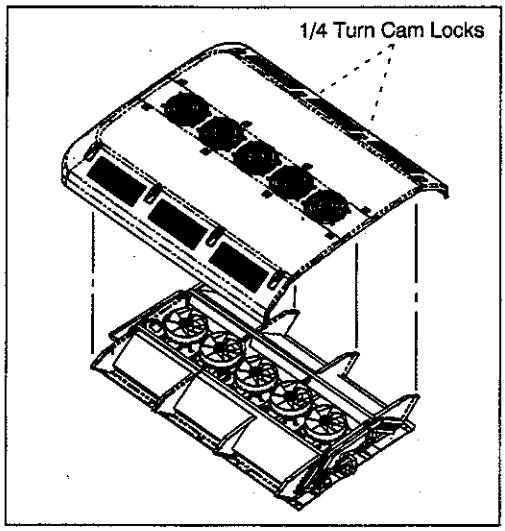


Figure 4-2 Condenser Cover Removal

2-3.4.4 Suction and Discharge Service Valves

The suction and discharge service valves (*Figure 4-3*) are provided with a double seat and a gauge port, which allows servicing of the compressor and refrigerant lines.

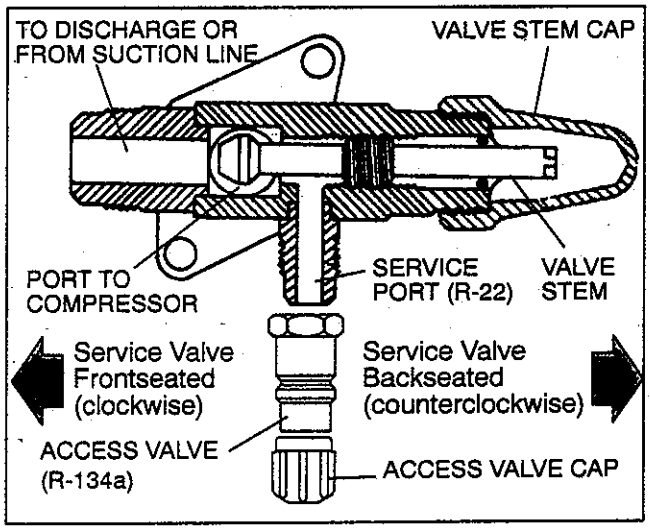


Figure 4-3 Suction or Discharge Service Valve

Turning the valve stem counterclockwise (all the way out) will backseat the valve to open the line to the compressor and close off the gauge port. In normal operation, the valve is backseated to allow full flow through the valve. The valve should always be backseated before removing the gauge port cap.

Turning the valve stem clockwise (all the way forward) will frontseat the valve to isolate the compressor line and open the gauge port.

To measure suction or discharge pressure, midseat the valve by opening the valve clockwise ¼ to ½ turn. With the valve stem midway between frontseated and backseated positions, the suction or discharge gauge port is open to both the compressor and the line.

2-3.4.4.1 Installing R-134a Manifold Gauge Set

A R-134a manifold gauge/hose set with self-sealing hoses is required for service of models covered within this manual. The manifold gauge/hose set is available from Carrier Transicold. (Carrier Transicold P/N 07-00294-00, which includes items 1 through 6, *Figure 4-4*). To perform service using the manifold gauge/hose set, do the following:

a. Preparing Manifold Gauge/Hose Set For Use

1. If the manifold gauge/hose set is new or was exposed to the atmosphere it will need to be evacuated to remove contaminants and air as follows:
2. Back seat (turn counterclockwise) both field service couples (see *Figure 4-4*) and midseat both hand valves.
3. Connect the yellow hose to a vacuum pump and an R-134a cylinder.
4. Evacuate to 10 inches of vacuum and then charge with R-134a to a slightly positive pressure of 1.0 psig.
5. Front seat both manifold gauge set hand valves and disconnect from cylinder. The gauge set is now ready for use.

b. Connecting Manifold Gauge/Hose Set

To connect the manifold gauge/hose set for reading pressures, do the following:

1. Remove service valve stem cap and check to make sure it is back seated. Remove access valve cap.
2. Connect the field service coupler (see *Figure 4-4*) to the access valve)
3. Turn the field service coupling knob clockwise, which will open the system to the gauge set.
4. Read system pressures.
5. Repeat the procedure to connect the other side of the gauge set.

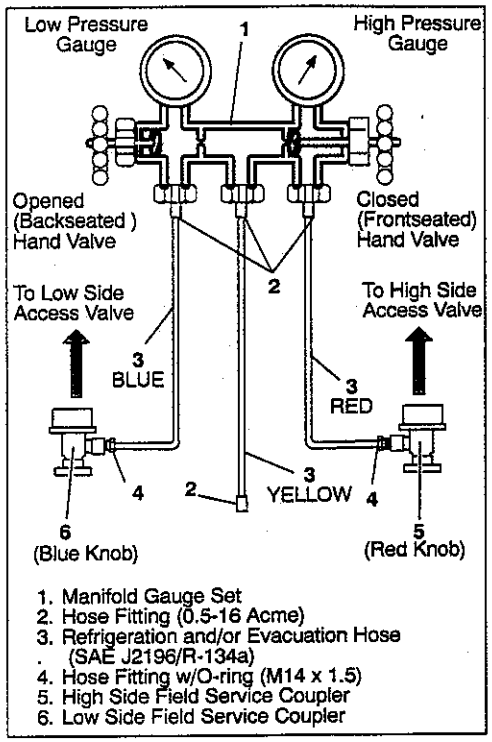


Figure 4-4 Manifold Gauge Set (R-134a)

c. Removing the Manifold Gauge Set

1. While the compressor is still ON, backseat the high side service valve.
2. Midseat both hand valves on the manifold gauge set and allow the pressure in the manifold gauge set to be drawn down to low side pressure. This returns any liquid that may be in the high side hose to the system.

⚠CAUTION: To prevent trapping liquid refrigerant in the manifold gauge set be sure set is brought to suction pressure before disconnecting.

3. Backseat the low side service valve. Backseat both field service couplers and front seat both manifold set hand valves. Remove the couplers from the access valves.
4. Install both service valve stem caps and access valve caps (finger-tight only).

2-3.4.5 Pumping the System Down or Removing the Refrigerant Charge

NOTE: To avoid damage to the earth's ozone layer, use a refrigerant recovery system whenever removing refrigerant.

2-3.4.5.1 System Pump Down for Low Side Repair

To service or replace the filter-drier, thermostatic expansion valve, suction line, liquid line solenoid valve or evaporator coil, pump the refrigerant to the condenser and receiver as follows:

a. Install manifold gauge set to the filter-drier inlet service valve. Refer to *Figure 4-5*.

b. Front seat the filter-drier inlet service valve by turning clockwise. Disconnect suction pressure transducer, install a jumper on the compressor mounted low pressure switch.

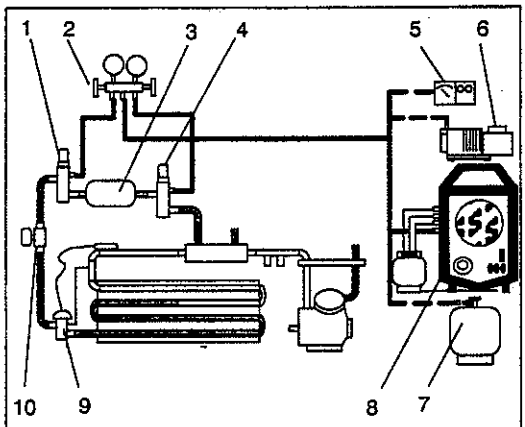
c. Start the system and run in cooling. Stop the unit when suction reaches a slight vacuum (1-2"/hg).

d. Front seat the compressor suction service valve to trap refrigerant in the high side of the system between the compressor suction service valve and the filter-drier inlet valve. Wait 5 minutes to verify that system remains in a vacuum. If system pressure rises above a vacuum, open the compressor suction service valve and repeat steps c and d until the system remains in a vacuum.

e. Service or replace necessary components.

f. Leak check connections and replace filter-drier. Refer to paragraph *Filter-Drier*.

g. Energize the Liquid Line Solenoid Valve (LSV) using an external power source (24 VDC).



1. Filter-Drier Outlet Service Valve
2. Manifold Gauge Set
3. Filter-Drier
4. Filter-Drier Inlet Service Valve
5. Thermistor Vacuum Gauge
6. Vacuum Pump
7. Refrigerant Cylinder
8. Reclaimer
9. Thermostatic Expansion Valve
10. Liquid Solenoid Valve

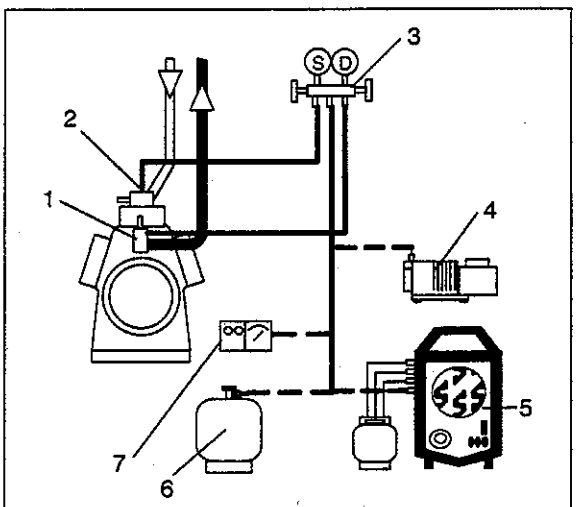
Figure 4-5 Low Side Pump Down Connections

h. Using refrigerant hoses designed for vacuum service, evacuate and dehydrate the low side of the system by connecting a vacuum pump to the center connection of manifold gauge set. Evacuate system to 500 microns. Close off pump valve, isolate vacuum gauge and stop pump. Wait 5 minutes to verify that vacuum holds.

i. Recharge low side with R-134a to 20 to 30 psig by admitting vapor from the refrigerant cylinder.

j. Re-connect the suction pressure transducer and remove the low pressure switch jumper. If required, clear any alarms that have been generated during this procedure.

k. Open service valves and check refrigerant level. Refer to paragraph *Check Refrigerant Charge*.



1. Discharge Service Valve and Port
2. Suction Service Valve and Port
3. Manifold Gauge Set
4. Vacuum Pump
5. Reclaimer
6. Refrigerant Cylinder
7. Thermistor Vacuum Gauge

Figure 4-6 Compressor Service Connections

2-3.4.5.2 Refrigerant Removal from an Inoperative Compressor

To remove the refrigerant from a compressor that is not operational, do the following:

a. Attach a manifold gauge set as shown in *Figure 4-6* and isolate the compressor by front seating the suction and discharge valves.

b. Recover refrigerant with a refrigerant reclaimer. If the discharge service valve port is not accessible, it will be necessary to recover refrigerant through the suction service valve port only.
c. Service or replace components as required and leak check the compressor.
d. Using refrigerant hoses designed for vacuum service, connect a vacuum pump to center connection of manifold gauge set. Evacuate compressor to 500 microns. Close off pump valve, isolate vacuum gauge and stop pump. Wait 5 minutes to verify that vacuum holds.
e. Once vacuum is maintained, backseat compressor service valves and disconnect manifold gauge set.
f. Check refrigerant level. Refer to paragraph *Checking Refrigerant Charge*. It may be necessary to clear any alarms that have been generated.

2-3.4.5.3 Pump Down an Operable Compressor for Repair

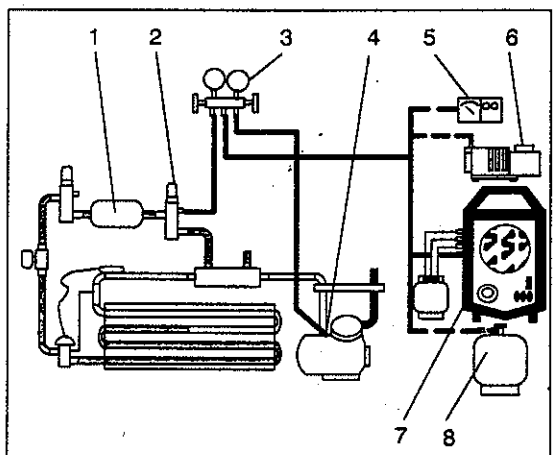
To service an operable compressor, pump the refrigerant into the condenser coil and receiver as follows:

a. Install manifold gauge set. Refer to *Figure 4-6*.
b. Front seat the compressor suction service valve by turning clockwise.
c. Install a jumper on the compressor mounted low pressure switch. Start the unit and run in cooling until 10 "/hg (25.4 cm/hg) of vacuum is reached. Shut the system down and tag out system power source.
d. Front seat the compressor discharge service valve and wait 5 minutes to verify that vacuum is maintained. If the pressure rises above vacuum, open the compressor discharge service valve and repeat steps c and d until a vacuum is maintained.
e. Service or replace components as required and leak check the compressor.
f. Using refrigerant hoses designed for vacuum service, connect a vacuum pump to the center connection of the manifold gauge set. Evacuate compressor to 500 microns. Close off pump valve, isolate vacuum gauge and stop pump. Wait 5 minutes to verify that vacuum holds.
g. Once vacuum is maintained, re-connect low pressure switch. Backseat compressor service valves and disconnect manifold gauge set.
h. Check refrigerant level. Refer to paragraph *Checking Refrigerant Charge*. It may be necessary to clear any alarms that have been generated.

2-3.4.5.4 Removing Entire System Charge

To remove the entire refrigerant charge, do the following:

a. Connect a manifold gauge set to the system as shown in *Figure 4-7*.
b. Connect a reclaimer to the center manifold gauge set connection.
c. Recover refrigerant in accordance with reclaimer manufacturers instructions.



1. Filter-Drier
2. Filter-Drier Inlet Service Valve
3 Manifold Gauge Set
4. Suction Service Valve and Port
5. Thermistor Vacuum Gauge
6. Vacuum Pump
7. Reclaimer
8. Refrigerant Cylinder

Figure 4-7 System Charge Removal Connections

2-3.4.6 Refrigerant Leak Check

A refrigerant leak check should always be performed after the system has been opened to replace or repair a component.

To check for leaks in the refrigeration system, perform the following procedure:

NOTE: It must be emphasized that only the correct refrigerant should be used to pressurize the system. Use of any other refrigerant will contaminate the system, and require additional evacuation.

a. Ensure the service valves are open and power the liquid line service valve from an external source.
b. If system is without refrigerant, charge system with refrigerant vapor to build up pressure to approximately 30 psig (R-134a).
c. Add sufficient nitrogen to raise system pressure to 150 to 200 psig (10.21 to 13.61 bar).
d. Check for leaks. The recommended procedure for finding leaks in a system is with an electronic leak detector. Testing joints with soap suds is satisfactory and may be necessary under conditions when an electronic leak detector will not function correctly.
e. Remove test gas and replace filter-drier.
f. Evacuate and dehydrate the system. Refer to *Evacuation and Dehydration* section.
g. Charge the unit. Refer to paragraph *2-3.4.8.*
h. Ensure that a Logic Board self-test has been performed and that there are no errors or alarms indicated. (Refer to *paragraph 2-3.2.1.3*)

2-3.4.7 Evacuation and Dehydration

2-3.4.7.1 General

The presence of moisture in a refrigeration system can have many undesirable effects. The most common are copper plating, acid sludge formation, "freezing-up" of metering devices by free water, and formation of acids, resulting in metal corrosion. A triple evacuation (Refer to paragraph *2-3.4.7.3 Procedure for Evacuation and Dehydrating System (Triple Evacuation)*) should be performed after a major system repair (compressor, evaporator, or condenser replacement). A one time evacuation (Refer to paragraph *2-3.4.7.4 Procedure for Evacuation and Dehydrating System (One Time Evacuation)*) should take place after a minor system repair (replacement of a solenoid valve or a filter-drier).

2-3.4.7.2 Preparation

NOTE: Using a compound gauge for determination of vacuum level is not recommended because of its inherent inaccuracy.

a. Evacuate and dehydrate only after pressure leak test. Refer to paragraph *2-3.4.6 Refrigerant Leak Check.*
b. Essential tools to properly evacuate and dehydrate any system include a good vacuum pump with a minimum of 6 cfm (10.2 m^3/hr) volume displacement, (CTD P/N 07-00176-11), and a good vacuum indicator (CTD P/N 07-00414-00).
c. Keep the ambient temperature above 60°F (15.6°C) to speed evaporation of moisture. If ambient temperature is lower than 60°F (15.6°C), ice may form before moisture removal is complete.

2-3.4.7.3 Procedure for Evacuation and Dehydrating System (Triple Evacuation)

a. Remove refrigerant using a refrigerant recovery system. Refer to *2-3.4.5.4 Removing Entire System Charge.*
b. The recommended method is connecting lines (refrigerant hoses designed for vacuum service) as shown in *Figure 4-7.*
c. Make sure vacuum pump valve is open.
d. Start vacuum pump. Slowly open valves halfway and then open vacuum gauge valve.

e. Evacuate unit until vacuum gauge indicates 2000 microns Hg vacuum. Close gauge valve, vacuum pump valve, and stop vacuum pump.
f. Break the vacuum with nitrogen. Raise system pressure to approximately 2 psig.
g. Purge the nitrogen from the system.
h. Repeat steps d. thru g. one time.
i. Start vacuum pump and open all valves. Dehydrate unit to 500 microns Hg vacuum.
j. Close off pump valve, and stop pump. Wait five minutes to see if vacuum holds.
k. Charge system. Refer to paragraph 2-3.4.8.2.

2-3.4.7.4 Procedure for Evacuation and Dehydrating System (One Time Evacuation)

a. Remove refrigerant using a refrigerant recovery system. Refer to paragraph *2-3.4.5.4.*
b. The recommended method is connecting lines (refrigerant hoses designed for vacuum service) as shown in *Figure 4-7.*
c. Make sure vacuum pump valve is open.
d. Start vacuum pump. Slowly open valves halfway and then open vacuum gauge valve.
e. Evacuate unit until vacuum gauge indicates 500 microns Hg vacuum.
f. Close off pump valve, and stop pump. Wait five minutes to see if vacuum holds.
g. Charge system. Refer to paragraph *2-3.4.8.2 Adding Full Charge.*

2-3.4.8 Adding Refrigerant to System

2-3.4.8.1 Checking Refrigerant Charge

The following conditions must be met to accurately check the refrigerant charge.
a. Coach engine operating at high idle.
b. Unit operating fully loaded (six cylinder) in cool mode for 15 minutes.
c. Compressor discharge (head) pressure to 150 psig (R-134a). It may be necessary to block condenser air flow to raise discharge pressure.
d. Under the above conditions, the system is properly charged when the liquid line sight glass is clear (no bubbles). Add or remove refrigerant to bring it to clear the sight glass.

2-3.4.8.2 Adding Full Charge

a. Install manifold gauge set at the compressor suction service valve and filter-drier inlet service valve. See *Figure 4-7.*
b. Evacuate and dehydrate system. Refer to paragraph *2-3.4.7 Evacuation and Dehydration.*
c. Place appropriate refrigerant cylinder on scales. Prepare to charge liquid refrigerant by connect charging hose from container to center connection on gauge manifold. Purge air from hoses.
d. Note weight of refrigerant and cylinder.
e. Open cylinder valve, backseat discharge valve on gauge manifold and allow liquid refrigerant to flow into the high side of the system.
f. When correct charge has been added, refer to paragraph *2-3.1.5 Refrigeration System Component Specification*, close cylinder valve and front seat manifold discharge valve. At this point, the high side of the system has been charged but the low side is still in a vacuum because the liquid line solenoid is normally closed.
g. Prepare the cylinder as required to allow vapor charging. Backseat the manifold suction valve and charge vapor to build 30 psig (R-134a) pressure on the manifold suction gauge. Close cylinder valve and front seat suction manifold set.
h. Check charge level in accordance with the procedures of paragraph *2-3.4.8.1 Checking Refrigerant Charge.*

2-3.4.8.3 Adding Partial Charge

a. Install manifold gauge set at the compressor suction service valve and filter-drier inlet service valve. See *Figure 4-7.*
b. Place appropriate refrigerant cylinder on scale. Prepare to charge vapor refrigerant by connecting charging hose from container to center connection on gauge manifold. Purge air from hoses.
c. Run the unit in the cool mode as described in section *2-3.4.8.1 Checking Refrigerant Charge.* With the suction service valve mid-seated, open the refrigerant cylinder valve and add vapor charge until the refrigerant level appears in the liquid line sight glass.

d. Backseat the suction service valve. Close the vapor valve on the refrigerant drum and note weight. Remove the manifold gauge set and replace all valve caps.

2-3.4.9 Checking for Noncondensibles

To check for noncondensibles, proceed as follows:

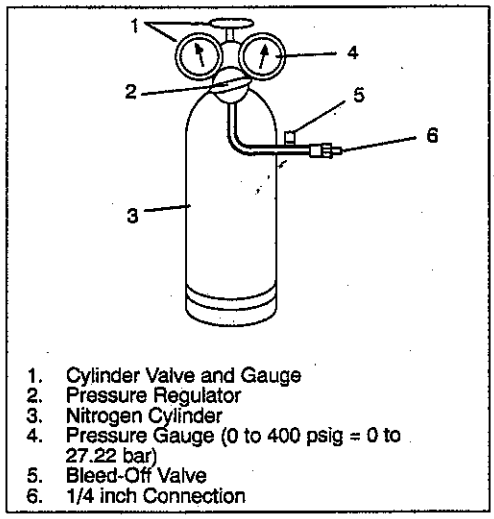
a. Stabilize system to equalize pressure between the suction and discharge side of the system.
b. Check temperature at the condenser and receiver.
c. Check pressure at the filter-drier inlet service valve.
d. Check saturation pressure as it corresponds to the condenser/receiver temperature using the Temperature-Pressure Charge, *Table 4-4*.
e. If gauge reading is 3 psig (0.20 bar) or more than the saturation pressure in step d, noncondensibles are present.
f. Remove refrigerant using a refrigerant recovery system.
g. Evacuate and dehydrate the system. Refer to paragraph *2-3.4.7.3 Procedure for Evacuation and Dehydrating System (Triple Evacuation)*
h. Charge the unit. Refer to paragraph *2-3.4.8.2 Adding Full Charge*.

2-3.4.10 Checking and Replacing High or Low Pressure Switch

▲WARNING: Do not use a nitrogen cylinder without a pressure regulator.

▲WARNING: Do not use oxygen in or near a refrigeration system as an explosion may occur.

a. Disconnect wiring and remove switch from unit. All units are equipped with a schrader valve at the pressure switch connections.
b. Connect switch to a cylinder of dry nitrogen. See *Figure 4-8*.
c. Connect an ohmmeter across switch terminals.
d. Set nitrogen pressure regulator higher than the upper switch setting. (refer to paragraph *2-3.1.5 Refrigeration System Component Specifications*.)
e. For a high pressure switch, close cylinder valve and open bleed-off valve. Open cylinder valve and slowly close bleed-off valve. The switch should open, (no continuity) within required cut out tolerance. Close cylinder valve and release pressure through the bleed-off valve. As pressure drops, switch should close, (continuity) within required cut in tolerance.

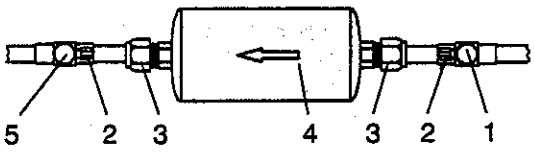


1. Cylinder Valve and Gauge
2. Pressure Regulator
3. Nitrogen Cylinder
4. Pressure Gauge (0 to 400 psig = 0 to 27.22 bar)
5. Bleed-Off Valve
6. 1/4 inch Connection

Figure 4-8 Checking High Pressure Switch

f. For a low pressure switch, close cylinder valve and bleed-off valve. Open cylinder valve to bring pressure above the cutout setting. Close the cylinder valve and slowly open bleed-off valve. The switch should open, (no continuity) within required cut out tolerance. Open cylinder valve and increase pressure by closing the bleed-off valve. As pressure increases, switch should close, (continuity) within required cut in tolerance.
g. Replace or re-install switch (as required) and reconnect wiring.

2-3.4.11 Filter-Drier



1. Filter-Drier Inlet Service Valve
2. Valve Service Port
3. Flare Nut
4. Filter-Drier
5. Filter-Drier Outlet Service Valve

Figure 4-9 Filter-Drier Removal

2-3.4.11.1 To Check Filter-Drier

The filter-drier (see *Figure 4-9*) must be changed if the drier is partially restricted or service has been performed on the refrigerant system. Check for a restriction by feeling the inlet and outlet lines of the filter-drier. If the outlet side feels cooler than the inlet side, then the filter-drier should be changed.

2-3.4.11.2 To Replace Filter-Drier

a. Perform a low side pump down. Refer to paragraph *2-3.4.5.1, (steps a through c)*.
b. Turn the driver's A/C switch to "OFF" position.
c. Front-seat the filter-drier outlet service valve and place a new filter-drier near the unit for immediate installation.
d. Remove two screws securing the filter-drier clamp. Remove the filter-drier clamp.

▲WARNING: The filter-drier may contain liquid refrigerant. Slowly loosen the flare nuts to avoid refrigerant contact with exposed skin or eyes.

e. Using two open end wrenches, slowly crack open the flare nuts on each side of the filter-drier. Remove the filter-drier.
f. Remove seal caps from the new filter-drier. Apply a light coat of compressor oil to the flares.
g. Assemble the new filter-drier to lines ensuring that the arrow on the body of the filter-drier points in the direction of the refrigerant flow (refrigerant flows from the receiver to the evaporator). Finger tighten flare nuts.
h. Tighten filter-drier flare nuts using two open end wrenches.
i. Evacuate the filter-drier and lines by connecting a vacuum pump as shown in *Figure 4-5*. Evacuate to 500 microns.
j. Back-seat (fully close) both service valve ports and replace valve caps.
k. Test filter-drier for leaks.
l. Check refrigerant level.

2-3.4.12 Servicing the Liquid Line Solenoid Valve

The Liquid line solenoid valve (*Figure 4-10*) requires no maintenance unless a malfunction to the internal parts or coil occurs. This may be caused by foreign material such as: dirt, scale, or sludge in the refrigeration system, or improper voltage to the coil.

There are only three possible valve malfunctions: coil burnout, failure to open, or failure to close.

Coil burnout may be caused by the following:

1. Improper voltage.
2. Continuous over-voltage, more than 10% or under-voltage of more than 15%.
3. Incomplete magnet circuit due to the omission of the coil housing or plunger.
4. Mechanical interface with movement of plunger which may be caused by a deformed enclosing tube.

Failure to open may be caused by the following:

1. Coil burned out or an open circuit to coil connections.
2. Improper voltage.
3. Defective plunger or deformed valve body assembly.

Failure to close may be caused by the following:

1. Defective plunger or deformed valve body assembly.
2. Foreign material in the valve.

2-3.4.12.1 Coil Replacement

a. It is not necessary to remove the refrigerant charge from the system.
b. Place main battery disconnect switch in OFF position and lock.
c. Disconnect wire leads to coil.
d. Remove coil retaining clip and nameplate.
e. Lift burned-out coil from enclosing tube and replace.
f. Connect wire leads and test operation.

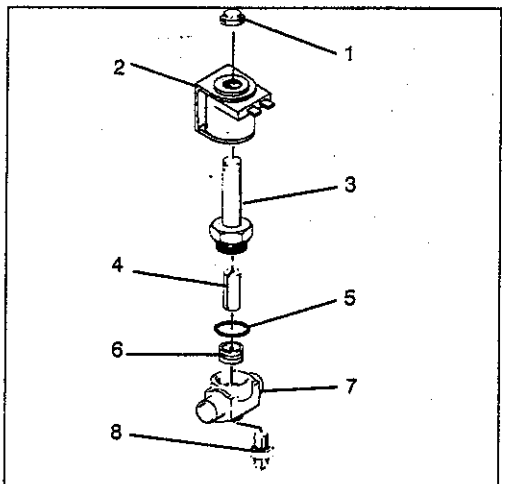
2-3.4.12.2 Internal Part Replacement

a. Perform a low side pump down. Refer to paragraph *2-3.4.5.1.*
b. Carefully loosen enclosing tube assembly and ensure no pressure remains within the valve. Disassemble valve and replace defective parts.
c. Assemble valve and leak check.
d. Evacuate low side and re-open system.

2-3.4.12.3 Replace Entire Valve

a. Perform a low side pump down. Refer to paragraph *2-3.4.5.1.* Remove coil and plunger assembly and un-braze valve from lines.
b. Remove valve assembly from bracket.
c. Disassemble new valve, to protect internal parts, and solder to lines.
d. Assemble and leak check valve.
e. Evacuate low side and re-open system.
f. Connect wire leads and test operation.

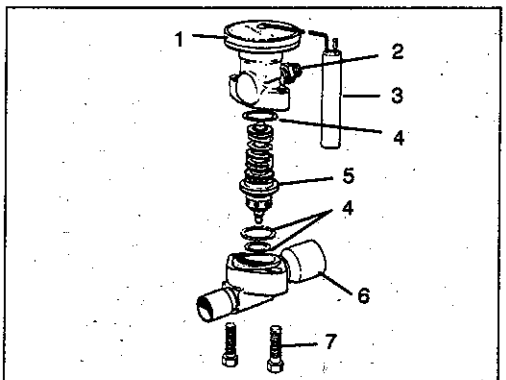
2-3.4.13 Thermostatic Expansion Valve



1. Snap Cap
2. Coil Assembly
3. Enclosing Tube Assembly
4. Plunger Assembly
5. Gasket
6. Piston Assembly
7. Body
8. Bracket Adapter

Figure 4-10 Liquid Line Solenoid Valve

The thermostatic expansion valve (*Figure 4-10*) is an automatic device which maintains constant superheat of the refrigerant gas leaving the evaporator regardless of suction pressure. The valve functions are: (a) automatic control of refrigerant flow to match the evaporator load and (b) prevention of liquid refrigerant entering the compressor. Unless the valve is defective, it seldom requires any maintenance.



1. Power Head Assembly
2. Equalizer Connection
3. Bulb
4. Gasket
5. Cage Assembly
6. Body Flange
7. Cap screw

Figure 4-11 Thermostatic Expansion Valve

2-3.4.13.1 Valve Replacement

a. Pump down low side of the unit. Refer to paragraph *2-4.4.5.1.*

b. Remove insulation from expansion valve and bulb. See *Figure 4-11* and *Figure 4-12.*

c. Loosen retaining straps holding bulb to suction line and detach bulb from the suction line.

d. Loosen flare nuts on equalizer line and disconnect equalizer line from the expansion valve.

e. Remove capscrews and lift off power head and cage assemblies and gaskets.

f. Check, clean and remove any foreign material from the valve body, valve seat and mating surfaces. If required, replace valve body.

NOTE: R-134a valves are non-adjustable.

g. Using new gaskets, install new cage and power head assemblies.

h. Fasten equalizer line to the expansion valve.

i. Leak check the new valve and evacuate and dehydrate low side. Refer to paragraph *2-3.4.5.1.*

j. The thermal bulb is installed below the center of the suction line (four or eight o'clock position). This area must be clean to ensure positive bulb contact. Strap thermal bulb to suction line. Ensure that retaining straps are tight and renew insulation.

k. If required, add vapor refrigerant to bring low side pressure to 20 to 30 psig (R-134a). Open filter-drier inlet service valve and compressor service valves.

l. Run the coach for approximately 30 minutes on fast idle.

m. Check refrigerant level. Refer to paragraph *2-3.4.8.1.*

Check superheat. Refer to paragraph *2-3.4.13.2.*

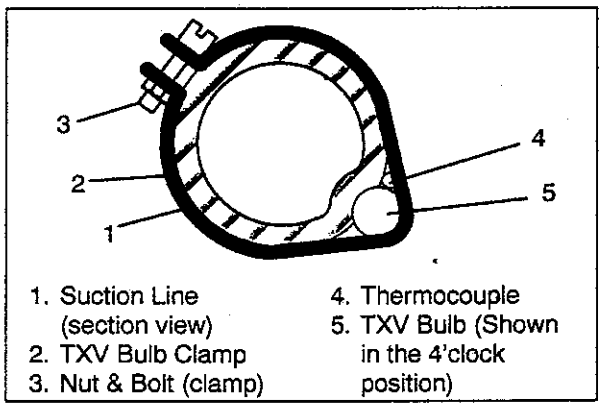
2-3.4.13.2 Superheat Measurement

NOTE: All readings must be taken from the TXV bulb location and out of the direct air stream.

a. Remove Presstite insulation from expansion valve bulb and suction line.

b. Loosen one TXV bulb clamp and make sure area under clamp is clean.

c. Place temperature thermocouple in contact with the suction tube and parallel to the TXV bulb, and then secure loosened clamp making sure both bulb and thermocouple are firmly secured to suction line. See *Figure 4-12*. Reinstall insulation around the bulb.



1. Suction Line (section view)
2. TXV Bulb Clamp
3. Nut & Bolt (clamp)
4. Thermocouple
5. TXV Bulb (Shown in the 4'clock position)

Figure 4-12 Thermostatic Expansion Valve Bulb and Thermocouple

d. Connect an accurate low pressure gauge to the low pressure port (*Figure 1-6*).

e. Start bus and run on fast idle until unit has stabilized, about 20 to 30 minutes.

NOTE: When conducting this test, the suction pressure must be at least 6 psig (0.41 bar) below the expansion valve maximum operating pressure (MOP). Refer to paragraph 2-4.1.5 for MOP.

f. From the temperature/pressure chart (*Table 4-4*), determine the saturation temperature corresponding to the evaporator outlet pressure.

g. Note the temperature of the suction gas at the expansion valve bulb. Subtract the saturation temperature from this temperature. The difference is the superheat of the suction gas.

h. The superheat may cycle from a low to high reading. Monitor the superheat taking readings every 3-5 minutes for a total of 5-6 readings. Calculate the superheats, add the readings and divide by the number of readings taken to determine average superheat. Refer to paragraph *2-4.1.5* for superheat setting.

i. If superheat is not within tolerance, replace the valve.

2-3.4.14 Replacing Return Air Filters

The return air filters are located behind the return air grill, inside the vehicle.

The filters should be checked for cleanliness periodically depending on operating conditions. A dirty filter will restrict air flow over the evaporator coil which may cause insufficient cooling or heating and possible frost buildup on the coil. To remove the filters, do the following.

a. Place main battery disconnect switch in OFF position and lock.

b. Remove the return air grille.

c. Loosen filter retaining hardware and remove the filter from the grille.

d. Reverse procedure to install new filters.

2-3.4.15 Compression Maintenance

2-3.4.15.1 Removing the Compressor

If compressor is inoperative and the unit still has refrigerant pressure, isolate the compressor and remove the refrigerant. Refer to paragraph *2-4.4.5.2.* If compressor is operative, perform a pump down. Refer to paragraph *2-4.4.5.3.*

a. Place main battery disconnect switch in OFF position and lock.

b. Tag and disconnect wiring to the high pressure and low pressure switch, unloaders and clutch.

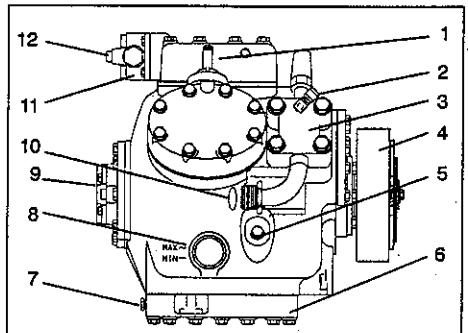
c. Remove tension on drive belts, remove drive belts.

d. Loosen bolts at suction and discharge service valve flanges and break seal to be sure pressure is released. Remove bolts.

e. Remove four bolts holding compressor to base.

f. Attach sling or other device to the compressor and remove compressor from the coach through the rear access door.

NOTES



1. Electric Unloader Valve
2. Suction Service Valve Charging Port
3. Suction Service Valve
4. Clutch
5. Oil Fill Plug
6. Bottom Plate
7. Oil Drain Plug
8. Oil Level Sight Glass
9. Oil Pump
10. O-ring
11. Discharge Service Valve
12. Service Port

Figure 4-13 Compressor

1. Service replacement compressors are sold without service valves. Valve pads are installed in their place. The optional unloaders are not supplied, as the cylinder heads are shipped with plugs. Customer should retain the original unloader valves for use on the replacement compressor.
2. The piston plug that is removed from the replacement compressor head must be installed in the failed compressor if returning for warranty or core credit.
3. Do not interchange allen-head capscrews that mount the piston plug and unloader, they are not interchangeable.
4. Check oil level in service replacement compressor. Refer to paragraphs *2-4.1.5* and *2-4.4.15.3.*

g. Remove the three socket head capscrews from the cylinder head(s) that have unloader valves installed. See *Figure 4-14.* Remove the unloader valve and bypass piston assembly, keeping the same capscrews with the assembly. The original unloader valve must be transferred to the replacement compressor. The plug arrangement removed from the replacement is installed in the original compressor as a seal. If piston is stuck, it may be extracted by threading a socket head capscrew into top of piston. A small Teflon seat ring at the bottom of the bypass piston plug must be removed.

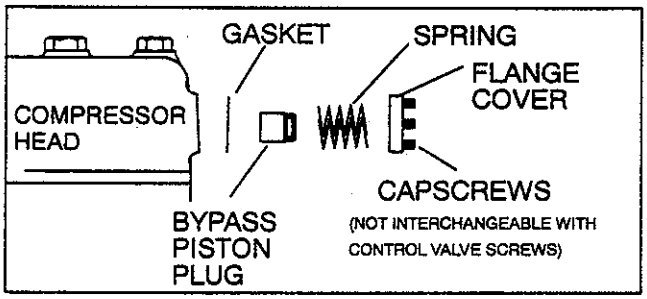


Figure 4-14 Removing Bypass Piston Plug

h. Remove the pressure switches and install on replacement compressor after checking switch operation. Refer to paragraph *2-4.4.10*

i. Remove clutch assemble and retain original clutch key. Install on replacement compressor.

j. Install compressor in unit by performing the removal steps in reverse. It is recommended that new locknuts be used when replacing compressor. Install new gaskets on service valves and tighten bolts uniformly (55 to 80 ft-lbs suction and 20 to 30 ft-lbs discharge service valves).

k. Leak check connections and replace filter-drier. Refer to paragraph *2-4.4.11.*

l. Using refrigerant hoses designed for vacuum service, connect a vacuum pump (see *Figure 4-6*) and evacuate compressor to 500 microns. Front seat both manifold valves to isolate the pump.

m. Open compressor service valves.

n. Start unit and check refrigerant level. Refer to paragraph *2-4.4.8.1.*

o. Check compressor oil level. Refer to paragraph *2-4.4.15.3.* Add or remove oil if necessary.

p. Check compressor unloader operation. Refer to paragraph *2-4.4.15.4.*

q. Backseat compressor service valves.

r. Remove manifold gauge set. Refer to paragraph *2-4.4.4.1.*

2-3.4.15.2 Transferring Compressor Clutch

To remove a clutch (see *Figure 4-15*) from a compressor and install on a replacement compressor, do the following:

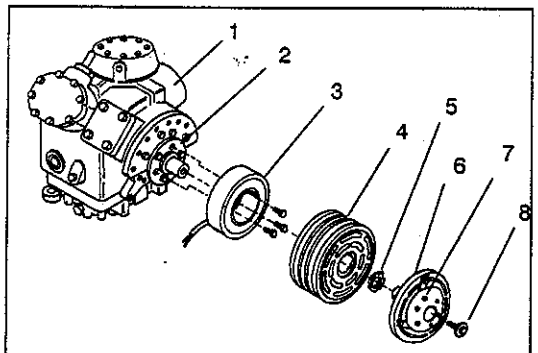
a. Place main battery disconnect switch in OFF position and lock.

b. Tag and disconnect wiring to the clutch.

c. Remove tension on drive belts, remove drive belts.

d. Remove the armature as a complete assembly by removing the retaining capscrews, lockwasher, and special 3/8 washer from the compressor crankshaft. Use special tool (CTD P/N 07-00240-01) to prevent crankshaft rotation.

e. Install a 7/8-14 x 4" (CTD P/N 07-00381-00) capscrew into the center hole of the armature assembly and use it as a jacking bolt to remove the armature. Use tool (CTD P/N 07-00240-01) as in step a. to prevent crankshaft rotation.



1. Compressor
2. Seal Cover
3. Coil
4. Rotor
5. Rotor Nut
6. Armature
7 Spacer Nuts
8. Retaining Capscrew Lockwasher, 3/8 Washer

Figure 4-15 Compressor Clutch

f. Using special tool (CTD P/N 07-00242-01), remove the rotor nut and rotor. Retain original key.

g. Noting the position of the wire, remove the three bolts holding the coil to the compressor.

h. Remove every other bolt from the seal cover of the new compressor in the same manner as the original compressor. Mount the coil assembly with the wire in the same orientation as it was mounted on the original compressor. Tighten the mounting bolts to 45-50 ft/lbs. (5.53-6.92 mkg).

i. Mount the rotor on the shaft. Seat the rotor to the hub, using the rotor nut. Be sure pulley turns freely without binding. Tighten rotor nut by first noting torque necessary to start the nut on the hub and then adding 50 ft/lbs. of torque.

j. Install armature on shaft using original key and tighten mounting bolt to 20 ft/lbs (2.8 mkg).

k. Perform a check of the air gap between the inside face of the armature and the mating face of the rotor. The air gap should be measured with a minimum of 50 psig (3.4 bar) in the crankcase. A preliminary check may be performed before the crankcase is pressurized but a final check must be performed before the clutch is operated. The gap should be between 0.030 and 0.060 inch (7.62 to 15.24 mm). If required, remove the six armature spacer nuts and spacer. Add or remove shims to adjust gap. Reinstall spacer nuts and tighten to 7-8 ft./lbs (1.0 to 1.1 mkg).

l. Reconnect wiring and test clutch operation.

2-3.4.15.3 Compressor Oil Level

To check, and if required correct, the compressor oil level do the following:

a. Operate the coach for at least one-half hour at fast idle speed, with the temperature controls at the coolest setting, and the compressor fully loaded. It may be necessary to pre-heat the coach and/or operate the system in the reheat mode to keep the compressor fully loaded throughout this procedure.

b. Ensure the system is fully charged (refer to paragraph *2-4.4.8.1*) and the compressor crankcase is warm to the touch after fifteen minutes of operation.

c. Shut off the system and immediately record the oil level in the compressor sight glass. See *Figure 4-13*. If the compressor is not level, an average between the sight glass levels will have to be made to determine level.

d. The correct oil level for this application should be between the bottom and ½ of the oil level sight glass. See *figure 4-13*. If the oil level is correct, release the coach into service. If the level is above the ½ sight glass maximum, proceed to step e. If the level is below the ½ sight glass maximum proceed to step f.

e. To remove oil and bring the level to the ½ sight glass maximum, do the following:

   1. With the system off, connect a manifold gauge set to the compressor suction and discharge service valves. Front seat the service valves to isolate the compressor from the system (See *Figure 4-6*) and reclaim the refrigerant to below atmospheric pressure. Shut off the reclaimer and verify the pressure does not rise. If the pressure rises, continue reclaiming until the pressure remains below atmospheric.

   ▲WARNING: Extreme care must be taken to ensure that all the refrigerant has been removed from the compressor crankcase or the resultant pressure will forcibly discharge compressor oil.

   2. Drain or pump out compressor oil until the level is brought to the proper level.
   3. Evacuate the compressor to 500 microns. Backseat the compressor service valves and repeat the oil level check procedure.

f. To add oil to the compressor, do the following:

   1. With the system off, connect a manifold gauge set to the compressor suction and discharge service valves. Front seat both service valves to isolate the compressor from the system (see *Figure 4-6*) and reclaim the refrigerant to below atmospheric pressure. Shut off the reclaimer and verify the pressure does not rise. If the pressure rises, continue reclaiming until the pressure remains below atmospheric.
   2. Add oil to the compressor crankcase slowly, through the oil fill plug opening (see *Figure 4-13*) to bring level to mid range of allowed levels.
   3. Evacuate compressor to 500 microns. Backseat compressor suction and discharge valves, start system and recheck oil level.
   4. Remove manifold gauge set.

2-3.4.15.4 Checking Unloader Operation

To check unloader operation do the following:

a. Install a manifold gauge set as shown in *Figure 4-7*. Ensure both manifold valves are frontseated and center connection is tight on bank fitting.

b. Midseat compressor suction service valve.

c. Disconnect the suction pressure transducer *Figure 1-6*. This will force the controller to energize the unloader(s)

d. Start the bus and run in cooling, lower set point if required to ensure system remains in full speed cooling.

e. Locate the unloader connector at the compressor. Observe manifold suction gauge while unplugging the connector. Pressure should decrease 3 to 5 psi (0.2 to 0.4 bar) when the unloader is unplugged and increase the same amount as the plug is reconnected. Repeat test for second unloader if fitted.

f. If pressures do not react as described, check unloader coil or repair unloader mechanism as required.

g. When testing is complete, reconnect transducer and unloader connectors and remove manifold gauge set.

h. Disconnection of the suction pressure transducer will cause an "A15" alarm. Once the transducer is reconnected, the alarm will go to inactive and can then be cleared.

2-3.4.16 Temperature Sensor Checkout

a. An accurate ohmmeter must be used to check resistance valves shown in *Table 4-1*.

b. Due to variations and inaccuracies in ohmmeters, thermometers or other test equipment, a reading within two percent of the chart value would be considered acceptable. If a sensor is bad, the resistance value would usually be much higher or lower than the value given in *Table 4-1*.

c. At least one sensor lead must be disconnected from the controller before any reading can be taken. Not doing so will result in a false reading. Two preferred methods of determining the actual test temperature at the sensor are an ice bath at 32°F (0°C) and/or a calibrated digital temperature meter.

Table 4-1 Temperature Sensor Resistance

Temperature		Resistance in Ohms
°F	°C	
-20	-28.9	165,300
-10	-23.3	117,800
0	-17.8	85,500
10	-12.2	62,400
20	-6.7	46,300
30	-1.1	34,500
32	0	32,700
40	4.4	26,200
50	10.0	19,900
60	15.6	15,300
70	21.1	11,900
77	25	10,000
80	26.7	9,300
90	32.2	7,300
100	37.8	5,800
110	43.3	4,700
120	48.9	3,800

2-3.4.17 Pressure Transducer Checkout

NOTE: System must be operating to check transducers.

a. With the system running use the driver display and manifold gauges to check suction and/or discharge pressure(s) simultaneously.

b. Determine with the gauges whether one or both pressure readouts are correct. If one is correct, exchange the pressure transducer locations. If the problem moves with the transducer, replace the faulty transducer.

c. If the driver display read out disagrees with both values shown on the manifold gauges proceed to step d.

⚠CAUTION: Use care when checking/manipulating wires/plugs attached to the Logic Board. Damage to the board or wiring harness can occur.

d. Verify that the wiring to the transducer(s) is in good condition.

e. Use a digital volt-ohmmeter to measure voltage across the transducer connector corresponding to terminals A & B. See *Figure 4-16*. The reading should be 5.0 VDC.

f. Use a digital volt-ohmmeter to measure wire continuity between the connector positions corresponding to C and J6-23 (Suction) or C and J6-20 (discharge). See *Figure 5-3.*

g. Use a digital volt-ohmmeter to measure voltage across the transducer at terminals A & C. See *Figure 4-16.* Compare to values in *Table 4-1.* A reading within two percent of the values in the table would be considered good.

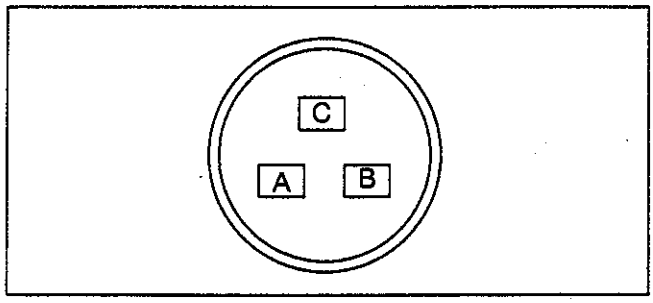


Figure 4-16 Transducer Terminal Location

2-3.4.18 Replacing Sensors and Transducers

a. Place main battery disconnect switch in OFF position and lock.

b. Tag and disconnect wiring from defective sensor or transducer.

c. Remove and replace defective sensor transducer. Sensor/transducer connections are fitted with Schreader valves to facilitate replacement.

d. Connect wiring to replacement sensor or transducer.

e. Checkout replacement sensor or transducer. Refer to section *2-4.4.16 or 2-4.4.17* as applicable.

f. Repair or replace any defective component(s), as required.

Table 4-2 Pressure Transducer Voltage

" /hg	Voltage	Psig	Voltage	Psig	Voltage	Psig	Voltage	Psig	Voltage	Psig	Voltage
20"	0.369	40	0.858	95	1.397	150	1.936	205	2.475	260	3.014
10"	0.417	45	0.907	100	1.446	155	1.985	210	2.524	265	3.063
Psig	**Voltage**	50	0.956	105	1.495	160	2.034	215	2.573	270	3.112
0	0.466	55	1.007	110	1.544	165	2.083	220	2.622	275	3.161
5	0.515	60	1.054	115	1.593	170	2.132	225	2.671	280	3.210
10	0.564	65	1.103	120	1.642	175	2.181	230	2.720	285	3.259
15	0.614	70	1.152	125	1.691	180	2.230	235	2.769	290	3.308
20	0.663	75	1.204	130	1.740	185	2.279	240	2.818	295	3.357
25	0.712	80	1.250	135	1.789	190	2.328	245	2.867	300	2.406
30	0.761	85	1.299	140	1.838	195	2.377	250	2.916	305	3.455
35	0.810	90	1.348	145	1.887	200	2.426	255	2.965	310	3.504

2-3.4.19 Logic Board Replacement

Control configuration is preset by the manufacturer and resetting of the parameters is not advised. If a replacement Logic Board is installed, it is necessary to match the configuration jumpers (see *Figure 1-7*) to the original board. *Table 4-3* provides a list of jumper functions. Carrier is not responsible for failures or damage resulting from unauthorized changes.

Table 4-3 Logic Board Configuration

Configuration	Description
A.	**High Reheat** - When this configuration is removed, the unit will default to high speed in reheat mode and in the low speed cool band. If not removed, heat/reheat will default to low speed.
B.	**High Vent** - When this configuration is removed, the unit will default to high speed in vent mode. If not removed vent mode will default to low speed.
C.	**Dry Heat** - When this configuration is removed, the unit will run on 100% reheat instead of heat.
D.	**Reheat/Cycle** - When the reheat cycle configuration is removed, the unit is in reheat mode. The default configuration is cycle clutch mode.
E.	**Transducers** - When the transducer configuration is removed, transducers will assume to be present.
F.	**Refrigerant R-22/R-134a** - When the refrigerant configuration is removed, the refrigerant is set for R-22. The default refrigerant is R-134a.
G.	**Unit Type** - Rearmount unit enabled with "G" removed and "H" installed.
H.	**Unit Type** - With "H" removed and "G" installed, roof top unit will be enabled.
I.	**Factory** - Reserved for the manufacturer.
J.	**Invert H_2O** - When this configuration is removed, the logic for the water temperature switch will be inverted.
K.	**Voltage** - when this configuration is removed, the voltage selection will be changed from 12 to 24 vdc.
L.	**Factory** - Reserved for the manufacturer.
M.	**Psig/Bars** - When this configuration is removed, the display will indicate pressure in bars. When not removed, the display will show temperatures in psig.
N.	**°C/°F** - When this configuration is removed, the display will show temperatures in °F. When not removed the display will show temperatures in °C.
O.	**PI Reheat** - When this configuration is removed, reheat mode will use the PI algorithm to vary the duty cycle of the heat valve. If it is not removed, the heat valve will be on constantly.
P.	**Low Ambient Lockout** - When this configuration is removed, the compressor clutch will disengage at 25°F. With this configuration in place, the compressor will disengage at 45°F.

Table 4-4 R-134a Temperature - Pressure Chart

Temperature		Vacuum		
°F	°C	"/hg	Kg/cm^2	Bar
-40	-40	14.6	37.08	0.49
.35	.37	12.3	31.25	0.42
-30	-34	9.7	24.64	0.33
-25	-32	6.7	17.00	0.23
-20	-29	3.5	8.89	0.12
-18	-28	2.1	5.33	0.07
-16	-27	0.6	1.52	0.02
Temperature		**Pressure**		
°F	°C	"/hg	Kg/cm^2	Bar
-14	-26	0.4	0.03	0.03
-12	-24	1.2	0.08	0.08
-10	-23	2.0	0.14	0.14
-8	-22	2.9	0.20	0.20
-6	-21	3.7	0.26	0.26
-4	-20	4.6	0.32	0.32
-2	-19	5.6	0.39	0.39
0	-18	6.5	0.46	0.45
2	-17	7.6	0.53	0.52
4	-16	8.6	0.60	0.59
6	-14	9.7	0.68	0.67
8	-13	10.8	0.76	0.74
10	-12	12.0	0.84	0.83
12	-11	13.2	0.93	0.91
14	-10	14.5	1.02	1.00
16	-9	15.8	1.11	1.09
18	-8	17.1	1.20	1.18
20	-7	18.5	1.30	1.28
22	-6	19.9	1.40	1.37
24	-4	21.4	1.50	1.48
26	-3	22.9	1.61	1.58

Temperature		Pressure		
°F	°C	Psig	Kg/cm^2	Bar
28	-2	24.5	1.72	1.69
30	-1	26.1	1.84	1.8
32	0	27.8	1.95	1.92
34	1	29.6	2.08	2.04
36	2	31.3	2.20	2.16
38	3	33.2	2.33	2.29
40	4	35.1	2.47	2.42
45	7	40.1	2.82	2.76
50	10	45.5	3.20	3.14
55	13	51.2	3.60	3.53
60	16	57.4	4.04	3.96
65	18	64.1	4.51	4.42
70	21	71.1	5.00	4.90
75	24	78.7	5.53	5.43
80	27	86.7	6.10	5.98
85	29	95.3	6.70	6.57
90	32	104.3	7.33	7.19
95	35	114.0	8.01	7.86
100	38	124.2	8.73	8.56
105	41	135.0	9.49	9.31
110	43	146.4	10.29	10.09
115	46	158.4	11.14	10.92
120	49	171.2	12.04	11.80
125	52	184.6	12.98	12.73
130	54	198.7	13.97	13.70
135	57	213.6	15.02	14.73
140	60	229.2	16.11	15.80
145	63	245.6	17.27	16.93
150	66	262.9	18.48	18.13
155	68	281.1	19.76	19.37

2-3.5 Electrical

2-3.5.1 Introduction

This section includes electrical wiring schematics covering the models listed in *Table 1-2.* The schematic shown in this section provides information for all unit models and optional configurations. The model 68RF353 units are fitted with 6 evaporator blower/motor assemblies and 5 condenser fan/motor assemblies. For applications with OEM supplied operating switches, the switches are wired to Logic Board connector J3 as shown. For units with a Micromate as the operators control, there is no wiring to the Logic Board J3 connector, instead the Micromate is hard wired to the Logic Board connector J2. When the Micromate is used for service or diagnostic purposes, it is wired in the same manner as shown for drivers panel, thru the optional Service Port.

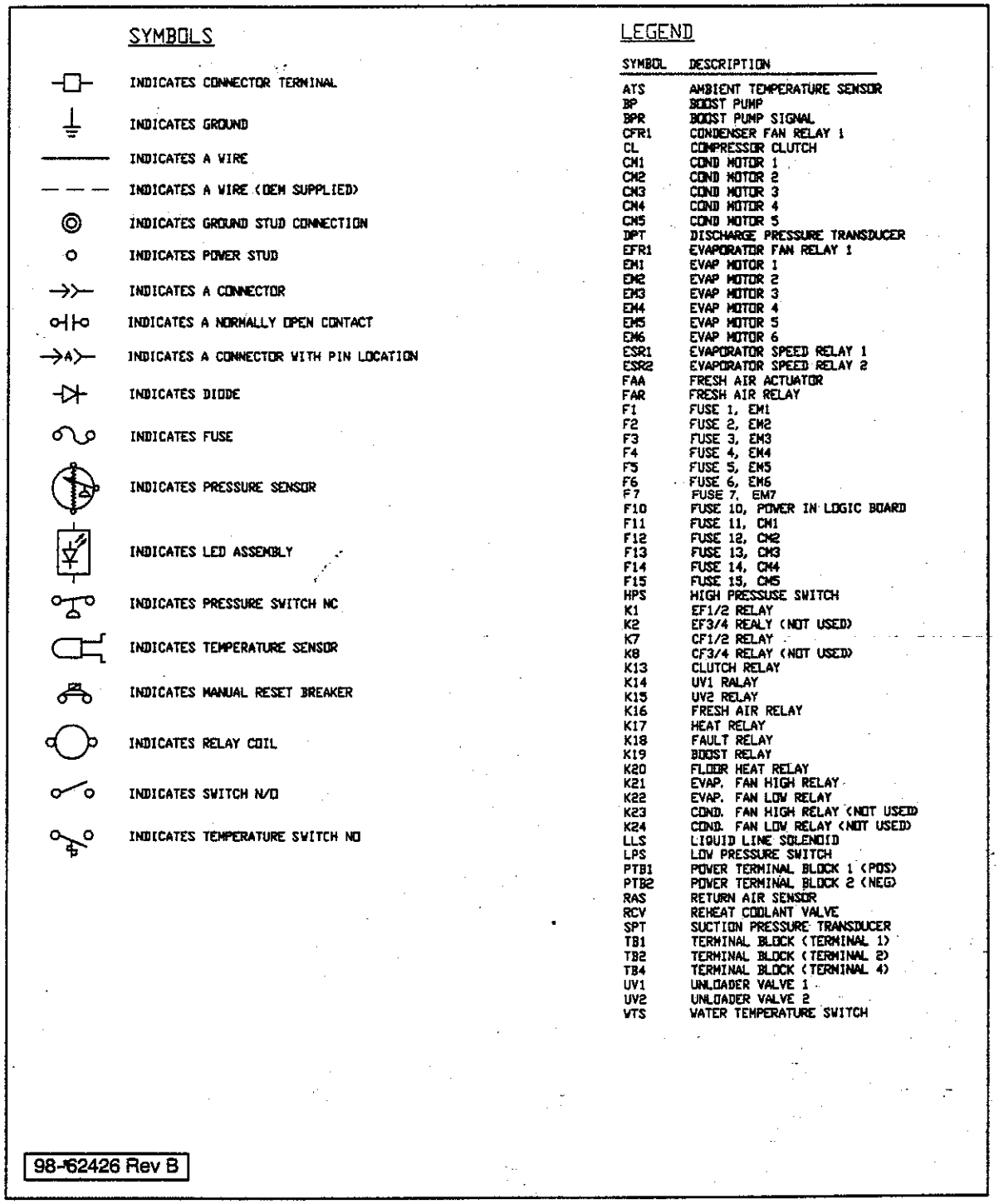
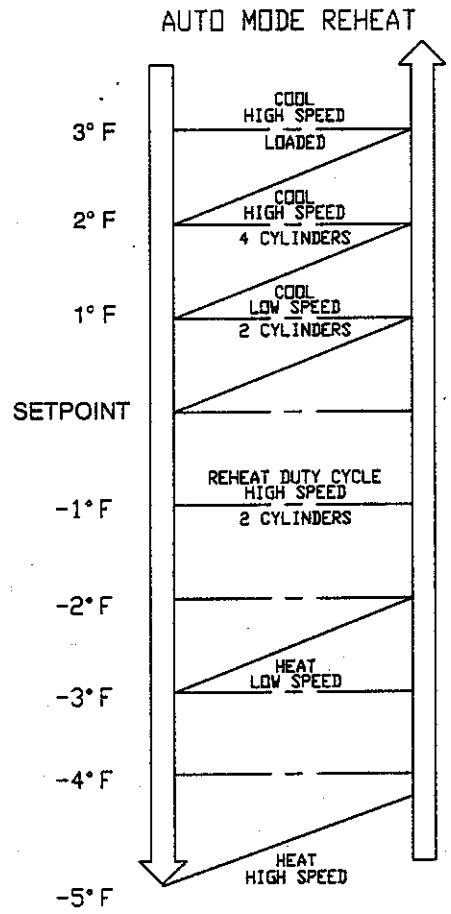


Figure 5-1 Symbols & Legend

LOGIC BOARD JUMPER CONFIGURATION

JUMPER	REMOVED	INSTALLED
A	X	
B		X
C		X
D	X	
E	X	
F		X
G		X
H		X
I	X	
J		X
K	X	
L	X	
M		X
N	X	
O		X
P		X



98-62426 Rev B

Figure 5-2 Logic Board Jumper Configuration & Auto Mode Reheat

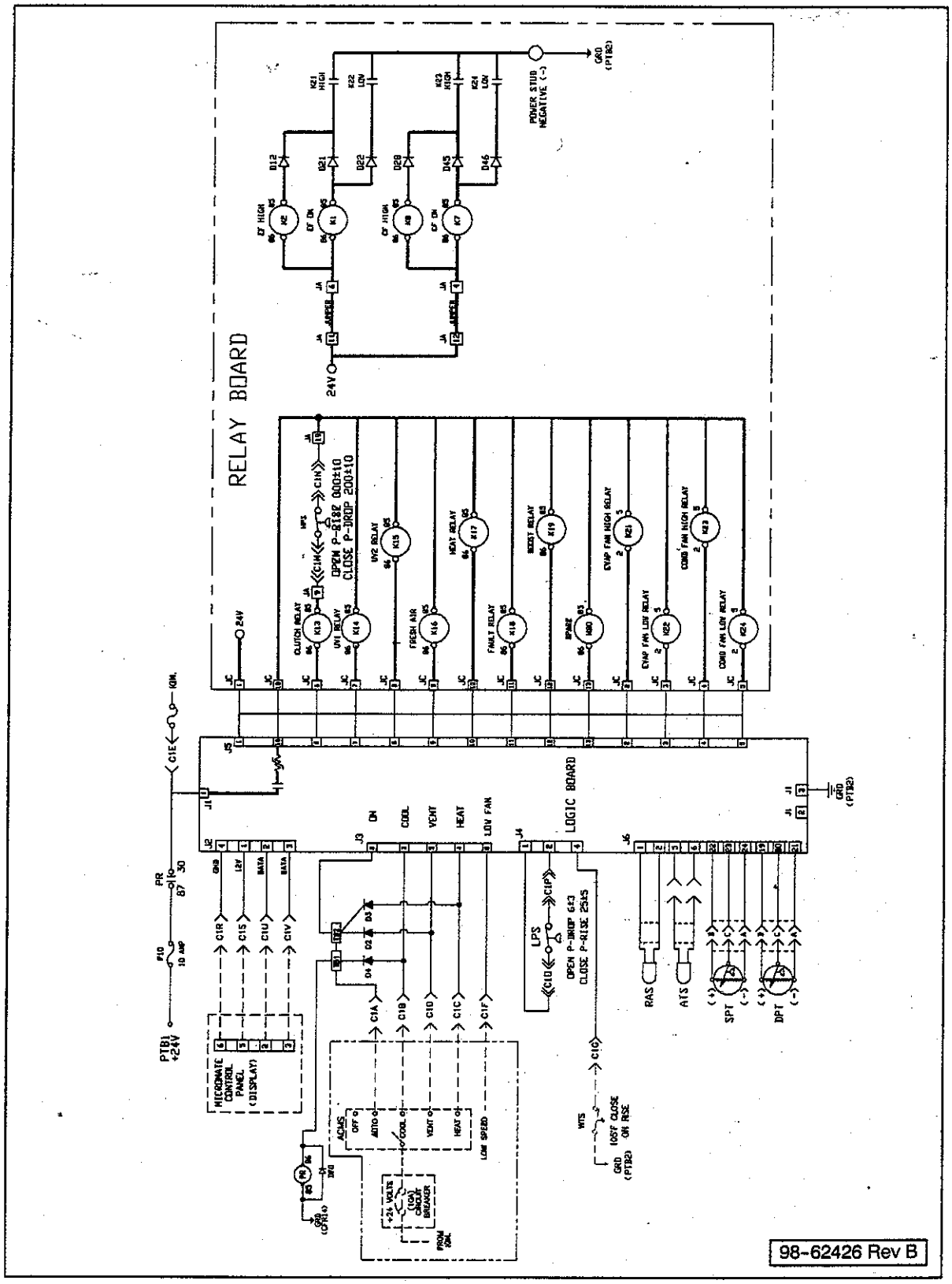


Figure 5-3 Relay Board

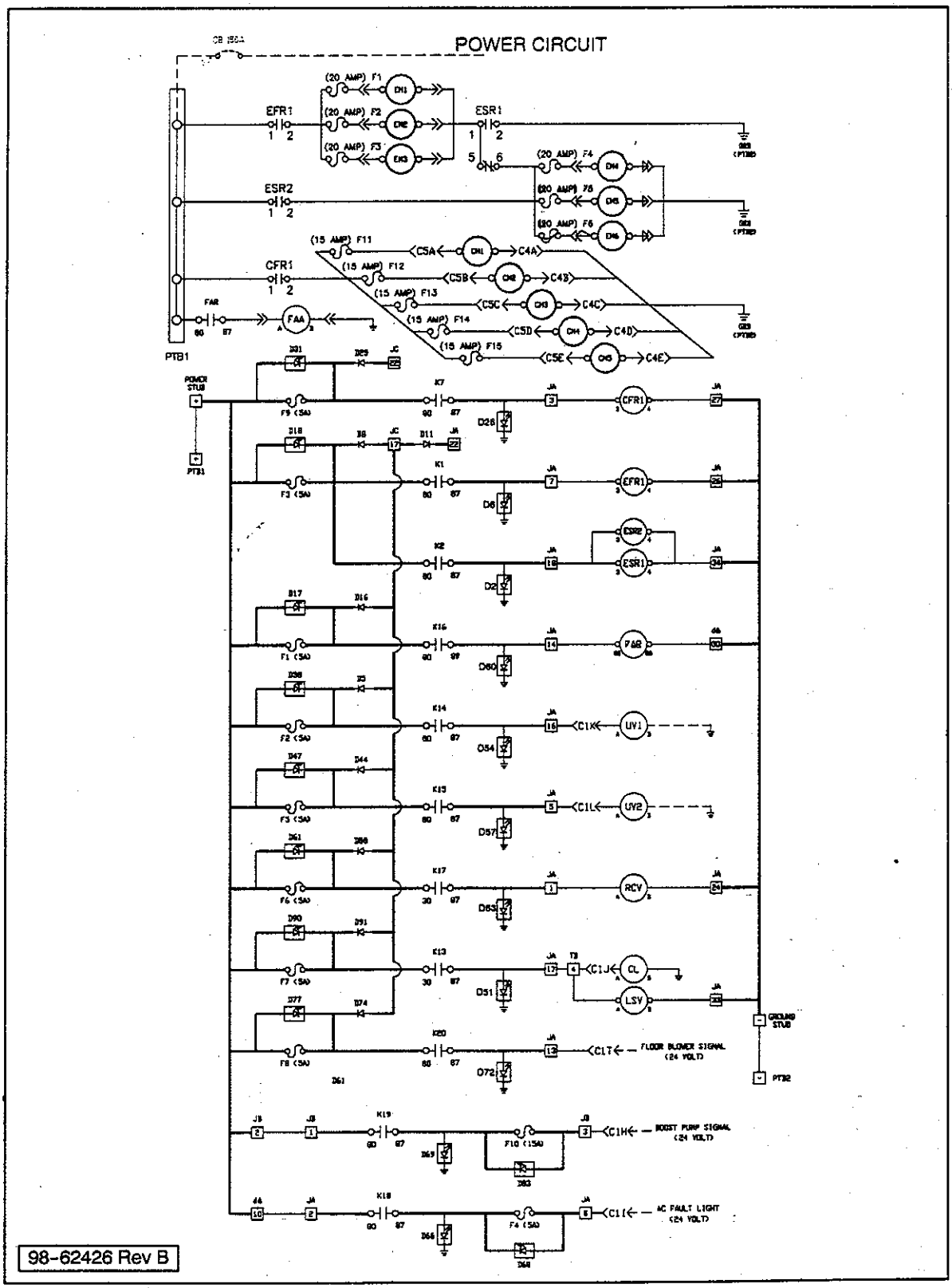
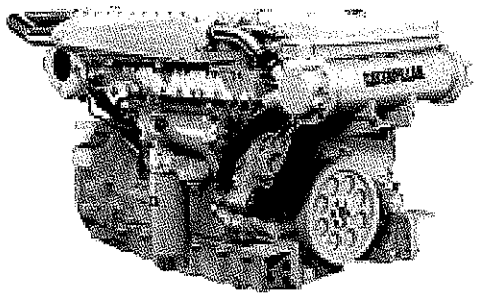


Figure 5-4 Power Circuit

3-1 Engine

3-1.1 Caterpillar C12, 410 HP Engine - Standard



The Express 4500 Bus is equipped with a Cat C12, 410 HP diesel engine. The Cat C-12 is the engine of choice for fleets requiring excellent performance and dependability in a lightweight package. Weighing in at approx. 2,700 lb. (940 kg), the C-12 features the best horsepower-to-weight ratio in the industry.

The engine takes full advantage of electronically controlled unit injection fuel system resulting in an environmentally friendly engine with outstanding performance and fuel economy. The C-12 engine comes well equipped with many standard items as listed on the following specification tables.

C12 Specifications	
Engine Configurations	I-6, 4-Stroke-Cycle-Diesel
Displacement	732 cu. In. (12 L)
Bore	130 mm (5.1 in.)
Stroke	150 mm (5.9 in.)
Aspiration	Turbocharged-Aftercooled
Governor	Electronic
Crankcase Capacity	Dry 29 quarts
Cooling System Capacity	72 quarts
Includes: Engine, Radiator, Heater/Defroster, Webasto Heater, Optional: UWE Baseboard Heater	
Rotation (from flyw heel end)	Counterclockw ise
Weight (approx. dry)	1177 kg (2595 lb)

C12 Dimensions	
Overall Length	1904.6 mm (74.98 in.)
Overall Width	968.6 mm (38.13 in.)
Overall Height	1004.5 mm (39.55 in.)

C12 Ratings			
Adv HP	Max HP	Peak Torque	Gov. Speed
410	425	1450	2100

Water Pump Capacity @ Engine RPM – 90 gallons per minute @ 2100.

Air Filter – Dry type – FARR ECO-SE 071921-004, single storage, disposable canister.

Turning Radius

*Curb Radius – 29.7 ft.

**Wall Radius – 35 ft.

**Curb radius is the minimum radius of turn to the outside edge of the front tire.*
***Wall radius is the minimum radius of turn to the outside edge of the front bumper.*

Alternator – 24 Volt negative ground, 280 amp Leece-Neville Internally Rectified.

Axles/Suspensions

Front

16,000 lb. front

Shock Absorbers – Direct acting, 1.75 dia. Bore double-action piston type shocks with long life bonded bushings, one per wheel.
Suspension – Arvin Meritor independent front suspension rated at 16,000 lbs. Dual wishbone type. Total (ground). Stabilizer (sway) bar, 2.12 inches diameter with urethane bushings. Turn angle up to 54 degrees.

Rear

23,000 lb. drive axle, single speed, 4.89 ratio.
Shock Absorbers – Direct acting, 1.38 dia. Bore double-action piston type shocks with long life bonded bushings one per wheel, Sachs.
Suspension – Arvin Meritor Drive Suspension, RFA 23,000 lbs. Four bag air suspension parallelogram type. Rated at 23,000 lbs.

Tag

13,000 lb. Arvin Meritor tag axle, two airbags.

Batteries

Two 8D batteries, limited maintenance batteries series parallel for 24 volt. 1075 CCA.

Braking System

Emergency/Parking

Type 30/30 dual diaphragm brakes on drive axle. Type 20 Long Stroke Magnum piston type brake system on tag axle.

Service

All wheel disc brakes. Meritor DX225 ADB. A Bosch six channel ABS system is provided to control all wheels. Type 20L on front and tag. Type 24 on drive.

Air tanks – Three tanks with a total capacity of 5760 cu. inches.

Air compressor – Bendix 13 CFM gear driven.

Bendix AD-9 – air dryer

Automatic Slack Adjuster - Meritor

Drive Line – SPL 250 series.

Exhaust – 16-gauge aluminized steel tubing with a vertically mounted, insulated, double-walled catalytic muffler that exits at the top left corner of the roof.

Frame – Raised mainframe via front and rear sub frames. Mainframe consists of single "C" channel rails 9.63 inches in height with 3.0 inch flanges, .25 inches thick running from rear of front basket to engine mount area. Rear sub frame consists of an upper and lower section connected via transition "Z" section. Sub frame is a single "C" channel rail 9.63 inches high with 3.0 inch flanges 0.24 inches thick. Rear sub frame runs from ahead of rear suspension to rear bumper. Main and sub frames assembled using formed/welded cross members attached with grade 8, Huck-style fasteners.

Fuel System – Dual 100 gallon tanks mounted in rear with fuel necks on right and left sides. Fuel sender is located on left side accessible through removable panels. Fuel fittings are accessible through removable panels. Dual fuel fill outside panels have turn screw latches or optional key locks.

Fuel Lines – Sized to meet engine manufacturer performance guidelines. CAT C-12 engine uses size 10 supply and size 8 return. All fuel lines are clamped and/or loomed and protected from chafing and heat.

Fuel Filter – Racor fuel filter water separator and pre-heater with CAT C-12: Racor 490R1230, 120 GPH, 200 watt heater, 30 micron, with primer pump, see-through bowl with drain and mounted on right sub frame with access through right side inspection door.

3-1.2 Starting the Engine:

1. Be sure parking brakes are on.
2. Check that transmission is in neutral.
3. With key switched on, check fuel gauge. Check brake warning buzzer or light, and neutral safety switch.
4. Start engine. Look and listen for trouble signs; check gauges.

3-1.2.1 With the Engine Running, Check (from driver's seat):

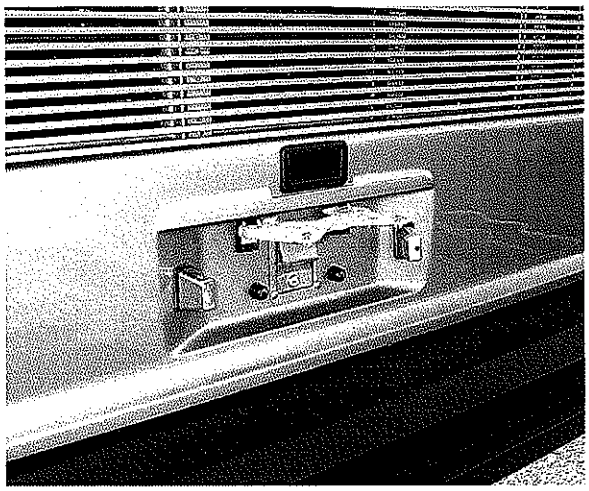
- Mirrors, interior and stepwell lights, and service door seal.
- Watch for any unusual feeling or sound from steering, brakes, and other controls. See that brake pedal has normal height and feel and that the brake gauge is reading correctly.
- Check Parking Brake operation by releasing and resetting it.
- Check horn, defroster and heater blowers, and windshield wiper operation.
- Check signals and lights for proper operation before driving away:
- Right- and left-turn signals in front and rear.
- Flasher warning lights in front and rear.
- Headlight high and low beams.
- Stoplights and taillights.
- Hazard flasher.

3-1.2.2 Final Check While the Coach is Starting to Move:

- Check that seatbelt is secure.
- Check that brake action feels sure and positive; not spongy.
- Watch for any unusual feeling, behavior, or noises in steering and check that the coach is generally under control and tracking straight.
- Brake to a stop and check all gauges.

REMEMBER: *Safety on the road depends on you. Observe weather and road conditions and drive accordingly. Be physically and mentally alert. When backing up near pedestrians or in congested areas, use outside monitor or director. Look around before driving away from where you are parked and observe all traffic rules and regulations.*

3-1.3 Engine Compartment

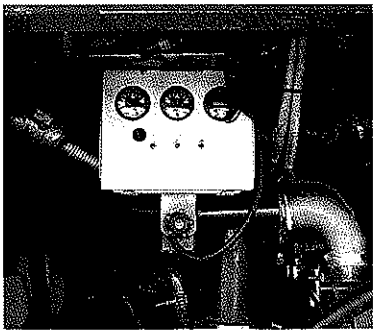


To open the rear engine compartment door, lift up the spring-loaded tag panel in the center of the door. Behind the tag panel is a locked latch mechanism which may be unlocked with the compartment key. Gripping and pulling the latch will allow the door to open.

▲WARNING: The engine compartment door opens and is supported by a gas spring. Open slowly, applying pressure to control the door panel as it opens.

This compartment allows access to the engine, oil fill, hydraulic reservoir, engine compartment instrument panel, transmission fluid filler, and engine oil dipstick.

3-1.3.1 Engine Compartment Instrument Panel



An instrument and switch panel is located in the upper left portion of the engine compartment. This panel contains gauges for oil pressure, engine temperature, and engine hours; and switches to allow starting the engine from the engine compartment.

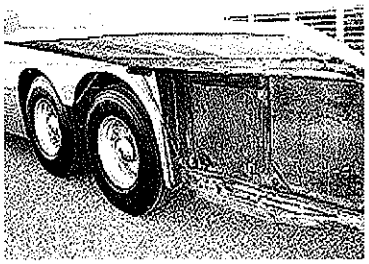
1. Engine Compartment Lights switch. A 2-position toggle switch which turns Engine Compartment lights on or off.

2. Engine Start switch. A momentary switch (normally off) which engages the starter when the Run Switch is in the Rear position.

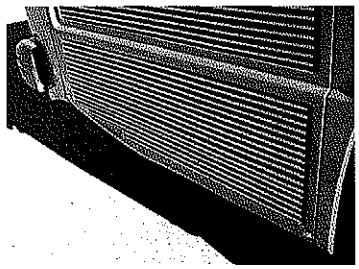
3. Run Switch. Allows engine to be started from front or rear of the vehicle. Has three positions: Front, Off, and Rear.

4. Engine oil pressure gauge.
5. Engine temperature gauge.
6. Engine hour meter. Displays the total number of hours of engine operation.
7. Remote throttle.

3-1.3.2 Side Engine Compartment Grilles



Access to the sides of the engine compartment is provided by means of hinged grille panels at the rear of the coach on both sides. The right grille provides access to the battery compartment and right-side engine components. The left grille provides access to the engine radiator for cleaning. The grilles can be opened without tools by turning the two thumb locks at the bottom corners. Be sure that the thumb locks are secure when closed before driving the vehicle.



3-1.4 Engine Operating Instructions

Sitting in a parked vehicle with engine running for an extended period, in either a confined or open environment, is dangerous. The best protection against carbon monoxide entry into the coach is a properly maintained engine exhaust system, body, and body ventilation system. It is recommended that the exhaust system and body be inspected by a competent mechanic:

- Each time the vehicle is raised for oil change.
- Whenever a change is noticed in the sound of the exhaust system.
- Whenever the exhaust system under body or rear of the vehicle is damaged.

Inspect all piping and joints. Replace clamps if leaking.

NOTE: Exhaust clamps are not reusable. Reseal with exhaust sealant and install new clamps wherever leaks are suspected. Do not run engine in confined areas, such as garages, any more than needed to move vehicle in or out of area. When the coach is stopped in an open area with engine running for any more than a short period, and if it is equipped with combination heating and external ventilation, adjust the heating or ventilation system to force outside air into the coach with blower set at medium or high speed. Remember: Keep air inlet grille clear of snow or other obstructions at all times to assure proper operation of the ventilation system.

3-1.4.1 Engine Starting Procedure

Precise starting procedures vary between different engine manufacturers and may also depend upon variable conditions such as temperature. See the appropriate engine manufacturer's operating manual for proper starting procedures.

General (normal) starting procedure

1. Apply parking brake.
2. Place transmission selector in Neutral.
3. Insert the key and turn it clockwise to the On position. Watch for the dash panel to complete its startup cycle (about 3 seconds).
4. Turn the key switch farther clockwise, to the Start position, engaging the starter. Do not press the accelerator.
5. Watch the instrument panel for any warning indicators, and allow the engine to warm up to operating temperature before driving.

IMPORTANT: If engine does not start at first, engage the starter for a maximum of 30 seconds before following with at least two minutes off-time. If engine fails to start after a reasonable time, determine cause of failure. Pumping the accelerator will not assist engine starting in any way. Refer to engine manufacturer's recommended procedures. Do not race the engine to reduce warm up time.

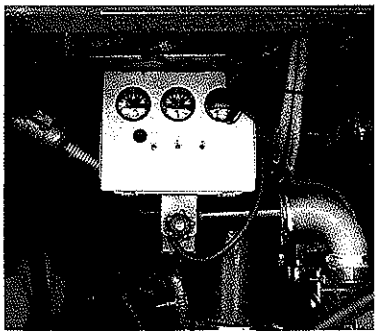
3-1.4.2 Starting With Booster Cables

▲WARNING: Batteries can emit potentially explosive fumes. Prevent sparks near the batteries. Do not allow battery cable ends to contact each other or the engine. Do not smoke when observing the battery electrolyte levels. Electrolytes are corrosive and can cause injury to skin or eyes. Always wear protective glasses when working with batteries. Your coach has a 12-volt starting system. Use only a 12 volt system for booster starting. The use of higher voltage will damage the electrical system.

Always connect the booster cables in parallel with the coach battery cables, Negative (-) to Negative (-) and Positive (+) to Positive (+). Reversing the battery cables can damage the alternator. Whenever working around the batteries, always attach the ground cable last and remove it first, to help avoid sparks.

1. Fasten the positive (+) clamp of the booster cable to the positive (+) post of the battery.
2. Fasten the negative (-) clamp of the booster cable to the negative (-) post of the battery.
3. Start the engine.
4. After the engine starts, disconnect the negative (-) booster cable from the battery.
5. Disconnect the positive (+) booster cable from the battery.

3-1.4.3 Starting The Engine From The Rear Of The Coach



The Engine Compartment Instrument Panel allows the engine to be started at the engine compartment for servicing procedures. Before starting in this manner, take all necessary precautions to ensure safety. Be sure everything and everyone is clear of all belts and other moving parts in and around the engine compartment. Do not wear dangling items such as name tag or eyeglass straps when working around the engine compartment.
Just as when starting the coach normally, the transmission must be in Neutral. Also, the Parking Brake must be on when starting from the rear

1. Move the Run Switch from front to rear position.
2. Press the Engine Start switch downward

To stop engine, move the Run Switch to the Off position, then return it to the Front position. If switch is left in Rear position, the vehicle cannot be started from the front. If the switch is in the Front position the engine cannot be started from the rear.

▲WARNING: While working on the engine, the Run Switch should be turned to the Off position for safety.

3-1.5 Using Engine As a Brake

In descending a steep or long grade, engine inertia can be used to help retard vehicle speed. Reduce speed before the grade and shift into the next lower gear. This technique allows you to use the brakes more sparingly, reducing the likelihood of brake overheating, which reduces brake effectiveness.

▲WARNING: Do not take transmission out of gear when going down a steep or long grade. You may not be able to get the transmission back into gear, and the drastic slowing of engine speed could reduce air pressure supply to the air brake system, resulting in decreased brake effectiveness.

3-1.6 Engine Warning System

This unit is equipped with an alarm system to signal low oil pressure and high engine temperature. If the engine temperature exceeds 210°F, or if the oil pressure drops below 6 psi, a buzzer sounds and an indicator lights in the Driver's Instrument Panel.

⚠CAUTION: If the alarm system sounds, shut the engine off immediately. Operation of the engine after the alarm sounds could cause serious engine damage.

3-1.7 Fuel And Lubricant Requirements

Express 4500 units should take advantage of the high energy content and generally lower cost of No. 2 diesel fuel. Experience has shown that diesel engines will operate satisfactorily on No. 1 fuel.

⚠ CAUTION: This coach is equipped with a transverse-mounted 200-gallon fuel tank with right side and left side fillers. Use caution when filling with a high delivery nozzle to prevent spillage.

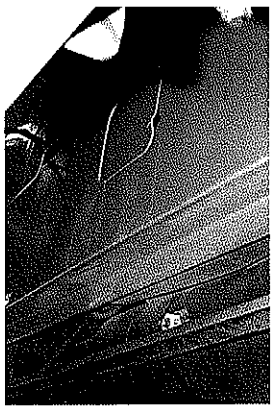
▲WARNING: Fuel spray may cause injury. Remove cap slowly. Do not fill more than 95% of liquid capacity.

3-1.7.1 Recommended Lubricants

⚠ CAUTION: Do not mix petroleum-based and synthetic lubricants or different brands of synthetic lubricants due to possible incompatibility. In addition there may be increased lubricant change intervals recommended for synthetic lubricants. Consult manufacturer's label for lubricant requirements.

Automatic Transmission Fluid. Holds 51.6 quarts transmission fluid. The recommended transmission fluid is either TranSynd™ or DEXRON®-III.
Rear Axle Lubricant. Multi-purpose chassis grease, 6% 12-hydroxy lithium stearate grese, NLGI grade #1, Meritor specification O-617-A or equivalent.
Hydraulic Power Steering Pump. Use Rando HD 32 (Texaco)
Power Take-Off (PTO) Splines. Use spline grease (Blue Bird Part No. 0029995)
Engine Oil. Use 10w30, engine holds 36 quarts.

3-1.8 Engine Cooling System



The engine coolant filler is located behind its own access door directly above the Engine Compartment Door. A coolant level sight glass is provided at the top of the engine compartment, directly below the coolant filler. Fill the system with the recommended coolant until the coolant is visible in the sight glass. Check the coolant level frequently and maintain the appropriate coolant level at all times.

The unit is equipped with a 50-50 solution of antifreeze and water. This mixture protects to -30°F. The driver should check antifreeze before taking unit into cold climate. For protection to -92°F, the mixture should be 68 percent antifreeze and 32 percent water. Never have more than 68 percent antifreeze.
The intervals at which coolant should be drained and replaced is dependent upon the type of coolant used. Caterpillar recommends Extended Life Coolants (ELC). The kind of coolant used may affect engine warranty. See your Caterpillar engine documentation for full information.

⚠CAUTION: Cold water should never be poured into the cooling system when engine is hot. Wait until engine cools; then add coolant with engine running. Fill until coolant level is visible in the sight glass, but do not overfill.

▲WARNING: Use extreme care when removing a radiator pressure-control cap. The sudden release of pressure from a heated cooling system can result in a loss of coolant and possible personal injury (scalding) from the hot liquid or steam. Turn cap slowly to gradually and completely vent off pressure before cap removal.

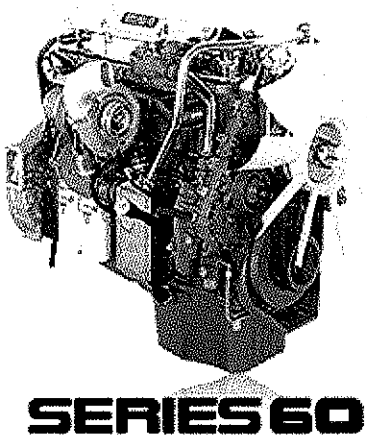
NOTE: For engine operations and maintenance, see the appropriate engine operations manual provided.

3-1.8.1 Coolant Hoses and Clamps

Regularly inspect the condition of coolant hoses and their clamps. Hoses which are worn, chafed, hardened, or cracked must be replaced before a leak develops.

Vehicles used in frequent stop-and-go service undergo temperature changes which can accelerate the wear of engine hoses. On an age-hardened hose, retightening a worm screw clamp will not stop connection leaks. The need to do so further indicates that the hose needs replacement. It is also important not to over tighten clamps, as this can damage the hose or distort the tubing connector. When replacing a hose, the clamp should be tightened to 45 inch-pounds. When checking a hose clamp, clamps should be tightened to a minimum of 34 inch-pounds.

3-1.9 Detroit Diesel Series 60 - Optional Engine



Wanderlodge offers a choice of an optional engine the Detroit Diesel Series 60. Basic specifications and operation of this engine are as follows:

3-1.9.1 Engine Model and Serial Number Designation

The engine serial number and model number are stamped on the cylinder block in the following location (as viewed from the flywheel end):

Left side just below the intake manifold and above the cast-in Detroit Diesel logo.

Option Labels
Computerized engine option labels are attached to the valve rocker cover. These labels contain the engine serial number and model number and, in addition, list any optional equipment used on the engine. Labels also include required tune-up information (injection timing, valve lash, max. no-load RPM, etc.)

3-1.9.2 Starting the Engine

If the engine has an emergency manual or automatic shutdown system, make sure the control is set in the open position before starting. The turbocharger may be seriously damaged if the engine is cranked with the air shutdown in the closed position.

The engine may require the use of a cold weather starting aid if the ambient temperature is below 40°F (4°C).

3-1.9.2.1 Initial Engine Start

To start a Series 60 engine be sure the transmission is in neutral or park and turn the ignition key on.

You will notice that both the "Check Engine" and "Stop Engine" lights will come on. This is the result of the DDEC (Detroit Diesel Electronic Controlled) computer diagnosing the system to ensure everything is functional, including the light bulbs for the "Check Engine" and "Stop Engine" warning lights. If everything is okay, both lights will go out in approximately five seconds.

IMPORTANT: Wait till both lights go out before starting engine. Start engine with foot off of the accelerator pedal.

NOTICE: If the warning lights stay on, consult with a DDEC technician. Operating the engine under these circumstances may result in engine damage.

To start engine:

1. Rotate key to start position.
2. If the engine fails to start within 15 seconds, release the key switch and allow the starting motor to cool for 15 seconds before trying again. If the engine fails to start after four attempts, an inspection should be made to determine the cause.

Air Starter - Because of the limited volume of most storage tanks and the relatively short duration of the cranking cycle, it is important to make sure the engine is ready to start before activating the air starter. Start an engine equipped with an air starter as follows:

1. Check the pressure in the air storage tank. If necessary, add air to bring the pressure up to at least the recommended minimum for starting.
2. With foot OFF the accelerator pedal, turn key to start position and hold until the engine starts.

3-1.9.2.2 Running the Engine

Oil Pressure - Observe the oil pressure gauge immediately after starting the engine. A good indicator that all of the moving parts are getting lubrication is when the oil pressure gauge registers pressure (5psi-34.5 kPa at idle speed). If there is no oil pressure indicated within 10 to 15 seconds, stop the engine and check the lubricating system. The pressure should not fall below 28 psi (193 kPa) at 1800 rpm, and normal operating pressure should be higher. If pressure does not fall within these guidelines, it should be checked with a manual gauge.

⚠ CAUTION: To avoid injury from hot oil, do not operate the engine with the rocker cover(s) removed.

Warm-Up - Run the engine at part throttle for about five (5) minutes to allow it to warm up before applying a load.

NOTE: During long engine idling periods with the transmission in neutral the engine coolant temperature may fall below the normal operating range. When prolonged idling is necessary, maintain at least 850 rpm spring/summer and 1200 rpm fall/winter.

3-1.9.3 Stopping the Engine

3-1.9.3.1 Normal Stopping

Decrease engine speed back to normal idle and put all shift levers in the neutral position.
Allow the engine to run between idle and 1000 rpm with no load for four or five minutes. This allows the engine to cool and permits the turbocharger to slow down. After four or five minutes, shut down the engine.

NOTE: Stopping a turbocharged engine immediately after high speed operation may cause damage to the turbocharger, as it will continue to turn without an oil supply to the bearings.

3-1.9.4 Emergency Jump Starting

DDEC III and DDECIV electronic control systems operate on 12 or 24 volts DC. If a DDEC III or IV engine with an electronic starting motor requires emergency jump starting, do not exceed 32 volts DC.

NOTE: Jump starting with voltages greater than those indicated or reversing battery polarity may damage the ECM (Electronic Control Module).

Before attempting to jump start the engine, make sure jumper cables are connected properly (positive to positive, negative to negative) and in the proper sequence (negative to negative last).

NOTE: Failure to observe this precaution can result in alternator and/or equipment damage.

CAUTION: To avoid injury from battery explosion or contact with battery acid, work in a well-ventilated area, wear protective clothing, and avoid sparks or flames near the battery. Always establish correct polarity before connecting cables to the battery or battery circuit. If you come in contact with battery acid:

- **Flush your skin with water.**
- **Apply baking soda or lime to help neutralize the acid.**
- **Flush your eyes with water.**
- **Get medical attention immediately.**

3-1.9.5 DDEC III/IV Engine Driving Tips

Accelerating the Bus - Engine response versus pedal movement may feel different from other mechanical governed engines you may have been driving. The electronic foot pedal assembly was designed to communicate "percentage" foot pedal travel to the engine's electronic control module. The engine will respond accordingly to the driver's demand.

You will probably have to get used to the limiting speed governor. This allows the driver to command total engine response between idle and rated speed, such as accelerating at half throttle. This is especially helpful when driving under slippery road conditions.

If you do require wide open throttle engine response, either accelerating or just plain pulling hard, the throttle will have be to held to the floor. To obtain maximum fueling at any speed, the foot pedal will have to be maintained at the fully depressed position.

Idling - In the past you may have heard that idling a diesel engine causes no engine damage but this is not true. Idling produces sulfuric acid which breaks down the oil and eats into bearings, rings, valve stems and engine surfaces. If you must idle the engine for cab heat or cooling, the high idle function of the cruise control switches should be utilized. An idle speed of 1100 RPM should be enough to provide cabin heat in above 32°F (0°C) ambients.

3-1.9.6 Engine Systems

3-1.9.6.1 Fuel System

The fuel system consists of the DDEC electronic fuel system controls, fuel injectors, fuel manifolds (integral with the cylinder head), fuel pump, a cooling plate for the electronic control module (ECM) on non-automotive engines, primary and secondary fuel filters, and the necessary connecting fuel lines. The primary filter (marked "P") or combination filter and fuel/water separator removes large impurities from the fuel. The secondary filter (marked "S") removes the smaller particles.

3-1.9.6.2 Lubrication System

The lubricating oil system consists of an oil pump, oil cooler, two full flow oil filters, bypass valves at the oil pump and oil filter adapter, and pressure regulator valve in the cylinder block vertical oil gallery.

3-1.9.6.3 Air System

In the air system used on Series 60 engines, outside air drawn into the engine passes through the air filter and is pulled into the turbocharger, where it is compressed. It then moves to the air-to-air charger cooler (heat exchanger) where it is cooled. From here it flows to the intake manifold and into the cylinders, where it mixes with atomized fuel from the injectors.

Dry type air cleaners are used on Series 60 engines. For optimum protection of the engine from dust and other airborne contaminants, service these air cleaners when the maximum allowable air restriction has been reached, or annually, whichever occurs first.

3-1.9.6.4 Cooling System

A radiator/thermo-modulated fan cooling system is used on Series 60 engines. This system has a centrifugal type fresh water pump to circulate coolant within the engine. Two full blocking type thermostats located in a housing attached to the right side of the cylinder head control the flow of coolant.

3-1.9.6.5 Electrical System

The electrical system consists of a starting motor, starting switch, battery-charging alternator, storage batteries, and the necessary wiring.

3-1.9.6.6 Exhaust System

Hot exhaust gas flowing from the exhaust manifold into the exhaust riser is used to drive the turbocharger.

CAUTION: Diesel engine exhaust and some of its constituents are known to the state of California to cause cancer, birth defects and other reproductive harm.

- **Always start and operate the engine in a well-ventilated area.**
- **If operating the engine in an enclosed area, vent the exhaust to the outside.**
- **Do not modify or tamper with the exhaust system or emission control system.**

3-1.9.6.7 Extended Storage

When leaving bus parked for an extended period of time (over winter, for example) engine may accumulate water in the oil pan through normal condensation of moisture (always present in the air) on the cold internal surfaces of the engine. Lube oil diluted by water cannot provide adequate bearing protection at engine startup. Detroit Diesel recommends that engine lube oil and filter(s) be replaced after extended storage.

NOTE: Failure to eliminate water-diluted lube oil may lead to serious engine damage at start-up.

3-1.10 Allison B500P Automatic Transmission

Transmission – Allison B500P Automatic.

Gears		Ratios
First		3.51
Second		1.906
Third		1.429
Fourth		1.0
Fifth		.73
Sixth		.639
Reverse		-4.801
Torque Converter	TC-541	1.897 stall ratio
Lubricant Capacity		29 qt. refill
Bell house size		SAE #2
Drive line		SPL 250 Spicer

B500P Specifications	
City Bus, Suburban Bus Rating	
Gross input power[1]	420 hp (313 kW)
Gross input torque	1300 lb-ft (1763 N·m)
Net turbine torque[2]	2450 lb-ft (3322 N·m)
Intercity Coach, Cross-Country Tour Coach Rating	
Gross input power[1]	500 hp (373 kW)
Gross input torque	1525 lb-ft (2068 N·m)
Net turbine torque[2]	2450 lb-ft (3322 N·m)
1 Gross Power Ratings as defined by ISO 1585 or SAE J1995.	
2 Turbine Torque limit based on SCAAN standard deductions.	

NOTE: For more detailed information on Allison B500 World Transmission refer to Section 5-1 Transmission of this manual.

3-2 Towing

3-2.1 Receiver Type Trailer Hitch

This is a 10,000 pounds rated capacity and 1,000 pounds tongue weight capacity receiver type hitch.

When using the rear hitch remember that the coach is intended for towing light loads. The coach is designed to be used primarily as a commercial coach, towing will affect durability and economy. Your safety and satisfaction require proper use. Avoid excessive loads. Do not use the coach to tow anything until it has been driven 500 miles (800 kilometers). Weight pushing down on the rear hitch must not exceed 1,000 pounds. We recommend weighing the coach, as it will be operated, to be certain that there is proper weight distribution. When weighing the coach be sure to take the passenger locations into consideration. Total weight of the coach and any vehicle towed by it must not exceed the GCWR.

▲WARNING: Any trailer being towed by the coach must have adequate brakes. Failure to follow these instructions will create a safety hazard and may result in an accident.

3-2.2 Tow Hooks

Two tow eyes are located at the front of the coach. Removable tow hooks are stored in a tray in left hand front drivers compartment. Insert hooks into receivers and secure with pins provided.

NOTE: If towing a vehicle from tow hooks spare tire door panel must be removed prior to towing.

▲WARNING: DO NOT LIFT COACH WITH TOW EYES. TOW EYES ARE FOR FLAT GROUND MANEUVERING ONLY.

3-2.3 Having Your Coach Towed

3-2.3.1 Towing Procedures

It is recommended that if a towing company is called make sure they use a wheel grid (an arm that goes under coach and lifts from the front tires.) *Refer to figures 1 and 2 below.*

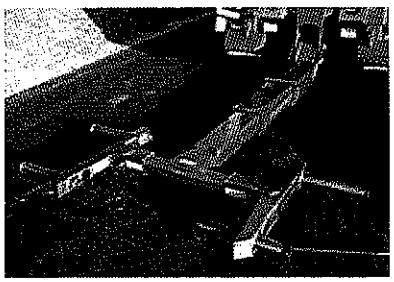


Figure 1

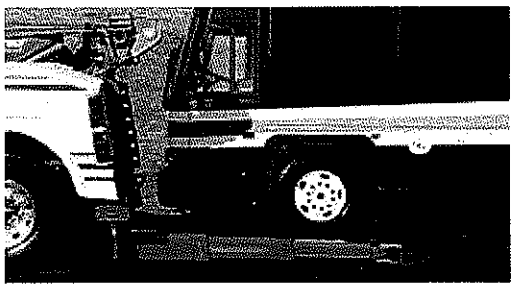


Figure 2

The towing company may need to locate the air valve (*see fig. 3*) to release the air brakes. The air valve is located in the engine compartment and should only be used by towing or service personnel. If the coach ever needs to be towed, use the following instructions:

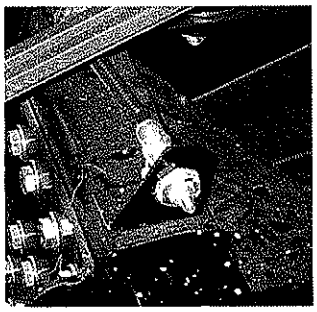


Figure 3

- Secure any loose or protruding parts if the coach is damaged.
- Inspect points of attachment on a disabled coach. If attachment points are damaged, select other attachment points at a substantial frame structural member.
- Never allow anyone to go under a coach while it is being lifted by towing equipment unless the disabled coach is adequately supported by safety stands.
- Do not lift the coach from the rear. Lifting from the rear will cause the front tires and suspension to be seriously overloaded, possibly resulting in a tire or front suspension failure. Rear frame extensions are not designed to withstand loads imposed by lifting the rear of the coach. Flat towing of coach from rear is acceptable.
- If rear wheels are disabled, place the coach on a flat bed trailer or use a heavy-duty dolly under the rear wheels and tow from the front of the coach.
- The drive shaft must be removed to protect transmission.

▲WARNING: In the event the coach requires towing ensure all precautions are followed. The driveline must be disconnected and the mud flap may need to be removed. Wanderlodge will not cover damage to the coach from a towing company.

3-2.3.2 Disabling the Parking Brake

- Block wheels securely before attempting this procedure.
- Remove the plug from the center of drive and tag axle brake cans. (*see fig. 4*)
- Use a wrench to tighten the bolt, which compresses the internal spring, releasing the brake.
- Repeat for the other brake cans.
- After towing, or when air pressure is again available, loosen the bolt and replace plug.
- Repeat for the other brake cans.

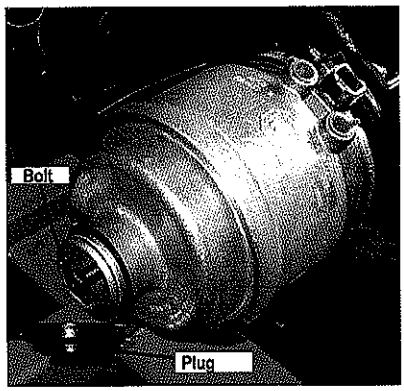


Figure 4

▲WARNING: Do not attempt to dissemble brake canisters without special tools and without having studied specific manufacturer's instructions. Canisters contain springs under very high tension. Improper handling could result in component damage or personal injury.

3-2.3.3 Towing With a Wheel Grid *(Front End Only)*

Make sure the tow truck can safely handle the weight of the coach. Give the towing company the weight of your coach when you call. If your coach is going to be towed with a wheel grid do the following:

- Maneuver wheel grid into position. After coach has been lifted, install safety chains on lower A-arms. (*See fig. 5*)
- Attach safety chains, which are completely independent of the primary lifting device, to the tow eyes, located in the spare tire compartment.
- When the coach is under tow allow enough room between the front of the coach and the rear of the tow vehicle while turning corners.

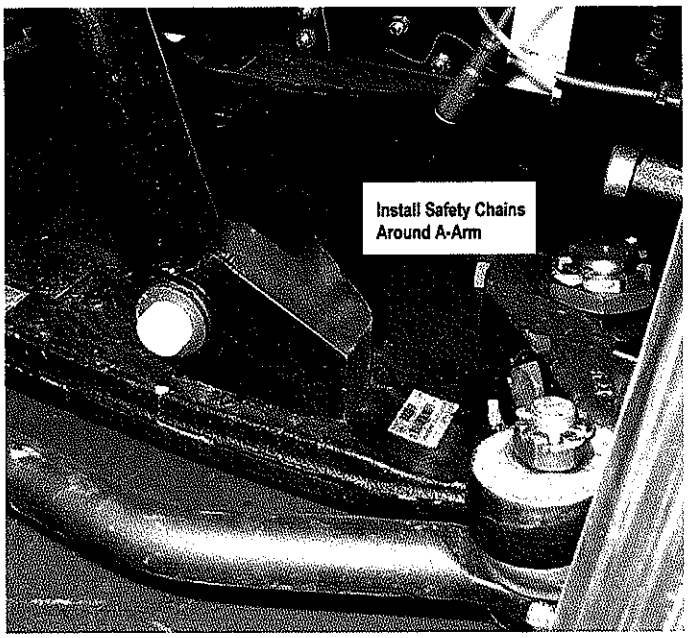


Figure 5 - Front Axle

3-3 Tires and Wheels

3-3.1 Tires

The coach is equipped with tubeless 315/80 R22.5 XZE load range H 16 ply rating Michelin steel and cord radial single front, dual drive and single tag turned to the outside. Spare tire and wheel located in slide out compartment located at front of coach, behind removable access panel.

3-3.1.1 Tire Inflation

For inflation pressures, refer to the Vehicle Certification Plate mounted on the wall panel at the lower left of the driver's compartment.

▲WARNING: Do not put air back in a tire that has been run flat, or is seriously low on air, without first removing the tire from the wheel and checking the tire and/or tube for damage.

Taking off and putting tires on bus wheels requires proper tools, safety equipment, and special training. Serious damage and/or injury can result from using the wrong service methods. Bus tires and wheels should be serviced only by trained people using the proper equipment.

When putting air in a tire on the vehicle, stand to the side and use a clip-on chuck and hose extension. Never add to your tires unless an accurate pressure gauge is also used. In choosing the right tire pressure, be careful not to go past the maximum pressure capacity shown on the tire.

Tire inflation pressure must not exceed the recommendations of the tire and/or wheel rim manufacturer for the specific load, speed, and application. The inflation pressure on the tire sidewall does not take the wheel or rim capacities into consideration. Tires should not be inflated above the pressure listed on the label without consulting your tire/wheel distributor.

3-3.2 Wheels

The coach comes with 22.5"x9.00" steel wheels, black, hub-piloted, 10-stud, 11.25" (285.75mm) bolt circle, 8.66" bore, 5 hand holes. Optional aluminum wheels are available for purchase.

3-3.2.1 Wheel And Rim Safety

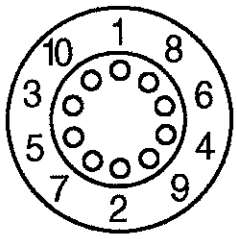
Wheels and wheel components must be properly maintained. An inflated tire is potentially very destructive. Accidents are caused by careless handling and inexperience. Safety literature can be obtained from your wheel and rim distributor, a wheel and rim manufacturer, NHTSA, or OSHA. If you have any questions, consult the distributor or manufacturer directly.
The load-carrying requirements of each vehicle should be determined before selecting the proper tire/wheel combination. Always remember that the weakest weight-carrying component of the vehicle (i.e., tire, wheel, axle, bearings, etc.) determines its overall maximum safe load-carrying capacity.

▲WARNING: Improper handling of wheels and rims has caused many injuries and deaths. Failure to follow directions is the leading cause of such accidents. Obtain procedures from wheel and rim manufacturer before working with a wheel or rim.

When replacing tires, use the same size, load range, and construction type as originally installed on the vehicle. The tire and wheel must always be properly matched. For example, do not mount a 20-inch tire on a 22-1/2-inch wheel. Failure to strictly adhere to these important instructions may result in an explosive separation and could cause serious bodily injury or death. It is critical to determine the size of each component before beginning any assembly operations.

▲WARNING cont. When replacing wheels, use original equipment manufacturer's wheels, or equivalent available from your dealer with equivalent capacity, width, offset, and mounting configuration as those originally installed on your vehicle. Use of improper replacement wheels and tires may adversely affect ride, handling, load carrying capacity, bearing life, clearance to body and chassis components, vehicle ground clearance, vehicle width, and brake cooling.

3-3.2.2 Tightening Wheel Stud Nuts



When installing wheels, gradually tighten wheel nuts following the sequence shown. Do not initially tighten each nut fully; rather, tighten them incrementally, working around the crisscross sequence tightening each nut a little more until all nuts are tightened to 450-500 foot-pounds [610-675 N•m].

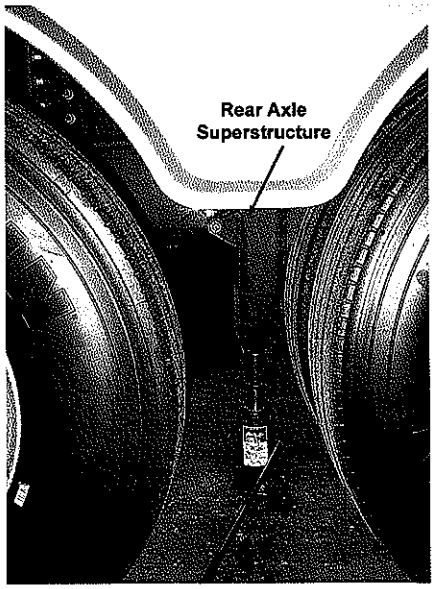
NOTE: On the drive axle's dual wheels, position outer tire and wheel assembly so that the valve stems of the inner and outer wheels will be in adjacent wheel holes or spaces.

3-3.2.3 Jacking Instructions

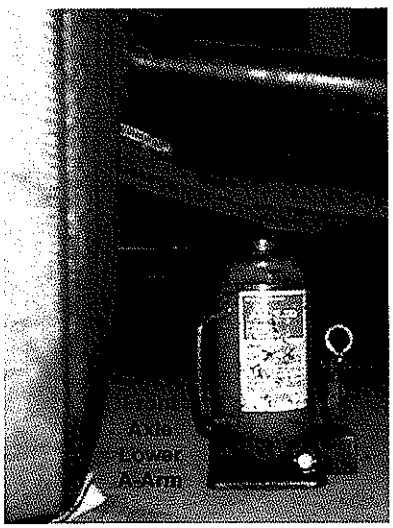
▲WARNING: Bumpers are not designed to support the weight of the vehicle. Do not work under bus supported by bumper jacks. Use only appropriate jack stands supporting frame rails when working under bus.

Roadside wheel changes can be extremely hazardous and should be avoided if at all possible. In the case of a wheel/tire problem, the operator should make every attempt to obtain qualified and fully-equipped professional assistance.

1. Park vehicle on flat, level concrete or comparable surface capable of supporting jacking device.
2. Apply parking brake.
3. Place chocks at front and rear of tires opposite wheel/or wheels to be lifted first.



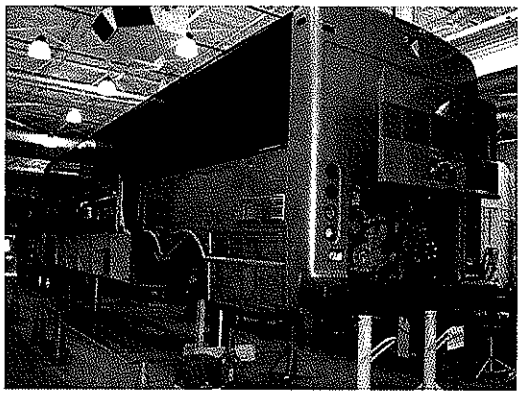
Rear Jacking Location



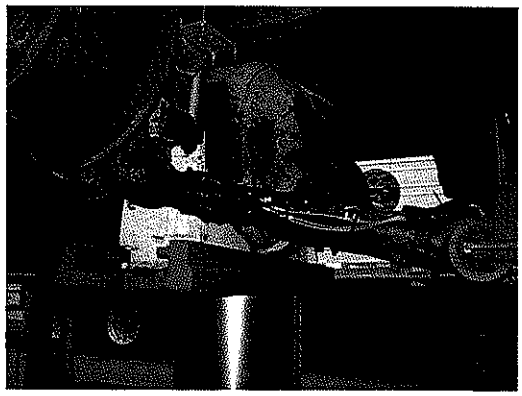
Front Jacking Location

4. Use jacks and jack stands or blocks of sufficient capacity to support the vehicle. Following the jack manufacturer's recommended procedure, place jack securely under axle or suspension beam and lift to required height for servicing. Be sure any locking device on the jack is in place and operating and solidly support the vehicle under the main frame rails with jack stands or blocks before working under or around the bus.
5. After servicing is complete, reverse above procedure.

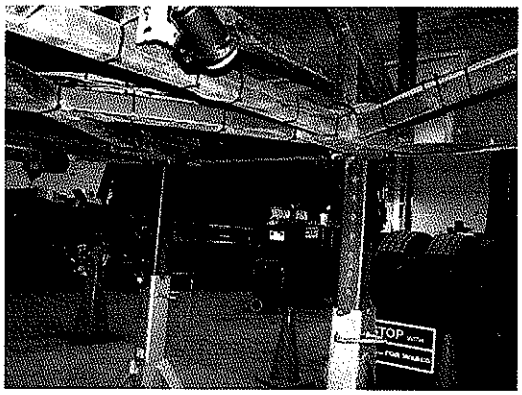
Twin Post Hoist Lifting Locations



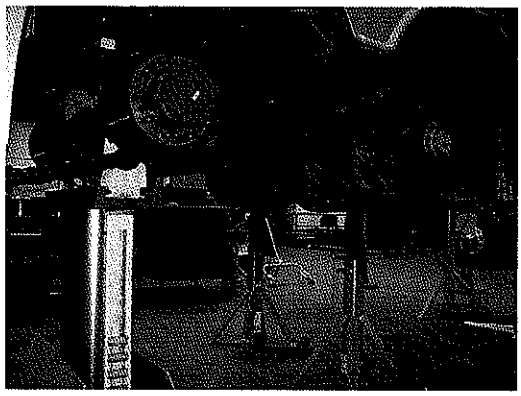
Side View Of Bus Lifted On Hoist



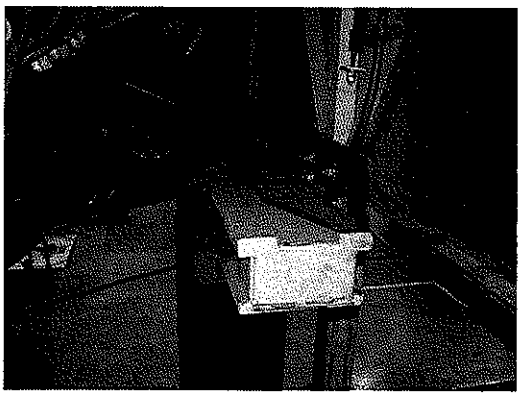
Drive Axle On Hoist



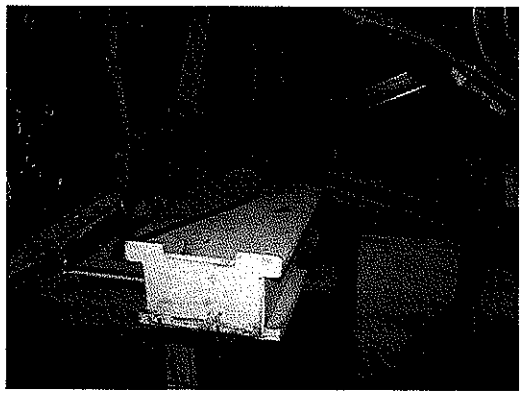
Front Of Bus With Jack Stands Placed Under It For Safety



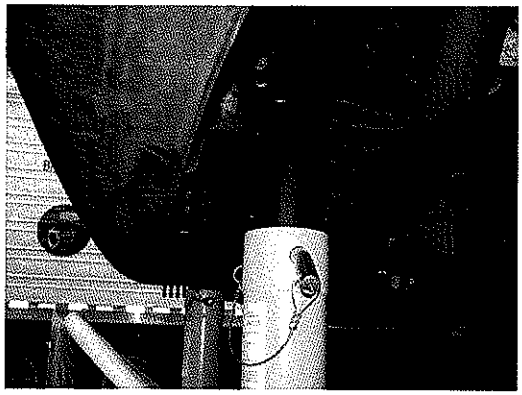
Side View Of Rear Axles



Left Front Of Bus On Hoist



Right Front Of Bus On Hoist



Side View Of Rear Jack Stands

Tag Axle Jack Stands

4-1 Interior/Exterior Storage

4-1.1 Interior Storage

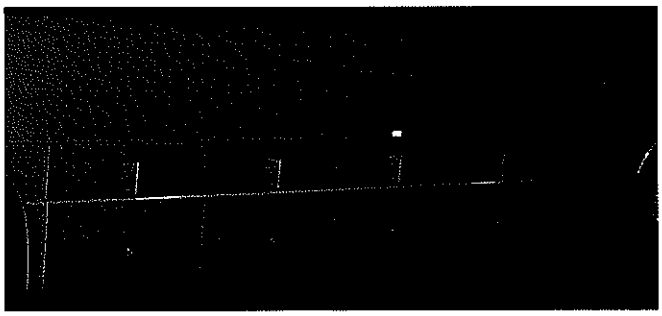
4-1.1.2 Parcel Racks

Overhead parcel racks that include integrated reading and aisle lights, HVAC vents and audio speakers. The racks run the full length of either side of the passenger compartment and include doors.

4-1.2 Exterior Storage

4-1.2.1 Luggage Compartments

Pass-through luggage compartments provide approximately 350 cubic feet of storage space. Luggage doors are manufactured from FRP. Exterior attached to inner steel structure. Manual mechanical latches on compartment doors (with an option for electric locks). Compartments have stainless steel, ribbed flooring for maximum durability and function.



4-2 Battery Systems

Two 8D batteries, limited maintenance batteries series parallel for 24 volt. 1075 CCA are supplied with your coach.

4-2.1 Slide Out Battery Compartment

The batteries are mounted in a slide-out tray behind the right side engine compartment grille. (*see fig. 1*) The battery compartment also contains a master battery power switch box for both the 12 volt and 24 volt circuits.

4-2.1.1 To Access Batteries:

1. Turn both thumb screws retaining the bottom of the right side Engine Compartment Access Grille (*fig. 1*) and open the grille fully.

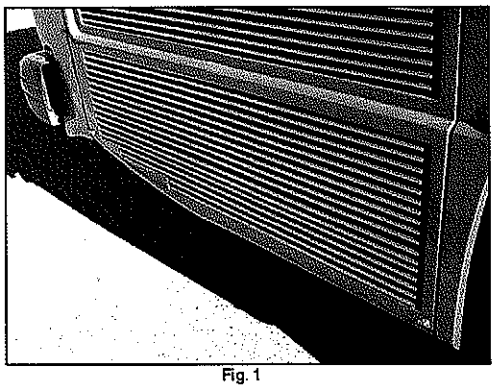


Fig. 1

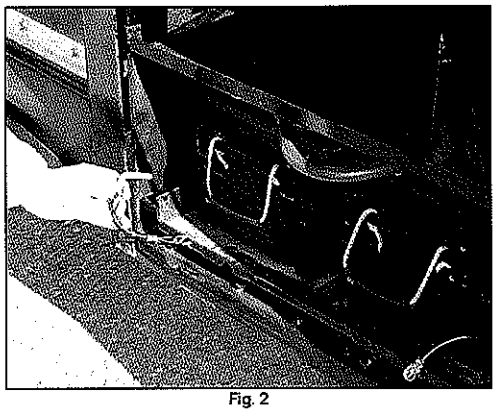


Fig. 2

2. Remove the tray retaining pins at both sides of the battery tray *(fig. 2*).

3.
3. Grasp the grab handles on the outward side of the batteries and pull firmly outward. (*fig. 3*)

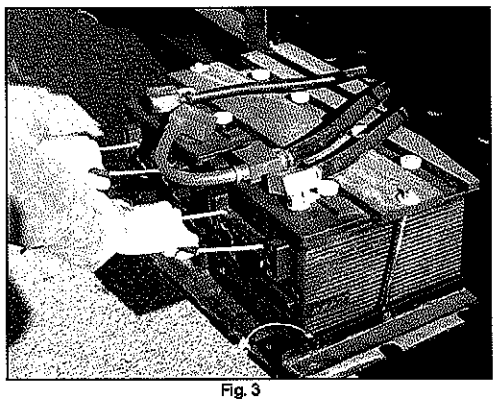


Fig. 3

4-2.1.2 To Remove Batteries:

1. Turn off both the 12 and 24 volt battery circuits.
2. Be sure to disconnect the ground-side battery cables first.
3. Disconnect the circuit-side battery cables.
4. Unbolt the nuts and washers from the battery tie down bolts and remove the retaining plate(s).
5. Lift out battery.

▲WARNING: Charging batteries produce hydrogen gas, which is explosive. Charge batteries in well-ventilated area, free from sparks and open flame. Use only properly insulated tools and always take full precautions to prevent accidental arcing between terminals.

4-2.1.3 Battery Tray Maintenance

Lead-acid batteries are heavy, so a firm grasp is required to slide out the battery tray. However, the tray is designed to slide without undue force. If the tray resists sliding, check seals, hinges, pins, and locks for mechanical damage. Check especially for signs of corrosive damage which may indicate damaged batteries. Clean the battery compartment with a nonabrasive degreaser. Every three months, lubricate hinges, slides, pins, and locks with a graphite-type or spray-type lubricant.

4-3 Heating/Air Conditioning

4-3.1 Air Conditioning/Heating Unit

The Air Conditioning 353 system includes R134A refrigerant, engine coolant heat exchanger, and basic driver control module. Cooling capacity of 110,000 BTU/HR and heating capacity of 137,000 BTU/HR. includes Carrier 05G compressor, driven by engine.

4-3.2 Optional Heating Units

There are two optional heating units to choose from. Both are described below:

4-3.2.1 Webasto

This is an 80,000 BTU Fuel Fired Pre-Heater.

4-3.2.2 Hydronic Baseboard Heat

Radiant baseboard heaters shall be located either side of the interior near floor level to provide heat to full length of the passenger compartment. The positioning of these heaters shall provide foot clearance.

4-4 Waste System

The bus comes equipped with a Monogram Sanitation Toilet with Clear Rinse Pump.

4-4.1 Operation

The waste tank is precharged with water to a predetermined level. A deodorant chemical should be added to the precharge.

When the flush button is depressed, compressed air flows into the upper pump chamber. The compressed air pushes the pump diaphragm downward displacing the fluid in the lower pump chamber for rinsing the bowl. Releasing the flush button reverses the air flow and allows the diaphragm to return to the starting position. As the diaphragm moves upward, the air in the upper chamber is exhausted through an air flow governor. A spring is used to return the diaphragm to its original position. As the diaphragm moves upward fluid is drawn through the pin filter into the lower chamber for the next flush cycle. A complete flush cycle takes approximately sixty seconds.

Servicing intervals for the System are determined by the bus operator.

During servicing, the tank is rinsed, contaminated fluid is eliminated from the pump and the tank precharged in the shortest time possible for any system. For best results, a minimum static water pressure of 50 PSIG (3.5 bar) is recommended. To further minimize service time, higher pressures may be used.

NOTE: Air pressure to the System is regulated between 5 and 7 PSIG (0.3 and 0.5 bar).

4-4.2 Components

The toilet consists of the following components:

- Trim Plate
- Bowl with Flapper
- Pump Hanger
- Clear Rinse Pump with Pin Filter
- Return Hose
- Rinse Hose
- Hose Clamps

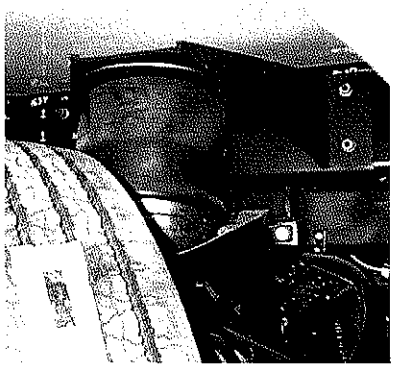
4-4.3 Maintenance

There is no scheduled maintenance with this model toilet.

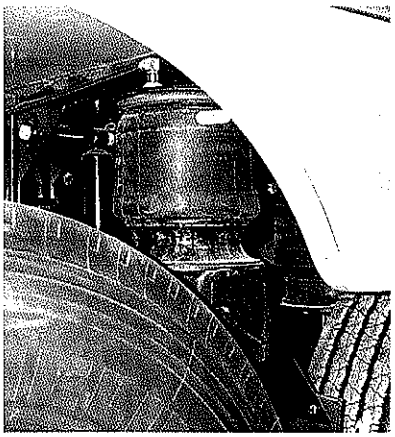
4-5 Air Suspension

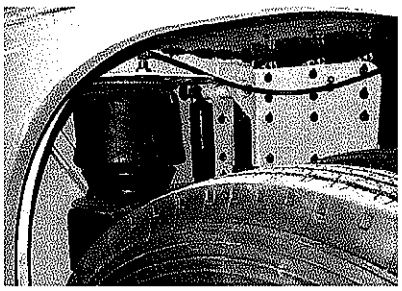
The Meritor Air Suspension differs greatly from conventional leaf or coil spring suspensions. It is designed to provide trouble-free operation, requiring minimal service and maintenance. This section is presented to provide the operator a general understanding of the air suspension's function and characteristics, and to assist in routine pre-operation inspection.

The Meritor air suspension uses pressurized air, drawn from the coach's air system, to inflate load carrying, shock absorbing air cushions mounted atop each of the vehicles' axles. There are eight such cushions on the coach; one on each side of the front axle; two on each side of the drive axle; and one on each side of the tag axle. Automatic height control valves regulate the air volume required for varying loads, and maintain a constant vehicle ride height by adding or exhausting air in the cushions as needed. The system's basic characteristic is its ability to provide a well-cushioned ride through a range of load conditions. The vehicle air pressure must be built up and maintained in excess of 100 psi to inflate the air springs before operating.



Most minor failures do not put the suspension out of operation or require roadside assistance. If immediate repair is not possible, the vehicle can be driven carefully to a service facility. If a suspension system component failure causes an air loss, a brake protection valve will automatically maintain a safe air brake pressure of 65 psi. If all air cushions go flat, rubber bumpers inside the air cushions carry the loaded vehicle. Mechanical stability through the suspension system allows the vehicle to be operated with care without excessive lean while air springs on only one side are pressurized.





As part of a daily outside inspection before operating the bus, visually inspect the suspension air cushions. With the vehicle parked on a level surface and engine running to maintain air pressure above 100 psi, check:

1. All air springs, to make sure they are equally firm.
2. The drive axle air spring height is 8.00 inches.
3. There is a clearance of at least two inches around the rubber air springs.

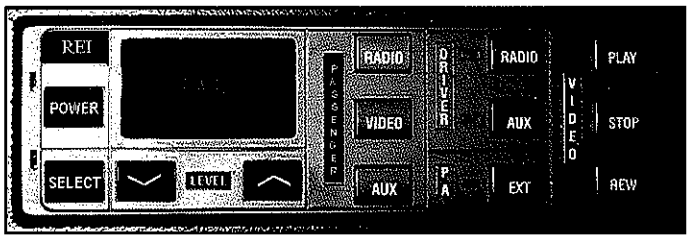
With the engine off:

1. Listen for any air leaks.
2. Check for any visible evidence of broken or abnormally worn parts
3. Check for any signs of wear due to insufficient clearance around air cushions or contact with other components.

4-6 Video and Audio

The standard for the Express coach is the REI System 2000 audio/video/pa system. This system features an AM/FM radio with CD, a public address system with hand held dynamic boom microphones, and a 5 monitor video system. Four monitors will be located under the overhead parcel rack and spaced appropriately for passenger viewing. One monitor will be installed in the center of the coach to roof structure between stepwell and driver's light. The VCR will be located in a lockable compartment in the forward section of the driver's side parcel rack. The radio and controller will be located in cut-outs in the driver's dash pod.

4-6.1 C-2000 Digital Control Unit



- C-2000 Control Unit allows complete digital control of audio system.
- Driver, passenger and public address audio can each be individually adjusted for optimum volume, bass and treble levels.
- Unit's video section controls the video cassette player's stop, rewind and play functions.
- LED window displays current function
- A bar graph indicates relative levels of passenger's audio.
- Control Unit has three public address microphone inputs and the ability to switch between internal and external speakers. (External speakers would require a temporary option.)

4-6.1.1 Options Available with REI System 2000

- 10 Disc CD Changer
- 16 Channel Cordless Microphone for the Tour Guide
- TV Antenna Kit for Local News Station
- Scenic View Observation System so all passengers can have a front seat view.

Optional Features

Below is a chart of Audio/Video features available. Some options are only available with other things and some are not available with certain things. Refer to the chart below for further explanation. For full descriptions of these features see descriptions below chart.

Option #	Option Name/Description	Avail. Only With	Not Avail. With
38104-01	**Radio, AM/FM Stereo, CD** - AM/FM radio with cd for use with parcel rack with integrated speakers.	**38108** Rack, Parcel	Any other radio features
38104-12	**Radio/CB**		
38104-13	**Radio AM/FM Stereo/CD w/PA**		
38104-14	**CD Player, 10 Disc REI**	**38105-06 or 07**	
38105-03	**Camera, RR Vision, w/Driver's Monitor.** Sony rear vision camera with in dash black and white monitor.		
38105-06	**VCR, w/Five Monitors, AM/FM Stereo, REI - Standard.** A VCR with five color TV monitors and AM/FM stereo radio shall be provided. The monitors shall be located under the overhead parcel rack and spaced appropriately for passenger viewing (Four installed in passenger area and one in front center). The VCR shall be located in a lockable compartment in the forward section of the driver's side parcel rack.		**38104-01** Radio, AM/FM Stereo, CD. **38105-07** Audio/Video System. **38104-13** Radio AM/FM Stereo/CD w/PA
38105-07	**Audio/Video System, REI, 3 Monitors** - VCR with three color monitors and an AM/FM CD stereo shall be provided system 2000 controller. Two monitors shall be located under the overhead parcel rack and spaced appropriately for passenger viewing. One monitor shall be installed in the center of coach to roof structure between stepwell and drivers light. The VCR shall be located in a lockable compartment in the forward section of the driver's side parcel rack. The radio and controller will be located in cut-outs in driver's dash pod.		**38104-01** Radio, AM/FM Stereo, CD. **38105-06** VCR w/Five Monitors, w/Driver's Monitor. **38104-13** Radio AM/FM Stereo/CD w/PA
38105-08	**Microphone, Cordless, REI.** A cordless microphone shall be provided. The microphone base unit will be installed inside the lower dash cabinet with the cordless microphone installed in the front face of the lower dash (near beginning of radius of cabinet).	**38105-06** VCR, w/five monitors or **38105-07** Audio/Video System	
38105-12	**TV Antenna**	**38105-06 or 07**	
38105-13	**Scenic View Camera - REI**	**38105-06 or 07**	

Panasonic Radio modified

Operation

The modified Panasonic radio provides both an audio source for the passengers and the driver. The driver's speaker volume is controlled by the radio volume control and the passenger's by the control head. The Panasonic radio also provides the control of 10 disc changer (if used)

Features

- PLL (Phase Locked Loop) Synthesized Tuning
- Memory buttons for preset stations 5-AM/15-FM (FM1, 2, 3)
- Auto preset and scan function
- Clock Function
- CD Changer Control

VCR Control Module w/Push Button

Operation

The VCR Control Module provides remote operation of the video system through a hard-wired connection. V-2100 VCP functions (play, stop, rewind, and power) and video monitor power are controlled by push buttons of the unit. Audio volume for the video system is adjusted by a control on the front of the VCR Control Module. This is done independently of the system volume control.

Video Cassette Player

Operation

Operation of the Video Cassette Player can be controlled by the VCR Control Module, (play, stop, power, and rewind) or by the front panel buttons on the unit itself.

NOTE: Special attention should be given to the Attention and Caution labels on the warning label.

Features:

- 12 Volt D.C. operation
- Built in dew sensor to prevent damage due to excessive moisture build up in unit. The unit will not accept tape if dew sensor is activated.
- Auto repeat and full auto functions.

M-2000 10" Video Color Monitor

Operation

The M-2000 monitors are automatically powered by the VCR Control Module when the TV button is activated. There is also a separate power on switch located at the rear of the monitor. This switch must be depressed in order for the monitor to function.

Features:

- A specially designed slide mounting bracket, which allows for easy installation and removal of the monitor. The amount also has a keyed lock (located on the back panel) to secure monitor.
- Separate controls for vertical hold, vertical size, contrast, brightness, horizontal hold, color and tint.

Panasonic 10-Disc CD Changer

Operation:

When used in conjunction with the Panasonic Dash Radio, the ten Disc CD Changer provides the improved clarity of CD audio. The CD changer is capable of holding ten audio CDs. The Changer is controlled by the Panasonic Radio. The radio controls include Track selection, Disc selection, Repeat and Random play.

Features:

- The CD Changer receives power (+12VDC) and all control signals from the radio through the circular connector on the rear of the unit.
- The CD magazine can be removed from the unit (via the eject button) for convenient storage and security.
- Compact size and easy mounting keeps the Parcel rack clear and open for baggage storage.

Scenic View Camera Kit

Operation:

The Scenic View Camera is capable of displaying the Driver's view of the road and surrounding over the coach monitors. The unit is mounted either on the center of the dash or the "A" post facing forward. The camera has a single four terminal connector exiting the bottom of the mounting bracket. The camera receives power (+12VDC) from the VCP and supplies a video signal to the VCP via an interconnecting cable. The cable connects to the 4 terminal connector on the camera and the 12-14V DC socket and the Video in jack on the rear of the VCP. For viewing, select video on the Control Head (do not push play). The Control Head turns the VCP on the camera's view is displayed over the monitors.

Features:

- All cabling and mounting provided in one easy to use kit.
- The kit includes optional audio wiring diagrams for providing audio (radio) during viewing.

4-6.2 Troubleshooting

The following charts show basic troubleshooting scenarios and what to do to fix the problem.

Audio

Problem	Possible Cause	Check/Solution
No audio, all channels. No audio on Radio, Auxiliary, Video or PA.	Set to minimum	The volume control on radio or PA with separate volume control.
	Radio	Verify power connections and any external current protection devices; fuses or circuit breakers.
	Defective Radio	If the radio turns on, and all other connections are correct, repair or replace radio.
Audio on only one side of the coach, right or left. Other side functions correctly.	Defective or improperly installed audio cable to speakers.	Check speakers connections on the radio.
		Reverse Right and Left speaker wires. If audio changes to other side of coach proceed to the next check, if not go to Radio Possible Cause.
		Check speaker harness for damage and connections. Repair or replace as necessary.
	Radio Defective or speaker problem.	Check speaker connections (reverse connections left for right). If still no change, repair or replace Radio.
No VCP audio, all other channels operate correctly.	Dirty Audio Heads in the VCP or bad Video Tape	Try playing a different video tape. Clean the VCP's heads with a high quality wet cleaning tape.
	VCP connections; Cable power.	Does VCP have power? If not, check power connections at the rear of the VCP, and at the Video Relay or contactor. Make certain Controller is in the VID mode. Repair or replace Audio Cable.
	Defective VCP.	If possible remove unit and bench test. Connect the unit to a monitor that has video and audio inputs using the VCP's video and audio outputs. If previous checks do not solve the problem, repair or replace VCP.
	Improperly connected or defective Controller.	Check cable connection at the rear of the Controller. If connections appear good and problem is not in the VCP, repair or replace the Controller.
No Radio audio, (one or both sides of coach) all other channels operate correctly.	Improperly connected or defective Radio.	Does Radio display tape mode? If yes, go to next. If no, repair or replace radio.
	Video Triggered	Disconnect Audio from VCP cable. Did radio audio return? If no, repair or replace radio. If yes, check VCP audio cable and/or video control module.
No PA Audio. All other channels operate correctly.	Defective microphone.	If possible, try a different microphone in the same location. If the different mic works, repair or replace the microphone. If another mic is not available, plug the microphone into another mic input. If mic works in another location continue with the following checks. If it still does not function, repair or replace microphone.
	Defective cable.	Check continuity on Microphone cable with continuity tester (meter). If a connection shows open replace, or repair, cable.
	Defective radio	If replacing the Microphone, and checking cable continuity has no effect, repair or replace audio.

Video

Problem	Possible Cause	Check/Solution
No power, all Monitors. Monitors blank, green LED on the rear panel off.	Video System not activated.	Activate all Video system via the button labeled TV POWER CONTROLLER.
	No power to Video relay, or wired incorrectly.	Verify power connections to relay and any external current protection devices, i.e. fuses or circuit breakers.
	Defective Video relay	Activate the Video System via the Control Head. Measure the Voltage on both sides of the Video relay's coil. The sides of the Video relay's coil. The side connected to the cable, orange wire, should measure approximately 0 volts. The opposite side should measure power (+12 or +24V depending on relay used). Relay should energize. If these voltages are present but the relay does not energize, replace the relay.
	Defective or improperly wired Controller	Verify that the green wire is connected to the relay coil. Activate the Video System (as previously described). Measure voltage levels at the relay coil. If the green wire does not measure near 0 Volts (less than 1V), and all other connections are correct, replace or repair the Controller.
	Power wire from video relay to monitors defective.	If power is being switched by the relay, verify that it is also present at the parcel racks, were the monitors connect to it. If not, repair or replace power wire.
Video System activates but not all the monitors power up. Green LED on the rear of the monitor is off.	Power wire to non-functioning monitor(s) defective or improperly connected.	Activate the Video System . Access the power connector, attached to the slide bracket. Verify connection and measure Voltage. If there is not 24 Volts present, trace back the appropriate power cable and verify connection and look for signs of damage. Repair or replace cable as necessary.
	Monitor or Slide Bracket Defective.	If previous power checks are OK, verify that the circuit breaker (located on the rear of the monitor) is not tripped. Reset if necessary.
		Remove a functioning monitor from another location and remove suspect monitor and replace it with known good unit. If unit now functions replace or repair suspect unit. If unit still does not operate verify the slide bracket connections and repair or replace unit as necessary.

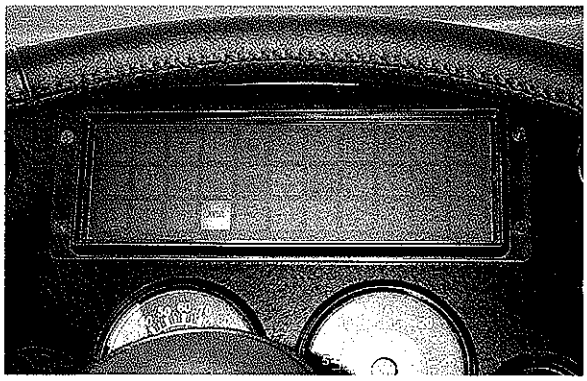
Video cont.

Problem	Possible Cause	Check/Solution
Monitors power up (screens light, screen LED on rear panel is on) but no video is displayed; all monitors.	VCP not operated properly.	Verify that a known good VHS tape has been inserted and that the VCP is in play. PLAY LED, on the front of VCP, is illuminated. VCP may be put into play from either the Controller or directly from the front panel of the VCP.
	VCP Video out connection defective or incorrect.	Check Video Out connection, at the rear of the VCP. Connection should be made to the jack labeled VIDEO
		If possible, remove VCP and check out the unit by connecting it directly into a monitor with a Video input. If
	Defective or improperly installed Video Distribution Amplifier *May not be installed on all systems.	Verify that the Distribution Amp has power connected to it. Verify that it is connected to the Video Out cable, from the rear of the VCP. Verify that the individual coax cables are correctly plugged into it. If there still is no video present at the monitors (and the VCP is operational) repair or replace the Video Distribution Amp. The indicator light on the Video Distribution Amp indicates the presence of a video signal not that power is present.
Video present on at least one monitor, intermittent or not played on one or more monitors.	Defective or improperly installed video coax cable. (P/N's may very)	Remove a monitor from a position that does display video and re-insert it into the position with the suspect unit. If position now display Video proceed to Defective Monitor Possible Cause. If not, Check coax connections, at the rear of the monitor, and at the other end of the cable. If the system has a Video Distribution Amp the other end will be at the amp. If not so equipped, the cable will have to be traced back to its connection point. Cable may be verified by performing a continuity check, or inserting a spare, known good cable in its place. Repair or replace cable as necessary.
	Defective Slide Mount	Remove monitor, check continuity on coax cable that extends from the rear of the unit. Repair or replace as necessary.
	Defective Monitor	If replacing suspect monitor corrects the problem. Repair or replace the Monitor.
Video displays noise or lines across screen, all monitors.	VCP has dirty video heads.	Clean heads with a high quality wet style VHS cleaning tape. *Unit may require professional cleaning.
	Defective tape.	Try a different tape that is known to be good and/or try tape in a different video machine.
	Defective VCP (model may vary).	If cleaning does not correct the problem, repair or replace unit.

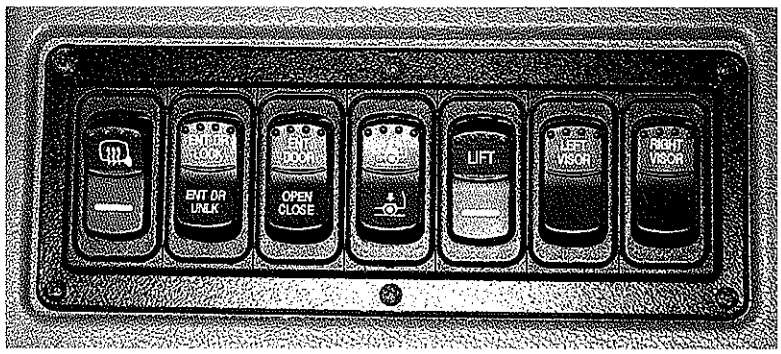
Video cont.

Problem	Possible Cause	Check/Solution
VCP does not function remotely from the Controller.	Defective or improperly installed VCP to Controller Cable.	Check cable connections at the rear of the Controller, and at the rear of the VCP. If possible perform a continuity test on the cable. Repair or replace cable as necessary.
	Defective Controller	Activate the Video System. Operate the VCP directly from its front panel controls. If unit functions correctly, and the VCP to Controller Cable has been checked, Repair or replace the Controller.
	Defective VCP (model may vary).	It may be difficult to determine if problem originates in the VCP or the Controller. If VCP cannot be operated directly from its front panel controls, or replacing the Controller does not correct the problem, repair or replace the VCP.

4-7 Kneeling Feature



The kneeling feature is designed to lower the front entrance door step for easier entry and exit by the passengers. The kneeling feature is controlled by a Kneel switch located on the driver's right side dash switch panel The bus transmission must be in neutral and the parking brake must be applied in order for the kneeling feature to function.



⚠CAUTION: Always straighten the front wheels before using the kneeling feature. Damage can occur if the front wheels are turned sharply when the bus is kneeled, as certain parts of the bus body may contact the tires.

As indicated by the icon on the switch, pressing the switch downward kneels the bus. Air is released from the front air suspension bags very rapidly, allowing the entrance door step to drop three inches in three seconds. The horn sounds as a warning and a yellow indicator appears in the instrument panel.
After passengers have boarded or exited, the bus is raised to normal height by pressing the Kneel switch upward.

▲WARNING: Always ensure that boarding passengers' feet are well clear of the boarding area before using the kneeling system.

▲WARNING: Vehicles equipped with a kneeling feature can drop suddenly and without warning. Bus must be solidly supported under the main frame rails at the front of the bus before working under or around the bus where personal injury could occur.

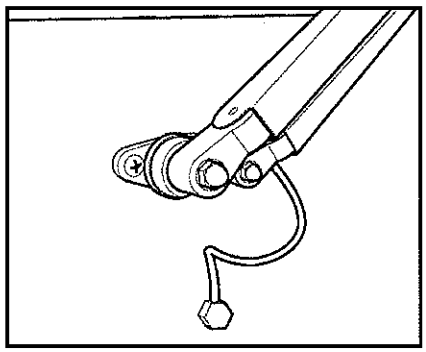
4-8 Windshield Wipers

The Express 4500 comes with dual two-speed electronic intermittent wipers with non-glare arms and blades. Wiper arms are parallelogram. Wipers have a delay position with the delay control on the lower dash. A washer fluid reservoir fill is located in the road side front compartment. Reservoir has a 2-2.5 gallon capacity.

4-8.1 Basic Procedures

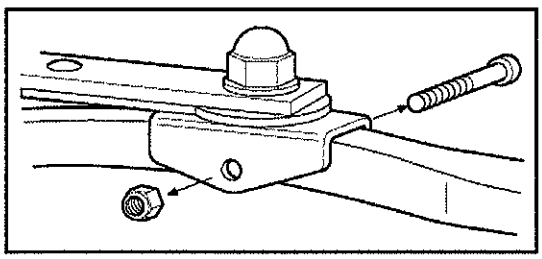
4-8.1.1 Wiper Arm Removal and Installation

To replace the wiper arm assembly:



1. Operate the wipers briefly, stopping the blades in the normal park position.
2. Lift the wiper away from windshield so that the spring pressure will not work against you while you remove the mounting nuts.
3. Remove the cap nuts, which secure the wiper arm to the wiper and the idler arm to the idler shaft.
4. Take note of the angle at which the wiper arm is mounted upon the splined shaft. Remove the wiper arm and place the. new arm (Blue Bird Part No. 1983600) over wiper shaft making sure the new arm is replaced at the same angle.
5. Replace original cap nuts on shafts and tighten.

4-8.1.2 Wiper Blade Assembly Replacement



To replace wiper blade assembly:

1. Loosen the lock nut on the mounting pivot bolt.
2. Remove the bolt and pull the wiper assembly loose from wiper arm.
3. Replace the wiper assembly (Blue Bird Part No. 1974070) using the original bolt and lock nut. Tighten lock nut securely, but do not over-tighten so as to compress the saddle. Blade must be free to pivot within the saddle. Threading the lock nut until it is flush with the pivot bolt's end will give a secure and serviceable installation.

5-1 Transmission

5-1.1 B500 World Transmission

The Allison B500 World Automatic Transmission is an electronically controlled transmission providing six forward speeds and one reverse. Fourth gear provides a 1-to-1 ratio. Sixth gear is an overdrive with a 0.64-to-1 ratio. With an Allison equipped vehicle, it is not necessary to select the right moment to upshift or downshift during changing road, traffic, or load conditions. The Allison B500 does it for you. However, knowledge of the gear ranges and when to select them will make vehicle control and your job even easier.

The transmission and selector must be in Neutral (N) to start the engine. The transmission and shift selector will return to Neutral when engine is stopped and power is switched off. If it does not return to N, or if it starts in any other gear, the unit has malfunctioned. Seek service immediately.

▲WARNING: If the operator leaves the vehicle, even momentarily, while the engine is running, it is very important to leave the transmission in neutral, with the parking brake and/or emergency brakes set and properly engaged, and the wheels chocked. The vehicle may move suddenly and unexpectedly if these precautions are not taken.

5-1.2 WTEC III Electronic Control System

The WTEC III Control System is standard on all MD, HD and B Series transmissions starting in 1998. The system consists of the following five major components connected by customer-furnished wiring harnesses:

- Electronic Control Unit (ECU)
- Engine throttle position sensor (or direct electronic communications link)
- Three speed sensors
- Remote shift selector
- Control module (which contains solenoid valves, a pressure switch, and an optional oil level sensor).

The following items transmit information to the ECU:

- The throttle position sensor (TPS) or engine-to-transmission communication link
- Speed sensors
- Pressure switch
- Shift selector

The ECU processes this information and then sends signal to actuate specific solenoids located on the control module in the transmission. These solenoids control the oncoming and offgoing clutch pressures to provide closed-loop shift control by matching rpm during a shift to a previously established desired profile that is programmed into the ECU.

A feature of WTEC III controls is "autodetect." Autodetect is active during a predetermined number of engine starts, depending upon the component or sensor being detected. These engine start cycles begin from when the transmission is installed during vehicle manufacture. Autodetect searches for the presence of the following transmission components or source of data inputs:

Retarder	Present, Not Present
Oil Level Sensor (OLS)	Present, Not Present
Throttle	Analog, J 1587, J 1939
Engine Coolant Temperature	Analog, J 1939, J 1587

Seek help from your nearest Allison Transmission service outlet when any of the above items are present, but are not responding properly.

Another feature of the MD, HD and B Series transmission is its ability to adapt or "learn" as it operates. Each shift is measured electronically, stored and used by the ECU to adapt or "learn" the optimum conditions for future shifts.

NOTE: If the shift quality of low mileage vehicles, or vehicles with new or recalibrated ECU is unacceptable, follow the procedure in SIL 16-WT-96 to properly restore good shift quality.

NOTE: Allison WTEC III electronic control systems are designed and manufactured to comply with all FCC and other guidelines regarding radio frequency interference/electromagnetic interference (RFI/EMI) for transportation electronics. Manufacturers, assemblers, and installers of radio-telephone or other two-way communication radios have the sole responsibility to correctly install and integrate those devices into Allison MD, HD and B Series transmission-equipped vehicles to customer satisfaction.

The ECU is programmed to provide the most suitable operating characteristics for a specific application. This manual does not attempt to describe all of the possible combinations. The information contained herein describes only the operating characteristics most frequently requested by vehicle manufacturers.

5-1.2.1 Torque Converter

The torque converter consists of the following three elements:

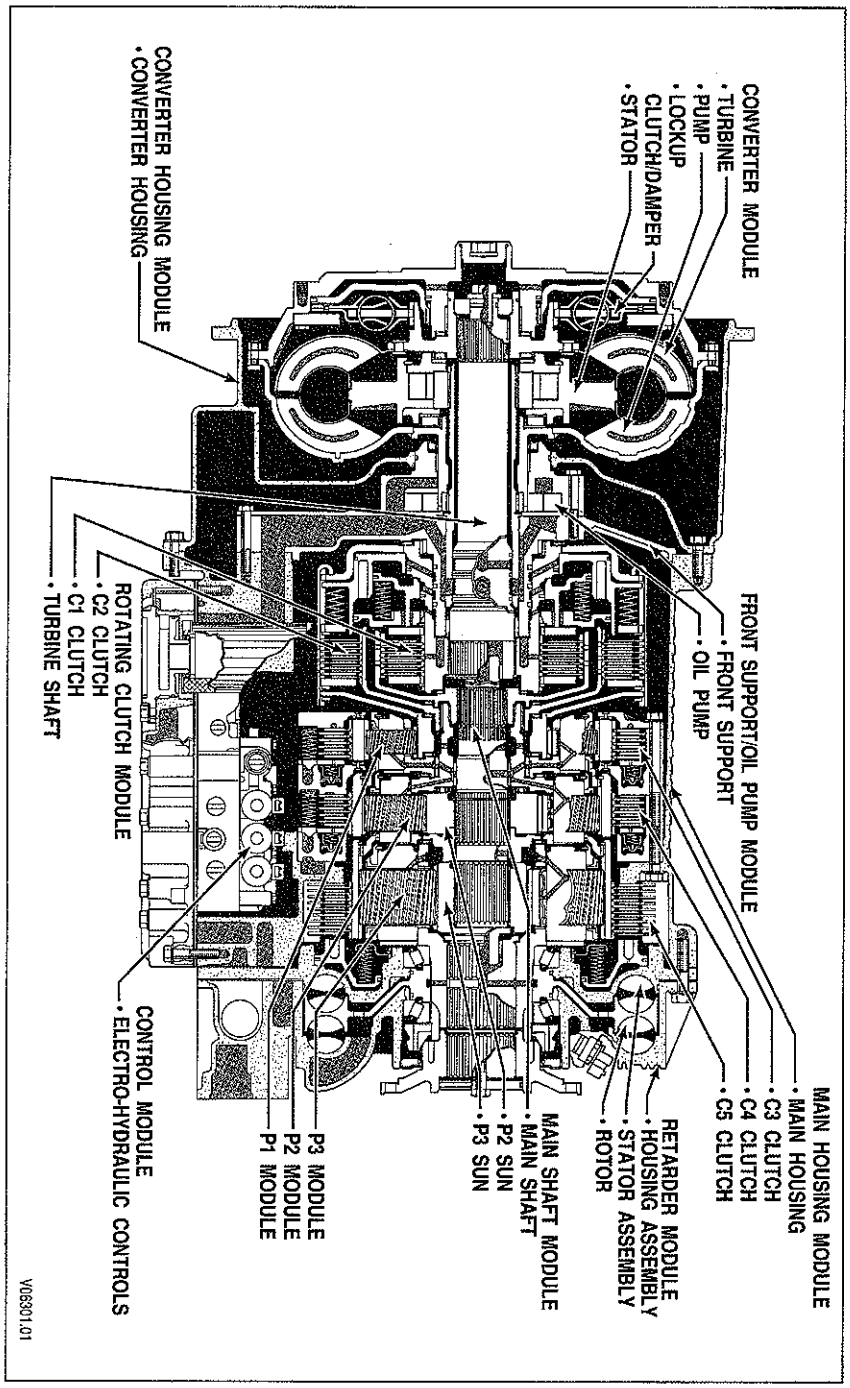
- Pump - input element driven directly by the engine.
- Turbine - output element hydraulically driven by the pump.
- Stator - reaction (torque multiplying) element.

The torque converter acts as a torque multiplier or fluid coupling. Torque multiplication occurs when the pump turns faster than the turbine. Torque multiplication decreases and stops as the turbine approaches the speed of the pump and the stator begins to rotate with the pump and turbine. The torque converter now functions as a fluid coupling.

The lockup clutch is located inside the torque converter and consists of the following three elements:

- Piston - driven by the engine
- Backplate - driven by the engine
- Clutch plate/torsional damper - located between the piston and backplate and splined to the converter turbine.

The lockup clutch/torsional damper is engaged and released in response to electronic signals from the ECU providing a direct drive from the engine to the transmission gearing. This eliminates converter slippage and provides maximum fuel economy and vehicle speed. The lockup clutch releases at low speeds or when the ECU detects conditions requiring it to be released. The torsional damper absorbs engine torsional vibration to prevent transfer through the power train.



Typical B 500R Transmission Cross Section

5-1.2.2 Planetary Gears and Clutches

A series of three helical planetary gear sets and shafts provides the mechanical gear ratios and direction of travel for the bus. The planetary gear sets are controlled by five multiplate clutches that work in pairs to produce six forward speeds and one reverse speed. The clutches are applied and released hydraulically in response to electronic signals from the ECU to the appropriate solenoids.

5-1.2.3 Cooler Circuit

Transmission fluid is cooled by an integral (transmission-mounted) or remote-mounted oil cooler. Connections to the cooling circuit are located at the front or rear of the transmission to facilitate installation of remote cooler lines. On shallow sump models, only rear ports are available. On retarder models, only rear cooler ports may be used. The integral cooler is located on the lower rear portion of the transmission, replacing the remote cooler manifold. Integral cooler oil ports are internal requiring only coolant to be routed to and from the cooler.

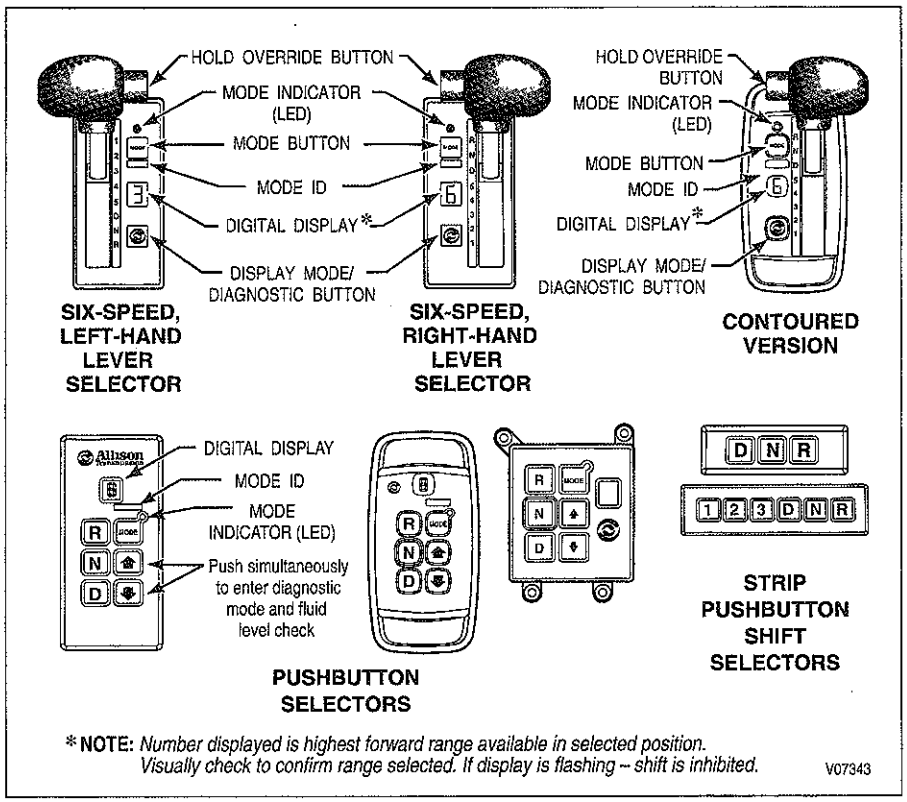
A new feature has been added on all retarder-equipped transmissions. Modification of the retarder housing allows the addition of either a remote or integral cooler for transmission sump fluid in addition to retarder out fluid. A cover is placed over the sump cooling ports when the provision is not used. The sump cooler ports are located on the lower right rear face of the retarder housing. These ports became available on the MD, B 300, B 400 Series in April, 2000, and on the HD and B 500 Series in July 2000.

5-1.2.4 Retarder

The self-contained retarder is at the output of the transmission and consists of a vaned rotor that rotates in a vaned cavity. The rotor is splined to and driven by the output shaft. An external accumulator holds transmission fluid until the retarder is activated. When the retarder is activated, the fluid in the accumulator is pressurized by the vehicle air system and directed into the retarder cavity. The interaction of the fluid with the rotating and stationary vanes causes the retarder rotor speed, and hence the output shaft to decrease and slow the vehicle or to limit speed on a downhill grade.

When the retarder is deactivated, the retarder cavity is evacuated and the accumulator is recharged with fluid.

5-1.3 Shift Selectors



Typical WTEC III Shift Selectors

5-1.3.1 Pushbutton Shift Selector (Full-Function, Non Strip-Type)

The push-button shift selector has **R, N, D,** ↓, ↑, a **MODE** button, and a digital display.

R Pushbutton - Press this button to select Reverse.
N Pushbutton - Press this button to select Neutral.
D Pushbutton - Press this button to select Drive. The highest forward range available will appear in the digital display window. The transmission will start out in the lowest available forward range and advance automatically to the highest range.
↑,↓ (Arrow) Buttons - When a lower range is desired, after D (Drive) has been pressed, press the ↓ (Down) arrow button until the desired range is shown in the display window. Likewise, if the transmission is held in a low range by the ↓ (Down) arrow, press the ↑ (Up) arrow to request the next higher range. Continuous pressing of either the ↑ (Up) or ↓ (Down) arrow buttons will request the highest or lowest range available.

Access fluid level data and diagnostic codes with the pushbutton selector by press the ↑ (Up) and ↓ (Down) arrow buttons at the same time. Refer to the section Fluid Level Check Using the Pushbutton Lever Shift Selector, for further information.

NOTE: Fluid level information is displayed (if an optional oil level sensor is present) after the first simultaneous press. Press both buttons again to obtain diagnostic data.

MODE Button - The MODE button may allow the driver to enable a secondary shift schedule or other special function that has been previously programmed into the electronic control unit at the request of the OEM. The name of the special function (ECONOMY) should appear on the MODE ID label adjacent to the MODE button. Press the MODE button activates the ECONOMY shift schedule and illuminates the MODE INDICATOR (LED). Other special functions which may be activated by the

MODE button are D1 selection or PTO enable. The MODe button is also used to view diagnostic code information. After viewing the first diagnostic code which appears in the digital display, press the MODE button to view the 2nd diagnostic code logged. Repeat this procedure to view the 3rd, 4th, and 5th code positions. The code displayed is active when the MODE INDICATOR (LED) is illuminated.

NOTE: Visually check the digital display whenever a new button is pushed to be sure that the range selected is shown (i.e. if the N (Neutral) button is pressed, N should appear in the digital display).

Digital Display - During normal operation, when D (Drive) is selected, the digital display shows the highest forward range attainable for the shift schedule in use. Abnormal operation is also indicated by the digital display. When all segments of the digital display are illuminated for more than 12 seconds, the ECU did not complete initialization.

When the digital display is blank, there is no power to the selector. When the display shows a "ᓚ" (cateye), a selector-related fault code has been logged.

Conditions which illuminate the CHECK TRANS light will disable the shift selector and the digital display will show the range actually attained. See Check Trans Light section later in manual for more information.

The transmission will not shift into range if a CHECK TRANS code is active. When the display shows either R or D has been requested and the display is flashing, the requested range has not been achieved due to an inhibit function.

Some inhibit functions are vehicle-related and will not result in diagnostic codes. Some examples are mentioned in the Range Selection section which follows. Check for active codes if no other inhibit function has been located. Once D (Drive) is attained, the transmission will shift into the lowest range programmed for the D (Drive) position, usually first.

Display Mode/Diagnostic Button - Allows access to optional fluid check information and diagnostic code information. Press the display mode/diagnostic button once to obtain transmission fluid level information (when an oil level sensor is present) and a second time to obtain diagnostic code information.

▲WARNING: If you leave the vehicle and the engine is running, the vehicle can move suddenly and you or others could be injured. If you must leave the engine running, do not leave the vehicle until you have completed all of the following procedures:

- **Put the transmission in N (Neutral)**
- **Ensure that the engine is at low idle (500-800 rpm)**
- **Apply the parking brake and emergency brakes and make sure they are properly engaged**
- **Chock the wheels and take any other steps necessary to keep the vehicle from moving.**

▲WARNING: R (Reverse) may not be obtained due to an active inhibitor. Always apply the service brakes when selecting R (Reverse) to prevent unexpected vehicle movement and because a service brake inhibit may be present. When the "R" is flashing, it indicates that the shift to R (Reverse) is inhibited. Check for active diagnostic codes if R (Reverse) is not obtained. See Downshift and Direction Change Inhibitor Feature later in the manual.

CAUTION: Do not idle in R (Reverse) for more than five minutes. Extended idling in R (Reverse) may cause transmission overheating and damage. Always select N (Neutral) whenever time at idle exceeds five minutes.

NOTE: Visually check the digital display window whenever a button is pushed or the lever is moved to be sure the range selected is shown (i.e. if the N (Neutral) button is pressed, N should appear in the digital display). A flashing display indicates that the range selected was not attained due to an active inhibit.

NOTE: Completely stop the vehicle and let the engine return to idle before shifting from a foreward range to Reverse or from Reverse to a forward range. The digital display will display R when Reverse is selected.

▲WARNING: When starting the engine, make sure the service brakes are applied. Failure to apply the service brakes may result in unexpected vehicle movement.

▲WARNING: Vehicle service brakes, parking brake, or emergency brake must be applied whenever N (Neutral) is selected to prevent unexpected vehicle movement. Selecting N (Neutral) does not apply vehicle brakes, unless an auxiliary system to apply the parking brake is installed.

▲WARNING: If you let the vehicle coast in N (Neutral), there is not engine braking and you could lose control. Coasting can also cause severe transmission damage. To help avoid injury and property damage, do not allow the vehicle to coast in N (Neutral).

Use N (Neutral) when you start the engine, to check vehicle accessories, and for extended periods of engine idle operation (longer than five minutes). For vehicles equipped with the pushbutton selector, Neutral is selected by the ECU at startup. The digital display will show N when Neutral is selected. Always select N (Neutral) before turning off the vehicle engine.

▲WARNING: D (Drive) may not be obtained due to an active inhibitor. Always apply the service brakes when selecting D (Drive) to prevent unexpected vehicle movement and because a service brake inhibit may be present. When the "D" is flashing, it indicates that the shift to D (Drive) is inhibited. Check for active diagnostic codes if D (Drive) is not obtained. See Downshift and Direction Change Inhibitor Feature later in the manual.

⚠CAUTION: Do not idle in D (Drive) for more than five minutes. Extended idling in D (Drive) may cause transmission overheating and damage. Always select N (Neutral) if time at idle is longer than five minutes.

NOTE: Turn off the vehicle HIGH IDLE switch, if present, before shifting from N (Neutral) to D (Drive) or R (Reverse). D (Drive) or R (Reverse) will not be attained unless the shift is made with the engine at idle. Also, be aware of other interlocks that would prevent obtaining D (Drive) or R (Reverse). Examples are "wheelchair lift not stored" and "service brakes not applied" (service brake interlock present).

The transmission will initially attain first range when D (Drive) is selected (except for those units programmed to start in second range). As vehicle speed increases, the transmission will upshift automatically through each range. As the vehicle slows, the transmission will downshift automatically through each range. The digital display will show the highest range available in D (Drive).

5-1.3.2 Upshifting and Downshifting

Occasionally, road conditions, load, or traffic conditions will make it desirable to restrict the automatic shifting to a lower gear. For example, progressively lower gears provide progressively greater engine braking effect when on long downhill grades.

Upshift (up arrow) and Downshift (down arrow) buttons enable the operator to restrict the automatic shifting range of the transmission to the next higher or lower gear, respectively. For example, after starting normally, with the transmission in Drive (D), the display panel indicates 6 as the highest gear which the transmission will automatically shift to. Pressing the down arrow once will cause the 6 to change to a 5, and the transmission will not automatically upshift beyond 5th gear. When the upshift/downshift arrows are used, the display panel indicates the current highest gear to which the

transmission will automatically shift. For downhill operation, however, the transmission may upshift above the highest selected gear when the engine governed speed is exceeded and damaging engine over-speed is a possibility.

1st Gear. Use first gear when pulling through mud or deep snow, when maneuvering in tight spaces, or while driving up or down steep grades. First gear provides the vehicle with its maximum driving power and maximum engine braking power.

5-1.3.3 Downshift/Reverse Inhibitor Feature

Although there is no limitation on up-shifting, there is on downshifting and on shifts from Neutral into Drive or Neutral into Reverse. If such a shift is selected when the engine speed or throttle position is too high, the ECU will prevent the shift from occurring until a lower engine speed is reached. If idle speed is too high, shifts to Drive or Reverse may be inhibited. A continuous "beep" tone is emitted when the Inhibitor feature is activated by improper shifts.

5-1.3.4 Shift Modes

The times at which the automatic transmission shifts gears are determined by engine speed (RPM) and load conditions. The Mode button of the transmission control panel allows the operator to alter the shifting behavior somewhat toward favoring earlier or later gear shifts relative to engine speed. Two shifting modes are standard: Performance and Economy. The initial mode at startup is Performance Mode. Pressing the Mode button switches the transmission to Economy Mode, which can result in greater average fuel economy, for example, on routes where roads are relatively flat rather than hilly.

A Check Transmission warning light is in the driver's instrument panel. Any conditions resulting in the Check Transmission light will disable the transmission control pad and no tones will be heard.

5-1.4 Driving Tips

5-1.4.1 Check Trans Light

The electronic control system is programmed to inform the operator of a problem with the transmission system and automatically take action to protect the operator, vehicle and transmission. When the Electronic Control Unit (ECU) detects a problem condition, the ECU restricts shifting, turns on the CHECK TRANS light on the instrument panel, and registers a diagnostic code.

NOTE: For some problems, diagnostic codes may be registered without the ECU activating the CHECK TRANS light. Your Allison Transmission authorized service outlet should be consulted whenever there is a transmission-related concern. They have the equipment to check for diagnostic codes and to correct problems which arise.

Each time the engine is started, the CHECK TRANS light will illuminate, then turn off after a few seconds. This momentary lighting is to show that the status light circuits are working properly. If the CHECK TRANS light does not illuminate during ignition, or if the light remains on after ignition, the system should be checked immediately.

Continued illumination of the CHECK TRANS light during vehicle operation (other than start-up) indicates that the ECU has signaled a diagnostic code. Illumination of the CHECK TRANS light is accompanied by a flashing display from the shift selector. The shift selector display will show the actual range attained and the transmission will not respond to shift selector requests.

The indications from the shift selector are provided to inform the operator that the transmission is not performing as designed and is operating with reduced capabilities. Before turning the ignition off, the transmission may be operated for a short time in the selected

range in order to "limp home" for service assistance. Service should be performed immediately in order to minimize the potential for damage to the transmission.

When the CHECK TRANS light comes on and the ignition switch is turned off, the transmission will remain in N (Neutral) until the condition causing the CHECK TRANS light is corrected.

Generally, while the CHECK TRANS light is on, upshifts and downshifts will be restricted and direction changes will not occur. Lever and pushbutton shift selectors do not respond to any operator shift requests while the CHECK TRANS light is illuminated. The lockup clutch is disengaged when transmission shifting is restricted or during any critical transmission malfunction.

5-1.4.2 Diagnostic Codes

Diagnostic codes are numerical indications relating to a malfunction in transmission operation. Each code consists of a two-digit main code and a two-digit subcode. These codes are logged in a list in the ECU memory with the most severe or otherwise most recent code listed first. A maximum of five codes (numbered d1-d5) may be listed in memory at one time. As codes are added, the oldest nonactive code is dropped from the list. If all codes are active, the code with the lowest priority that is not included on the severity list is dropped from the list. Access to the diagnostic codes and code information is through the pushbutton and lever shift selectors, the Pro-Link® Diagnostic Data Reader, or ATDT™.

The ECU separately stores the active and historical (nonactive) codes. An active code is any code that is current in the ECU decision-making process. Historical codes are codes that are retained in the ECU's memory and will not necessarily affect the ECU decision-making process. Historical codes are useful in determining if a problem is isolated, is intermittent, or results from a previous malfunction.

When the diagnostic mode is entered, the first code (position d1) is displayed as follows (each display item lasts for about one second): d,1, main code (two digits displayed one-at-a-time), subcode (two digits displayed one-at-a-time), sequence repeats. Press the MODE button momentarily to display codes for position d2-d5 in the same manner. After a fixed number of ignition cycles, a code may be deleted from memory if it has not recurred. The shift selector diagnostic mode will end automatically after two minutes without operator input.

5-1.4.3 Diagnostic Code Display Procedure

Diagnostic codes can be read and cleared by two methods:

- With the ATDT™ or Pro-Link® 9000 Diagnostic Data Reader. The use of the ATDT™ or Pro-Link® 9000 diagnostic tool is described in the instruction manual furnished with each tool.
- With the pushbutton or lever shift selector

Pushbutton Shift Selector

To Begin the Diagnostic Process:

- Bring the vehicle to a stop at a safe location.
- Apply the parking brake

To Display Stored Codes:

- Simultaneously press the ↑ (Up) and ↓ (Down) arrow buttons once to access the diagnostic display mode - press the buttons twice if a transmission oil level sensor is installed.
- Observe the digital display for codes (codes will appear one digit at a time)
- Press the MODE button to see the next code - repeat for subsequent codes.

NOTE: Be sure to record all codes displayed before they are cleared. This is essential for troubleshooting.

To Clear Active Indicators and Resume Vehicle Operation:

- Press and hold the MODE button for approximately three seconds until the mode indicator (LED) flashes. Release the MODE button and active indicators such as the CHECK TRANS light will not be illuminated. Some codes are self-clearing and others require ignition cycles to clear.

5-1.4.4 Accelerator Control

▲WARNING: To help avoid injury or property damage caused by sudden movement of the vehicle, do not make shifts from N (Neutral) to D (Drive) or R (Reverse) when the throttle pedal is depressed. If you shift while the throttle is depressed too far, the transmission will only engage if the throttle pedal is released in the next three seconds. This may cause a sudden movement of the vehicle. Leaving the throttle pedal depressed longer than three seconds causes the transmission to remain in N (Neutral). Avoid this condition by making shifts from N (Neutral) to D (Drive) or R (Reverse) only when the throttle is closed.

The position of the accelerator pedal influences the timing at which automatic shifting occurs. When the pedal is fully depressed, upshifts will occur automatically at high engine speeds. A partially depressed position of the pedal will cause the upshifts to occur at lower engine speeds. An electronic throttle position signal tells the ECU how much the operator has depressed the pedal. Excessive throttle position affects directional change shifts (shifts from N (Neutral) to D (Drive) or R (Reverse).)

5-1.4.5 Downshift and Direction Change Inhibitor Feature

NOTE: Turn off the vehicle HIGH IDLE switch, if present, before shifting from N (Neutral) to D (Drive) or R (Reverse). The shift from N (Neutral) to D (Drive) or R (Reverse) is inhibited when engine speed is above idle.

There is no speed limitation on upshifting, but there is on downshifting and for shifts which cause a direction change such as D (Drive) to R (Reverse) or R (Reverse) to D (Drive).

Manual range downshifts will not occur until a programmed value of output speed is reached. When a range downshift is manually selected and the transmission output speed is above the programmed value of the selected range, the transmission will stay in the range it was in even though a lower range was requested. Apply the vehicle service brakes or a retarding device to reduce the transmission output speed to the programmed value so the shift to the lower range will occur.

Directional shifts, D (Drive) to R (Reverse) or R (Reverse) to D (Drive), will not occur if selected when throttle position, engine speed, or transmission output speed is above the calibration limit for a calibration time period. The current calibration time period for engine speed is 0.5 second and for throttle position and output speed is three seconds.

Shifts from N (Neutral) to D (Drive) or R (Reverse) are also inhibited when the ECU has been programmed (by input/output function) to detect that auxiliary equipment is in operation and the shift should not be allowed.

When a directional shift is inhibited, the ECU will put the transmission in N (Neutral). The digital display, if present, will flash the letter of the range selected (D or R). Reselect D (Drive) or R (Reverse) when engine throttle, engine speed, and transmission output speed are below

the calibration value. With a pushbutton selector, just depress the desired pushbutton again. With a lever selector, move the lever to N (Neutral) and then to the desired range.

When a direction change shift is requested and the engine throttle, engine speed, and transmission output speed drop below the calibration value during the calibration time interval, the shift to D (Drive) or R (Reverse) will occur. For example, if the transmission output speed was just above the calibration limit when R (Reverse) was selected, but dropped below the limit during the next three seconds, the shift to R (Reverse) would occur (assuming the engine was at idle and throttle was closed).

5-1.4.6 Using the Engine to Slow the Vehicle

▲WARNING: If you just downshift or just use service brakes when going downhill, you can lose control and cause injury and property damage. To help avoid loss of control, use a combination of downshifting, braking, and other retarding devices. Downshifting to a lower transmission range increases engine braking and helps you to maintain control.

The transmission has a feature to prevent automatic upshifting above the lower range selected. However, during downhill operation, if engine governed speed is exceeded in the lower range, the transmission may upshift to the next higher range. This will reduce braking and could cause a loss of control. Apply the vehicle brakes or other retarding device to prevent exceeding engine governed speed in the lower range selected.

To use the engine as a braking force, select the next lower range. If the vehicle is exceeding the maximum speed for this range, use the service brakes and/or retarder to slow the vehicle. When a lower speed is reached, the ECU will automatically downshift the transmission.

Engine braking provides good speed control for going down grades. When the vehicle is heavily loaded, or the grade is steep, it may be desirable to preselect a lower range before reaching the grade. If engine-governed speed is exceeded, the transmission will upshift automatically to the next range.

5-1.4.7 Cold Weather Starts

All MD, HD and B Series transmissions are programmed to restrict full operation until specific temperatures are reached. Refer to the following chart for temperature restrictions.

Sump Oil Temperature	CHECK TRANS Light	Operation
-32°C (-25°F) to -7°C (19°F)*	OFF	Neutral, Reverse, Second
-7°C (19°F)*	OFF	Full operation in all ranges

***NOTE: When sump temperature is below 10°C (50°F), and transmission fluid is C-4 (not DEXRON® or TransSynd™), follow this procedure when making directional change shifts:**

- **To shift from forward to reverse; select N (Neutral) and then R (Reverse).**
- **To shift from reverse to forward; select N (Neutral) and then D (Drive), or other forward range.**

Failure to follow this procedure may cause illumination of the CHECK TRANS light and then transmission operation will be restricted to N (Neutral).

Transmission operation at cold ambient temperatures may require preheating or the use of a lower viscosity transmission fluid. Refer to RECOMMENDED AUTOMATIC TRANSMISSION FLUID AND VISCOSITY GRADE section later in this manual.

5-1.4.8 Driving on Snow or Ice

▲WARNING: Using the retarder on wet or slippery roads may cause loss of traction on the drive wheels - your vehicle may slide out of control. To help avoid injury or property damage, turn the retarder enable to OFF when driving on wet or slippery roads.

NOTE: The retarder is automatically disabled whenever the vehicle's ABS (antilock brake system) is active. However, in case the ABS system malfunctions, it is recommended that the retarder enable switch, if present is disabled.

If possible, reduce the vehicle speed and select a lower range before traction is lost. Select the range that will not exceed the speed you expect to maintain.

Accelerate or decelerate very gradually to prevent loss of traction. It is very important to reduce speed gradually when a lower range is selected. It is important that you reach the lower range selected before attempting to accelerate. This will avoid an unexpected downshift during acceleration.

5-1.4.9 High Fluid Temperature

The transmission is considered to be overheated when any of the following temperatures are exceeded.

Sump fluid	121°C (250°F)
Fluid to cooler	149°C (300°F)
Retarder out fluid	165°C (330°F)

If the sump fluid temperature reaches 128°C (262°F) the ECU will inhibit operation in the higher ranges ("EMERGENCY" vehicles are not affected).

If the transmission overheats during normal operations, check the fluid level in the transmission. (Refer to the Fluid Check Procedures as described in the Care and Maintenance Section of the manual.)

If the engine temperature gauge indicates a high temperature, the transmission is probably overheated. Stop the vehicle and check the cooling system. If it appears to be functioning properly, run the engine at 1200-1500 rpm with the transmission in N (Neutral). This should reduce the transmission and engine temperatures to normal operating levels in 2 or 3 minutes. If temperatures do not decrease, reduce the engine rpm.

⚠ CAUTION: The engine should never be operated for more than 30 seconds at full throttle with the transmission in range and the output stalled. Prolonged operation of this type will cause the transmission fluid temperature to become excessively high and will result in severe overheat damage to the transmission.

If the engine temperature indicates a high temperature, an engine or radiator problem is indicated. If high temperature in either the engine or transmission persists, stop the engine and have the overheating condition investigated by maintenance personnel.

5-1.4.10 Parking Brake

▲WARNING: Take the following precautions so that unexpected, possible sudden vehicle movement is avoided. Whenever it becomes necessary to leave the vehicle, even momentarily, while the engine is in operation, place the transmission shift

selector in N (Neutral) (or for special pumping operations, disconnect drive to the wheels), set the parking brake and/or emergency brakes, and chock the wheels.

The parking brake is only intended to secure an unattended vehicle with the engine ignition OFF. Always maintain the vehicle parking brake system according to the manufacturer's specifications. The parking brake may not have sufficient capacity to restrain a vehicle with the engine running and the transmission in a forward or reverse range. As indicated in the above WARNING when the vehicle is unattended and the engine is in operation, the transmission must be in N (Neutral) (or for special pumping operations, drive to the wheels disconnected) with the brakes fully applied and the wheels chocked.

5-1.4.11 Towing or Pushing

CAUTION: Failure to lift the driving wheels off the road, disconnect the driveline, or remove the axle shafts before pushing or towing can cause serious transmission damage.

The engine cannot be started by pushing or towing. Before pushing or towing do one of the following:

- Disconnect the driveline
- Lift the drive wheels off the road
- Remove the axle shafts from the drive wheels.

Be sure to cover the wheel openings to prevent loss of lubricant and entry of dust and dirt if the axle shafts are removed. An auxiliary air supply will usually be required to actuate the vehicle brake system.

5-1.4.12 Cruise Control Operation

Operating an Allison WTEC III equipped vehicle on cruise control may cause the transmission to shift cycle if the cruise control is set close to a scheduled shift point. One of the following actions may eliminate shift cycling:

- Select a different shift schedule by pushing the MODE button on the shift selector.
- Select a lower range by pushing the ↓ (Down) arrow or moving the lever on the shift selector.
- Change the cruise control speed setting away from the shift point.

The engine brake on some vehicles equipped with an Allison WTEC III transmission may be controlled by the transmission ECU. With this configuration, the transmission will automatically select a lower range when the engine brake is applied or the throttle is near idle position.

Operating a vehicle in cruise control with engine brake turned-on, controlled by the transmission ECU, may cause unwanted application of the engine brake when the cruise control decelerates for downhill grades. Operator may choose to turn off cruise control to eliminate unwanted condition.

5-1.4.13 Turning Off the Vehicle

Be sure to always select N (Neutral) prior to turning off the vehicle engine.

5-1.5 Power Takeoff Operation

5-1.5.1 Engine-Driven Power Takeoff (PTO)

CAUTION: Do not exceed the engagement and operational speed limits imposed on the driven equipment during the operation of the PTO.

If a PTO is present, it will normally be mounted on either the left or right side of MD, B 300, and B 400 models. There is also an option to have the PTO mounted on the left side or top of the transmission. On HD and B 500 models, the PTO will be located on the left side or on the top of the transmission. The PTO drive gear is engine-driven and therefore provides direct engine power. The PTO can be operated when the vehicle is either moving or stopped.

The PTO gear is in constant mesh with the drive gear in the converter housing. However, the PTO may either be constant drive (output always powered) or clutched drive. When the PTO is clutch driven, the clutch is part of the PTO not the transmission. A clutch drive PTO is powered only when the PTO clutch is engaged.

Be sure that the limits for PTO engagement speed and operational speed are not exceeded. Consult the vehicle manufacturer's literature for these speed limits. Also, all MD, HD, and B-equipped vehicles with PTO enable have engagement and operational speed limits programmed into the ECU to help protect PTO equipment. Some speed limits have default values which are programmed out of the operating range and will need to be set for your particular PTO duty cycle. Consult your vehicle manufacturer to see if your transmission has been programmed and what operational limits have been established.

When the programmed engagement speed is exceeded, the PTO will not engage. The PTO engagement must be retired after the speed has been reduced. When operational speeds (either engine or transmission output) are exceeded, the PTO will deactivate and the PTO engagement process must be repeated.

5-1.6 Care and Maintenance

5-1.6.1 Periodic Inspections

The Allison MD, HD and B Series transmissions require minimum maintenance. Careful attention to the fluid level and the connections for the electronic and hydraulic circuits is most important.

Do the following periodic inspection:

- Keep the transmission clean for easier inspection.
- Make periodic checks for loose bolts and fluid leaks around fittings, lines, and transmission openings.
- Check the condition of the electrical wiring harnesses regularly.
- Check the engine cooling system occasionally for evidence of transmission fluid that would indicate a faulty oil cooler.
- Report any abnormal condition to your maintenance personnel.

5-1.6.2 Prevent Major Problems

Help the WTEC III control system oversee the operation of the transmission. Minor problems can be kept from becoming major problems if you notify an Allison Transmission distributor or dealer when one of these conditions occur:

- Shifting feels odd
- Transmission leaks fluid
- Unusual transmission-related sounds

NOTE: Changes in sound caused by normal engine thermostatic fan cycling, while climbing a long grade with a heavy load, may be mistaken for transmission-related sounds.

- CHECK TRANS light comes on frequently.

5-1.6.3 Importance of Proper Fluid Level

It is important that proper fluid level be maintained at all times because the transmission fluid cools, lubricates, and transmits hydraulic power. If the fluid level is too low, the converter and clutches do not receive an adequate supply of fluid. If fluid level is too high, the fluid can aerate. Aerated fluid can cause the transmission to shift erractically or overheat.

The MD, HD and B Series transmissions have an optional oil level (OLS) sensor that allows the operator to obtain an indication of fluid level from the shift selector. However, no oil level sensor diagnostics take place unless the OLS is "autodetected" by the WTEC III control system. Frequently check for the presence of oil level diagnostics if the transmission is known to contain an OLS. If an OLS is not detected during a fixed number of starts, the WTEC III system concludes that no OLS is present. If an OLS is known to be present, but has not been detected, then troubleshooting of the OLS circuit is required. After the OLS circuit is repaired, reset "autodetect" or manually select the OLS function using the ATDT™ or Pro-Link®.

NOTE: To correctly check the transmission fluid level using the dipstick, the transmission fluid must be at operating temperature. The oil level sensor method of checking the fluid level compensates for transmission fluid temperature between 60°C-104°C (140°F-220°F). Any temperature below 60°C (140°F) or above 104°C (220°F) will result in an* INVALID FOR DISPLAY *condition.

5-1.6.4 Fluid Level Check Using the Pushbutton or Lever Shift Selector

The transmission must be equipped with the optional oil level sensor to be able to read fluid level information.

NOTE: The pushbutton and lever selectors can display one character at one time.

- Park the vehicle on a level surface, shift to N (Neutral), and apply the parking brake.
- **Pushbutton shift selector** - If equipped with an oil level sensor, simultaneously press the ↑ (Up) and ↓ (Down) arrow buttons.
- **Lever shift selector** - If equipped with an oil level sensor, press the display mode button one time.

NOTE: The fluid level check may be delayed until the following conditions are met:

- The fluid temperature is above 60°C (140°F) and below 104°C (220°F).
- The transmission is in N (Neutral)
- The engine is at idle.
- The transmission output shaft is stopped. (The vehicle has been stationary for approximately two minutes to allow the fluid to settle.)

The indication of a delayed fluid level check is a "-" in the display window followed by a numerical countdown display. The countdown, starting at 8, indicates the time remaining in the two minute setting period.

- **Correct Fluid Level** - "o,L" is displayed ("o,L" represents "Fluid (Oil) Level Check Mode"), followed by "o,K," The "o,K" display indicates the fluid is within the correct fluid level zone. The sensor display and the transmission dipstick may not agree exactly because the oil level sensor compensates for fluid temperature.

NOTE: Fluid level diagnostic displays occur one character at a time.

- **Low Fluid Level** - "o,L" is displayed ("o,L" represents "Fluid (Oil) Level Check Mode"), followed by "Lo" ("Lo" represents "Low Oil Level") and the number of quarts the transmission fluid is low. Example: "2" indicates 2 additional quarts of fluid will bring the fluid level within the middle of the "oK" zone.
- **High Fluid Level** - "o,L" is displayed ("o,L" represents "Fluid (Oil) Level Check Mode"), followed by "HI" ("HI" represents "High Oil Level") and the number of quarts

the transmission is overfilled. Example: "1" indicates 1 quart of fluid above the full transmission level.

- **Invalid for Display** - "o,L" is displayed ("o,L" represents "Fluid (Oil) Level Check Mode"), followed by "-" and a numerical display. The numerical display is a fault code and indicates conditions are not proper to receive the fluid level information, or that there is a system malfunction. The fault codes that may be encountered are shown in Table 2 below.

Display	Cause of Code
o,L, -, 0,X	Setting time too short
o,L, -, 5,0	Engine speed (rpm) too low
o,L -, 5,9	Engine speed (rpm) too high
o,L -, 6,5	Neutral must be selected
o,L, -, 7,0	Sump fluid temperature too low
o,L, -, 7,9	Sump fluid temperature too high
o,L, -, 8,9	Output shaft rotation
o,L, -, 9,5	Sensor failure*
*Report sensor failure display to a distributor or dealer in your area (check the telephone directory for an Allison Transmission distributor or dealer nearest you).	

Table 2 - Oil Level Fault Codes

CAUTION: Low or high fluid level can cause overheating and irregular shift patterns. These conditions can damage the transmission if not corrected.

NOTE: To exit the fluid level display mode, press any range button on the pushbutton shift selector, or press the display mode (diagnostic) button twice on the lever shift selector.

5-1.6.5 Fluid Level Check Using the Strip Pushbutton Shift Selector

The transmission must be equipped with the optional oil level sensor to be able to read fluid level information.

NOTE: The strip pushbutton selector has no display capability. Fluid level information can only be obtained by using the ATDT™ or Pro-Link® 9000.

Park the vehicle on a level surface and shift to N (Neutral). Apply the parking brake and/or emergency brakes.
Obtain oil level information by following the procedure in the ATDT™ User Guide, GN3433EN, or Pro-Link® 9000 manual or by using the OEM-supplied auxiliary display. Fluid level information may be delayed when certain conditions are not met. The ATDT™ or Pro-Link® 9000 will display a message showing which conditions have not been met. These conditions are:

- Settling time too short
- Engine speed (rpm) too low
- Engine speed (rpm) too high
- N (Neutral) must be selected
- Sump fluid temperature too low (below 60°C or 140°F)
- Sump fluid temperature too high (above 104°C or 220°F)
- Output shaft rotation

5-1.6.6 Manual Fluid Check Procedure

▲WARNING: If you leave the vehicle and the engine is running, the vehicle can move suddenly and you or others could be injured. If you must leave the engine running, do not leave the vehicle until you have completed all of the following procedures:

- **Put the transmission in N (Neutral)**
- **Ensure that the engine is at low idle (500-800 rpm)**
- **Apply the parking brake and emergency brakes and make sure they are properly engaged**
- **Chock the wheels and take any other steps necessary to keep the vehicle from moving.**

Clean around the end of the fill tube before removing the dipstick. This will aid in preventing dirt or foreign matter from entering the hydraulic system, which can cause valves to stick, undue wear of transmission parts, or clogged passages. Check the fluid level by the following procedure and report any abnormal level to your maintenance personnel.

5-1.6.7 Cold Check

The Cold Check determines if the transmission has enough fluid to be operated safely until a Hot Check can be made.

CAUTION: DO NOT start the engine until the presence of sufficient transmission fluid has been confirmed. Remove the transmission fluid dipstick and be sure that the static fluid level is near the HOT FULL mark.

A cold check may be made when the fluid 16°-49°C (60°-120°F). Before the engine is started, pull the transmission dipstick and confirm that the transmission fluid level is near the HOT RUN mark.

To perform a COLD CHECK, do the following:

- Start the engine and run it at idle (500-800 rpm) in N (Neutral) for about one minute.
- Move the vehicle to a level surface, put transmission in N (Neutral), and set the parking brake.
- With the engine idling (500-800 rpm), shift to D (Drive) and then to R (Reverse) to clear air from the hydraulic circuits.
- Shift to N (Neutral) and leave engine at idle.
- Remove the dipstick and wipe clean. Reinsert the dipstick into the transmission.
- Remove the dipstick and check the fluid level. If the fluid on the dipstick is within the COLD RUN band, the level is satisfactory. If the fluid level is not within this band, add or drain fluid as necessary to bring the level within the COLD RUN band.
- Perform a Hot Check at the first opportunity after normal operating temperature (71°-93°C; 160°-200°F) is reached.

CAUTION: The transmission must not be operated for extended periods of time until a Hot Check has verified proper fluid level. Transmission damage can result from extended operation at improper fluid level conditions.

CAUTION: An accurate fluid level check cannot be made unless the engine is idling (500-800 rpm) in N (Neutral), the transmission fluid is at the proper temperature, and the vehicle is on a level surface.

5-1.6.8 Hot Check

The transmission fluid must be hot to ensure an accurate check because the fluid level rises as temperature increases.

To perform a HOT CHECK, do the following:

- Be sure fluid has reached normal operating temperature (71°-93°C; 160°-200°F). If a transmission temperature gauge is not present, check fluid level when the engine water temperature gauge has stabilized and the transmission has been operated under load for at least one hour.
- Park the vehicle on a level surface and shift to N (Neutral). Apply the parking brake and allow the engine to idle at 500-800 rpm.
- Remove the dipstick and wipe clean. Reinsert the dipstick into the transmission.
- Remove the dipstick and check the fluid level. The safe operating level is anywhere within the HOT RUN band on the dipstick.
- If the level is not within this band, add or drain fluid as necessary to bring the level within the HOT RUN band.
- Be sure fluid level checks are consistent. Check the fluid level more than once and if readings are not consistent, check to be sure that the transmission breather is clean and not clogged. If readings are still inconsistent, contact the nearest Allison distributor or dealer.

5-1.6.9 Recommended Automatic Transmission Fluid and Viscosity Grade

Hydraulic fluids (oils) used in the transmission are important influences on transmission performance, reliability, and durability. TranSynd™ and DEXRON® III fluids are recommended for all MD, HD, and B Series applications.

TranSynd™ is a full synthetic transmission fluid developed by Allison Transmission and Castrol Ltd. This fluid meets Allison specifications for Severe Duty and Extended Drain Intervals. TranSynd™ is fully qualified to the Allison TES 295 specifications and is available through Allison distributors and dealerships.

To ensure the fluid is qualified for use in Allison transmissions, check for the DEXRON® III license numbers on the container or consult the lubricant manufacturer. Consult your Allison Transmission dealer or distributor before using other fluid types.

CAUTION: Disregarding minimum fluid temperature limits can result in transmission malfunction or reduced transmission life.

When choosing the optimum viscosity grade of fluid, duty cycle, preheat capabilities, and/or geographical location must be taken into consideration. Table 3 lists the minimum fluid temperatures at which the transmission may be safely operated without preheating. Preheat with auxiliary heating equipment or by running the equipment or vehicle with the transmission in neutral for a minimum of 20 minutes before attempting range operation.

Viscosity Grade	Ambient Temperature Below Which Preheat Is Required	
	Celsius	Fahrenheit
SAE 0W-20* or TranSynd™	-30	-22
DEXRON® III	-27	-17
SAE 10W	-20	-4
SAE 15W-40	-15	5
SAE 30	0	32
SAE 40	10	50
* "Artic" as defined by MIL-L-46167B		

Table 3 - Minimum Operating Temperature for Transmission Fluid

5-1.6.10 Keeping Fluid Clean

CAUTION: Do not use containers or fillers for transmission fluid that have been used for any antifreeze solution. Antifreeze and coolant solutions contain ethylene glycol which, if introduced into the transmission, can cause the clutch plates to fail.

It is absolutely necessary that transmission fluid be clean. The fluid must be handled in clean containers to prevent foreign material from entering the transmission.

5-1.6.11 Fluid and Internal Filter Change Interval Recommendations

CAUTION: Transmission fluid and filter change frequency is determined by the severity of transmission service. More frequent changes may be necessary than recommended in the general guidelines when operating conditions create high levels of contamination or overheating.

Allison requires all MD, HD and B Series transmissions to have the main filter (not the lube filter or fluid) changed after the first 5,000 miles (8000 km) or 200 hours of operation, whichever comes first. Refer to SIL 10-TR-99, latest revision, for convention kit and fluid information. Refer to Mechanic's Tips (MT3004EN), latest version, for location of the main filter and the filter change procedure.

Table 4 is given only as a general guide for fluid and filter change intervals for MD 3000/B 300/B 400 Series transmissions.

Table 5 is given only as a general guide for fluid and filter change intervals for HD 4000/B 500 Series transmissions.

Schedule 1 - Recommended Fluid and Filter Change Intervals (Non-TranSynd™/Non-TES 295 Fluid)

SEVERE VOCATION				GENERAL VOCATION			
Fluid	Filter			Fluid	Filters		
	Main	Internal	Lube/Auxiliary		Main	Internal	Lube/Auxiliary
12,000 Miles (20 000 km) 6 Months 500 Hours	12,000 Miles (20 000 km) 6 Months 500 Hours	Overhaul	12,000 Miles (20 000 km) 6 Months 500 Hours	25,000 Miles (40 000 km) 12 Months 1000 Hours	25,000 Miles (40 000 km) 12 Months 1000 Hours	Overhaul	25,000 Miles (40 000 km) 12 Months 1000 Hours

NOTE: The following recommendations in Schedule 2 are based upon the transmission containing 100% of TranSynd™ fluid. MD/HD Product Line Filter change intervals in Schedule 2 are only valid with the use of Allison Transmission Gold series filters. Flushing Machines are not recommended or recognized due to variation and inconsistencies with ensuring removal of 100% of the used fluid.

Schedule 2 - Recommended Fluid and Filter Change Intervals (TranSynd™/TES 295 Fluid)							
75,000 Miles (120 000 km) 36 Months 3000 Hours	75,000 Miles (120 000 km) 36 Months 3000 Hours	Overhaul	75,000 Miles (120 000 km) 36 Months 3000 Hours	150,000 Miles (240 000 km) 48 Months 4000 Hours	75,000 Miles (120 000 km) 36 Months 3000 Hours	Overhaul	75,000 Miles (120 000 km) 36 Months 3000 Hours

Table 4 - Transmission Fluid and Filter Change for MD 3000/B 300/B 400

NOTE: *Change fluid/filters after recommended mileage, months, or hours have elapsed, whichever occurs first.*
Severe Vocation: *All Retarders, On/Off Highway, Refuse, Transit, and Intercity Coach with duty cycle greater than one (1) stop per mile.*
General Vocation: *Intercity Coach with duty cycle less than or equal to one (1) stop per mile and all other vocations.*

Local conditions, severity of operation or duty cycle may require more or less frequent fluid change intervals that differ from the published recommended fluid change intervals of Allison Transmission. Transmission protection and fluid change intervals can be optimized by the use of fluid analysis. Filters must be changed at or before recommended intervals.

Schedule 1 - Recommended Fluid and Filter Change Intervals (Non-TranSynd™/Non-TES 295 Fluid)

SEVERE VOCATION				GENERAL VOCATION			
Fluid	Filter			Fluid	Filters		
	Main	Internal	Lube/Auxiliary		Main	Internal	Lube/Auxiliary
12,000 Miles (20 000 km) 6 Months 500 Hours	12,000 Miles (20 000 km) 6 Months 500 Hours	Overhaul	12,000 Miles (20 000 km) 6 Months 500 Hours	25,000 Miles (40 000 km) 12 Months 1000 Hours	25,000 Miles (40 000 km) 12 Months 1000 Hours	Overhaul	25,000 Miles (40 000 km) 12 Months 1000 Hours

NOTE: The following recommendations in Schedule 2 are based upon the transmission containing 100% of TranSynd™ fluid. MD/HD Product Line Filter change intervals in Schedule 2 and 3 are only valid with the use of Allison Transmission Gold series filters. Flushing Machines are not recommended or recognized due to variation and inconsistencies with ensuring removal of 100% of the used fluid.

4 Inch Control Module (3.5 Inch Approximately) - Requires Filter Kit P/N 29540494							
Schedule 2 - Recommended Fluid and Filter Change Intervals (TranSynd™/TES 295 Fluid)							
75,000 Miles (120 000 km) 36 Months 3000 Hours	75,000 Miles (120 000 km) 36 Months 3000 Hours	Overhaul	75,000 Miles (120 000 km) 36 Months 3000 Hours	150,000 Miles (240 000 km) 48 Months 4000 Hours	75,000 Miles (120 000 km) 36 Months 3000 Hours	Overhaul	75,000 Miles (120 000 km) 36 Months 3000 Hours

Table 5 - Transmission Fluid and Filter Change for MD 4000/B 500 Series

Schedule 3 - Recommended Fluid and Filter Change Intervals (Non-TranSynd™/Non-TES 295 Fluid)

SEVERE VOCATION				GENERAL VOCATION			
Fluid	Filter			Fluid	Filters		
	Main	Internal	Lube/Auxiliary		Main	Internal	Lube/Auxiliary
50,000 Miles (80 000 km) 24 Months 2000 Hours	50,000 Miles (80 000 km) 24 Months 2000 Hours	Overhaul	50,000 Miles (80 000 km) 24 Months 2000 Hours	150,000 Miles (240 000 km) 48 Months 4000 Hours	50,000 Miles (80 000 km) 24 Months 2000 Hours	Overhaul	50,000 Miles (80 000 km) 24 Months 2000 Hours

Table 5 - Transmission Fluid and Filter Change for HD 4000/B 500 Series

NOTE: *Change fluid/filters after recommended mileage, months, or hours have elapsed, whichever occurs first.*
Severe Vocation: *All Retarders, On/Off Highway, Refuse, Transit, and Intercity Coach with duty cycle greater than one (1) stop per mile.*
General Vocation: *Intercity Coach with duty cycle less than or equal to one (1) stop per mile and all other vocations.*

Local conditions, severity of operation or duty cycle may require more or less frequent fluid change intervals that differ from the published recommended fluid change intervals of Allison Transmission. Transmission protection and fluid change intervals can be optimized by the use of fluid analysis. Filters must be changed at or before recommended intervals.

CAUTION: Transmission fluid and filters must be changed whenever there is evidence of dirt or a high temperature condition is indicated when the transmission fluid is discolored, has a strong odor or has exceeded oil analysis limits shown in Table 6.

Fluid Analysis. Transmission protection and fluid change intervals can be optimized by monitoring fluid oxidation according to the tests and limits shown in Table 6. Consult your local telephone directory for fluid analysis firms. To ensure consistent and accurate fluid analysis, use only one fluid analysis firm.

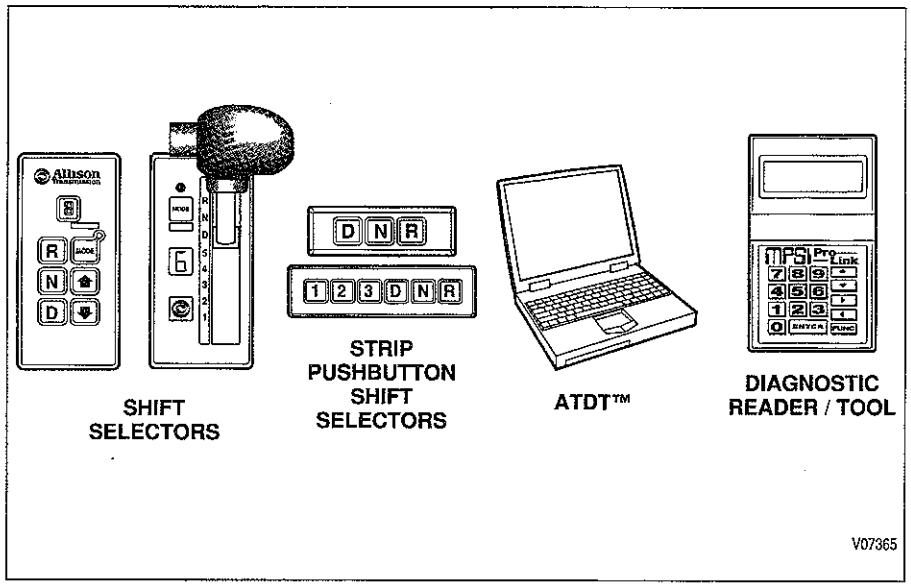
Test	Limit
Viscosity	25% change from new fluid
Total Acid Number	3.0* change from new fluid
Solids	2% by volume maximum
*mg of KOH to neutralize a g of fluid.	

Table 6 - Fluid Oxidation Measurement Limits

5-1.7 Diagnosis

5-1.7.1 Diagnostic Codes

Continued illumination of the CHECK TRANS light during vehicle operation (not start-up) indicates the ECU has signaled a diagnostic code. Poor performance may activate a code without illuminating the CHECK TRANS light. Up to five diagnostic codes can be recorded. Diagnostic codes can be read and cleared by two methods: by using the ATDT™ or Pro-Link® 9000 Diagnostic Tool or by using the shift selectors shown below. Use of the ATDT™ or Pro-Link® 9000 Diagnostic Tool is described in the instruction manual furnished with each tool. Code reading, clearing methods, and complete code descriptions are presented in the WTEC III Troubleshooting Manual, TS2979EN available online at: http://www.allisontransmission.com/publications/TS_listings.jsp .



Shift Selector/ATDT™/Pro-Link® 9000 Diagnostic Tool

5-1.8 Customer Service

5-1.8.1 Owner Assistance

The satisfaction and goodwill of the owners of Allison transmissions are of primary concern to Allison Transmission Division (ATD), its distributors, and their dealers.

As an owner of an Allison transmission, you have service locations throughout the world that are eager to meet your parts and service needs with:

- Expert service by trained personnel
- Emergency service 24 hours a day in many areas
- Complete parts support
- Sales teams to help determine your transmission requirements
- Product information and literature

Normally, any situation that arises in connection with the sale, operation, or service of your transmission will be handled by the distributor or dealer in your area (check the telephone directory for the Allison Transmission service outlet nearest you).

Refer to the Worldwide Sales and Service Directory (SA2229EN) for the current listings of Allison Transmission authorized distributors and service dealers. This directory is available from SGI, Inc. or go on the internet at: http://www.allisontransmission.com/locator/index.jsp

We recognize, however, that despite the best intentions of everyone concerned, misunderstandings may occur. To further assure your complete satisfaction, we have developed the following three-step procedure to be followed in the event a problem has not been handled satisfactorily.

Step One - Discuss the problem with a member of management from the distributorship or dealership. Frequently, complains are the result of a breakdown in communication and can quickly be resolved by a member of management. If you have already discussed the problem with the Sales or Service Manager, contact the General Manager.

All ATD dealers are associated with an ATD distributor. If the problem originates with a dealer, explain the matter to a management member of the dealership with whom the dealer has his service agreement. The dealer will provide his ATD distributor's name, address, and telephone number on request.

Step Two - When it appears the problem cannot be resolved readily at the distributor level without additional assistance, contact the Allison Transmission Regional Office responsible for the local distributor. You will be assisted by a member of the Regional Service Manager's staff, depending on the nature of your problem.

For prompt assistance, please have the following information available,

- Name and location of authorized distributor or dealer
- Type and make of equipment
- Transmission model number, serial number, and assembly number (if applicable). This data is available on the nameplate located on the right side of the transmission. Also provide the ECU calibration identification number (CIN) which is located elsewhere in the vehicle.
- Transmission delivery date and accumulated miles and/or hours of operation
- Nature of problem
- Chronological summary of unit's history

Step Three - If you contacted a regional office and you are still not satisfied, present the entire matter to the Home Office by writing to the following address or calling the phone number below:

Manager, Warranty Administration - PF9
Allison Transmission
P.O. Box 894
Indianapolis, IN 46206-0894
Phone: 1-800-524-2303

The inclusion of all pertinent information will assist the Home Office in expediting the matter. If an additional review by the Home Office of all the facts involved indicates that some further action can be taken, the Regional Office will be advised.

When contacting the Regional or Home Office, please keep in mind that ultimately the problem will likely be resolved at the distributorship or dealership utilizing their facilities, equipment, and personnel. Therefore, it is suggested the above steps be followed in sequence when experiencing a problem.

Your purchase of an Allison Transmission product is greatly appreciated, and it is our sincere desire to assure complete satisfaction.

To obtain a complete Owner's Guide from Allison go to the Allison website at:
http://www.allisontransmission.com/publications/pubs/OM2995EN.jsp

5-2 Transmission/Maintenance-Service

5-2.1 Periodic Inspection and Care

Clean and inspect the exterior of the transmission at regular intervals. Severity of service and operation conditions determine the frequency of these inspections. Inspect the transmission for:

- Loose bolts - transmission and mounting components
- Fluid leaks - repair immediately
- Loose, dirty, or improperly adjusted throttle sensor linkage
- Damaged or loose hoses
- Worn, frayed, or improperly routed electrical harnesses
- Worn or out-of-phase driveline U-joints and slip fittings.

CAUTION: When welding on the vehicle:

- **DO NOT WELD on the vehicle without disconnecting the ECU from all control system wiring harness connectors.**
- **DO NOT WELD on the vehicle without disconnecting ECU battery power and ground leads.**
- **DO NOT WELD on any control components.**
- **DO NOT CONNECT welding cables to any control components.**

A label describing on-vehicle welding precautions is available from your authorized Allison service dealer and should be installed in a conspicuous place. A vehicle used in a vocation that requires frequent modifications or repairs involving welding ***must*** have an on-vehicle welding label.

IMPORTANT NOTE: Be sure to check transmission fuel level on a regular basis. Transmission fluid cools, lubricates, and transmits hydraulic power. Always maintain proper fluid level. If fluid level is too low, the torque converter and clutches do not receive an adequate supply of fluid and the transmission overheats. If the level is too high, the fluid aerates - causing the transmission to shift erratically and overheat. Fluid may be expelled through the breather or dipstick tube when the fluid level is too high.

5-2.1.1 Transmission Fluid Check

Electronic Fluid Check Procedure: If the transmission you are maintaining has an oil level sensor, fluid level information can be displayed on the shift selector. If the transmission does not have an oil level sensor refer to Manual Fluid Check Procedure further in this manual.

Displaying Fluid Level Information. Use the following procedure to display fluid level information:

- For a pushbutton shift selector:
  Simultaneously press the ↑ (Up) and ↓ (Down) arrow buttons.
- For a lever shift selector:
  Press the DISPLAY MODE button.

Oil (Fluid) Level Mode. A two minute countdown begins after entering oil level mode. The display flashes and an 8, 7,. . .1 count occurs during the two minute countdown. Oil level information displays after the countdown and when the following conditions are met:

- Engine at idle
- Sump oil at operating temperature
- Transmission output shaft stopped
- Transmission in neutral
- Oil level sensor functioning properly

Shift Selector Display. After two minutes the shift selector will display the fluid level data as in the following examples:

CODE	MEANING OF CODE
OL OK OK	Oil level is correct
OL LO 01	Oil level is one quart low - or as many quarts as needed
OL HI 01	Oil level is one quart high - or as many quarts as overfilled

The shift selector can only display two characters at a time. One character is displayed under the MONITOR label and one under the SELECT label. The oil level information is sequentially displayed as in the following examples:

If the oil level is correct -

Select	Monitor
O	L
O	K
O	K

If the oil level is low -

Select	Monitor
O	L
L	O
O	1

If the oil level is high -

Select	Monitor
O	L
H	I
O	1

NOTE: Failure to meet any of the above conditions stops the two minute countdown. One of the following codes displays on the shift selector to show the reason for the countdown interruption. Once all conditions have been met, the countdown resumes where it stopped.

CODE	CAUSE OF CODE
50	Engine rpm too low
59	Engine rpm too high
65	Neutral not selected
70	Sump oil temperature too low
79	Sump oil temperature too high
89	Output shaft rotation
95	Sensor failure
	– Engine Speed
	– Output Speed
	– Temperature
	– Oil Level

If oil level cannot be checked and a code is issued indicating the reason, the following type display appears:

Select	Monitor
O	L
–	–
5	9

NOTE: Report sensor failure to a distributor or dealer in your area. Check the telephone directory for an Allison Transmission distributor or dealer near you.

Exiting the Oil Level Display Mode.

- For a pushbutton shift selector:
  Press any range selection button.
- For a lever shift selector:
  Press the DISPLAY MODE button, or select a range.

Manual Fluid Check Procedure. Clean all dirt from around the end of the fluid fill tube before removing the dipstick. Do not allow dirt or foreign matter to enter the transmission. Dirt or foreign matter in the hydraulic system may cause undue wear of transmission parts, make valves stick, and clog passages. Check the fluid level using the following procedure and record the level in your maintenance log.

▲**WARNING:** When checking the fluid level, be sure the transmission is in N (neutral), the parking brake and/or emergency brake is set properly, and the wheels are chocked. Unexpected and possible sudden vehicle movement may occur if these precautions are not taken.

Cold Check Procedure. The purpose of the cold check is to determine if the transmission has enough fluid to be operated safely until a hot check can be made.

⚠CAUTION: The fluid level rises as fluid temperature increases. DO NOT fill above the "COLD RUN" band if the transmission fluid is below normal operating temperatures.

- Park the vehicle on a level surface. Apply the parking brake and chock the wheels.
- Run the engine for at least one minute. Shift to D (Drive), then to N (Neutral), and then shift to R (Reverse) to fill the hydraulic system. Finally, shift to N (Neutral) and allow the engine to idle (500-800 rpm).
- With the engine running, remove the dipstick from the tube and wipe clean.
- Insert the dipstick into the tube and remove. Check the fluid level reading. Repeat the check procedure to verify the reading.
- If the fluid level is within the "COLD RUN" band, the transmission may be operated until the fluid is hot enough to perform a "HOT RUN" check. If the fluid level is not within the "COLD RUN" band, add or drain as necessary to bring it to the middle of the "COLD RUN" band.
- Perform a hot check at the first opportunity after the normal operating temperature of 71°C-93°C (160°F-200°F) is reached.

Hot Check Procedure.

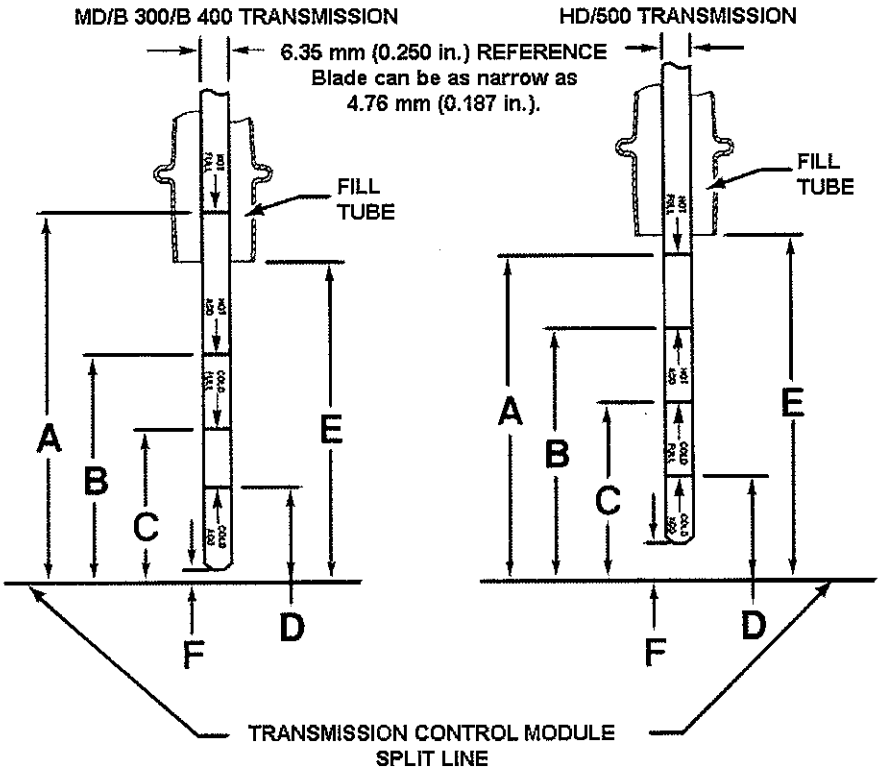
⚠CAUTION: The fluid must be hot to ensure an accurate check. The fluid level rises as temperature increases.

- Operate the transmission in D (Drive) range until normal operating temperature is reached:
  - Sump temperature 71°C-93°C (160°F-200°F)
  - Converter-out temperature 82°C-104°C (180°F-220°F)
- Park the vehicle on a level surface and shift to N (Neutral). Apply the parking brake and chock the wheels. Allow the engine to idle (500-800 rpm)
- With the engine running, remove the dipstick from the tube and wipe clean.
- Insert the dipstick into the tube and remove. Check fluid level reading. Repeat the check procedure to verify the reading.

NOTE: Safe operating level is within the "HOT RUN" band on the dipstick, (see fig. 1). The "HOT RUN" band is between the "HOT FULL" AND "HOT ADD" marks.

- If the fluid level is not within the "HOT RUN" band, add or drain as necessary to bring the fluid level to within the "HOT RUN" band.

Consistency of Readings. Always check the fluid level at least twice and with the engine running. Consistency is important to maintaining accuracy of the reading. If inconsistent readings persist, check the transmission breather to be sure it is clean and unclogged.



OIL SUMP	TRANSMISSION/SUMP DESCRIPTION	DIMENSION A	DIMENSION B	DIMENSION C	DIMENSION D	DIMENSION E	DIMENSION F**
N/A	All HD/B 500	106.7 mm (4.20 in.)	76.2 mm (3.00 in.)	66.0 mm (2.60 in.)	*	132.6 mm (5.22 in.)	13.8 mm (0.54 in.)
2.00 in.***	B 300/B 400 "STANDARD"	101.6 mm (4.00 in.)	73.7 mm (2.90 in.)	50.8 mm (2.00 in.)	*	86.6 mm (3.41 in.)	5.9 mm (0.23 in.)
4.00 in.***	B 300/B 400 "DEEP OPTIONAL"	101.6 mm (4.00 in.)	63.5 mm (2.50 in.)	45.7 mm (1.80 in.)	*	86.6 mm (3.41 in.)	5.9 mm (0.23 in.)
2.00 in.***	MD 3060/3560 "SHALLOW OPTIONAL"	101.6 mm (4.00 in.)	73.7 mm (2.90 in.)	50.8 mm (2.00 in.)	*	86.6 mm (3.41 in.)	5.9 mm (0.23 in.)
4.00 in.***	MD 3060/3560 "STANDARD"	101.6 mm (4.00 in.)	63.5 mm (2.50 in.)	45.7 mm (1.80 in.)	*	86.6 mm (3.41 in.)	5.9 mm (0.23 in.)
7.00 in.***	MD 3070PT "STANDARD"	101.6 mm (4.00 in.)	63.5 mm (2.50 in.)	45.7 mm (1.80 in.)	*	86.6 mm (3.41 in.)	5.9 mm (0.23 in.)

NOTE: Calibrate level marking locations with respect to transmission control module split line and fill tube.
Illustration not to scale.
**Dimension determined by installation.*
***Reference dimension only. Actual dimension to be determined by installation.*
****Reference drawing AS66-60.*
*****Reference drawing AS67-60.*

Figure 1 - Standard WT Series Dipstick Markings

NOTE: When filling the transmission be sure to lay dipstick in a clean place to avoid foreign material and contaminants from entering the transmission.

5-2.1.2 Fluid Recommendations

TranSynd™ is a fully synthetic transmission fluid developed by Allison Transmission and Castrol Ltd. This fluid meets Allison specifications for Severe Duty and Extended Drain Intervals. TranSynd™ is fully qualified to the GM DEXROM®-III and Allison C4 specifications and is available through Allison distributors and dealerships.

Hydraulic fluid (oils) used in the transmission are important influences on transmission performance, reliability, and durability. DEXRON®-III and TranSynd™ fluids are recommended for use in the MD, HD and B Series transmissions.

Some DEXRON®-III fluids are also qualified as Type C-4 fluids. To ensure the fluid is qualified for use in Allison transmission, check for a DEXRON®-III or C-4 fluid license or approval numbers on the container, or consult the lubricant manufacturer. Consult your Allison Transmission dealer or distributor before using other fluid types. Fluid types such as Type F and universal farm fluids may or may not be properly qualified for use in your Allison transmission.

CAUTION: Disregarding minimum fluid temperature limits can result in transmission malfunction or reduced transmission life.

When choosing the optimum viscosity grade of fluid to use, duty cycle, preheat capabilities, and/or geographical location must be taken into consideration. The following table lists the minimum fluid temperatures at which the transmission may be safely operated without preheating the fluid. Preheat with auxiliary heating equipment or by running the equipment or vehicle with the transmission in Neutral for a minimum of 20 minutes before attempting range operation.

	Ambient Temperature Below Which Preheat is Required	
Viscosity Grade	**Celsius**	**Fahrenheit**
MIL-L-46167	-51	-60
MIL-L-2104D	-32	-25
SAE 0W-20 or TranSynd™	-30	-22
DEXRON®-III	-27	-17
SAE 10W	-20	-4
SAE 10W-30	-20	-4
SAE 15W-40	-15	5
SAE 30W	0	32
SAE 40W	10	50

5-2.1.3 Transmission Fluid and Filter Change Intervals

Frequency. Transmission fluid and filter change frequency is determined by the severity of transmission service. See **Table 1** as a general guide. More frequent changes may be necessary when operation conditions create high levels of contamination or overheating.

SEVERE VOCATION			GENERAL VOCATION		
Oil	Filters		Oil	Filters	
	Main	Lube/ Auxiliary		Main	Lube/ Auxiliary
Required Initial Filter Change Interval (All Fluids)					
	8000 km (5,000 Miles) 200 Hours	8000 km (5,000 Miles) 200 Hours		8000 km (5,000 Miles) 200 Hours	8000 km (5,000 Miles) 200 Hours
Recommended Fluid and Filter Change Intervals (Non-TranSynd™ Fluids)					
19 300 km (12,000 Miles) 6 Months 500 Hours	19300 km (12,000 Miles) 6 Months 500 Hours	19 300 km (12,000 Miles) 6 Months 500 Hours	40 200 km (25,000 Miles) 12 Months 1000 Hours	40 200 km (25,000 Miles) 12 Months 1000 Hours	40 200 km (25,000 Miles) 12 Months 1000 Hours
Recommended Fluid and Filter Change Intervals (TranSynd™ Fluid)					
80 400 km (50,000 Miles) 24 Months 2,000 Hours	80 400 km (50,000 Miles) 24 Months 2,000 Hours	80 400 km (50,000 Miles) 24 Months 2,000 Hours	160 900 km (100,000 Miles) 48 Months 4,000 Hours	80 400 km (50,000 Miles) 24 Months 2,000 Hours	80 400 km (50,000 Miles) 24 Months 2,000 Hours

Table 1 - Transmission Fluid and Filter Change

SEVERE VOCATION			GENERAL VOCATION		
Oil	Filters		Oil	Filters	
	Main	Lube/ Auxiliary		Main	Lube/ Auxiliary
Modified Fluid and Filter Change Intervals (Mixture* of TranSynd™ and Non-TranSynd™ Fluids)					
40 200 km (25,000 Miles) 12 Months 1,000 Hours	40 200 km (25,000 Miles) 12 Months 1,000 Hours	40 200 km (25,000 Miles) 12 Months 1,000 Hours	80 400 km (50,000 Miles) 24 Months 2,000 Hours	40 200 km (25,000 Miles) 12 Months 1,000 Hours	80 400 km (50,000 Miles) 24 Months 2,000 Hours
* Mixture is defined as the quantity of fluid remaining in the transmission after a standard fluid change combined with the quantity of TranSynd that is required to fill the transmission to the proper level. A mixture of TranSynd vs. Non-TranSynd other than as defined in this paragraph does not meet the requirements that permit eleigibility for the TranSynd fluid and filter change intervals.					
NOTE: Change fluid/filters after recommended distance, months, or hours have elapsed, whichever comes first.					
Severe Vocation: All Retarders, On/Off Highway, Refuse, Tour Coach and Transit					
General Vocation: All Others					

Table 2 - Transmission Fluid and Filter Change

Abnormal Conditions. Transmission fluid must be changed whenever there is evidence of dirt or a high temperature condition. A high temperature condition is indicated by the transmission fluid being discolored or having a strong odor, or by fluid analysis. Local conditions, severity of operation, or duty cycle may require more or less frequent fluid or filter change intervals.

Fluid Analysis. Transmission protection and fluid change intervals can be optimized by monitoring fluid oxidation according to the tests and limits shown in **Table 3**.

Test	Limit
Viscosity	±25% change from new fluid
Total Acid Number	+3.0* change from new fluid
Solids	2% by volume maximum
* mg of KOH to neutralize a g of fluid	

Table 3. Fluid Oxidation Measurement Limits

5-2.1.4 Transmission Fluid Contamination

Fluid Examination. At each fluid change, examine the drained fluid for evidence of dirt or water. Normal condensation will appear in the fluid during operation.

Water. Obvious water contamination of the transmission fluid or transmission fluid in the cooler (heat exchanger) water indicates a leak between the water and fluid areas of the cooler. Inspect and pressure test the cooler to confirm the leak. Replace leaking coolers.

NOTE: Cooler water can also be contaminated by engine oil; be sure to locate the correct source of cooler water contamination.

Engine Coolant. Engine coolant in the transmission hydraulic system requires immediate action to prevent malfunction and possible serious damage. Completely disassemble, inspect, and clean the transmission. Remove all traces of the coolant, and varnish deposits resulting from engine coolant contamination. Replace friction clutch plates contaminated with engine coolant (ethylene glycol).

Metal. Metal particles in the fluid (except for the minute particles normally trapped in the oil filter) indicate internal transmission damage. If these particles are found in the sump, the transmission must be disassembled and closely inspected to find their source. Metal contamination requires complete transmission disassembly. Clean all internal and external hydraulic circuits, cooler, and all other areas where the particles could lodge.

⚠CAUTION: If excessive metal contamination has occurred, replace the oil cooler and visually inspect all bearings in the transmission.

5-2.1.5 Transmission Fluid and Filter Change Procedure

NOTE: Do not drain the transmission fluid if only filters are being replaced.

1. **Drain Fluid.**
   - Drain the fluid when the transmission is at operating temperature - 71°C-93°C (160°F-200°F). Hot fluid flows quicker and drains more completely.
   - Remove the drain plug from the control module and allow the fluid to drain into a suitable container.
   - Examine the fluid as described in *Section 5-2.1.4*.

2. **Replace Filters.**
   - Remove twelve bolts, two filter covers, two O-rings, two square cut seals, and two filters from the bottom of the control module (*refer to Figure 2*)

NOTE: Lubricate only the O-ring inside the filter cartridges.

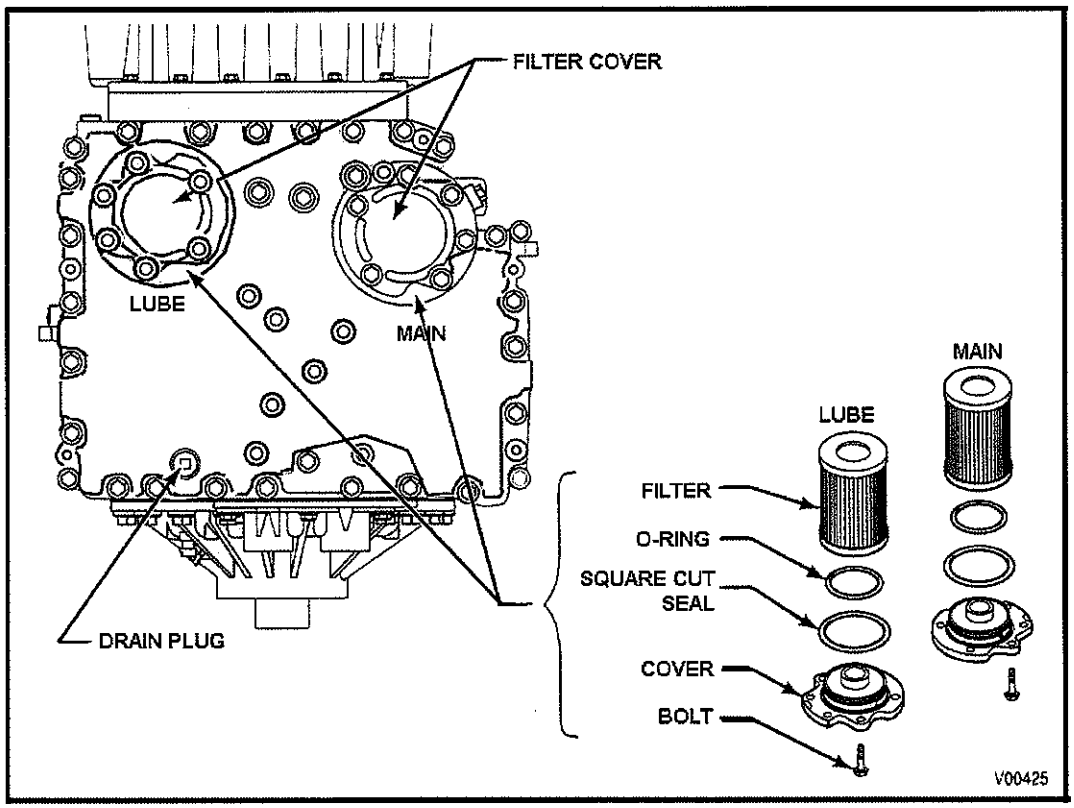


Figure 2. Location of Filters for Service

- Pre-lube and install an O-ring on each cover assembly. Install a square cut seal on each cover assembly. Install the filters onto the cover assemblies.

CAUTION: Do not use the bolts to draw filter covers to the sump. This can damage the covers, seals or sump.

- Install filter and cover assemblies into the filter compartment. Align each filter/cover assembly with the holes in the channel plate/sump. Push the cover assemblies in by hand to seat the seals.
- Install six bolts into each cover and tighten to 51-61 N·m (38-44 lb. ft.)
- Replace the drain plug O-ring. Install the plug and tighten to 25-32 N·m (18-24 lb. ft.)

3. **Refill Transmission.** The amount of refill fluid is less than the amount used for the initial fill. Fluid remains in the external circuits and transmission cavities after draining the transmission. After refill, check the fluid level using the procedure described in *Section 5-2.1.1 Transmission Fluid Check.*

			Initial Fill*		Refill*	
Transmission	Sump	PTO	Liters	Quarts	Liters	Quarts
B 300/400	Standard	N/A	21	22	13	14
B 300/400	Deep	N/A	27	29	19	20
B 500	Standard	Yes	41	43	37	39
B 500	Standard	No	38	40	25	26
B 500	Deep	Yes	48	51	37	39
B 500	Deep	No	45	48	34	36
HD 4060/4560	Standard	Yes	48	51	37	39
	Standard	No	45	48	34	36
	Shallow	Yes	41	43	37	39
	Shallow	No	38	40	25	26
MD 3060/3560	Standard	No	24.5	26	18	19
MD 3070PT**	Standard	Yes	37	39	30	32
* Approximate quantity, does not include external lines and cooler hose.						
**The sump is 7.00 inches deep.						

Table 4 - Transmission Fluid Capacity

5-2.1.6 Fluid Leak Diagnosis

5-2.1.6.1 Finding a Leak

1. Identify the fluid. Determine whether it is engine oil, automatic transmission fluid, or hydraulic fluid from a specific vehicle system.

2. Operate the vehicle to reach normal operating temperature and park the vehicle. Inspect the vehicle to identify the source of the leak. Refer to the following list for possible points of fluid and their causes.

Transmission mating surfaces:
- Attaching bolts not correctly tightened
- Improperly installed or damaged gasket
- Mounting face damaged

Housing leak:
- Filler pipe or plug seal damaged or missing
- Filler pipe bracket dislocated
- Oil cooler connector fittings loose or damaged
- Output shaft seals worn-out or damaged.
- Pressure port plugs loose.
- Porous casting

Leak at converter end:
- Converter seal damaged
- Seal lip cut (check converter hub for damage)
- Garter spring missing from seal
- Converter leak in weld area or O-ring seal
- Porous casting

Fluid comes out of fill tube:
- Overfilled - incorrect dipstick
- Plugged vent
- Water or coolant in fluid - fluid will appear milky
- Incorrect electronic fluid level indication
- Drain-back holes plugged

3. Visually inspect the suspected area. Inspect all the gasket mating surfaces for leaks.

4. If the leak still cannot be identified, then clean the suspected area with a degreaser, steam, or spray solvent. Clean and dry the area. Operate the vehicle for several miles at varying speeds. Inspect the vehicle for leaks. If the source of the leak is still not identified, use powder method, and/or black light and dye method as explained below.

5-2.1.6.2 Powder Method

- Clean the suspected area.
- Apply an aerosol-type white powder.
- Operate the vehicle under normal operating conditions.
- Visually inspect the suspected area and trace the leak path over the white powder surface to the source.

NOTE: Dye and black light kit is available for finding leaks. Refer to the manufacturer's directions when using the kits. See kit directions for the color of the fluid dye mix.

5-2.1.6.3 Black Light and Dye Method

- Pour the specified amount of dye into the transmission fill tube.
- Operate the vehicle in normal operating conditions.
- Direct the black light toward the suspected area. The dyed fluid will appear as a brightly colored path leading to the source.

5-2.1.6.3 Repairing the Leak

Once the leak has been traced back to its source, inspect the leaking part for the following conditions, and repair the leaking part.

- Gaskets:
  - Fluid level/pressure is too high
  - Plugged vent or drain-back holes
  - Improperly tightened fasteners or dirty/damaged threads
  - Warped flanges or sealing surfaces
  - Scratches, burrs, or other damage to a sealing surface
  - Damaged or worn-out gasket
  - Cracked or porous casting
  - Improper sealant used (where applicable)

- Seals:
  - Fluid level/pressure is too high
  - Plugged vent or drain-back holes
  - Damaged seal bore
  - Damaged or worn-out seal
  - Improper installation
  - Cracks in component
  - Output shaft surface scratched, nicked or damaged
  - Loose or worn-out bearing causing excess seal wear

- Sealing Flange:
  - Inspect the sealing flange for bends; replace the sealing flange if bent.

5-2.1.7 Breather

5-2.1.7.1 Location and Purpose

The breather is located on top of the transmission converter housing. The breather prevents air pressure buildup within the transmission and its passage must be kept clean and open.

5-2.1.7.2 Maintenance

The amount of dust and dirt encountered will determine the frequency of breather cleaning. Use care when cleaning the transmission. DO NOT SPRAY STEAM, WATER, OR CLEANING SOLUTION DIRECTLY AT THE BREATHER. Spraying steam, water, or cleaning solution at the breather can force the water or cleaning solution into the transmission.

5-2.1.7.3 Replacement

Always use a wrench of the proper size to remove or replace the breather. Pliers or a pipe wrench can crush or damage the stem and produce metal chips which could enter the transmission. Tighten the breather to 12-16 N·m (9-12 lb ft).

5-2.1.8 Troubleshooting

5-2.1.8.1 DO NOT SHIFT Light

The **Do Not Shift** light is usually located on the vehicle's instrument panel. When the light is "ON" and accompanied by eight seconds of short beeps from the shift selector, shifts are being restricted by the ECU.

- This occurs when the ECU senses abnormal conditions.
- During this time, the "Select" digit on the shift selector is blank.
- The transmission may continue to operate with inhibited shifting.
- The ECU will not respond to shift selector requests.
- Direction changes and shifts to and from neutral will not occur. If the lever shift selector is moved while DO NOT SHIFT is indicated, a continuous alarm sounds. This alarm continues until the shifter is moved back to the position it was in when the light came on initially.
- If ignition is turned "OFF" and then "ON" while the DO NOT SHIFT light is displayed, the transmission will remain in neutral until the code is cleared.

Any time the DO NOT SHIFT light is displayed, the ECU logs to a diagnostic code in memory. These diagnostic codes can be accessed through the shifter display or a diagnostic tool.

NOTE: Diagnostic codes can be logged without illuminating the DO NOT SHIFT light. This occurs when the ECU senses a problem, but determines the problem won't cause immediate transmission damage or dangerous performance.

5-2.1.8.2 Diagnostic Codes Overview

Code List Position	Main Code	Sub Code	Active Indicator	Ignition Cycle Counter	Event Counter
d1	21	12	YES	00	10
d2	41	12	YES	00	04
d3	23	12	NO	08	02
d4	34	12	NO	13	01
d5	56	11	NO	22	02
Displayed on shift selector			YES = *MODE* *ON* Displayed	Accessible by Pro-Link® diagnostic tool only.	

Diagnostic codes are listed in memory. Up to five codes can be stored, with the most recent code listed first.

Diagnostic codes consist of a two-digit main code and a two-digit sub code.

- Main codes are listed first and provide the general condition or area of fault detected by the ECU.
- Sub codes are listed second and provide specific areas or conditions within the main code that caused the occurrence.
- Example - Code 13 12: 13 indicates a problem with ECU voltage; 12 indicates the problem was caused by low voltage.
- Example - Code 21 12: 21 indicates a problem with throttle position sensor signal; 12 indicates the throttle position sensor signal was low.

When using the shift selector to retrieve trouble codes, the illumination of the MODE ON indicator on the shift selector indicates that the code displayed is currently active. If the MODE ON indicator is not illuminated with the displayed code, the code is inactive. In the normal operating mode, the MODE ON display indicates secondary mode operation.

- The Ignition Cycle Counter determines when inactive diagnostic codes are automatically cleared from the code list. The counter is incremented each time a normal ECU powerdown occurs (ignition turned off). Inactive codes are cleared from the code list after the counter reaches 25.
- The Event Counter counts the number of occurrences of a diagnostic code. If a code is already in the code list and the code is again detected, that code is moved to position D1, the active indicator is turned on and the Ignition Cycle Counter is cleared, and 1 is added to the Event Counter.
- You can access the ignition cycle counter and event counter information through Pro-Link diagnostic tool only.

5-2.1.8.3 Clearing The Trouble Codes Using Shift Selector

During installation, "false" codes can be recorded in the electronic control's memory. You must clear these codes prior to road testing the vehicle. Use the shift selector to clear the codes. Refer to *Figure 3*.

- Enter the diagnostic mode on pushbutton selectors by pressing the "up" and "down" arrow buttons simultaneously. (Press twice if there is an oil level sensor present.)
- Enter the diagnostic mode on level selectors by momentarily pressing the "Display" button. (Press twice if there is an oil level sensor present.)
- To clear all active indicators, press and hold the MODE button approximately 3 seconds until a tone sounds once.
- To remove all codes, press and hold the MODE button for approximately 10 seconds until the shift selector tone sounds twice.

5-2.1.8.4 Retrieving Troubleshooting Codes

During installation, "false" diagnostic codes can be recorded in the electronic control's memory. Clear these codes before road testing the vehicle. After road testing the vehicle, check for the codes. Retrieve the codes by using the shift selector. *Refer to Figure 3*.

- Enter diagnostic mode.
- The display will list the code's logged position (d1, d2, d3, etc), then follow with the main code and a sub code (this repeats every 2 seconds until the "MODE" button is pushed again).
- Momentarily push the "MODE" button to move to the next code stored in memory.
- When you have retrieved all the codes, the display will return to the first code listed and repeat the sequence. RECORD ALL THE CODES.

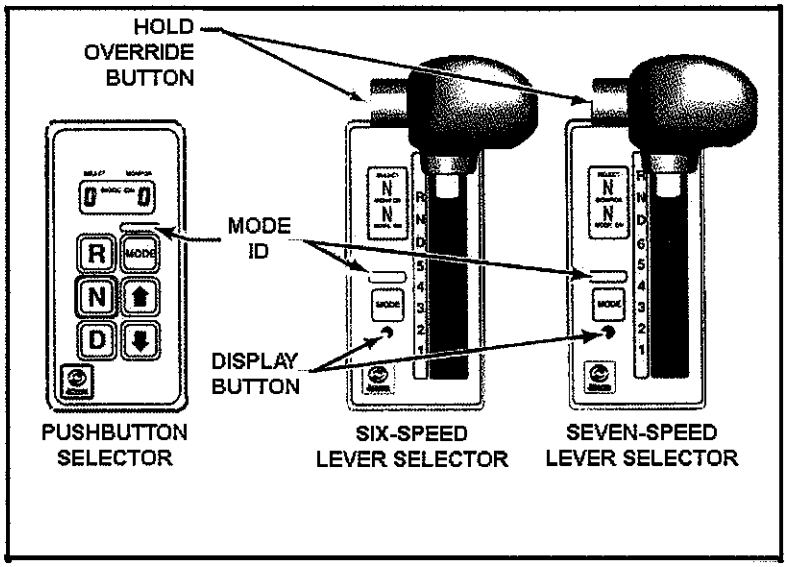


Figure 3 - Shift Selector

5-2.1.8.5 Troubleshooting When No Diagnostic Codes are Present

- Always start with the basics:
  - Make sure the shifter is in the appropriate range.
  - Check the fluid level.
  - Make sure batteries are properly connected and charged.
  - Make sure electrical connections are properly made.
  - Check support equipment for proper installation and operation.
- If the shifting process is rough, give the shifts time to "converge" before assuring there is a problem.
- Refer to the WT Troubleshooting Manual's "General Troubleshooting of Performance Complaints" section.
  - These troubleshooting charts list a variety of conditions that may or may not relate to the Electronic Control.
  - Some conditions and suggested checks include mechanical and hydraulic items.
- If the troubleshooting charts refer to an Electronic Control check, use the diagnostic code troubleshooting information that best applies to the situation.
- Use the WT's individual clutch-apply circuit pressure taps when necessary.

5-2.1.8.6 Troubleshooting Intermittent Diagnostic Codes

Intermittent codes are a result of conditions which are not always present.

When conditions causing the code exist, the code is logged in memory. The code stays in memory until it's manually cleared or cycled out.

When intermittently occurring codes exist, check for the following items:

- Dirty, damaged harness connectors and terminals.
- Terminals not fully seated in connectors.
- Damaged harnesses (due to poor routing, chafing, excessive heat, tight bends, etc.).
- Improperly mounted electric control components.
- Poor connector seals (where applicable).
- Exposed harness wires.
- EMI generating components and accessories.

To help locate intermittents, it sometimes helps to place the appropriate tester on the suspect component or circuit and simulate operating conditions - wiggle, pull, bump, and bend while watching the tester.

5-2.1.8.7 Exiting Diagnostic Mode

To exit the diagnostic mode, do one of the following:

- Do nothing; wait until the calibrated time has passed and the system automatically returns to normal operation.
- Using a pushbutton shift selector, simultaneously press the ↑ (Up) and ↓ (Down) arrow buttons.
- Using a pushbutton shift selector, press D (Drive), N (Neutral), or R (Reverse).
- Using a lever shift selector, press the DISPLAY MODE button.
- Using a lever shift selector, move the shift lever to any position other than the one it was in when the diagnostic display mode was activated.

6-1 Brakes

6-1.1 Antilock Brake System (ABS)

Your coach may be equipped with a six-channel, six-sensor, six-modulator antilock brake system (ABS). If this new system is found on your vehicle, please call your local distributor for service or questions relating to brakes on your vehicle.

When there is a fault in the ABS system, it is recorded in the memory banks of the electronic control unit (ECU). The ABS indicator lamp uses blink codes to specify certain faults. Service personnel can then identify these problems and repair them more quickly and efficiently.

6-1.1.1 ABS Indicator Lamp

In normal mode, the ABS indicator lamp will light briefly during ignition, then turn off. If this lamp fails to light during ignition, have the system serviced immediately. An active fault is indicated if the ABS indicator lamp turns on during ignition, and remains on when the vehicle is driven faster than four miles per hour. Since the fault may affect the safety of the vehicle, its cause should be investigated immediately.

If there is a stored fault, the ABS indicator lamp will turn on during ignition, remain on, then turn off when the vehicle is driven faster than four miles per hour. This indicates that a fault has been recorded in the system, but it is not currently active. A stored fault will remain in the ECU's memory bank until it is erased, so it could reflect a previously active fault which has since been corrected. Even though an inactive fault may not be as immediate a threat as an active fault, it should be investigated by qualified service personnel as soon as possible so the stored fault codes may be cleared from the ECU's memory.

6-1.1.2 Air Brakes

A coach equipped with a dual air brake system consists of separate complete systems for the front and rear service brakes. A separate reservoir and air gauge is provided for each of these systems. A dual treadle valve is provided for operating the service brake system. In addition to providing excellent service brake performance, this dual brake system is equipped with safety features which allow the driver to use the emergency stopping system through the service brake treadle valve. In the event of a failure in the air reserve for the front brakes, the rear service brakes can still be applied using the treadle valve, since the two service brake systems operate independently. If there is a failure in the air reserve for the rear service brake system, the front service brakes and the rear spring brakes can be applied through the treadle valve. This allows the operator to use a normal method of braking during an emergency situation.

However, in the case of an air reserve failure, the low air pressure warning buzzer will sound and warning light will activate, and the respective air gauge on the dash will indicate which system has lost air pressure. The coach must not be operated under those conditions, but repaired before continuing operation.

The rear spring brakes can also be actuated by pulling the dash-mounted Parking Brake valve knob located on the lower portion of the instrument panel. These spring brakes cannot be fully released until the air reserve pressure is above 65 psi. These brakes are in the released position when the control valve is pushed in, and in the applied position when the control valve is out. If there is a loss in air pressure, the valve will automatically move to the brake applied position and cannot be released until the air reserve pressure has been replenished.

6-1.1.3 Schrader Valve

A Schrader valve is provided in the engine compartment to facilitate charging the air brake system using the common type of air hose found at service stations and garages. Charging the system in this manner should only be done for emergency or service-related temporary purposes, such as to be able to move a bus with an inoperative compressor or to operate the service brakes without the engine running.

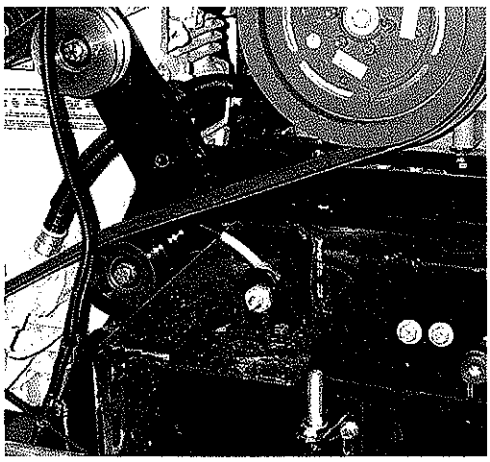


Fig. 1 - Schrader Valve

6-1.1.4 Parking

Fig. 2 - Parking Brake Valve

Use the dash-mounted Parking Brake valve to apply the rear spring brake when parking the coach. When the parking brake is applied, and the ignition switch is On, a red dash-mounted light will warn the driver that the brake is applied.

⚠CAUTION: Do not attempt to move bus before spring brakes are released.

6-1.1.5 Draining Air Tanks

Condensation must be drained from all compressed air tanks regularly. The tanks on the Express 4500 are equipped with automatic valves which perform this purging during normal operation. An air dryer helps minimize water, oil, and other contaminants in before they reach the wet tank. The air dryer also has an automatic drain valve on its reservoir which ejects during the on-off cycle of the compressor. On valves with heating elements, freeze protection is operational when the ignition is turned on.

6-1.1.6 Releasing Spring Brakes Manually:

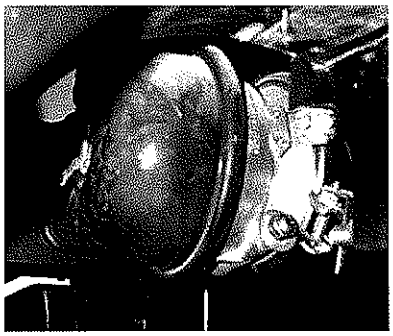


Fig. 3 - Brake Pin Drive

If air pressure fails in the brake system, a spring in the brake actuation chambers automatically applies the brakes. If system pressure cannot be reestablished, the service brakes on both sides of both rear axles must be released manually in order to move the coach.

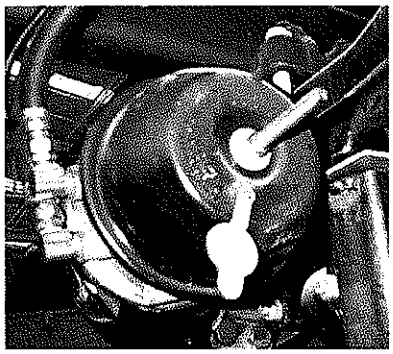
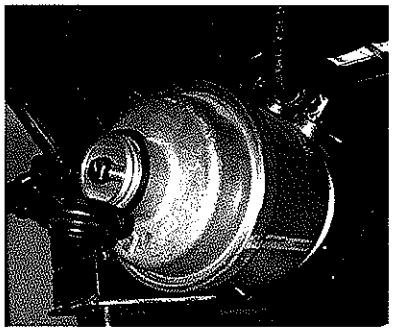


Fig. 4 - Brake Pin Drive Installed



WARNING: Bus must be secured against accidental rolling with wheel chocks or by tow vehicle before brake springs are released manually. Failure to do so may result in bodily injury and/or property damage.

Fig. 5 - Brake Release Tag Axle

6-1.1.6.1 To manually release the drive axle brakes:

1. Remove the release stud tool and nut from the carrying pocket on the brake chamber assembly. There is one such tool for each of the two brakes.
2. Remove the access plug from the end of the spring chamber.
3. Insert the release stud through the opening in the chamber and into the spring pressure plate. Turn the release stud one quarter turn to engage the stud tangs with the slot in the pressure plate.
4. Keep the stud tangs engaged while installing the washer and nut on the outside end of the release stud. Tighten the nut until the spring is fully caged and the brake is fully released.
5. Repeat this procedure for the other side of the drive axle.

Do not loosen or remove the release stud and nut unless the brake chamber is completely assembled and is securely clamped. When air pressure is restored, remove the release stud and reinstall it in its carrying pocket.

6-1.1.6.2 To manually release the tag axle brakes:

1. Remove the access plug from the end of the spring chamber.
2. Using a socket wrench, tighten the exposed hex head end of the spring bolt. Tighten until the spring is completely caged and the brake is fully released.
3. Repeat this procedure for the other side of the tag axle.

6-1.2 Automatic Traction Control

The optional ATC (automatic traction control) function is available with all possible U12 ECU configurations. In addition to the required ABS components, ATC also requires a single ATC valve (for brake control) and an engine interface, SAE J1922/J1939 (for engine torque control). A brake switch input is also required and can be provided via the engine interface or wired directly from the brake light switch.

6-1.2.1 ATC Functional Data

Working range:

• Brake Control first time intervention	<25 MPH (40kph)
• Brake Control (needed	<25 MPH) 25 MPH up to Vmax
• Engine Control	Up to Vmax
• Engine Control Slip in ATC Deep Snow Mode	6 MPH +6%

6-1.2.2 Engine-controller Intervention

The ABS/ATC ECU communicates with the vehicle-engine ECU and informs it of the required reduction in injected fuel quantity. Depending upon the equipment fitted in the vehicle, the following interfaces are possible:

- SAE J1922
- SAE J1939

6-1.2.3 Deep Snow Mode

On surfaces like snow, mud or gravel, a Deep Snow Mode can be activated with a momentary ATC switch-connecting Pin X1-6 to ground. This mode allows greater drive wheel spin for better traction.

CAUTION: In the Deep Snow Mode, vehicle stability is reduced.

The system incorporates an automatic calibration function for tire sizes. Before this function has completed its calculations for tire size (applies particularly in case of tire-size change) differences in the calculated speeds can lead to engine-controller activity. This can be suppressed by operating the ATC Deep Snow Mode switch. The learning process is completed after the vehicle has been driven straight-ahead for several minutes. The Deep Snow Mode switch should be pushed again to return to the normal ATC function mode.

6-1.2.4 Stop Light Switch Evaluation

For all configurations with ATC, a stop light switch input to the ECU is required. The stop light switch input is not required for ABS only configurations, although for common wire harness designs it can be used. The main purpose of the stop light input information is to prevent ATC operation if the brake pedal is applied.

The stop light switch information can be delivered to the ECU either via direct wiring connection to the stop light switch (pin 6, connector x2) or via J-1939 with message CC/VS, source address 23d.

For the configuration "ABS with ATC", when power is switched "on" the correct functioning of the SLS is checked by waiting for the transition from "operated" to "not-operated" when the brake pedal is pressed and released. If this transition does not take place after "Power On", ATC is disabled and the ATC lamp remains on. The corresponding information is then available through blink codes or J1587 diagnosis.

This information is not stored permanently in the EEPROM. As soon as the brake pedal is pressed again the information disappears, the ATC lamp goes out, and the ATC function is enabled for operation.

If there is a fault in the SLS-information, or in the respective wiring (cable break, short-circuit to battery), the ECU is unable to detect the brake-pedal actuation. If the ATC lamp fails to go out even though the brake pedal has been actuated, and the SLS fault code is still displayed, this indicates a fault in the stop light switch or the wiring. ATC will remain disabled until the fault is corrected.

6-1.2.5 ATC Indicator Lamp

The ATC indicator lamp is illuminated in the following circumstances:

- At key-ON the lamp remains ON until the driver presses the brake pedal.
- When the Deep Snow Mode is selected, the lamp flashes ON and OFF slowly.
- During automatic traction control system operation, the lamp flashes ON and OFF rapidly.
- The lamp remains ON if the stop light has not activated since power-up, or if the stop light switch or the engine interface communication is not detected.
- When ATC is disabled for dyno testing, the lamp remains ON.

7-1 Engine, Transmission and Chassis_____

7-1.1 General Inspection

To ensure safety and convenience and to minimize operating costs, the Operator should establish a routine inspection regimen. Any suspected malfunctions or defects should be reported to maintenance personnel and corrected before further operation of the vehicle.

Daily Inspection

- Check fuel level.
- Drain air tanks (cold weather).
- Check engine oil level.
- Check coolant level.
- Check automatic transmission fluid level.

Outside the motor home:

- Clean the windshield, mirrors, front windows, headlights, taillights, directional lights, and stop lights.
- Check that the exhaust tailpipe is not obstructed.
- Check tire pressure and treads.
- Check for missing wheel lug nuts.
- Ensure that area under the coach is clear.
- Inspect the general outside appearance for cleanliness. Identifying markings (license plate, motor home number, etc.) must be clean and clear.
- Ensure that exterior mirrors are clean and properly adjusted.

Inside the coach:

- Inspect for general cleanliness of seats and floors.
- Make sure steps and aisles are dry and unobstructed.
- Verify that all emergency exits open and close properly.
- Check emergency equipment and first aid kit.
- Make sure that fire extinguisher is in place and properly charged.
- Clean windows and windshield around driver's area.
- Ensure that exterior mirrors and clean and properly adjusted.

Starting the engine:

1. Be sure parking brakes are on.
2. Put transmission in neutral.
3. With key switched on, check fuel gauge. Check brake warning buzzer or light, and neutral safety switch.
4. Start engine. Look and listen for trouble signs; check gauges.

With the engine running, check (from driver's seat):

- Mirrors, interior and stepwell lights, and service door seal.
- Watch for any unusual feeling or sound from steering, brakes, and other controls. See that brake pedal has normal height and feel and that the brake gauge is reading correctly.
- Check Parking Brake operation by releasing and resetting it.
- Check horn, defroster and heater blowers, and windshield wiper operation.
- Check signals and lights for proper operation before driving away:
  - Right and left turn signals in front and rear.
  - Flasher warning lights in front and rear.
  - Headlight high and low beams.
  - Stoplights and taillights.
  - Hazard flasher.

Final check while the coach is starting to move:

- Check that seatbelt is secure.
- Check that brake action feels sure and positive; not spongy.
- Watch for any unusual feeling, behavior, or noises in steering and check that the bus is generally under control and tracking straight.
- Brake to a stop and check all gauges.

REMEMBER: Safety on the road depends on you. Observe weather and road conditions and drive accordingly. Be physically and mentally alert. When backing up near pedestrians or in congested areas, use outside monitor or director. Look around before driving away from where you are parked and observe all traffic rules and regulations.

Weekly Inspection:

- Adjust brakes.
- Drain air tanks (warm weather).
- Check tire tread and inflation pressure.
- Inspect seat belts and buckles.
- Inspect outside lights for proper operation.

7-1.2 Maintenance Schedule

Monthly or 1,000 Miles

- Inspect all emergency equipment and mounting fasteners. Inspect fire extinguisher to see if fully charged, and check contents of first aid kit(s) for freshness, sterility, full supply, and expiration dates.
- Inspect tires for correct pressure, and check for signs of wear. Torque outer wheel nuts to 450-500 foot-pounds (610-675 N•m).
- Inspect window latches and slides for proper operation and secure closure.
- Inspect seat frames for secure attachment to the floor and wall.

Monthly or 3,000 Miles

- Check fuel system (Drain fuel and contaminants, if required).
- Check battery water level.
- Inspect brake chambers.

3 Months or 5,000 Miles

- Lubricate all hinges and window latches for ease of operation.
- Lubricate all window channels with silicone or graphite.
- Change main heater air filter (depending on operating conditions).
- Lubricate hinge and latch mechanisms on access doors.
- Inspect heater valves to verify proper function.
- Change engine oil and oil filter.
- Inspect fuel cap, tank, and fuel lines.
- Inspect engine fuel tank vents.
- Inspect engine air filter, replace if required.
- Inspect driveshaft.
- Lubricate universal joint and slip joint.
- Lubricate brake camshaft, king pins, tie rod ends, and slack adjusters.

3 Months or 24,000 Miles

- Inspect Bendix air dryer.
- Check for loose or disconnected electrical connections and damaged wiring.
- Check the vehicle brake warning system.

6 Months or 6,000 Miles

- Check lubricant level in rear axle.
- Inspect rear axle vent.
- Clean and/or replace air compressor filters.
- Check power steering fluid level.
- Lubricate steering drag rod.
- Check single and double check valves.
- Lubricate spring pin.
- Inspect alternator.
- Clean battery posts.
- Disassemble and clean the air compressor governor and repair, as required.
- Clean and lube treadle valve.
- Change engine fuel filter.
- Clean and lubricate accelerator treadle valve.

12 Months or 12,000 Miles

- Complete Quarterly Maintenance Checklist.
- Bleed all air from heaters.
- Tighten all heater hose clamps.
- Check heater hoses, motor wheels, and fans on heaters.
- Clean heater core.
- Inspect power steering pump.
- Inspect steering gear.
- Lubricate steering column.
- Check front and rear suspension bolt torque.
- Inspect suspension system and components.
- Inspect radiator hoses.
- Pressure-test engine cooling system.
- Check heater panels and housing.

12 Months or 24,000 Miles

- Check air tank pop-off valves.
- Change automatic transmission filter.
- Change internal automatic transmission filter.
- Inspect automatic transmission vent.
- Change power steering reservoir filter.
- Change lubricant in rear axle.

24 Months or 24,000 Miles

- Clean radiator.
- Change thermostat.
- Clean relay valves, spring brake valves, parking brake valves, and quick release valves.
- Clean pressure protection valves.

These checklists are suggested. They do not replace or supersede local or state required driver inspection procedure.

Detroit Diesel Series 60 Maintenance Schedule

Please refer to the following chart for a quick maintenance guide to keep your engine running at it's optimum potential perform scheduled maintenance regularly.

Scheduled Maintenance Service	6 Months/ 5,000 Miles	12 Months/ 10,000 Miles	24 Months/ 20,000 Miles	36 Months/ 30,000 Miles	48 Months/ 40,000 Miles
Engine Oil and Filter Change	X	X	X	X	X
Engine Oil and Filter Change	X	X	X	X	X
Change Engine Fuel Filter		X	X	X	X
Hydraulic Fan Fluid and Filters			X		X
Change Rear Axle Oil	X		X		X
Service Air Dryer			X		X
Inspect Leveling Jack System		X	X	X	X
Drain Air Tanks			X		X
Check and Adjust Brakes		X	X	X	X
Change Racor Filter		X	X	X	X
Change Engine Air Cleaner		X	X	X	X
Drain Water in Fuel Tanks		X	X	X	X
Inspect Belts and Hoses			X		X
Service Generator Complete		X	X	X	X
Service Transmission			X		X
Test Ph and Coolant		X	X	X	X
Service Aqua Hot		X	X	X	X

Scheduled Maintenance Service	60 Months/ 50,000 Miles	72 Months/ 60,000 Miles	96 Months/ 70,000 Miles	108 Months/ 80,000 Miles
Engine Oil and Filter Change	X	X	X	X
Engine Oil and Filter Change	X	X	X	X
Change Engine Fuel Filter	X	X	X	X
Hydraulic Fan Fluid and Filters		X		X
Change Rear Axle Oil		X		X
Service Air Dryer		X		X
Inspect Leveling Jack System	X	X	X	X
Drain Air Tanks		X		X
Check and Adjust Brakes	X	X	X	X
Change Racor Filter	X	X	X	X
Change Engine Air Cleaner	X	X	X	X
Drain Water in Fuel Tanks	X	X	X	X
Inspect Belts and Hoses		X		X
Service Generator Complete	X	X	X	X
Service Transmission		X		X
Test Ph and Coolant	X	X	X	X
Service Aqua Hot	X	X	X	X

9-1 Specifications, Engine/Chassis

9-1.1 Engine

9-1.1.1 Caterpillar C-12 - Standard

4-cylinder diesel, turbo with air to air cooler.

No. of Cylinders	6 - In Line
Bore (inches)	5.12
Stroke	5.91
Displacement (cu. in.)	728
Compression Ratio	16.25 to 1
Taxable Horsepower	62.91
Gross BHP @ RPM	410 @ 2100
Gross Torque (lb/ft) **@ RPM**	1450 @ 1200
Maximum Governor RPM - Load	2100
Governor - Type	Electronic
Sump Capacity (High-Low)	30-27L or 32-29 Qts.
Total Oil System Capacity (Qts.)	34L or 36 Qts. 10 PSI @ Idle
Cooling System - Capacity (qts.)	35 (Antifreeze Protection to -34°F)
Fan	2 tandem mounted Thermostatically controlled 25 in. diameter with 9 blades 30 in. diameter with 9 blades
Water Pump Capacity @ Gov. Eng. RPM	107 GPM @ 2400
Alternator Capacity	24 Volt - 300 Amp Leece - Neville
Oil Filter - Type	Full Flow/By-Pass Spin On
Air Cleaner - Type	Farr ECO-SE (Dry) w/restriction indicator
Air Compressor	Bendix 13 CFM
Fuel System	Electronically controlled: The engine has built-in diagnostics in order to ensure that all of the components are operating properly. In the event of a system component failure, the operator will be alerted to the condition by a check engine light.
Exhaust System	Single Pipe with Aluminized Steel muffler. 5" OD tailpipe

9-1.1.2 Detroit Diesel Series 60 - Option

4-cylinder diesel, turbo with air to air cooler.

No. of Cylinders	6 - In Line
Bore (inches)	5.12
Stroke	6.3
Displacement (cu. In.)	778
Compressions Ratio	16.5 to 1
Taxable Horsepower	62.91
Gross BHP @ RPM	430 @ 2100
Gross Torque (lb/ft) **@ RPM**	1450 @ 1200
Maximum Governor RPM - Load	2100
Governor - Type	Electronic
Total Oil System Capacity (Qts.)	40 qts.
Cooling System - Capacity (Qts.)	TBD
Fan	2 tandem mounted Thermostatically controlled
	25 in. diameter with 9 blades
	30 in. diameter with 9 blades
Alternator Capacity	24 Volt - 280 Amp Leece - Neville
Oil Filter - Type	Full Flow Spin On
Air Compressor	Bendix 13 CFM
Fuel System	Electronically controled: The engine has built-in diagnostics in order to ensure that all of the components are operating properly. In the event of a system component failure, the operator will
Air Cleaner - Type	Farr ECO-SE (Dry) w/restriction indicator
Exhaust System	Single Pipe with Aluminized Steel muffler. 5" OD tailpipe

9-1.2 Tires

Tire Size/Brand	Rim/Wheel Size	Tire/Wheel Capacity @ Max. Pressure	Axle Position	Wheel Comments
315R/80R PXZA-1 (Michelin)	22.5 x 9.00	17500 @ 125 psi	Front	Hub Piloted
		28640 @ 115 psi	Rear	

9-2 Electrical Systems Specifications

9-2.1 DINEX G2A Multiplex Wiring

9-2.1.1 What is It?

Multiplex Wiring (MPX) simplifies the way electrical devices are hooked up together. It allows for two or more data transmissions to take place on the same wire. In the world of traditional wiring systems - such as wiring harnesses, and relays - as much as three miles of wires can be used. These harnesses run hundreds of signals, using hundreds of wires, just to keep a single transit vehicle operational. Instead of having three miles of complicated wiring harnesses and a number of failure prone connectors, multiplexing sends multiple signals at the same time through a common pair of wires to turn-on or turn-off various electrical devices.

The Multiplex hardware which makes up the system is composed of:

- A separate power supply
- Several control modules
- And a unique cabling system made up of connectors and multi-stranded wires that run through a cable.

Some benefits of the Multiplex system are:

- It is a simpler system
- Reduced number of connectors
- Troubleshooting is done easily
- Reduced vehicle down-time
- Ease of operation

9-2.1.2 Basic Operation

- The DINEX-G2A-MPX is a microprocessor-based system. It uses multiplex data-bus architecture.
- The DINEX-G2A-MPX uses a small, compact, powerful module to perform full computer functions. This central module controls a family of small, lightweight microprocessor-basic control and monitor functions.

9-2.2 Guidelines to Follow

The following guidelines must be followed when doing any work on vehicle electrical components or wiring, such as installing electrical accessories (radios or speakers, public address systems, etc.)

- Before beginning any electrical work, turn off battery disconnect switches in engine compartment.
- Use only proper gauge wiring with high temperature insulation, such as, chemically cross-linked polyethylene, which meets SAE J-1128 (-51°C to +125°C).
- Be certain any added circuit is protected by the use of a fuse or circuit breaker.
- Any push-on terminal must be insulated.
- Always secure wires away from any sharp metal edges or moving components.
- Where wiring is connected to moving component such as the engine, provide an adequate slack loop to allow for motion in all directions. Clamp the loop at both sides of the moving component(s).
- Be certain there is sufficient length in wires so no wires are pulled in tension.
- Wires should be secured to remain a minimum of four inches from exhaust pipes, manifolds or turbochargers unless components are adequately shielded from heat damage.
- Use rubber grommets whenever wires must pass through holes.
- All wires are covered in loom.

- Avoid routing wires in contact with fuel lines or plastic components.
- Always be sure ground straps are replaced when any work is done on engine components.
- Do not splice into existing wires. Route wire(s) full length to the appropriate source.
- If accessories must be added, relays may be required; check installation instructions thoroughly.

9-2.2.1 Zone and Fuse Locations

Rear PDC (Power Distribution Center) located in Engine Compartment.

24V Fuses

125A	Carrier HVAC Roof Top Unit	
150A	A Zone Battery Power	(Located Exterior Below Driver)
125A	D Zone Battery Power	(Located on Rear Bulkhead)

12V Fuses

100A	A Zone Battery Power
100A	D Zone Battery Power

A Zone

A2	Module Fuses		
	10A	Curbside Landing Lights	12V
	10A	Roadside Landing Lights	12V
	7.5A	Mirror Heat	12V
	7.5A	Kneeling Alarm	12V
	7.5A	Air Horn	12V
	7.5A	Gauge and Switch Dimmer	12V

A3	Module Fuses		
	7.5A	Front Ignition	24V
	7.5A	Generator Run Signal for Carrier HVAC	24V
	7.5A	Brake Interlock Solenoid	24V
	7.5A	Electric Horn	24V

A4	Module Fuses		
	7.5A	Heated Drain Valves	24V
	7.5A	Kneeling Exhaust Solenoid	12V

A	Zone Circuit Breakers	
	12V Battery	
	10A	Diagnostics Power
	10A	Radio
	7.5A	Dash Instruments
A	Zone Circuit Breakers	
	12V Ignition	
	7.5A	Pacific Insight Gauge Module
	7.5A	Mirror Power
	7.5A	Dash Instruments
	10A	Radio Ignition
	15A	Drivers Visor
	15A	Hatch Fan/Bay Locks
	24V Ignition	
	10A	Bay Lighting

B	Zone Location: Lower Right Dash		
	B1 Module Fuses		
	15A	Low Beam Headlights	12V
	15A	High Beam Headlights	12V
	7.5A	Left Turn Lights (Front)	12V
	7.5A	Right Turn Lights (Front)	12V
	7.5A	Stepwell Light	12V
	7.5A	Reverse Camera	12V
	7.5A	Warning Buzzer	12V
	7.5A	Fire Bell	12V
	B2 Module Fuses		
	10A	Fog Lights	12V
	7.5A	Front Marker Lights	12V
	7.5A	Door	24V
	7.5A	Windshield Wiper	12V
	7.5A	Door Clamp	24V
	7.5A	Door Extend	24V
	7.5A	Door Retract	24V
	7.5A	Generator Run Signal (Front HVAC)	24V
B	Zone Circuit Breakers		
	12V	Battery	
	15A	Front HVAC	
	10A	Cigarette Lighter	
	30A	Windshield Wiper	

C1	Zone Location: Aft of Front Door in Luggage Rack		
	C1 Module Fuses		
	7.5A	Side Turn Light (CS) (Forward and Aft)	12V
	15A	Interior Lights (Curbside Rear)	12V
	7.5A	Interior Lights (Curbside Front)	12V
	7.5A	Entry Light	12V
	7.5A	Map Light (Curbside)	12V
	7.5A	Kneel Warning Lights	12V

C2	Zone Location: Aft of Driver in Luggage Rack		
	C2 Module Fuses		
	7.5A	Side Turn Light (RS) (Forward and Aft)	12V
	15A	Interior Lights (Roadside Rear)	12V
	7.5A	Interior Lights (Roadside Front)	12V
	7.5A	Front and Side Upper Clearance Lights	12V
	7.5A	Drivers Light	12V
	7.5A	Map Light Roadside	12V

D	Zone Location: Rear Bulkhead		
	D1 Module Fuses		
	7.5A	Rear Marker/Clearance Lights	12V
	7.5A	High Mount Stop/Stop Lights	12V
	7.5A	Left Turn Light	12V
	7.5A	Right Turn Light	12V
	7.5A	Hand Throttle Enable	12V
	7.5A	Back Up Alarm/Lights	12V
	7.5A	Deceleration Lights	12V
	D2 Module Fuses		
	10A	Fuel Heater	24V
	7.5A	Reverse Stop Lights	12V
	7.5A	Starter Solenoid	24V
	7.5A	Water Pump	24V
	7.5A	Hydraulic Fan Relay	24V
	7.5A	Air Dryer	24V
	7.5A	Rear Ignition	24V
	7.5A	Alternator Excitor/Fan Power	24V
	D3 Module Fuses		
	7.5A	Throttle Interlock	Ground
	7.5A	ABS Traction Control Enable	Ground
	7.5A	Transmission Service Brake	Ground
	7.5A	Engine Service Brake	Ground
	7.5A	Engine Brake Low/High	Ground
	7.5A	Engine Brake Med/High	Ground
	7.5A	Shift Inhibit	Ground
	7.5A	Fast Idle	Ground

D	Zone Circuit Breakers/Fuses	
	12V Battery	
	15A	Engine Compartment Lights
	30A	ABS System
	12V Ignition	
	15A	Rear Pacific Insight Gauge Module
	15A	Rear Ignition
	5A	ABS System
	24V Battery	
	30A	Engine ECU Battery
	10A	Transmission ECU Battery
	24V Ignition	
	25A	Fan Power
	5A	Engine ECU Ignition
	10A	Transmission ECU Ignition

9-2.2.2 Wiring Circuit Color Codes

Control Wire Numbering/Color Code System

Color	Last Digit of Wire Number
Tan	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Purple	7
Gray	8
Black	9
Pink	0
White	Used for All Grounds

First series of the letter = the Multiplex Zone

First series of the number = the voltage and pin assignment of the connector at the module.

A2-105

A2 = A Zone

A2 = A2 Module

105 = (1 = 12 volts) (05 = PIN #5 Color Green)

Example: D2-214

D2 = D Zone

D2 = D2 Module

214 = (2 = 24 Volts) (14 = PIN#14 Color Yellow)

Blue Bird Non I/O Control Wire Numbering/Color Code System

24 Volt Wires are Red

12 Volt Wires are Orange

Example: 24VIGIN 10

24V = 24 Volts color Red

IGN = Ignition

10 = 10 Gauge Wire

Example: 12VBATT12

12V = 12 Volts Color Orange

BATT = Battery

12 = 12 Gauge Wire

All other wires that do not fit into these categories will be function coded.

Module Type	Used at Zone
G2A0MBC-32	A1
G2A-DIO-888	A2 A3 A4 C1 C2 D1 D2 D3
T2-DIO-240G-R7 or T2-32LED-OB-01	B1

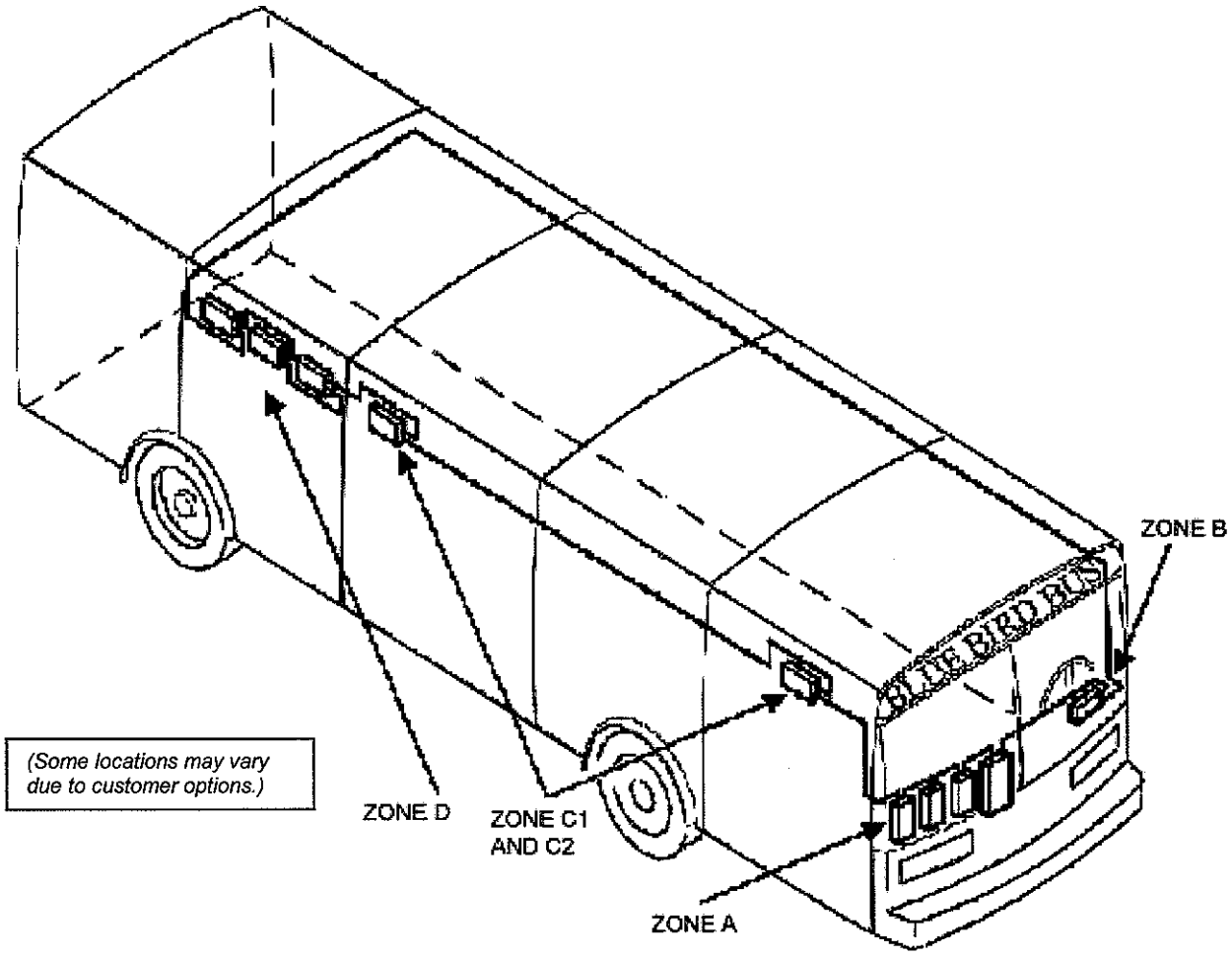


Fig. 1 - Zone Locations

9-2.2.3 Typical Module Locations

Modules are located in zones as near to the needed inputs and outputs as possible. The locations of the modules reduce the amount of "hard" wire necessary to reach the module. Some examples of zone locations are:

Zone A: Driver's Area/Main Panel

Zone B: Above Driver

Zone C: Front Door/Rear Door

Zone D: Engine Area

9-2.2.4 How the DINEX G2A System Works

The inputs to the Main Bus Controller (MBC) Module are supplied by the driver operated controls and the various switches and sensors linked together in the system.

G2A-MBC-32 module can receive up to 32 inputs. It does not have outputs and feedback channels.

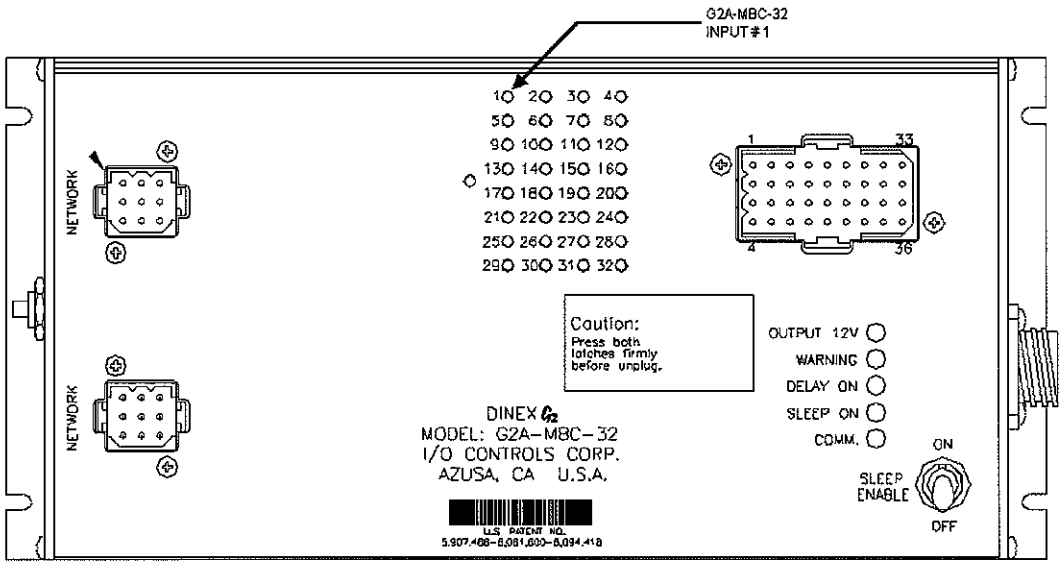


Fig. 2 - G2A-MBC-32

When the driver turns on a switch, the inputs are activated and a signal goes to the MBC.

The MBC is the COMMAND CENTER or the switchboard.

The MBC receives inputs as an on or off signal and relays the signal to the module that executes the commands. After the module executes the command it keeps track of how the system is working. Each module in the system has a unique address.

The MBC uses the DATA CABLE to link up with the various modules required to do the job.

The DATA CABLE is made up of eight, small gauge wires. The twist pair wire keeps out all unwanted noise that might distort the data. Data travels through the cable at 115,200 BPS or 1/1,000,000th of a second.

The DATA CABLE talks to all components through a unique "loop" link-up. The MBC checks in with each module and issues instruction. As a check, it rechecks its inputs to verify that the job has been done.

LEDs tell the driver/operator if the modules are working as he has instructed.
Single-controller systems are used in the Data Bus Cable. MBC is the only controller in a system and is the only programmable module among the system components.

The Main Bus Controller (MBC) is the general-in-command. It has the special built-in features, such as a computer, which tells all listeners what to do. After the MBC issues a command it tracks the work in progress.

The MBC communicates all instructions via a data cable to all modules in the network. Each module is identified by an address, like an employee, social security, or phone number. The MBC contacts modules by using this special ID number.

G2A-MBC-32 module can receive up to 32 inputs. The G2A-MBC-32 module does not have outputs and feedback channels.

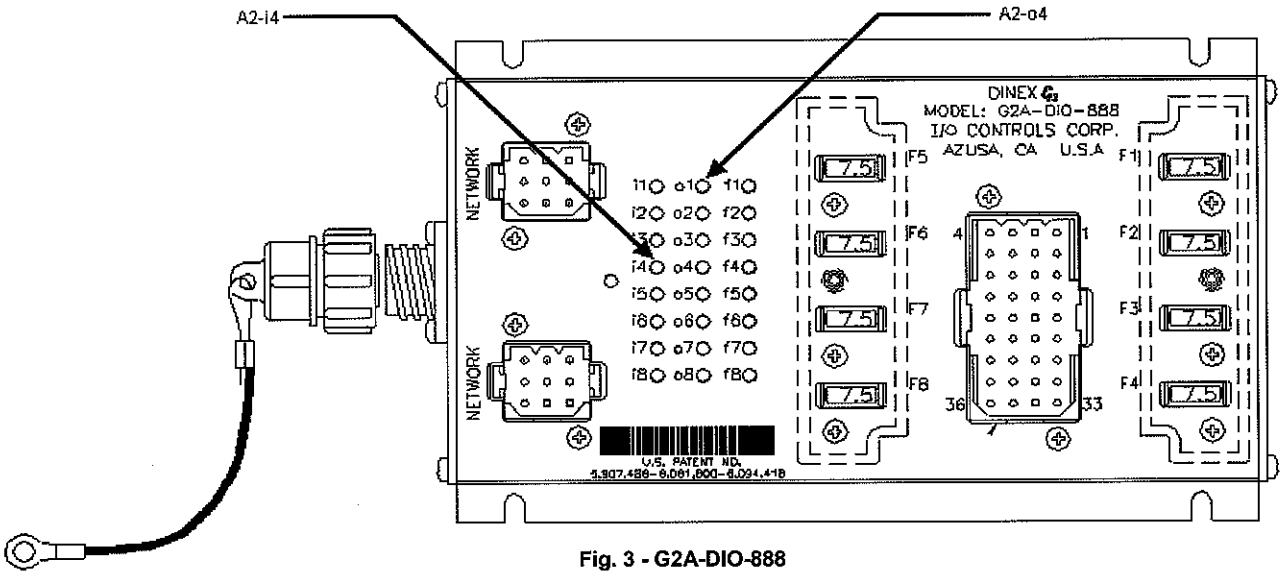


Fig. 3 - G2A-DIO-888

Multiplex modules are each assigned a unique address. This address allows the MBC to communicate directly with each specific module. Each module has a sub-address that relates to a specific circuit.

Most DIO modules can control up to eight output circuits and receive eight more inputs, and, optionally, 8 feedback channels.

For example, in the figure of G2A-DIO-888 above,

A	=	Module location on the bus
4	=	Module number
I4	=	Input point on the module

Thus,

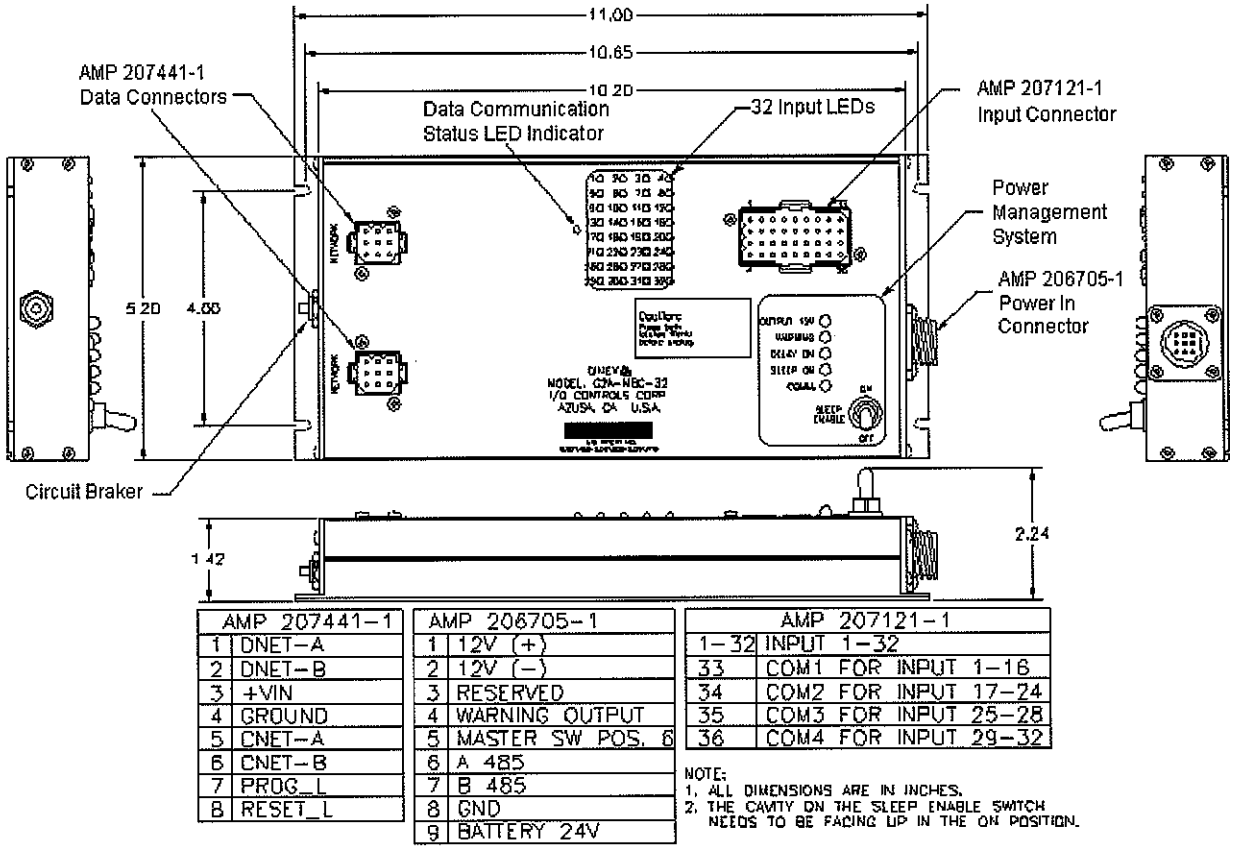
MBC-1	=	Input from master switch/run position
A2-i4	=	Input from interlock stop light pressure switch
A2-o1	=	Output to stop light lamps

The loop and how it works:

The MBC uses the main data bus cable to communicate with all the modules in turn, one after the other.

The MBC only addresses each module - using its unique address - one at a time, telling it what to do and then the MBC rechecks its inputs to verify the job has been done as ordered.

The Main Bus Controller with PMS Module G2A-MBC-32



AMP 207441-1	
1	DNET-A
2	DNET-B
3	+VIN
4	GROUND
5	CNET-A
6	CNET-B
7	PROG_L
8	RESET_L

AMP 206705-1	
1	12V (+)
2	12V (-)
3	RESERVED
4	WARNING OUTPUT
5	MASTER SW POS. 6
6	A 485
7	B 485
8	GND
9	BATTERY 24V

AMP 207121-1	
1-32	INPUT 1-32
33	COM1 FOR INPUT 1-16
34	COM2 FOR INPUT 17-24
35	COM3 FOR INPUT 25-28
36	COM4 FOR INPUT 29-32

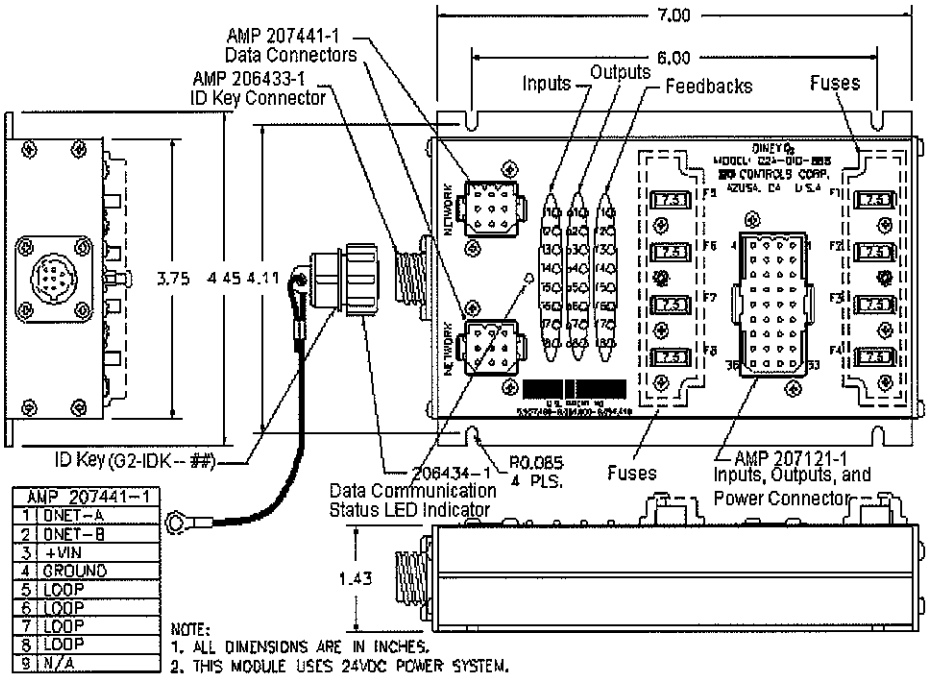
NOTE:
1. ALL DIMENSIONS ARE IN INCHES.
2. THE CAVITY ON THE SLEEP ENABLE SWITCH NEEDS TO BE FACING UP IN THE ON POSITION.

Fig. 4 - G2A-MBC-32 Module Diagram

The Main Bus Controller – G2A-MBC-32 -- is the top-level device. It is the command post for what's happening throughout the operating system.

- The Main Bus Controller controls and monitors up to 16 modules in a single level of data bus.
- It interfaces with 32 inputs and contains its own power management unit for entire system.
- It interfaces with switches, such as limit switches, temperature and pressure switches, and can directly control other modules.
- LED status indicators are provided on all input points.
- It stores instructions for control and monitor.
- It supports Automatic Test Equipment.
- All I/O points are optically isolated.
- It replaces relays with solid state, electrical switching.
- The MBC is simple to replace in the field.
- It has Built-In Self Test functions in software.

Intelligent Digital Input/Output Control Module G2A-DIO-888



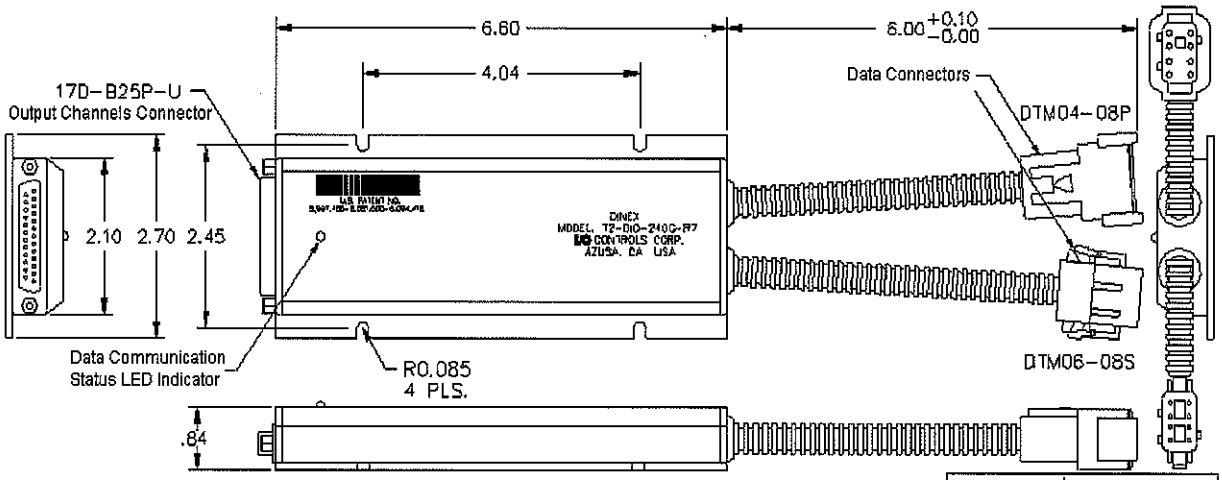
AMP 207441-1	
1	DNET-A
2	DNET-B
3	+VIN
4	GROUND
5	LOOP
6	LOOP
7	LOOP
8	LOOP
9	N/A

AMP 207121-1		
PIN	SOURCE OUTPUT CONNECTION	SINK OUTPUT CONNECTION
1,2	CH 1 POWER	CH 1 OUTPUT
5,6	CH 1 OUTPUT	GROUND
9,10	CH 2 POWER	CH 2 OUTPUT
13,14	CH 2 OUTPUT	GROUND
17,18	CH 3 POWER	CH 3 OUTPUT
21,22	CH 3 OUTPUT	GROUND
25,26	CH 4 POWER	CH 4 OUTPUT
29,30	CH 4 OUTPUT	GROUND
4	CH 5 POWER	CH 5 OUTPUT
8	CH 5 OUTPUT	GROUND
12	CH6 POWER	CH 6 OUTPUT
16	CH 6 OUTPUT	GROUND
20	CH 7 POWER	CH 7 OUTPUT
24	CH 7 OUTPUT	GROUND
28	CH 8 POWER	CH 8 OUTPUT
32	CH 8 OUTPUT	GROUND
33	GROUND	GROUND
34	POWER 24V	POWER 24V
3	INPUT 1	INPUT 1
7	INPUT 2	INPUT 2
11	INPUT 3	INPUT 3
15	INPUT 4	INPUT 4
19	INPUT 5	INPUT 5
23	INPUT 6	INPUT 6
27	INPUT 7	INPUT 7
31	INPUT 8	INPUT 8
35	INPUT COMMON	INPUT COMMON
36	N/C	N/C

Fig. 5 - G2A-DIO-888 Module Diagram

- DIO normally can only handle 8 inputs, 8 feedbacks and 8 outputs.
- Special DIO units allow additional input controls (up to 32 inputs total).
- Replace like devices with like devices. READ THE LABELS first before replacing one unit with another.
- DIOs are on/off units only and are not programmable.
- Feed-back circuits are used for BIST (Built-In Self Test)

Intelligent Digital 24 Outputs Gateway Module T2-DIO-240G-R7



NOTE:
1 ALL DIMENSIONS ARE IN INCHES

CONNECTOR	17D-B25P-U																								
PIN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
OUTPUT CHANNEL	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	GND

DTM04-08P/DTM06-08S		
PIN	COL.	FUNCTION
1	YEL	DNET RS-485+
2	GRN	DNET RS-485-
3	RED	+12V, ISOLATED
4	BLK	GROUND, ISOLATED

Fig. 6 - T2-DIO-24OG-R7 Module Diagram

- For driving LED modules.
- Total 24 outputs.
- LEDs on the instrument panel are the outputs.
- Acts as gateway on DINEX network and other host systems.

32LED Indicator Panel T2-32LED-OB-01

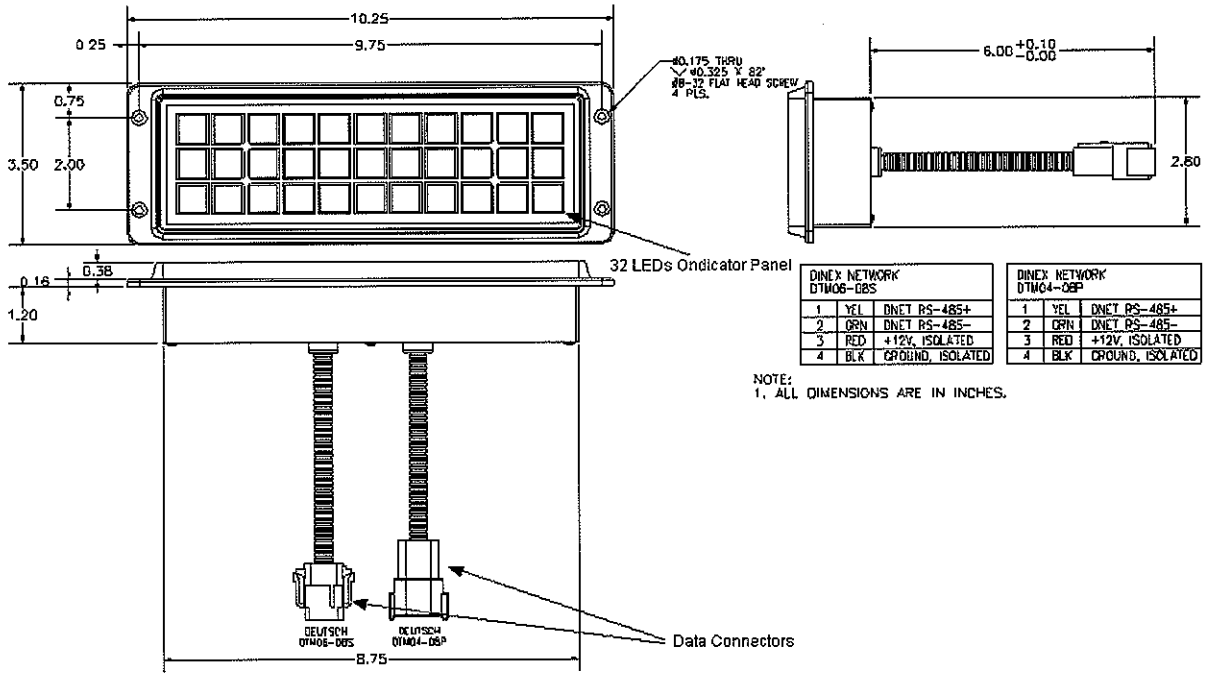


Fig. 7 - T2-32LED-OB-01 Panel Diagram

- Instrument Panel LEDs are multiplexing modules.
- Total 32 LED indicators.
- LEDs on the instrument panel are the outputs.
- Each indicator contains multiple LED elements.
- The LED cluster can be removed/replaced as a unit or LEDs can be removed/replaced individually.
- Replacement LEDs are not labeled (each label is a separate piece).
- First indication that an LED is failing maybe a dimming of the LED.

9-2.2.5 Diagnosis and Troubleshooting

The DINEX G2A system is composed of a network of rugged modules connected to a single data bus. This data bus interfaces with DINEX G2A modules. The DINEX G2A modules interface with sensors, switches, actuators and vehicle control devices.

The simplified wiring of the DINEX G2A network system makes troubleshooting relatively simple in most cases.

9-2.2.5.1 Four Basic Steps to Diagnosis and Troubleshooting:

- Visual Inspection
- I/O Test Kit Verification
- Software Testing and Programming
- BIST (Built-In Self Test)

1. Visual Inspection

Eighty-five percent of failed circuits can be diagnosed by using modules' LEDs - failures usually related to defective parts, i.e., bulbs, switches, etc. This section discusses in depth how to diagnose and troubleshoot through visual inspection.

2. I/O Test Kit Verification

The I/O Control Test Kit provides for the testing of modules and the communication network. The I/O Control Test Kit will assist you in
diagnosing those faults not found during visual inspection. *The next chapter will introduce these test kits in more details.*

3. Software Testing and Programming

Software Testing provides a way of verifying module programming or programming of replacement modules. *Please refer to bus manufacturer's control logic diagrams/ladder charts for software testing and programming.*

NOTE: If the three steps fail to locate or solve the faults, then the module is suspect. The module must be returned to the manufacturer for repair.

No internal repairs are permitted unless authorized by the factory.

4. BIST (Built-In Self Test)

The BIST may be invoked any time. It is a passive test which uses the feedback circuits to check the output circuits. It also checks the DINEX module communications.

9-2.2.5.1 Visual Inspection

- Visual inspection of the LEDs on the DINEX G2A modules will normally lead to the identification of 85% of all faults.
- Use Ladder Logic Diagrams -- to identify the relationship and the hook-up of devices -- and,
- Electrical Schematics -- to trace the circuits linked to a malfunctioning module indicated by the LED -- is all that is required at the Visual Inspection Level.
- Input Circuit LEDs.
- Ground connection – Verify that pin 16 of the large round AMP connector has a good chassis ground connection.

All modules, except PMS and junction boxes, have green LEDs to monitor input circuits. Each input has its own address. The lighted green LED indicates active input.

NOTE: Some vehicle options - such as mirror heaters, air dryers, etc. - will not turn on the amber LED until a preset temperature is reached.

LED marker lights will not turn on the amber LED's at all.

- Output Circuit LEDs

DIO-888s use two LEDs, amber and red, to monitor output. If the circuit is off, the amber LED is lighted. The circuit is complete and ready, but is not active.

A lighted red LED indicates that the circuit is active. The amber LED is off.

- Using LED on the modules to diagnose failed components.
- The "tools" necessary to diagnose faults are LEDs on the modules, "Ladder Charts" (or logic diagrams) and Electrical Schematics.
- When an LED does not indicate proper circuit operation, the electrical schematic can be used to trace the circuit from the module(s) to the input or output.
- Multiplex Test Equipment, Step 2, should not be necessary until, and only until, visual inspection has failed to indicate the failure or to confirm the functionality of the operation.

Checking the Input LEDs

- The MBC and DIO modules have green LEDs to monitor all inputs.
- Each input point has a unique location or sub-address. When the green LED is on, the input is ACTIVE.

LEDs Monitor Circuits

NOTE: During normal operation, the red and amber LEDs alternate off

With the circuit turned off: An amber LED comes on. (The amber LED indicates circuit integrity.) A circuit is complete and ready, but IT DOES NOT MEAN THE CIRCUIT IS ACTIVE.

When the circuit is in use: A red LED will come on. This indicates that the circuit is ACTIVE. The amber LED turns off.

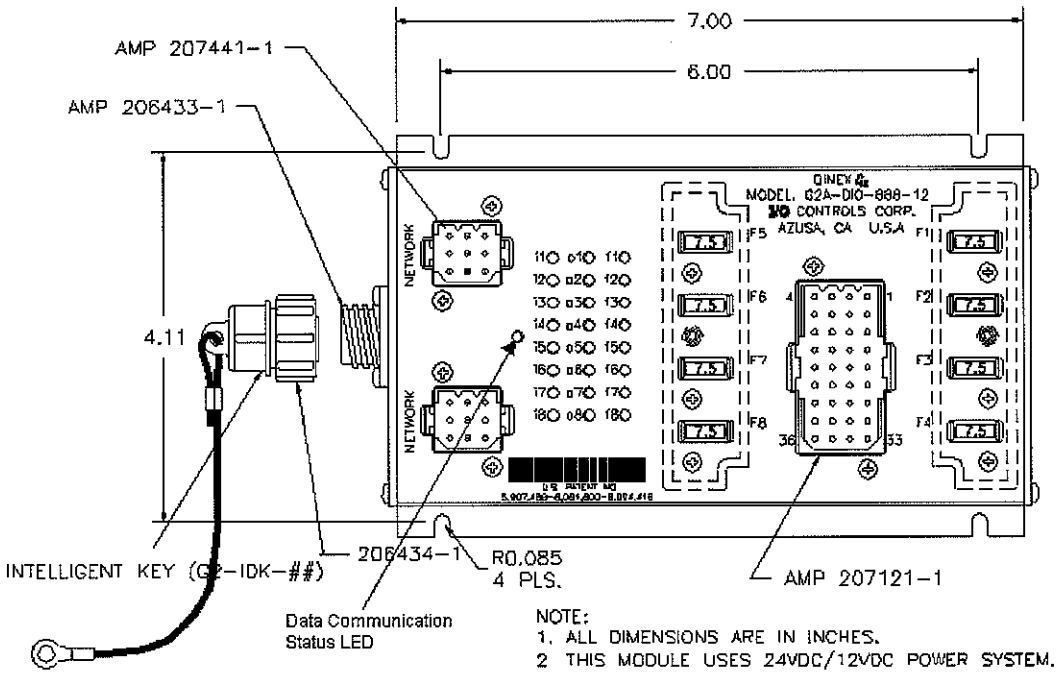


Fig. 8 - Data Communication Status LED Program

The Data Communications Status LED

NOTE: On some models, according to specification of each particular customer, the Data Communication Status LED is located on the left side panel of the module.

- The MBC, and DIO modules have Data Communications Status LED mounted on the left side of the face of the module, as shown in the figure above for a DIO module.
- The Data Link LED flashes at a rapid rate to indicate that the module is communicating.
- Modules in communication with DIOs respond with flashing LEDs. When multiple circuits respond, check the Data Link LED to see if it is flashing.

Tips on locating the site of a Failure using LEDs on the DIO modules

- If the load circuit is open -- i.e., bulb blown, burned solenoid, broken wire, etc.—the amber LED will not light up.
- If both amber and red LEDs are on when the circuit is active, check the fuse.
- If a module's red LED is out,
  a) check the data communication status LED on the left side of the module
  b) check cable for loose connections or damage,
  c) or check the related input status.

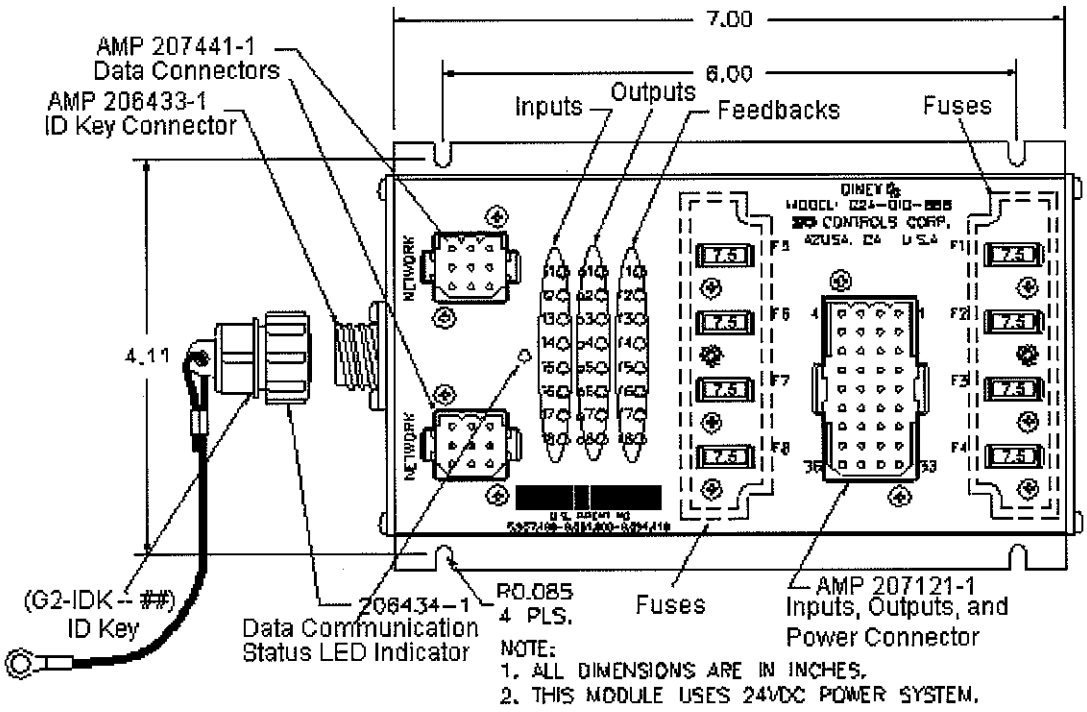


Fig. 9 - LEDs Visual Inspection Diagram

Tips on locating the site of a Failure using LEDs on the DIO modules

- Internal circuits in the multiplex units (DIO) allow a small amount of current to flow to the output load -- even when the load is inactive.

- Current from the battery bus bar will pass through the amber LED, a large resistor, and the load to get to ground.

- A blown fuse will still allow current to flow through the amber LED and the red LED will be on because the circuit is trying to activate itself.

The No Connection Circuit

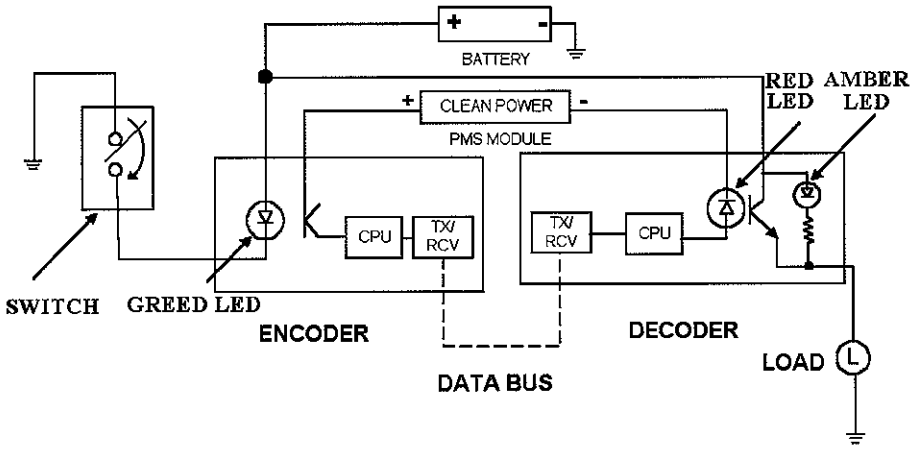


Fig. 10 - Functional Diagram of DINEX MPX System

- The simplified circuit on the previous page shows that there are no direct links among input, the data bus, and the output.
  - The green LED turns on the sensor and switch inputs.
  - A light sensing (solar) transistor closes and a CPU sends out a signal on the data bus.
  - The receiving CPU lights the red LED.
  - Another light sensing transistor closes and completes the circuit from the battery to the load.
- No direct wire links eliminates the need for external diodes.
- Danger of voltage spikes damaging the data loop or modules is eliminated.

LADDER CHARTS

Understanding the Ladder Charts

Think of ladder charts as logic diagrams, see below:

Active And Inactive Inputs

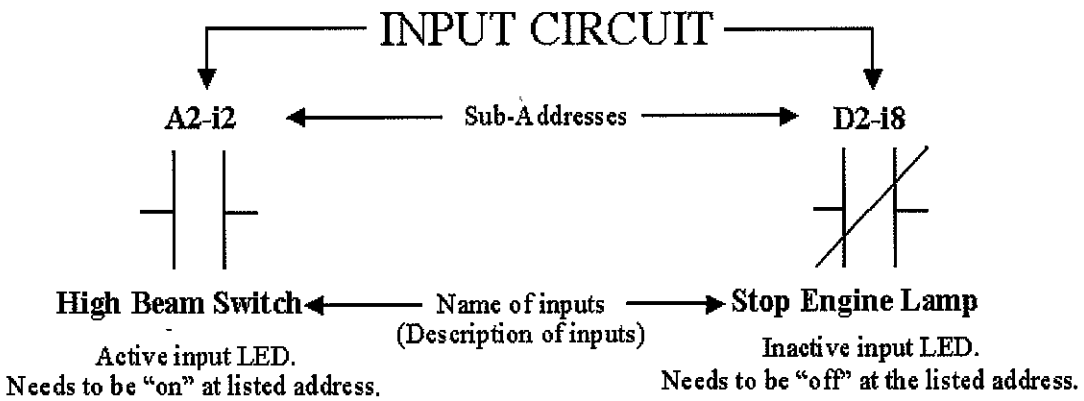


Fig. 11 - Active and Inactive Component Diagram

- The MBC can be programmed to use open (inactive) or closed (active) switch input to determine a course of action.
- Imagine a relay that is normally open. Imagine the LED as a relay coil:
    - With no power to the relay, the LED is off. The relay is in the normally open position.
    - When power is applied, the LED is on and the relay is in the closed position. The current flows through the control load.

About Ladder Charts

- Simple charts make diagnosing circuits easy.
- All conditions must be met to complete an action.
- Charts indicate any parallel circuits for an action.

What Do Ladder Charts Look Like?

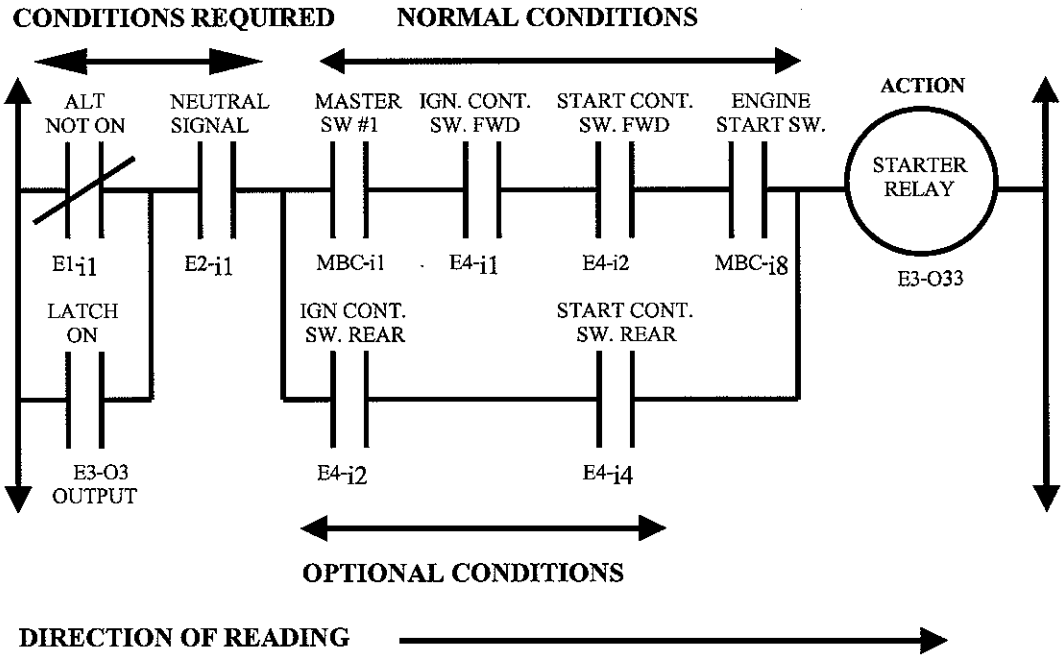


Fig. 12 - Ladder Charts Diagram

More About Ladder Charts

- The Ladder Chart above shows each step necessary for a vehicle to be started.
    1. The alternator must not be charging.
    2. Vehicle is in neutral.
    3. From the front -- the master switch is on.
    4. From the rear -- the rear ignition and starter switches may be used.
    5. From the rear -- the ignition and starter control switches are set in front start position.
    6. Use the starter button.
    7. "Latch On" function circuit is set for starter relay.
        a. Circuit remains complete as long as starter is cranking, even if alternator starts to charge.
        b. Starter can not be re-engaged if alternator is charging.

BIST (Built-In Self Test)

On the buses, the 'Left Turn' and 'Right Turn' lamps on the Dashboard LED display can display a flash code if there is any Dinex module communication failure or Output Feedback problem. These are generally known as BIST flash codes, for Built In Self Test. The Right Turn, Left Turn, and Diagnostic Light Test switch must all be on at once in order to begin a flash code cycle.

Once begun, the flash code sequence will go through and check all of the modules, so there is no need to hold all three switches continuously. The flash code sequence will cycle again if the three switches are on, otherwise the BIST sequence will check each module and then stop. The warning buzzer is usually on when the Diagnostic Light Test switch is on, but the buzzer is silenced during the BIST. If there is no BIST failure, then the warning buzzer will sound periodically while all three switches are held on and neither the Left Turn nor the Right Turn dashboard lamp will light.

The Right Turn lamp on the Dashboard LED display will flash quickly to show which module has a failure. The Left Turn lamp will flash slowly to show which output channel(s) from the failed module is actually bad. If the Left Turn lamp does not flash, then this indicates a module communications failure rather than an output failure.

RIGHT TURN Lamp is:	Meaning
Off	Dinex module is OK
One Flash	Module A2 #64 Fault
Two Flashes	Module A3 #65 Fault
Three Flashes	Module A4 #66 Fault
Four Flashes	Module C1 #67 Fault
Five Flashes	Module C2 #68 Fault
Six Flashes	Module D1 #69 Fault
Seven Flashes	Module D2 #70 Fault
Eight Flashes	Module D1 #71 Fault
14 Flashes	Module A1 (MBC) #77 Fault (internal)
15 Flashes	Module B1 #78 Fault
9 - 13, or 16 Flashes	Incorrect Dinex program, Incorrect Accessory (Palm PC).
LEFT TURN Lamp is:	Meaning
Off	Nothing (Or Communication Fail)
One Flash	Module output #1 failure
Two Flashes	Module output #2 failure
Three Flashes	Module output #3 failure
Four Flashes	Module output #4 failure
Five Flashes	Module output #5 failure
Six Flashes	Module output #6 failure
Seven Flashes	Module output #7 failure
Eight Flashes	Module output #8 failure

MBC 32IN MODULE A1				
Input				
Name	**Wire #**	**Color**	**Voltage**	**Description**
A1-I01	MBC001	TN	GND	KEY SW IGNITION
A1-I02	MBC002	RD	GND	HEADLIGHT SW ON POSITION
A1-I03				HEADLIGHTS PARK POSITION
A1-I04	MBC004	YL	GND	FRONT START SW
A1-I05	MBC005	GN	GND	REAR LANDING LT SW
A1-I06	MBC006	BL	GND	CS LANDING LTS SW
A1-I07	MBC007	PU	GND	R/S LANDING LT SW
A1-I08	MBC008	GY	GND	UNDERSEAT LT SW (BLUE)
A1-I09	MBC009	BK	GND	LUGG DOOR UNLOCK SIGNAL
A1-I10	MBC010	PK	GND	HAZARD SW
A1-I11	MBC011	TN	GND	INTERIOR LTS NORM
A1-I12	MBC012	RD	GND	INTERIOR LTS ALL
A1-I13	MBC013	OR	GND	INT LTS MASTER SW
A1-I14				LUGG DOOR LOCK SIG
A1-I15	MBC015	GN	GND	CLEARANCE LTS SW
A1-I16	MBC016	BL	GND	CLEAR LT INTERUPT SW
A1-I17	MBC017	PU	GND	CHIME OVERRIDE SW
A1-I18				KNEEL UP SW
A1-I19	MBC019	BK	BND	KNEEL DOWN SW
A1-I20	MBC020	PK	GND	LIFT AUTHORIZE SW
A1-I21	MBC021	TN	GND	LIFT OVERRIDE SW
A1-I22	MBC022			SILENT ALARM SW
A1-I23	MBC023	OR	GND	HORN SW
A1-I24				ACCESSORY (RV)
A1-I25	MBC025	GN	24V	DEFROST/HEAT SIGNAL
A1-I28				12V DISCONNECT SHUTDOWN
A1-I30				A/C FAIL
A1-I31	MBC231	TN	24V	NEUTRAL SIGNAL
A1-I32				RAMP STOW SIGNAL

Flag		
Name	**Location**	**Description**
A1-F01	A1D01, R 0	ATS OK TO RUN FLAG
A1-F02	A1D01, R 1	BIST COMBO FLAG
A1-F03	A1D01, R 8	SLOW BIST FLAG
A1-F04	A1D01, R 10	BIST CHIRP FLAG
A1-F05	A1D01, R 12	FLASH CODE FLAG
A1-F06	A1D02, R 2	CAT NO DATA J1939 FROM ENGINE
A1-F07	A1D02, R 4	ABS NO DATA J1939

Code	
Name	**Description**
A1-C01	DINEX G2 KERNEL 1 CALL SUBROUTINES
A1-C02	DINEX G2 KERNEL 2 MAIN BODY SUBROUTINES
A1-C03	DINEX G2 KERNEL 3 FLASH CODE FLAG
A1-C04	DINEX G2 KERNEL 4 RESET BIST
A1-C05	DINEX G2 KERNEL BIST COUNTER
A1-C06	DINEX G2 KERNEL 6 SLOW BIST FLAG
A1-C07	DINEX G2 KERNEL 7 FORCE POINTS
A1-C08	START-UP SEQUENCE J1939
A1-C09	CATERPILLAR J1939 TO DINEX
A1-C10	ABS J1939 TO DINEX
A1-C11	J1939 DINEX J1939 OUTPUTS

MBC 32IN MODULE A2				
Input				
Name	**Wire #**	**Color**	**Voltage**	**Description**
A2-I01				HORN SELECT SW (ELECTRIC)
A2-I02	A2-007	PU	GND	HORN SELECT (AIR) SW
A2-I03	A2-011	TN	GND	AISLE LTS W
A2-I04	A2-015	GN	GND	ABS TRACT CTRL SW
A2-I05	A2-019	BK	GND	MIRROR HEAT SW
A2-I06	A2-023	OR	GND	DRIVERS LT SW
A2-I07	A2-027	PU	GND	READING LTS SW
A2-I08				READING LTS TEST SW

MBC 32IN MODULE A2					
Output					
Name	**Wire #**	**Color**	**Voltage**	**Location**	**Description**
A2-O01	A2-105/106		12V	A2D01, R 0	C/S LANDING LTS
A2-O02	A2-113/114		12V	A2D01, R 2	R/S LANDING LTS
A2-O03				A2D01, R 4	ADA (LIFT) LIGHTS
A2-O04			12V	A2D01, R 6	KNEEL LEVEL SOL.
A2-O05	A2-108	GY	12V	A2D01, R 8	MIRROR HEAT
A2-O06	A2-116	BL	12V	A2D01, R 10	KNEELING ALARM
A2-O07	A2-124	YL	12V	A2D01, R 1	AIR HORN
A2-O08				A2D02, R 3	DIMMER

Timer				
Name	**Timer Type**	**Time**	**Time Off**	**Description**
A2-T03	Delay Off	300.00		5 MINUTE TIMER

NOTE: Time is in seconds. For example 300 seconds = 5 minutes.

MBC 32IN MODULE A3				
Input				
Name	**Wire #**	**Color**	**Voltage**	**Description**
A3-I01	A3-003	OR	GND	CRUISE ON/OFF SW
A3-I02	AD-007	PU	GND	CRUISE SET SW
A3-I03				CRUISE RESUME SW
A3-I04				ENGINE BRAKE ENABLE SW
A3-I05				ENGINE BRAKE LOW SW
A3-I06				ENGINE BRAKE MED SW
A3-I07				ENGINE BRAKE HIGH SW
A3-I08				HIGH IDLE SW

MBC 32IN MODULE A3					
Output					
Name	**Wire #**	**Color**	**Voltage**	**Location**	**Description**
A3-O01	A3-205/206		24V	A3D01, R 0	12V/24V IGN BUS
A3-O02				ADD01, R 2	3 MPH SIGNAL (RV)
A3-O03	A3-221/222		24V	A3D01, R 4	UNDERSEAT LTS
A3-O04				A3D01, R 7	KNEEL RISE SOL.
A3-O05	A3-208	GY	24V	A3D01, R 10	GEN RUN MAIN A/C
A3-O06				A3D01, R 14	KNEEL EXHAUST SOL.
A3-O07	A3-224	YL	24V	A3D02, R 0	BRAKE INTLK SOLENOID
A3-O08	A3-232	RD	24V	A3D02, R 9	ELECTRIC HORN

MBC 32IN MODULE A4				
Input				
Name	**Wire #**	**Color**	**Voltage**	**Description**
A4-I01				TAG AXLE DUMP SW
A4-I02				SHIFT INHIBIT (RV)
A4-I03	A4-011	TN	GND	FIRE SHUTDOWN SIGNAL
A4-I04				MASTER RLY INPUT (RV)
A4-I05				LOW AIR WARNING
A4-I06				LOW FUEL WARNING
A4-I07				KNEEL RISE SENSOR
A4-I08				KNEEL EXHAUST SENSOR

MBC 32IN MODULE A4					
Output					
Name	**Wire #**	**Color**	**Voltage**	**Location**	**Description**
A4-O01	A4-205/206		24V	A4D02, R 0	LIFT POWER
A4-O02				A4D02, R 2	HEATED DRAIN VALVES
A4-O04	A4-229/230		12V	A4D02, R 5	TAG AXLE DUMP SOL.
A4-O05	A4-108	GY	12V	A4D02, R 9	STOP REQUEST LIGHTS
A4-O06	A4-116	BL	12V	A4D03, R 0	PASS CHIMES
A4-O07	A4-124	YL	12V	A4D03, R 7	W/C CHIMES
A4-O08	A4-232	RD	24V	A4D03, R 13	SILENT ALARM OUTPUT

Timer				
Name	**Timer Type**	**Time**	**Time Off**	**Description**
A4-T01	Turn On	2.00		TURN ON 2 SEC

NOTE: Time is in seconds. For example 2.00 seconds = 2 seconds.

Flag		
Name	**Location**	**Description**
A4-F01	A4D01, R 0	RAMP FLAG
A4-F02	A4D01, R 7	KNEEL DOWN FLAG
A4-F03	A4D01, R 12	KNEEL UP FLAG

32 LED DISPLAY A5					
Output					
Name	**Wire #**	**Color**	**Voltage**	**Location**	**Description**
A5-O01				A5-D01, R3	A/C FAIL
A5-O02				A5-D01, R6	LIFT AUTHORIZED
A5-O03				A5-D01, R7	LEFT TURN
A5-O04				A5-D01, R12	WATER IN FUEL
A5-O05				A5-D01, R14	LOW FUEL
A5-O06				A5-D02, R0	BRAKE
A5-O07				A5-D02, R3	DAYTIME RUN LTS
A5-O08				A5-D02, R6	LIFT DOOR OPEN
A5-O09				A5-D02, R9	ROOF VENT
A5-O10				A5-D02, R12	KNEEL
A5-O11				A5-D03, R 0	LIFT NOT STOWED
A5-O12				A5-D03, R 3	ATC TRACTION CTRL
A5-O13				A5-D03, R6	TAG AXLE DUMP
A5-O14				A5-D03, R9	BAGGAGE UNLOCKED
A5-O15				A5-D03, R13	PARK
A5-O16				A5-D04, R 0	HOSTESS
A5-O17				A5-D04, R 4	LOW COOLANT
A5-O18				A5-D04, R 8	HIGH BEAM
A5-O19				A5-D04, R11	TRANS TEMP
A5-O20				A5-D04, R14	ALT FAIL
A5-O21				A5-D05, R 0	STOP ENGINE
A5-O22				A5-D05, R 4	RESTROOM EMERGENCY
A5-O23				A5-D05, R7	LOW AIR
A5-O24				A5-D05, R10	CHECK ENGINE
A5-O25				A5-D05, R13	ADA STOP REQUEST
A5-O26				A5-D06, R0	HYDRAULIC TEMP
A5-O27				A5-D06, R 3	ABS BRAKING FAULT
A5-O28				A5-D06, R 7	STOP REQUEST
A5-O29				A5-D06, R10	CHECK TRANS
A5-O30				A5-D06, R13	WAIT TO START
A5-O31				A5-D07, R 0	FIRE
A5-O32				A5-D07, R 3	RIGHT TURN SIGNAL

Timer				
Name	**Timer Type**	**Time**	**Time Off**	**Description**
A5-T01	Turn On	3.00		LAMP TEST
A5-T02	Turn On	10.00		HOSTESS 10S ON
A5-T03	Turn On	4.00		TT TEST BYPASS

NOTE: Time is in seconds. For example 3.00 seconds = 3 seconds.

Flag		
Name	**Location**	**Description**
A5-F01	A5-D01, R 0	TEST 3 SEC
A5-F02	A5-D01, R 2	TT TEST BYPASS

B1 MODULE B1				
Input				
Name	**Wire #**	**Color**	**Voltage**	**Description**
B1-I01				HIGH BEAM SW
B1-I02				LFT TURN SW
B1-I03				RT TURN SW
B1-I07				SERVICE BRK PSI SW
B1-I08				P BRAKE PSI SW

B1 MODULE B1					
Output					
Name	**Wire #**	**Color**	**Voltage**	**Location**	**Description**
B1-O01				B1-D01, R 2	LOW BEAM LTS
B1-O02				B1-D01, R 5	HIGH BEAM LTS
B1-O03				B1-D01, R 7	LFT TURN LTS & MIRROR
B1-O04				B1-D01, R 11	RT TURN LTS & MIRROR
B1-O05				B1-D02, R 0	STEPWELL LTS
B1-O06				B1-D02, R 2	BACK UP CAMERA
B1-O07				B1-D02, R 4	WARNING BUZZER
B1-O08				B1-D02, R15	FIRE BELL

Timer				
Name	**Timer Type**	**Time**	**Time Off**	**Description**
B1-T01	Flash	0.50	0.50	FLASH TIMER

Flag		
Name	**Location**	**Description**
B1-F01	B1-D01, R 0	FLASH FLAG

B2 MODULE B2				
Input				
Name	**Wire #**	**Color**	**Voltage**	**Description**
B2-I01				FRT DOOR CLOSE SIGNAL
B2-I02				DASH FRT DOOR UNLOCK SW
B2-I03				DASH FRT DOOR OPEN SW
B2-I04				DASH FRT DOOR CLOSE SW
B2-I05				FOG LT SW
B2-I06				DASH FRT DOOR LOCK SW

B2 MODULE B2					
Output					
Name	**Wire #**	**Color**	**Voltage**	**Location**	**Description**
B2-O01				B2-D01, R 0	FOG LTS
B2-O02				B2-D01, R 4	FRONT MARKERS
B2-O03				B2-D01, R 9	DOOR POWER
B2-O04				B2-D01, R 12	WIPER IGNITION
B2-O05				B2-D02, R 0	FRT DOOR CLAMP
B2-O06				B2-D02, R 4	FRT DOOR EXTEND
B2-O07				B2-D02, R 8	FRT DOOR RETRACT
B2-O08				B2-D02, R 15	GEN RUN FRONT A/C

Timer				
Name	**Timer Type**	**Time**	**Time Off**	**Description**
B2-T01	Delay On	0.35		FT DOOR .35 DELAY

ZONE C1 DIO 808 C1				
Input				
Name	**Wire #**	**Color**	**Voltage**	**Description**
C1-I01				C/S PASS STOP REQ
C1-I02				C/S ADA STOP REQ
C1-I03				EGRESS WIN SIG
C1-I04				ROOF HATCH OPEN SW
C1-I07				HOSTESS CALL SW
C1-I08				LIFT DOOR SIG

ZONE C1 DIO 808 C1					
Output					
Name	**Wire #**	**Color**	**Voltage**	**Location**	**Description**
C1-O01	C1-205/206		24V	C1D01, R 0	RT TURN LTS
C1-O02				C1D01, R 4	NIGHT LIGHTS
C1-O03				C1D01, R 6	C/S LUGG RACK LTS
C1-O04				C1D01, R 10	C/S VEST LTS
C1-O05	C1-108	GR	12V	C1D01, R 14	AISLE LTS (CEILING)
C1-O06	C1-116	BL	12V	C1D02, R 0	ENTRY LT
C1-O07	C1-124	YL	12V	C1D02, R 7	C/S READING LTS
C1-O08	C1-132	RD	12V	C1D02, R 11	KNEEL LIGHT

ZONE C2 DIO 808 C2				
Input				
Name	**Wire #**	**Color**	**Voltage**	**Description**
C2-I01	C2-003	OR	GND	PASS STOP REQ. SW
C2-I02	C2-007	PU	GND	R/S ADA STOP REQ. SW
C2-I03				EGRESS WINDOW SIG
C2-I04	C2-015	GN	GND	ROOF HATCH SW
C2-I05				DOOR MASTER SW
C2-I07	C2-027	PU	GND	HOSTESS CALL SW

ZONE C2 DIO 808 C2					
Output					
Name	**Wire #**	**Color**	**Voltage**	**Location**	**Description**
C2-O01	C2-205/206		24V	C2D01, R 0	LFT TURN LTS
C2-O02				C2D01, R 4	NIGHT LIGHTS
C2-O03				C2D01, R 6	LUG RAG R/S LTS
C2-O04				C2D01, R 10	R/S VEST LTS
C2-O05	C2-108	GY	12V	C2D01, R 13	UPPER MARKERS FRT & SIDE
C2-O06	C2-116	BL	12V	C2D02, R 4	DRIVERS LT
C2-O07	C2-124	YL	12V	C2D02, R 10	R/S READING LTS
C2-O08	C2-132	RD	12V	C2D02, R 14	FAREBOX LT

Timer				
Name	**Timer Type**	**Time**	**Time Off**	**Description**
C2-T01	Delay Off	5.00		5 SEC DELAY OFF

Flag		
Name	**Location**	**Description**
C2-F01		REAR DOOR SW SET
C2-F02		PRIOR REAR DOOR SW STATUS
C2-F03		C2-01 FLAG

Zone D1 DIO 808 D1				
Input				
Name	**Wire #**	**Color**	**Voltage**	**Description**
D1-I01	D1-003	OR	GND	TEMP DETECTORS
D1-I02	D1-007	PU	GND	GEN RUN SIGNAL
D1-I03	D1-011	TN	GND	HOT HYD FLUID LT
D1-I04				HOT HYD FLUID FAN

ZONE D1 DIO 808 D1					
Output					
Name	**Wire #**	**Color**	**Voltage**	**Location**	**Description**
D1-O01	D1-105/106		12V	D1D01, R 0	REAR MARKER/CLEARANCE/LICENSE PLATE LAMPS
D1-O02	D1-113/114		12V	D1D01, R 4	STOP LAMPS
D1-O03	D1-121/122		12V	D1D01, R 6	R/S TURN SIGNAL
D1-O04	D1-129/130		12V	D1D01, R 10	C/S TURN SIGNAL
D1-O05				D1D01, R 14	TAIL LTS LICENSE
D1-O06	D1-116	BL	12V	D1D02, R 0	HAND THROT ENABLE
D1-O07	D1-124	YL	12V	D1D02, R 3	BACKUP ALARM/LIGHTS
D1-O08	D1-132	RD	12V	D1D02, R 8	DECEL LIGHTS

ZONE D2 DIO 808 D2				
Input				
Name	**Wire #**	**Color**	**Voltage**	**Description**
D2-I01	D2-003	OR	GND	IGN CNTL-FWD SW
D2-I02	D2-007	PU	GND	IGN CNTL-REAR SW
D2-I03	D2-011	TN	GND	REAR START SW
D2-I04				ENGINE DOOR OPEN
D2-I05	D2-019	BK	GND	REST RM EMERGENCY SW
D2-I06	D2-023	OR	GND	WATER IN FUEL

ZONE D2 DIO 808 D2					
Output					
Name	**Wire #**	**Color**	**Voltage**	**Location**	**Description**
D2-O01	D2-205	GN	24V	D2D01, R 0	FUEL HEATER
D2-O02				D2D02, R 2	REAR LANDING LTS
D2-O03	D2-222	RD	24V	D2D01, R 6	STARTER SOLENOID
D2-O04	D2-229/230		24V	D2D01, R 12	WATER PUMP
D2-O05	D2-208	GY	24V	D2D01, R 14	HYDRAULIC FAN RLY
D2-O06	D2-216	BL	24V	D2D02, R 0	AIR DRYER
D2-O07	D2-224	YL	24V	D2D02, R 3	REAR IGN POWER
D2-O08	D2-232	RD	24V	D2D02, R 8	ALTERNATOR EXCITER/FAN POWER

Timer				
Name	**Timer Type**	**Time**	**Time Off**	**Description**
D2-T01	Turn On	15.00		15 SEC TIMER

ZONE D3 DIO 808 D3				
Input				
Name	**Wire #**	**Color**	**Voltage**	**Description**
D3-I01	D3-003	OR	GND	THREE MPH SPEED SIGNAL (167V5)
D3-I06	D3-023	OR	GND	CHECK TRANS SIGNAL (115S31)
D3-I07	D3-027	PU	GND	REVERSE SIGNAL (113V4)
D3-I08	D3-031	BN	GND	HOT RANS SIGNAL (105V19)

ZONE D3 DIO 808 D3					
Output					
Name	**Wire #**	**Color**	**Voltage**	**Location**	**Description**
D3-O01	D3-001	TN	GND	D3D01, R 0	THROTTLE INTERLOCK
D3-O02				D3D01, R 6	ABS TRACT CTL SIGNAL
D3-O03	D3-018	GY	GND	D3D01, R 10	TRANS SERVICE BRAKE
D3-O04				D3D01, R 13	ENGINE SERVICE BRAKE SIGNAL
D3-O05	D3-004	YL	GND	D3D01, R 0	ENG BRAKE LO/HI
D3-O06	D3-012	RD	GND	D3D02, R 4	ENG BRAKE MED/HI
D3-O07	D3-020	PK	GND	D3D02, R 8	SHIFT INHIBIT SIGNAL
D3-O08	D3-028	GY	GND	D3D02, R 13	FAST IDLE

GW-J1939 INPUT RUNGS G1		
Flag		
Name	**Location**	**Description**
G1-F01	G1-D01, R 0	LOW COOLANT
G1-F02	G1-D01, R 2	IDLE VALIDATION ACCEL PEDAL POSITION
G1-F03	G1-D01, R 4	STOP ENGINE
G1-F04	G1-D01, R 6	CHECK ENGINE
G1-F05	G1-D01, R 8	ABS WARN LAMP AMBER
G1-F06	G1-D01, R 10	ATC LAMP STATE

GW-J1939 INPUT RUNGS G1	
Code	
Name	**Description**
GI-C01	J1939 FROM CAT COOLANT LEVEL
GI-C02	J1939 FROM CAT ACCEL PEDAL POSITION
GI-C03	J1939 FROM CAT BIT 1
GI-C04	J1939 FROM CAT BIT 2
GI-C05	J1939 FROM ABS BIT 1
GI-C06	J1939 FROM ABS BIT 2

GW-J1939 OUTPUT RUNGS GO		
Flag		
Name	**Location**	**Description**
GO-F32	GO-D01, R 11	GW-1939 COMM FAIL FLAG

GW-J1939 OUTPUT RUNGS GO	
Code	
Name	**Description**
GO-C01	J1939 ENABLE CRUISE SW
GO-C02	J1939 SET CRUISE SW
GO-C03	J1939 RESUME CRUISE SW
GO-C04	J1939 COAST CRUISE SW
GO-C05	J1939 ACCCEL CRUISE SW
GO-C32	J1939 OUTPUTS FROM DINEX

System Flags		
Flag		
Name	**Location**	**Description**
FOK	S1-D01, R 0	FORCE OUTPUT OK
FSCAN		SYSTEM 1ST SCAN

Cross Reference for A1 Type: DIO 32/0

Name	Diagram	Location
A1-I01	A1D01	Row 0, Col 0
A1-I01	A1D01	Row 2, Col 2
A1-I01	A2D01	Row 4, Col 0
A1-I01	A2D01	Row 6, Col 0
A1-I01	A2D01	Row 8, Col 0
A1-I01	A3D01	Row 0, Col 0
A1-I01	A3D01	Row 10, Col 0
A1-I01	A3D01	Row 4, Col 0
A1-I01	A3D01	Row 3, Col 0
A1-I01	A4D01	Row 0, Col 0
A1-I01	A4D01	Row 12, Col 0
A1-I01	A4D01	Row 7, Col 0
A1-I01	A4D02	Row 2, Col 0
A1-I01	A4D02	Row 5, Col 0
A1-I01	A4D02	Row 9, Col 0
A1-I01	A4D03	Row 0, Col 0
A1-I01	A4D03	Row 7, Col 0
A1-I01	A5D01	Row 0, Col 0
A1-I01	A5D01	Row 12, Col 0
A1-I01	A5D01	Row 14, Col 0
A1-I01	A5D01	Row 2, Col 0
A1-I01	A5D01	Row 3, Col 0
A1-I01	A5D01	Row 7, Col 1
A1-I01	A5D02	Row 12, Col 0
A1-I01	A5D02	Row 3, Col 0
A1-I01	A5D02	Row 9, Col 0
A1-I01	A5D03	Row 13, Col 0
A1-I01	A5D03	Row 3, Col 0
A1-I01	A5D03	Row 6, Col 0
A1-I01	A5D03	Row 9, Col 0
A1-I01	A5D04	Row 0, Col 0
A1-I01	A5D04	Row 11, Col 0
A1-I01	A5D04	Row 14, Col 0
A1-I01	A5D04	Row 4, Col 0
A1-I01	A5D04	Row 8, Col 0
A1-I01	A5-D05	Row 0, Col 0
A1-I01	A5-D05	Row 10, Col 0
A1-I01	A5-D05	Row 4, Col 0

Name	Diagram	Location
A1-I01	A5-D05	Row 7, Col 0
A1-I01	A5-D06	Row 0, Col 0
A1-I01	A5-D06	Row 10, Col 0
A1-I01	A5-D06	Row 3, Col 0
A1-I01	A5-D07	Row 0, Col 0
A1-I01	A5-D07	Row 3, Col 1
A1-I01	B1-D01	Row 11, Col 0
A1-I01	B1-D01	Row 2, Col 0
A1-I01	B1-D01	Row 3, Col 0
A1-I01	B1-D01	Row 5, Col 0
A1-I01	B1-D01	Row 7, Col 0
A1-I01	B1-D02	Row 0, Col 0
A1-I01	B1-D02	Row 12, Col 0
A1-I01	B1-D02	Row 2, Col 0
A1-I01	B1-D02	Row 4, Col 0
A1-I01	B2-D01	Row 0, Col 0
A1-I01	B2-D01	Row 12, Col 0
A1-I01	B2-D01	Row 4, Col 0
A1-I01	B2-D02	Row 0, Col 0
A1-I01	B2-D02	Row 15, Col 0
A1-I01	B2-D02	Row 4, Col 0
A1-I01	B2-D02	Row 8, Col 0
A1-I01	C1D01	Row 0, Col 0
A1-I01	C1D01	Row 10, Col 0
A1-I01	C1D01	Row 14, Col 0
A1-I01	C1D01	Row 4, Col 0
A1-I01	C1D01	Row 6, Col 0
A1-I01	C1D02	Row 0, Col 0
A1-I01	C1D02	Row 7, Col 0
A1-I01	C2D01	Row 0, Col 0
A1-I01	C2D01	Row 10, Col 0
A1-I01	C2D01	Row 13, Col 0
A1-I01	C2D01	Row 4, Col 0
A1-I01	C2D01	Row 6, Col 0
A1-I01	C2D02	Row 10, Col 0
A1-I01	C2D02	Row 14, Col 0
A1-I01	C2D02	Row 4, Col 0
A1-I01	D1D01	Row 0, Col 0

Cross Reference for A1 Type: DIO 32/0 *continued*

Name	Diagram	Location
A1-I01	D1D01	Row 10, Col 0
A1-I01	D1D01	Row 14, Col 0
A1-I01	D1D01	Row 6, Col 0
A1-I01	D1D02	Row 0, Col 0
A1-I01	D1D02	Row 3, Col 0
A1-I01	D1D02	Row 8, Col 0
A1-I01	D2D01	Row 0, Col 0
A1-I01	D2D01	Row 12, Col 0
A1-I01	D2D01	Row 14, Col 0
A1-I01	D2D01	Row 2, Col 0
A1-I01	D2D01	Row 6, Col 0
A1-I01	D2D01	Row 8, Col 0
A1-I01	D2D02	Row 0, Col 0
A1-I01	D2D02	Row 3, Col 0
A1-I01	D2D02	Row 8, Col 0
A1-I01	D3D01	Row 10, Col 0
A1-I01	D3D01	Row 13, Col 0
A1-I01	D3D01	Row 6, Col 0
A1-I01	D3D02	Row 0, Col 0
A1-I01	D3D02	Row 13, Col 0
A1-I02	D3D02	Row 4, Col 0
A1-I02	D3D02	Row 8, Col 0
A1-I02	S1-D01	Row 0, Col 0
A1-I02	A2D02	Row 3, Col 0
A1-I02	A3D01	Row 4, Col 3
A1-I02	A5-D02	Row 3, Col 2
A1-I02	A5-D04	Row 8, Col 1
A1-I02	B1-D01	Row 2, Col 1
A1-I02	B1-D01	Row 3, Col 1
A1-I02	B1-D01	Row 5, Col 1
A1-I02	B2-D01	Row 0, Col 1
A1-I02	B2-D01	Row 4, Col 1
A1-I02	C1D01	Row 10, Col 1
A1-I02	C1D01	Row 14, Col 1
A1-I02	C1D01	Row 6, Col 1
A1-I02	C1D02	Row 0, Col 1
A1-I02	C2D01	Row 10, Col 1
A1-I02	C2D01	Row 14, Col 1

Name	Diagram	Location
A1-I02	C2D01	Row 6, Col 1
A1-I03	C2D02	Row 5, Col 0
A1-I03	D1D01	Row 1, Col 1
A1-I03	D1D01	Row 14, Col 1
A1-I03	A3D01	Row 5, Col 3
A1-I03	A5D02	Row 3, Col 3
A1-I03	B2D01	Row 5, Col 1
A1-I04	C2D01	Row 15, Col 1
A1-I04	C2D02	Row 6, Col 0
A1-I05	D1D01	Row 2, Col 1
A1-I06	D2D01	Row 6, Col 1
A1-I07	D2D01	Row 8, Col 1
A1-I08	D2D01	Row 2, Col 1
A1-I09	A2D01	Row 0, Col 0
A1-I09	A2D01	Row 2, Col 0
A1-I10	A3D01	Row 4, Col 2
A1-I10	A3D02	Row 5, Col 0
A1-I10	A5D03	Row 9, Col 1
A1-I10	A5D01	Row 11, Col 1
A1-I10	A5D07	Row 7, Col 1
A1-I10	B1D01	Row 13, Col 0
A1-I10	B1D01	Row 9, Col 0
A1-I10	C1D01	Row 2, Col 0
A1-I11	C2D01	Row 2, Col 0
A1-I11	D1D01	Row 12, Col 0
A1-I11	D1D01	Row 8, Col 0
A1-I11	C1D01	Row 10, Col 3
A1-I12	C1D01	Row 7, Col 2
A1-I12	C2D01	Row 10, Col 3
A1-I12	C2D01	Row 7, Col 2
A1-I12	C1D01	Row 11, Col 3
A1-I13	D1D01	Row 6, Col 2
A1-I13	C2D01	Row 11, Col 3
A1-I13	C2D01	Row 6, Col 2
A1-I13	A3D01	Row 4, Col 1
A1-I13	C1D01	Row 10, Col 4
A1-I13	C1D01	Row 14, Col 3
A1-I13	C1D01	Row 6, Col 3

Cross Reference for A1 Type: DIO 32/0 *continued*

Name	Diagram	Location
A1-I13	C1D02	Row 0, Col 2
A1-I13	C1D02	Row 7, Col 1
A1-I13	C2D01	Row 10, Col 4
A1-I13	C2D01	Row 6, Col 3
A1-I13	C2D02	Row 10, Col 1
A1-I14	A3D02	Row 5, Col 1
A1-I14	A5D03	Row 9, Col 3
A1-I15	C2D01	Row 13, Col 1
A1-I15	D1D01	Row 0, Col 1
A1-I16	A1D01	Row 1, Col 2
A1-I16	C2D01	Row 14, Col 2
A1-I16	D1D01	Row 1, Col 2
A1-I17	A4D02	Row 9, Col 1
A1-I17	A4D03	Row 0, Col 1
A1-I17	A4D03	Row 7, Col 1
A1-I18	A4D01	Row 12, Col 4
A1-I18	A4D01	Row 7, Col 6
A1-I19	A4D01	Row 7, Col 4
A1-I19	A5D02	Row 12, Col 1
A1-I20	A4D01	Row 0, Col 1
A1-I21	A1D01	Row 1, Col 1
A1-I21	A3D02	Row 0, Col 1
A1-I21	D3D01	Row 0, Col 1
A1-I21	D3D02	Row 9, Col 4
A1-I22	A4D03	Row 13, Col 0
A1-I23	A2D02	Row 1, Col 1
A1-I23	A3D02	Row 9, Col 1
A1-I25	D2D01	Row 12, Col 1
A1-I30	A5D01	Row 3, Col 1
A1-I31	A1D01	Row 0, Col 3
A1-I31	A4D01	Row 0, Col 3
A1-I31	A4D01	Row 12, Col 3
A1-I31	A4D01	Row 7, Col 3
A1-I31	D2D01	Row 3, Col 2
A1-I31	D2D01	Row 6, Col 4

Name	Diagram	Location
A1-I31	D2D01	Row 8, Col 3
A1-I31	D3D01	Row 10, Col 2
A1-I31	D3D02	Row 13, Col 1
A1-I32	A3D02	Row 0, Col 0
A1-I32	D3D01	Row 0, Col 3
A1-I32	D3D02	Row 9, Col 3
A1-F02	A1D01	Row 10, Col 1
A1-F02	A1D01	Row 12, Col 0
A1-F02	A1D01	Row 2, Col 0
A1-F02	A1D01	Row 3, Col 0
A1-F02	A1D01	Row 8, Col 0
A1-F02	A5D01	Row 7, Col 0
A1-F02	A5D01	Row 9, Col 0
A1-F02	A5D07	Row 3, Col 0
A1-F02	A5D07	Row 5, Col 0
A1-F03	A1D01	Row 10, Col 2
A1-F03	A5D01	Row 9, Col 1
A1-F03	A5D07	Row 5, Col 1
A1-F04	A1D01	Row 2, Col 1
A1-F04	B1D02	Row 12, Col 1
A1-F04	B1D02	Row 9, Col 1
A1-F05	A5D01	Row 9, Col 2
A1-F05	A5D07	Row 5, Col 2
A1-F06	A5D05	Row 1, Col 1
A1-C01	A1D01	Row 4, Col 0
A1-C02	A1D01	Row 6, Col 0
A1-C03	A1D01	Row 12, Col 1
A1-C04	A1D01	Row 3, Col 1
A1-C05	A1D01	Row 10, Col 3
A1-C06	A1D01	Row 8, Col 1
A1-C07	A1D01	Row 14, Col 1
A1-C08	A1D02	Row 0, Col 1
A1-C09	A1D02	Row 2, Col 0
A1-C10	A1D02	Row 4, Col 0
A1-C11	A1D02	Row 6, Col 0

Cross Reference for A2 Type: DIO 8/8

Name	Diagram	Location
A2-I01	A3D02	Row 9, Col 0
A2-I02	A2D02	Row 1, Col 0
A2-I03	C1D01	Row 14, Col 2
A2-I04	D3D01	Row 6, Col 1
A2-I05	A2D01	Row 8, Col 1

Name	Diagram	Location
A2-I06	C2D02	Row 4, Col 1
A2-I07	C1D02	Row 7, Col 2
A2-I07	C2D02	Row 10, Col 2
A2-I08	C1D02	Row 8, Col 2
A2-I08	C2D02	Row 11, Col 2

Name	Diagram	Location
A2-T02	A2D01	Row 8, Col 2

Cross Reference for A3 Type: DIO 8/8

Name	Diagram	Location
A3-I01	D1D02	Row 8, Col 3
A3-I01	GO-D01	Row 0, Col 0
A3-I01	GO-D01	Row 2, Col 1
A3-I01	GO-D01	Row 4, Col 1
A3-I01	GO-D01	Row 6, Col 1
A3-I01	GO-D01	Row 8, Col 1
A3-I02	GO-D01	Row 2, Col 0
A3-I02	GO-D01	Row 4, Col 2
A3-I02	GO-D01	Row 6, Col 2
A3-I02	GO-D01	Row 8, Col 0

Name	Diagram	Location
A3-I03	GO-D01	Row 4, Col 0
A3-I03	GO-D01	Row 6, Col 0
A3-I04	D3D02	Row 0, Col 1
A3-I04	D3D02	Row 4, Col 1
A3-I05	D3D02	Row 0, Col 2
A3-I06	D3D02	Row 4, Col 2
A3-I07	D3D02	Row 1, Col 2
A3-I07	D3D02	Row 5, Col 2
A3-I08	D3D02	Row 13, Col 3

Name	Diagram	Location
A3-O07	A3D02	Row 6, Col 0

Cross Reference for A4 Type: DIO 8/8

Name	Diagram	Location
A4-I01	A4D02	Row 5, Col 1
A4-I01	A5-D03	Row 6, Col 1
A4-I02	D3D02	Row 8, Col 6
A4-I05	A5-D05	Row 7, Col 1
A4-I05	B1-D02	Row 4, Col 1
A4-I06	A5-D01	Row 14, Col 1

Name	Diagram	Location
A4-I07	A2D01	Row 6, Col 1
A4-I07	A3D01	Row 7, Col 1
A4-I07	A4D01	Row 13, Col 5
A4-I07	A5-D02	Row 12, Col 2
A4-I07	A5-D02	Row 13, Col 2
A4-I08	A3D01	Row 14, Col 1

Name	Diagram	Location
A4-O05	A4D02	Row 13, Col 4
A4-O05	A5-D06	Row 7, Col 0
A4-O06	A4D03	Row 2, Col 3

Name	Diagram	Location
A4-O07	A4D03	Row 9, Col 3
A4-O07	A5-D05	Row 13, Col 0

Name	Diagram	Location
A4-F01	A2D01	Row 12, Col 0
A4-F01	A3D02	Row 1, Col 0
A4-F01	A4D02	Row 0, Col 0
A4-F01	A5-D01	Row 6, Col 0
A4-F01	B1-D01	Row 12, Col 1
A4-F01	B1-D01	Row 8, Col 1
A4-F01	C1D01	Row 1, Col 1
A4-F01	C2D01	Row 1, Col 1
A4-F01	D1D01	Row 11, Col 1
A4-F01	D1D01	Row 7, Col 1

Name	Diagram	Location
A4-F01	D3D01	Row 1, Col 0
A4-F01	D3D02	Row 14, Col 0
A4-F02	A2D01	Row 10, Col 0
A4-F02	A3D01	Row 14, Col 0
A4-F02	C1D02	Row 11, Col 0
A4-F02	D3D01	Row 3, Col 2
A4-F02	D3D02	Row 8, Col 2
A4-F03	A2D01	Row 11, Col 0
A4-F03	A3D01	Row 7, Col 0
A4-F03	A4D01	Row 13, Col 4

Cross Reference for A5 Type: DIO 0/32

Name	Diagram	Location
A5-O10	A3D02	Row 2, Col 0
A5-O10	A5-D02	Row 13, Col 3

Name	Diagram	Location
A5-O14	A5-D03	Row 10, Col 2
A5-O16	A5-D04	Row 2, Col 2

Name	Diagram	Location
A5-T01	A5-D01	Row 0, Col 1
A5-T02	A5-D04	Row 2, Col 3

Name	Diagram	Location
A5-T03	A5-D01	Row 2, Col 1

Name	Diagram	Location
A5-F01	A5-D01	Row 10, Col 0
A5-F01	A5-D01	Row 13, Col 0
A5-F01	A5-D01	Row 15, Col 0
A5-F01	A5-D01	Row 4, Col 0
A5-F01	A5-D02	Row 1, Col 0
A5-F01	A5-D02	Row 11, Col 0
A5-F01	A5-D02	Row 14, Col 0
A5-F01	A5-D02	Row 4, Col 0
A5-F01	A5-D02	Row 6, Col 0
A5-F01	A5-D03	Row 0, Col 0
A5-F01	A5-D03	Row 11, Col 0
A5-F01	A5-D03	Row 14, Col 0
A5-F01	A5-D03	Row 4, Col 0
A5-F01	A5-D03	Row 7, Col 0
A5-F01	A5-D04	Row 12, Col 0
A5-F01	A5-D04	Row 15, Col 0
A5-F01	A5-D04	Row 3, Col 0

Name	Diagram	Location
A5-F01	A5-D04	Row 5, Col 0
A5-F01	A5-D04	Row 9, Col 0
A5-F01	A5-D05	Row 11, Col 0
A5-F01	A5-D05	Row 14, Col 0
A5-F01	A5-D05	Row 2, Col 0
A5-F01	A5-D05	Row 5, Col 0
A5-F01	A5-D05	Row 8, Col 0
A5-F01	A5-D06	Row 1, Col 0
A5-F01	A5-D06	Row 11, Col 0
A5-F01	A5-D06	Row 13, Col 0
A5-F01	A5-D06	Row 4, Col 0
A5-F01	A5-D06	Row 8, Col 0
A5-F01	A5-D07	Row 1, Col 0
A5-F01	A5-D07	Row 6, Col 0
A5-F02	A5-D02	Row 13, Col 1
A5-F02	A5-D03	Row 10, Col 1
A5-F02	A5-D04	Row 2, Col 1

Cross Reference for B1 Type: DIO 8/8

Name	Diagram	Location
B1-I01	A5-D04	Row 8, Col 2
B1-I01	B1-D01	Row 2, Col 2
B1-I01	B1-D01	Row 5, Col 2
B1-I01	B2-D01	Row 0, Col 3
B1-I02	A5-D01	Row 7, Col 2
B1-I02	B1-D01	Row 7, Col 1
B1-I02	C2D01	Row 0, Col 1
B1-I02	D1D01	Row 6, Col 1
B1-I03	A5-D07	Row 3, Col 2
B1-I03	B1-D01	Row 11, Col 1
B1-I03	C1D01	Row 0, Col 1
B1-I03	D1D01	Row 10, Col 1
B1-I07	A1D01	Row 1, Col 0
B1-I07	A5-D02	Row 0, Col 0
B1-I07	D1D01	Row 4, Col 0

Name	Diagram	Location
B1-I07	D1D02	Row 10, Col 3
B1-I07	D3D01	Row 10, Col 1
B1-I07	D3D01	Row 13, Col 1
B1-I07	D3D02	Row 8, Col 1
B1-I08	A1D01	Row 0, Col 4
B1-I08	A4D01	Row 0, Col 2
B1-I08	A4D01	Row 12, Col 1
B1-I08	A4D01	Row 7, Col 1
B1-I08	A5-D02	Row 3, Col 4
B1-I08	A5-D03	Row 13, Col 1
B1-I08	B1-D01	Row 3, Col 3
B1-I08	D2D01	Row 7, Col 0
B1-I08	D2D01	Row 9, Col 0
B1-I08	D2D02	Row 4, Col 1
B1-I08	D3D02	Row 13, Col 2

Name	Diagram	Location
B1-T01	B1-D01	Row 0, Col 0

Name	Diagram	Location
B1-F01	A5-D01	Row 11, Col 2
B1-F01	A5-D01	Row 7, Col 3
B1-F01	A5-D07	Row 3, Col 3
B1-F01	A5-D07	Row 7, Col 2
B1-F01	B1-D01	Row 11, Col 2
B1-F01	B1-D01	Row 7, Col 2

Name	Diagram	Location
B1-F01	C1D01	Row 0, Col 2
B1-F01	C1D02	Row 11, Col 1
B1-F01	C2D01	Row 0, Col 2
B1-F01	D1D01	Row 10, Col 2
B1-F01	D1D01	Row 6, Col 2
B1-F01	D1D02	Row 8, Col 4

Cross Reference for B2 Type: DIO 8/8

Name	Diagram	Location
B2-I01	A4D03	Row 2, Col 2
B2-I01	A4D03	Row 9, Col 2
B2-I01	B1-D02	Row 0, Col 1
B2-I01	C1D01	Row 10, Col 2
B2-I01	C1D02	Row 0, Col 3
B2-I01	C2D01	Row 10, Col 2
B2-I01	C2D02	Row 14, Col 1
B2-I03	B2-D02	Row 0, Col 2

Name	Diagram	Location
B2-I03	B2-D02	Row 4, Col 2
B2-I03	B2-D02	Row 8, Col 3
B2-I04	A4D02	Row 13, Col 2
B2-I04	B2-D02	Row 0, Col 3
B2-I04	B2-D02	Row 4, Col 3
B2-I04	B2-D02	Row 8, Col 2
B2-I05	B2-D01	Row 0, Col 2

Name	Diagram	Location
B2-T01	B2-D02	Row 4, Col 4

Cross Reference for C1 Type: DIO 8/8

Name	Diagram	Location
C1-I01	A4D02	Row 9, Col 2
C1-I01	A4D03	Row 1, Col 2
C1-I02	A4D02	Row 10, Col 2
C1-I02	A4D03	Row 8, Col 2
C1-I04	A5-D02	Row 9, Col 1

Name	Diagram	Location
C1-I07	A4D03	Row 3, Col 2
C1-I07	A5-D04	Row 0, Col 1
C1-I08	A2D01	Row 4, Col 1
C1-I08	A3D02	Row 3, Col 1
C1-I08	A4D01	Row 0, Col 4

Cross Reference for C2 Type: DIO 8/8

Name	Diagram	Location
C2-I01	A4D02	Row 11, Col 2
C2-I01	A4D03	Row 0, Col 2
C2-I02	A4D02	Row 12, Col 2
C2-I02	A4D03	Row 7, Col 2
C2-I04	A5-D02	Row 10, Col 1

Name	Diagram	Location
C2-I05	A3D02	Row 0, Col 4
C2-I05	B1-D02	Row 6, Col 1
C2-I07	A4D03	Row 4, Col 2
C2-I07	A5-D04	Row 1, Col 1

Name	Diagram	Location
C2-T01	C2D02	Row 14, Col 2

Cross Reference for D1 Type: DIO 8/8

Name	Diagram	Location
D1-I01	A5-D07	Row 0, Col 1
D1-I01	B1-D02	Row 15, Col 0
D1-I02	A1D01	Row 0, Col 2
D1-I02	A3D01	Row 10, Col 1
D1-I02	A5-D02	Row 3, Col 1
D1-I02	A5-D04	Row 14, Col 1

Name	Diagram	Location
D1-I02	B1-D01	Row 3, Col 2
D1-I02	B2-D02	Row 15, Col 1
D1-I02	D1D02	Row 8, Col 1
D1-I02	D2D01	Row 6, Col 5
D1-I03	A5-D06	Row 0, Col 1
D1-I03	B1-D02	Row 7, Col 1

Cross Reference for D2 Type: DIO 8/8

Name	Diagram	Location
D2-I01	D2D01	Row 6, Col 2
D2-I01	D2D01	Row 8, Col 2
D2-I01	D2D02	Row 3, Col 1
D2-I02	A3D02	Row 4, Col 0
D2-I02	D2D01	Row 7, Col 1
D2-I02	D2D01	Row 9, Col 1
D2-I02	D2D02	Row 4, Col 0
D2-I02	D3D01	Row 5, Col 2

Name	Diagram	Location
D2-I02	D3D02	Row 13, Col 4
D2-I02	D3D02	Row 8, Col 5
D2-I03	D2D01	Row 7, Col 2
D2-I03	D2D01	Row 9, Col 2
D2-I04	D2D01	Row 6, Col 3
D2-I05	A5-D05	Row 4, Col 1
D2-I05	B1-D02	Row 8, Col 1
D2-I06	A5-D01	Row 12, Col 1

Name	Diagram	Location
D2-O03	D2D01	Row 8, Col 4
D2-O03	D2D01	Row 9, Col 3

Name	Diagram	Location
D2-T01	D2-D01	Row 6, Col 6

Cross Reference for D3 Type: DIO 8/8

Name	Diagram	Location
D3-I01	A1D01	Row 0, Col 1
D3-I01	A3D01	Row 2, Col 0
D3-I01	A3D02	Row 0, Col 3
D3-I01	B2-D02	Row 0, Col 1
D3-I01	B2-D02	Row 4, Col 1
D3-I01	B2-D02	Row 8, Col 1

Name	Diagram	Location
D3-I06	A5-D06	Row 10, Col 1
D3-I07	D1D02	Row 3, Col 1
D3-I07	D2D01	Row 2, Col 2
D3-I08	A5-D04	Row 11, Col 1
D3-I08	B1-D02	Row 5, Col 1

Name	Diagram	Location
D3-O08	D3D01	Row 4, Col 2
D3-O08	D3D02	Row 8, Col 3

Cross Reference for GI Type: DIO 0/32

Name	Diagram	Location
GI-F01	A5-D04	Row 4, Col 1
GI-F02	D1D02	Row 8, Col 2
GI-F03	A5-D05	Row 0, Col 1

Name	Diagram	Location
GI-F04	A5-D05	Row 10, Col 1
GI-F05	A5-D06	Row 3, Col 1
GI-F06	A5-D03	Row 3, Col 1

Name	Diagram	Location
GI-C01	GI-D01	Row 0, Col 0
GI-C02	GI-D01	Row 2, Col 0
GI-C03	GI-D01	Row 4, Col 0

Name	Diagram	Location
GI-C04	GI-D01	Row 6, Col 0
GI-C05	GI-D01	Row 8, Col 0
GI-C06	GI-D01	Row 10, Col 0

Cross Reference for GO Type: DIO 0/32

Name	Diagram	Location
GO-C01	GO-D01	Row 0, Col 4
GO-C02	GO-D01	Row 2, Col 4
GO-C03	GO-D01	Row 4, Col 4

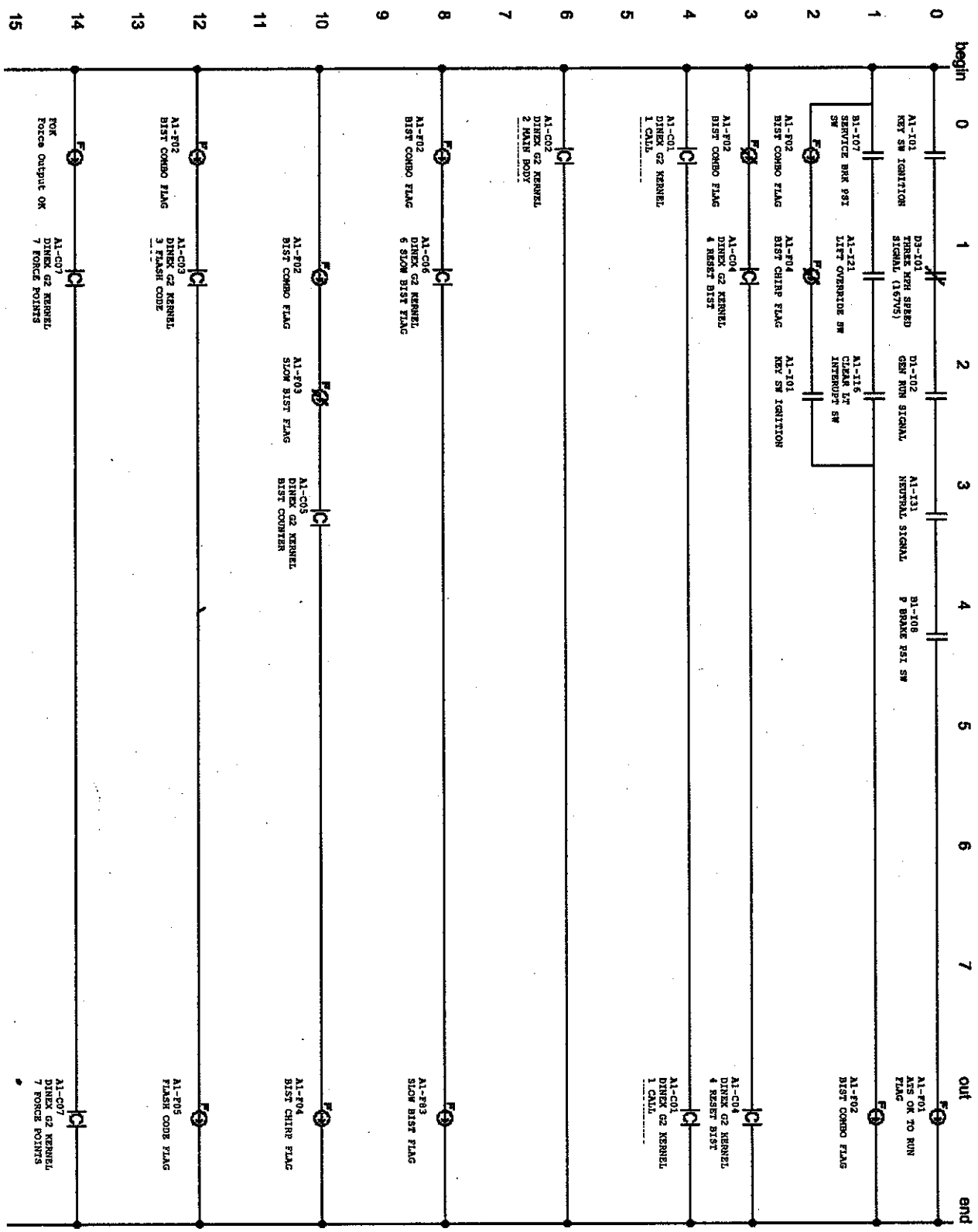
Name	Diagram	Location
GO-C04	GO-D01	Row 6, Col 4
GO-C05	GO-D01	Row 8, Col 4
GO-C32	GO-D01	Row 11, Col 0

Cross Reference for System Type: System

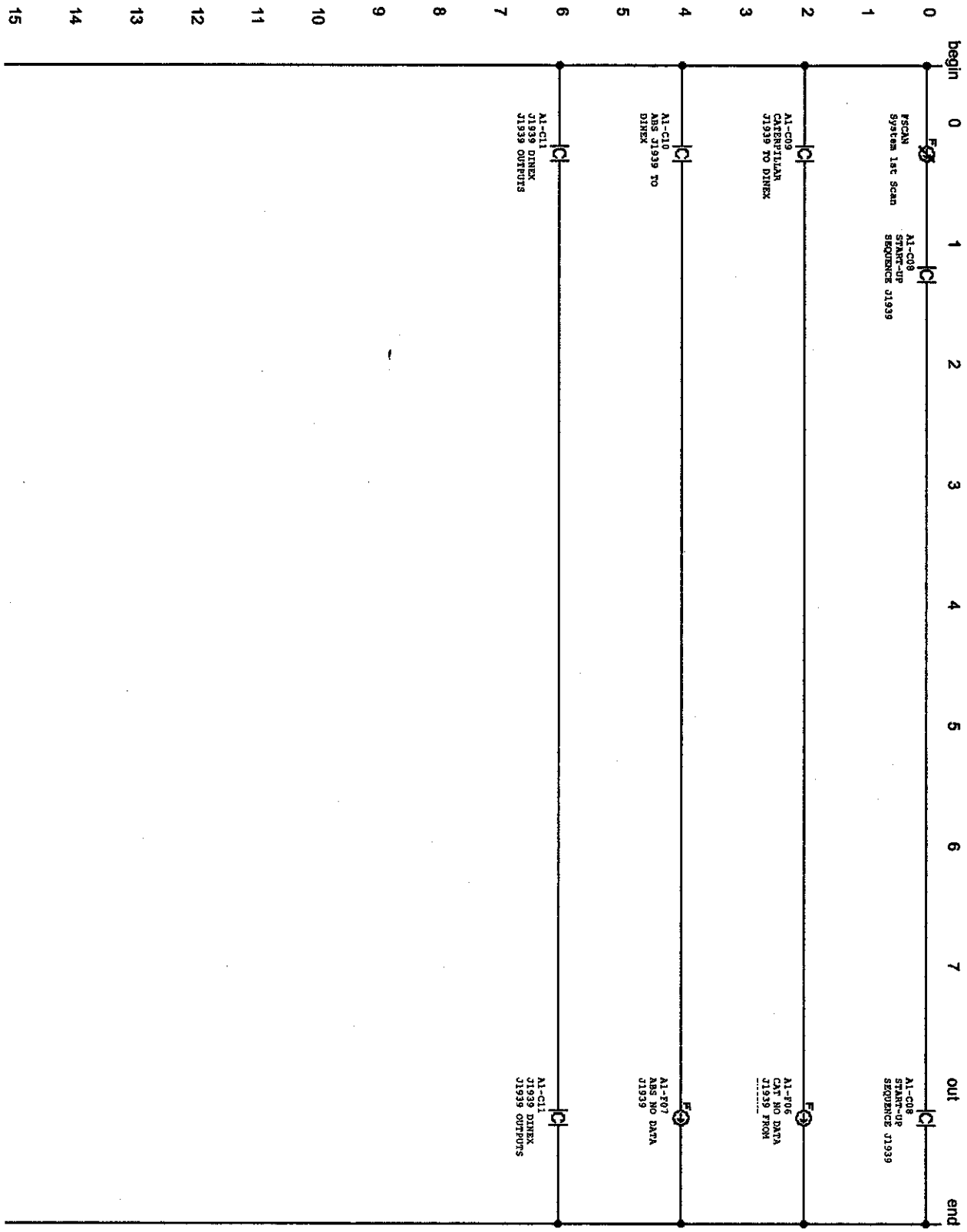
Name	Diagram	Location
FOK	A1D01	Row 14, Col 0

Name	Diagram	Location
FSCAN	A1D02	Row 0, Col 0

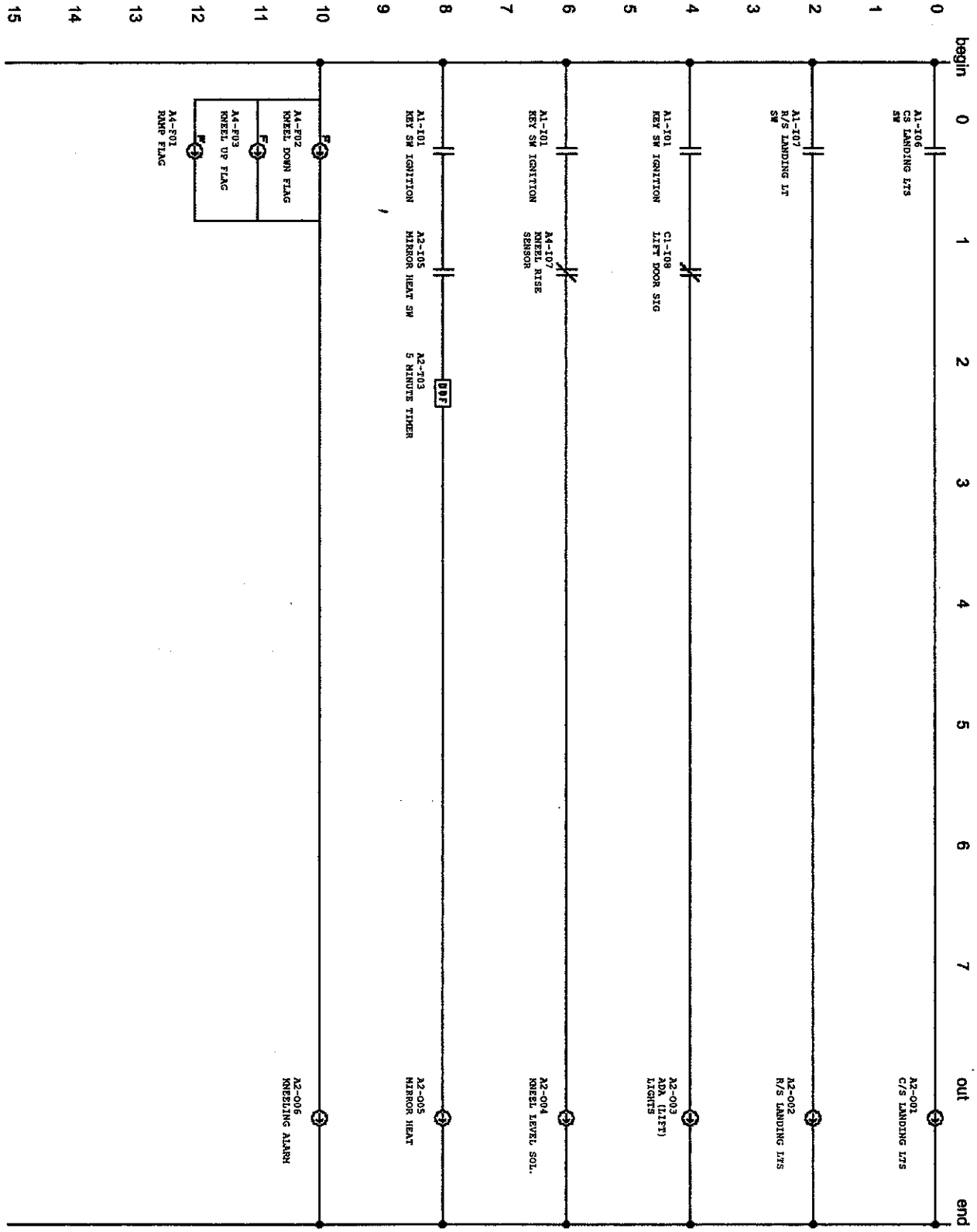
A1D01 M4RE COACH 40/45



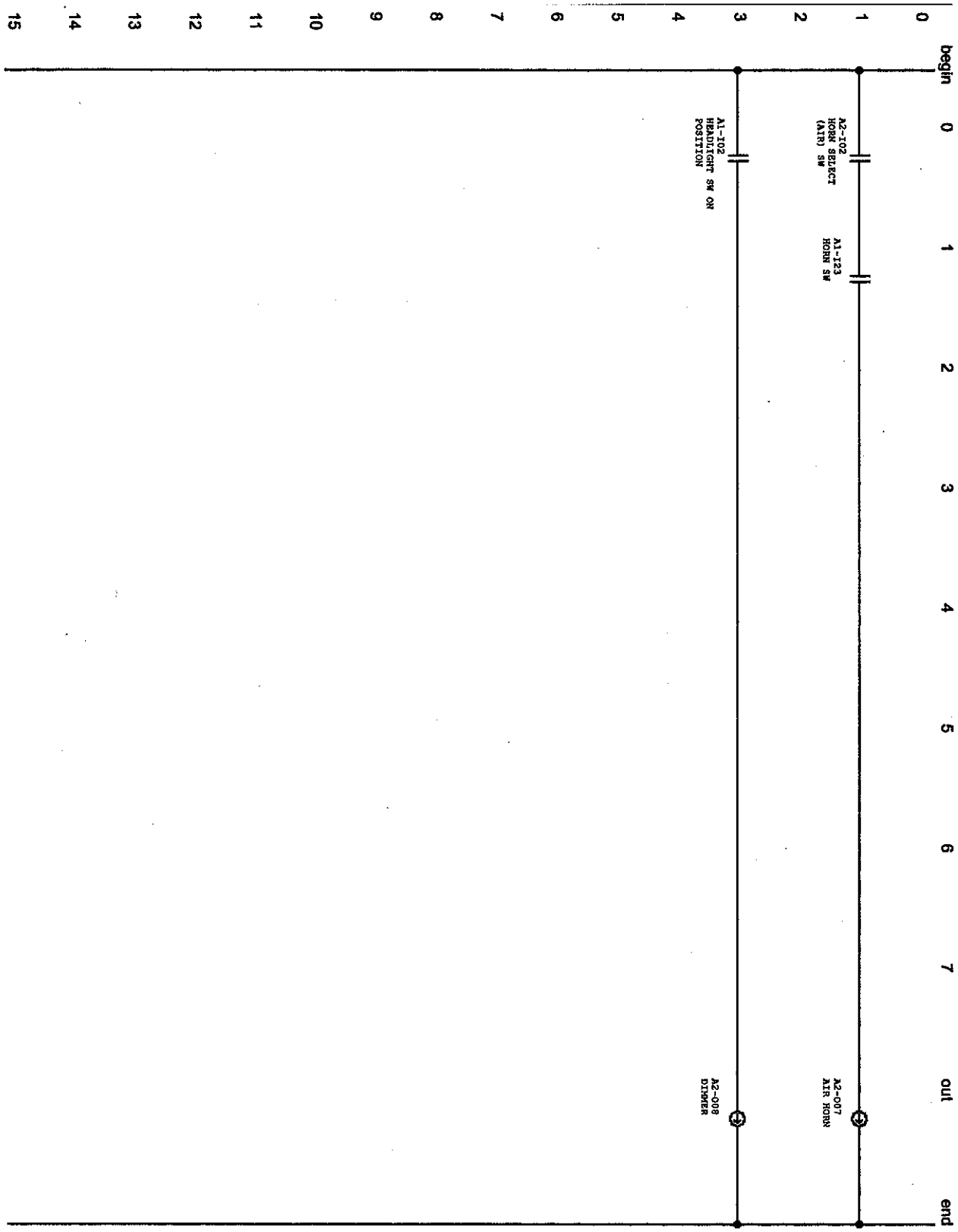
A1D02 M4RE COACH 40/45



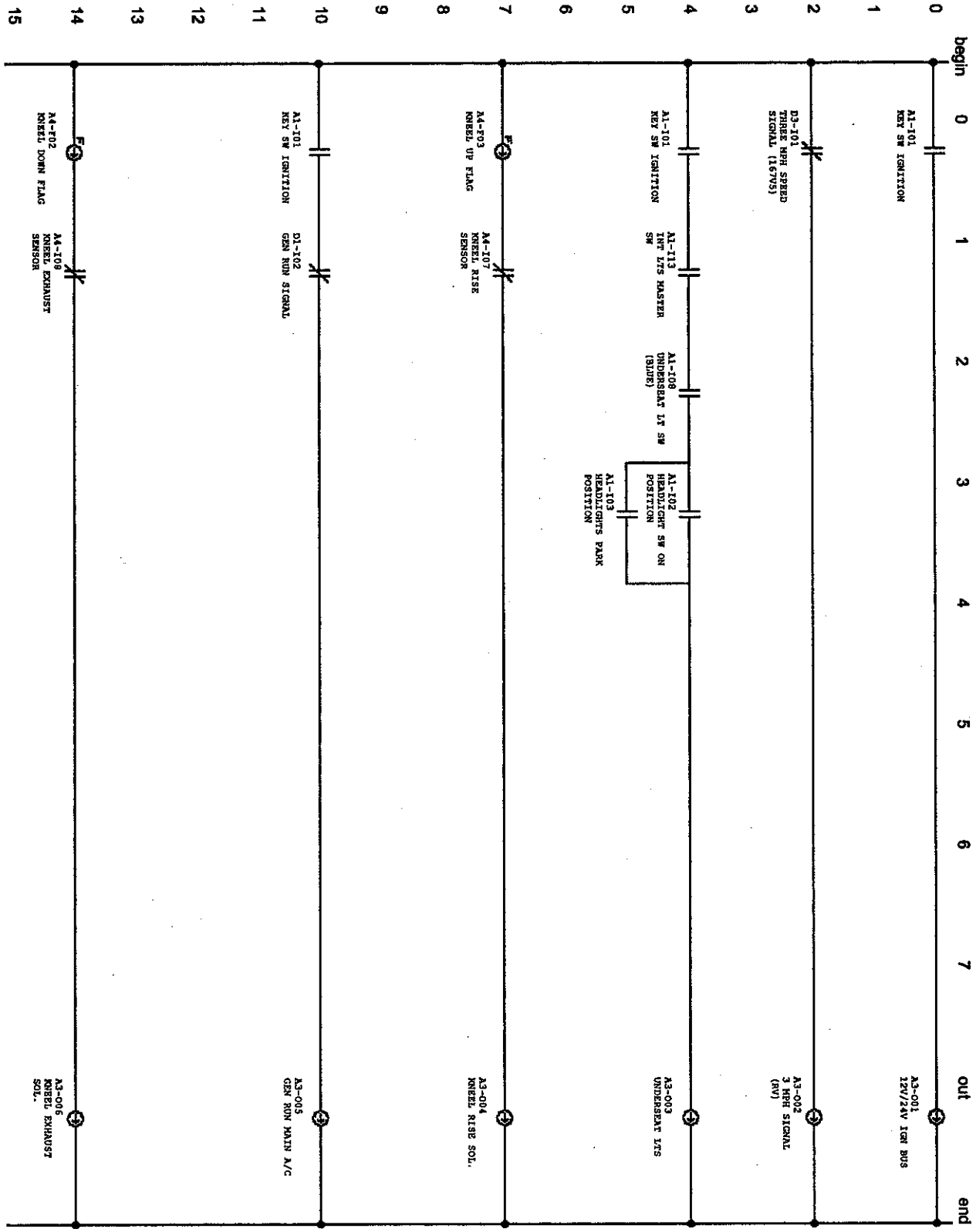
A2D01 M4RE COACH 40/45



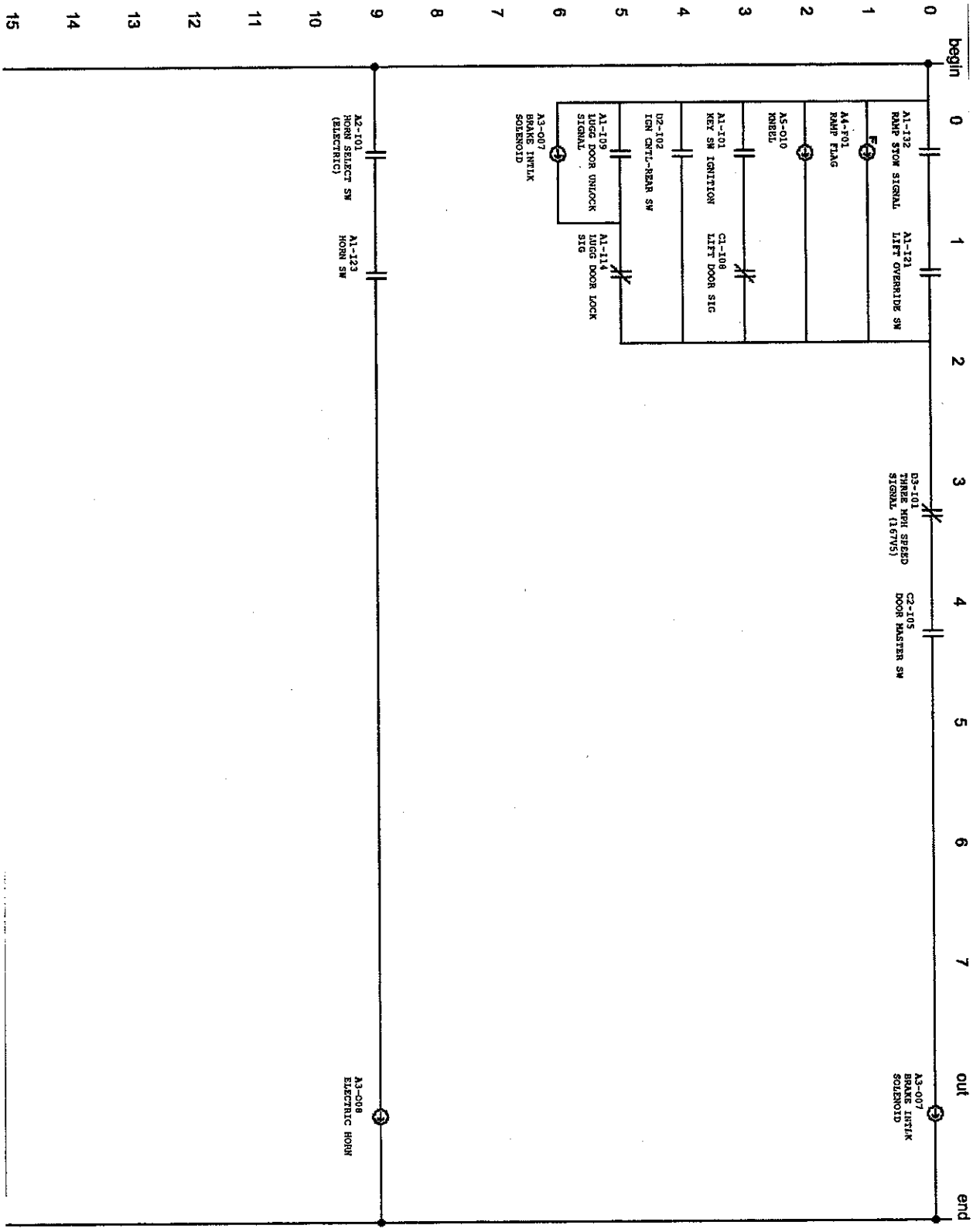
A2D02 M4RE COACH 40/45



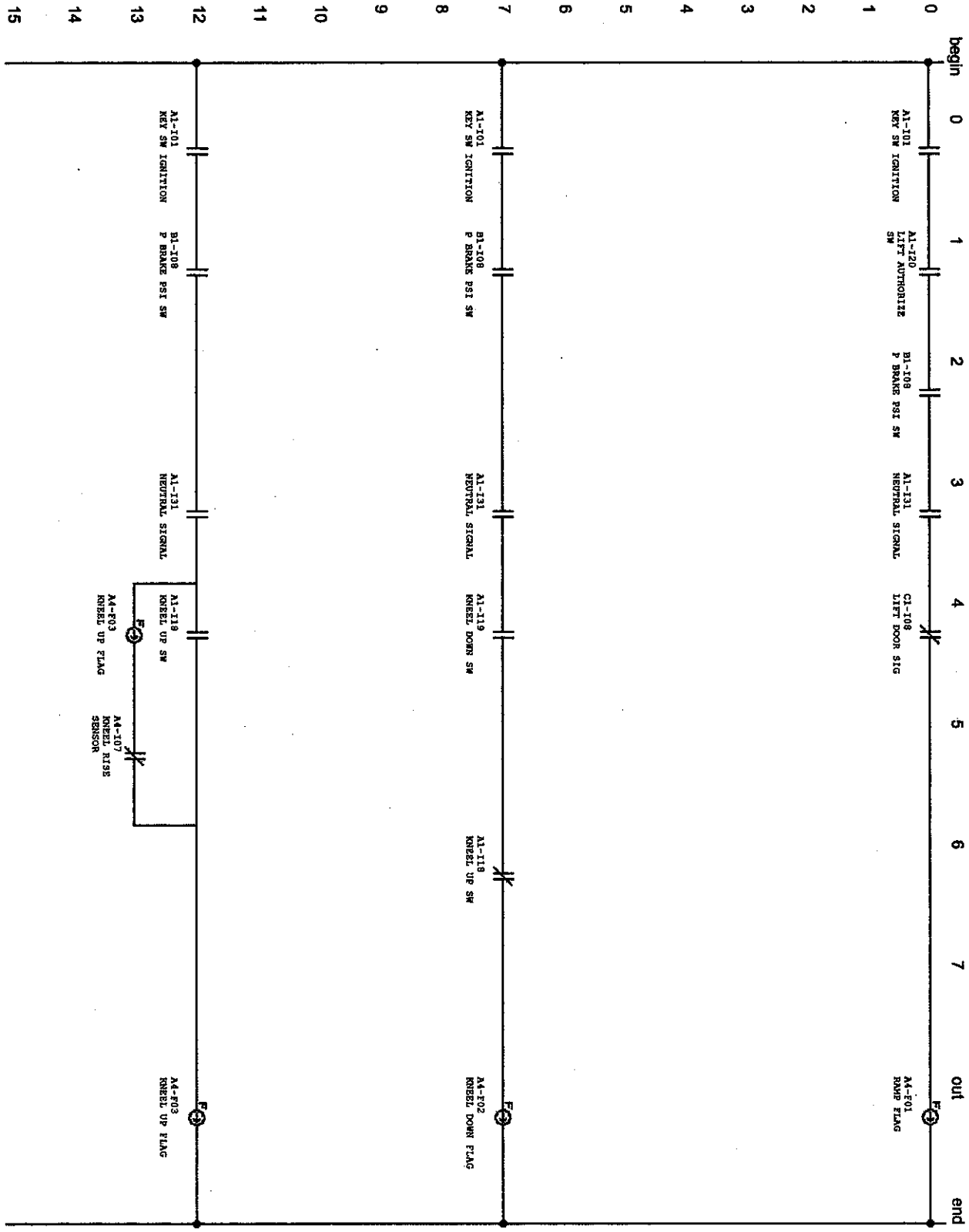
A3D01 M4RE COACH 40/45



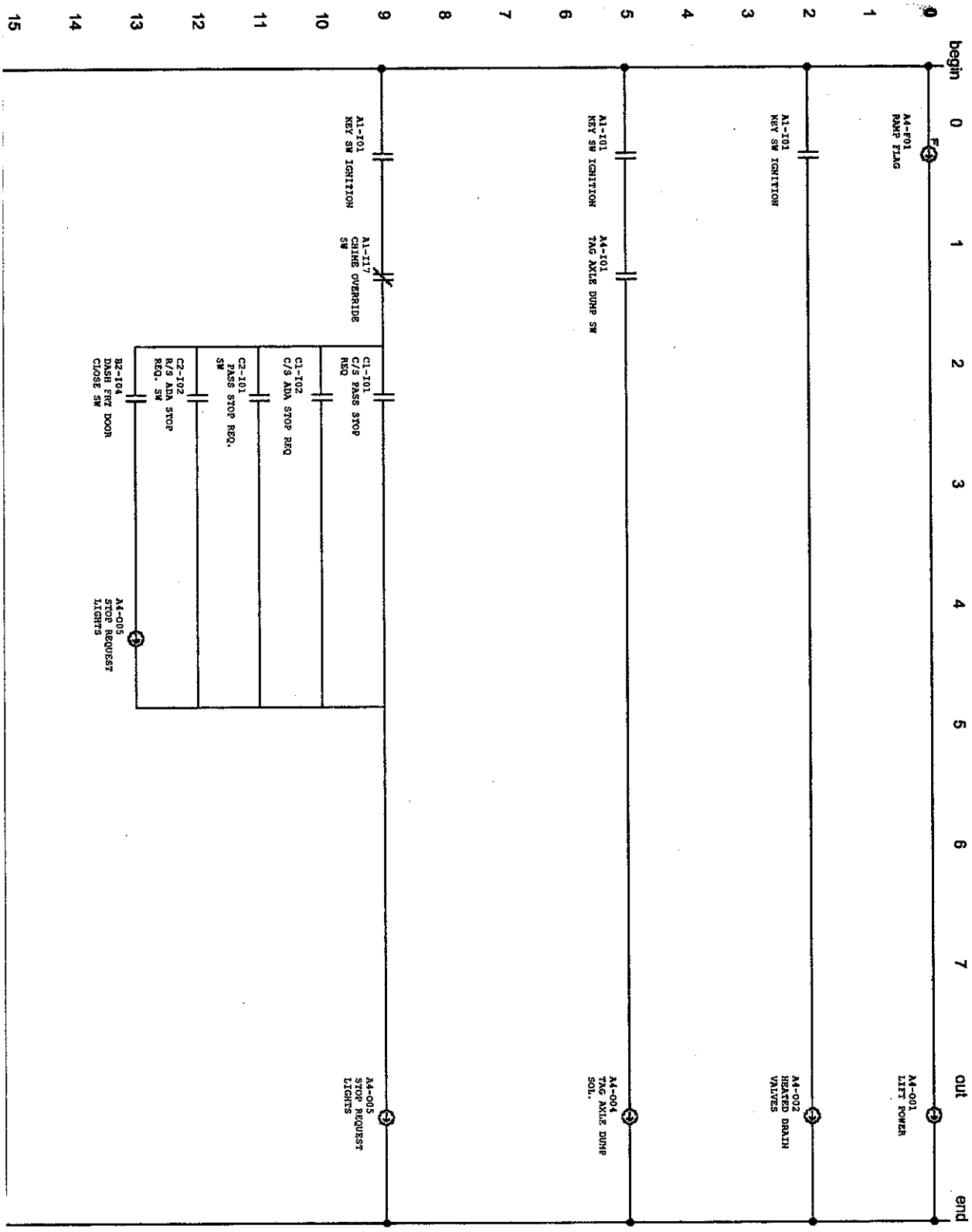
A3D02 M4RE COACH 40/45



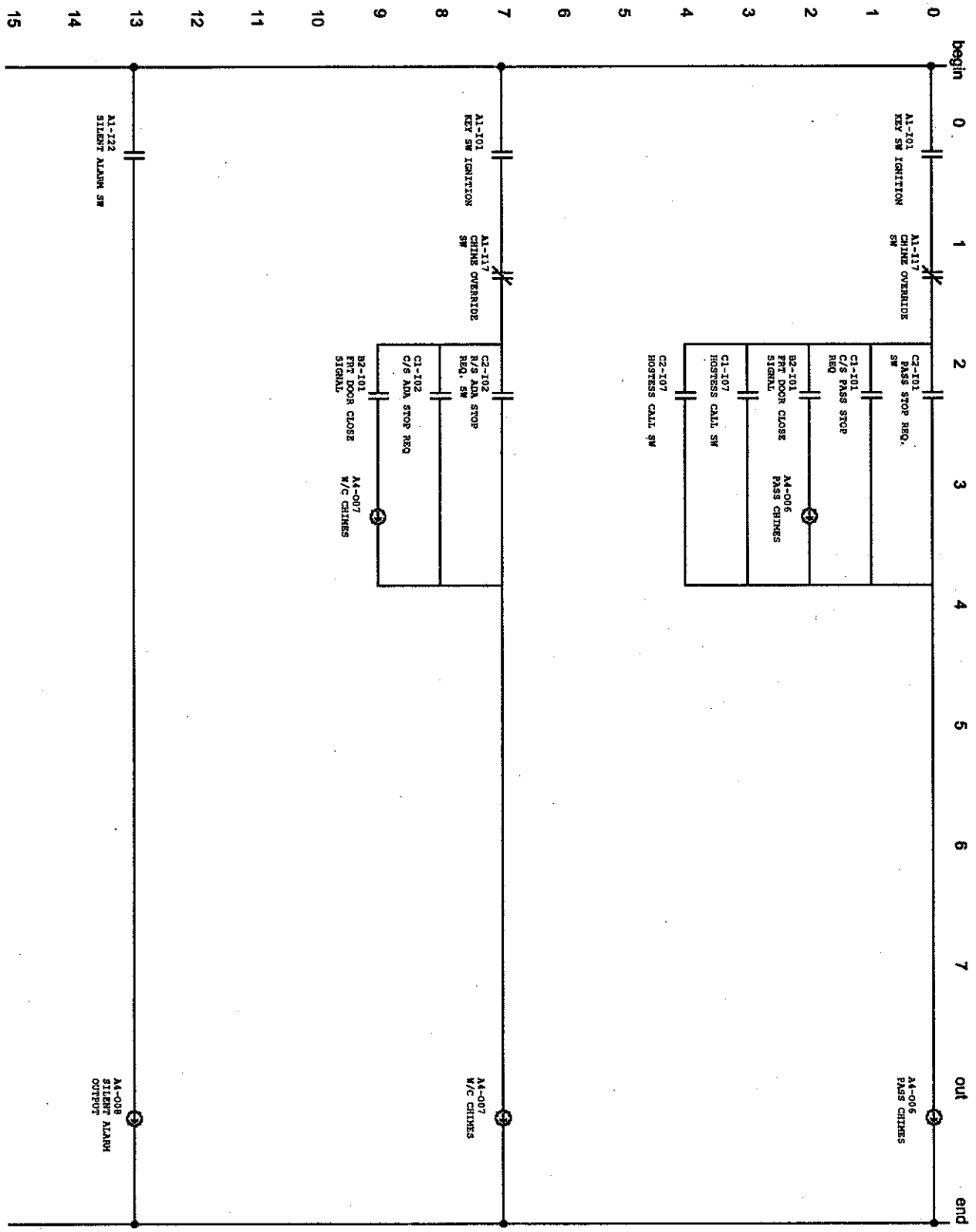
A4D01 M4RE COACH 40/45



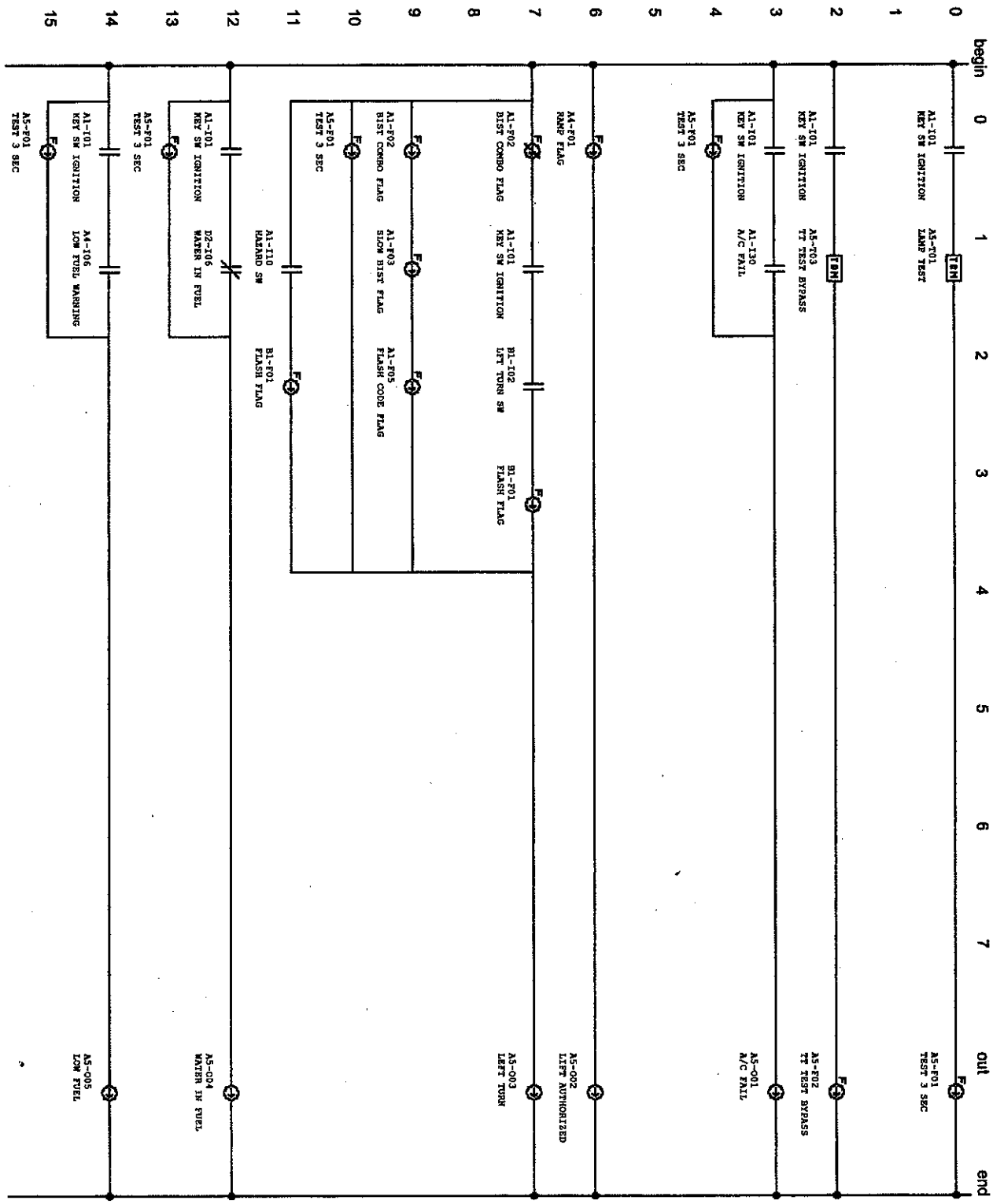
A4D02 M4RE COACH 40/45



A4D03 M4RE COACH 40/45

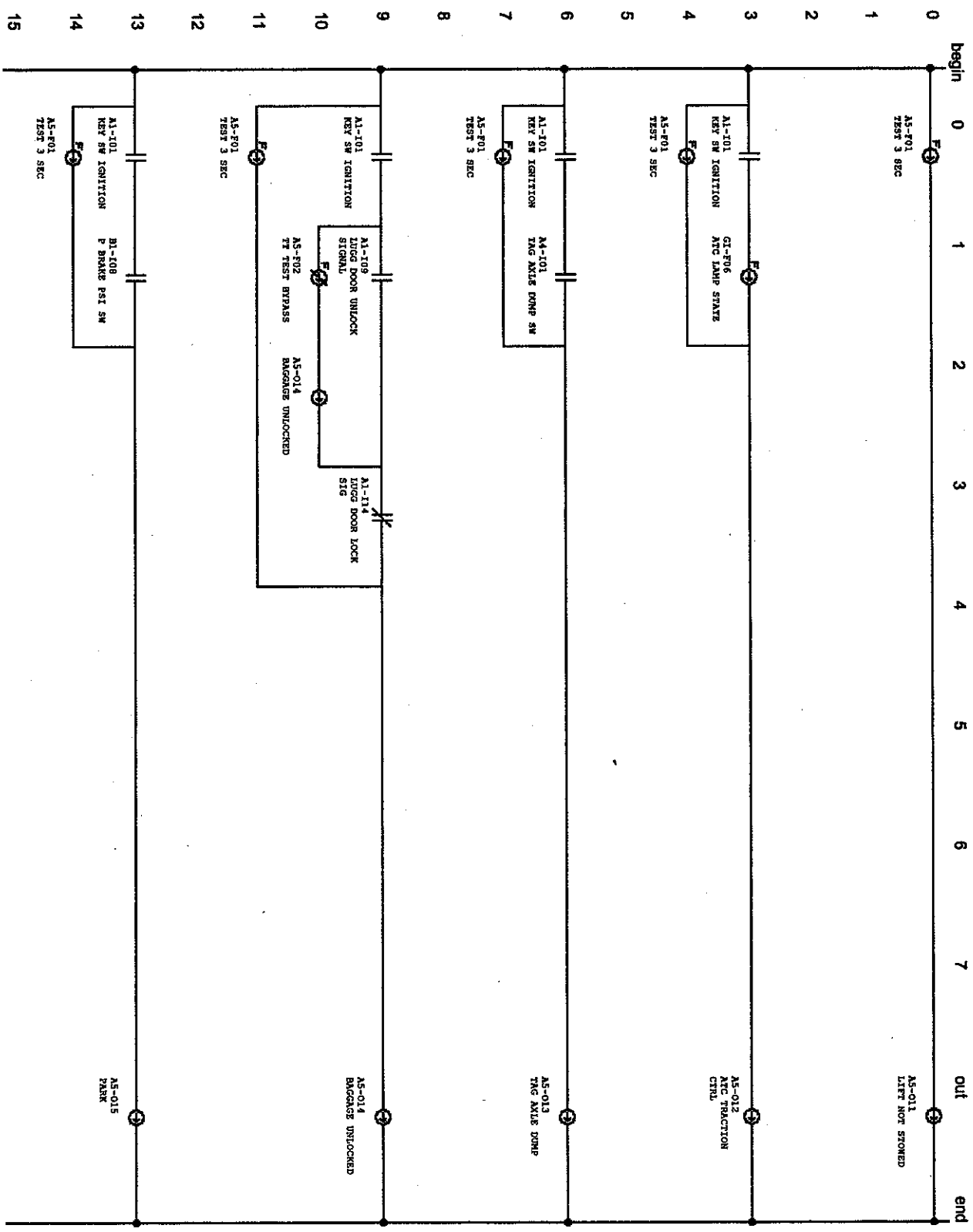


A5D01 M4RE COACH 40/45

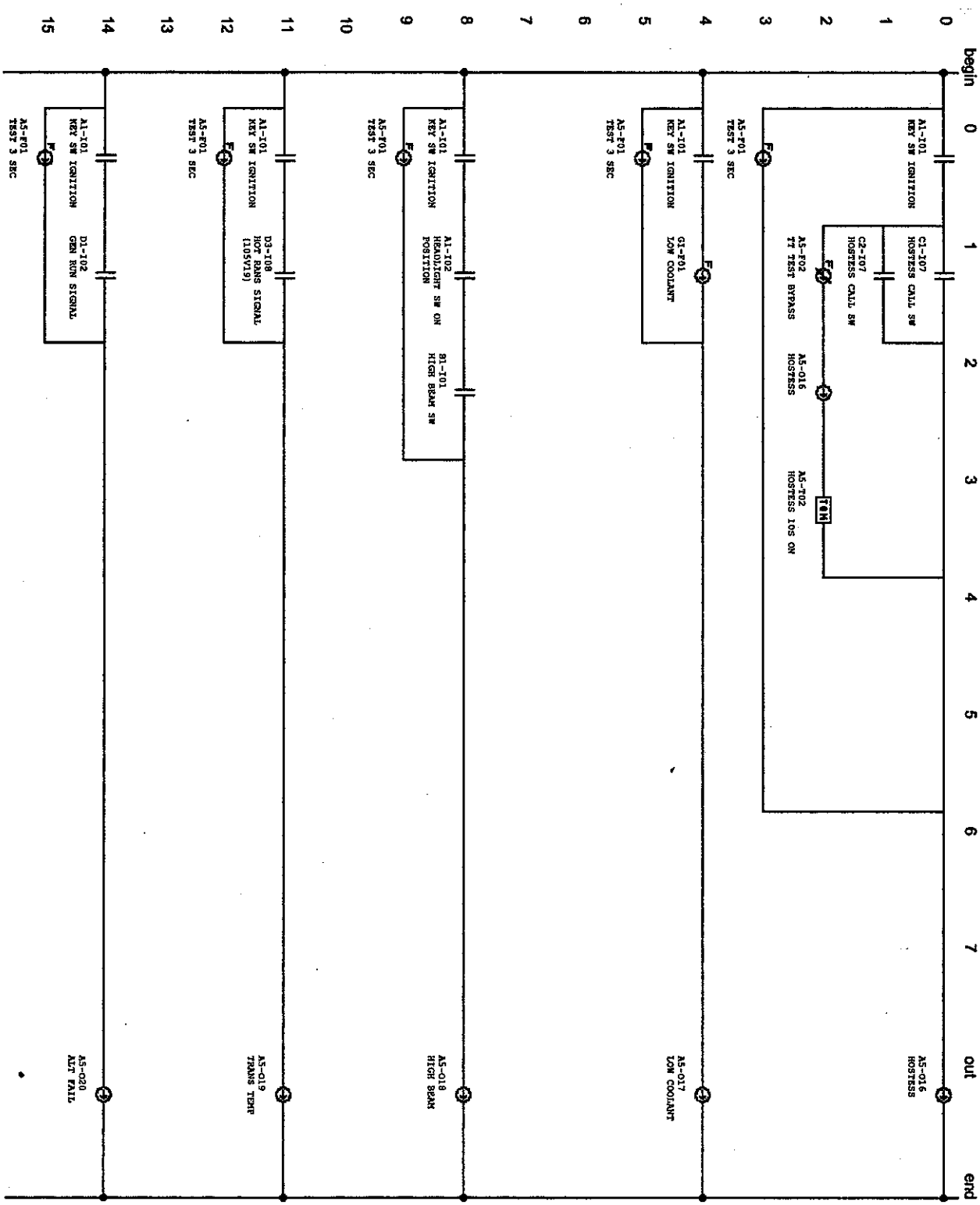


A5D02 M4RE COACH 40/45

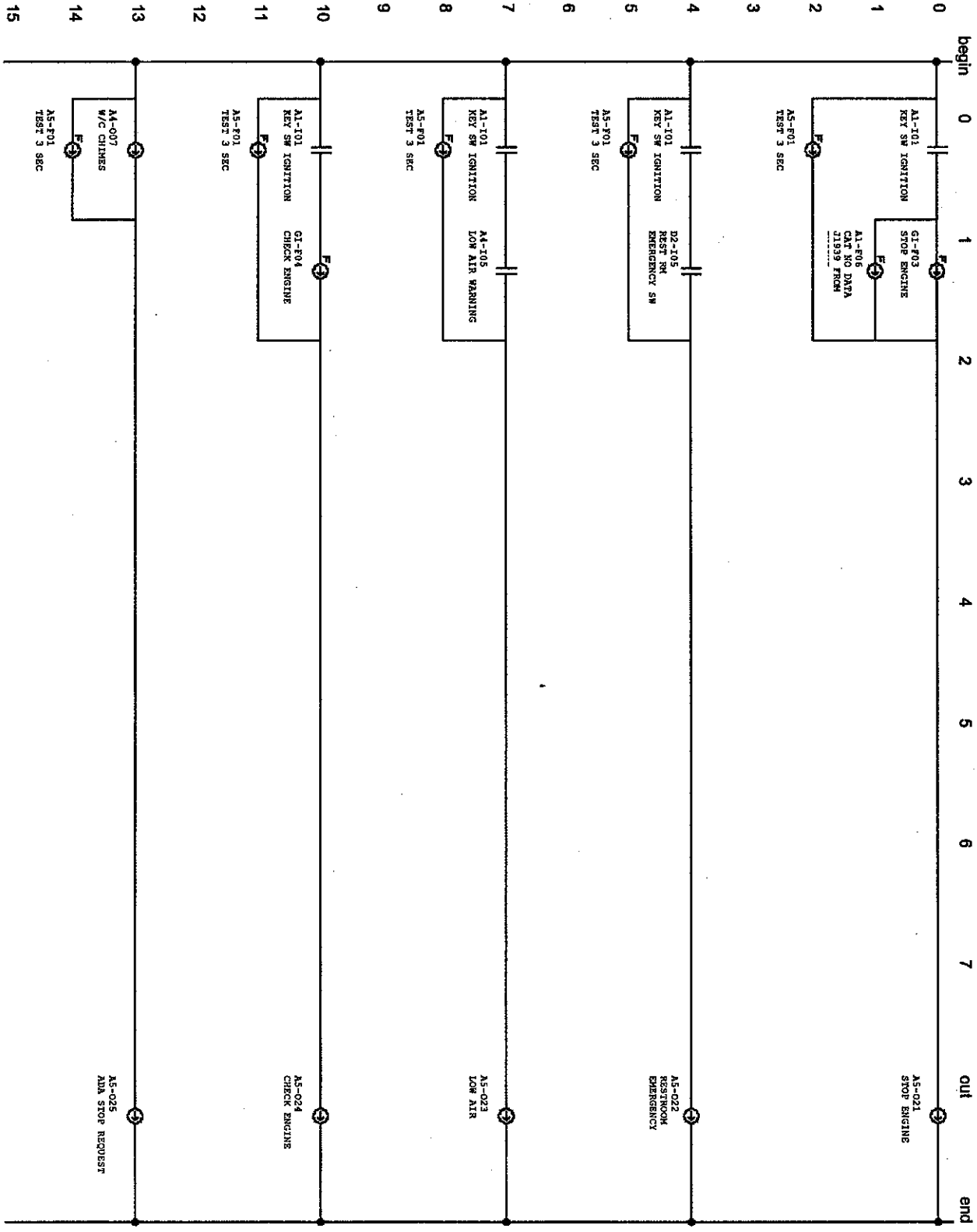
A5D03 M4RE COACH 40/45



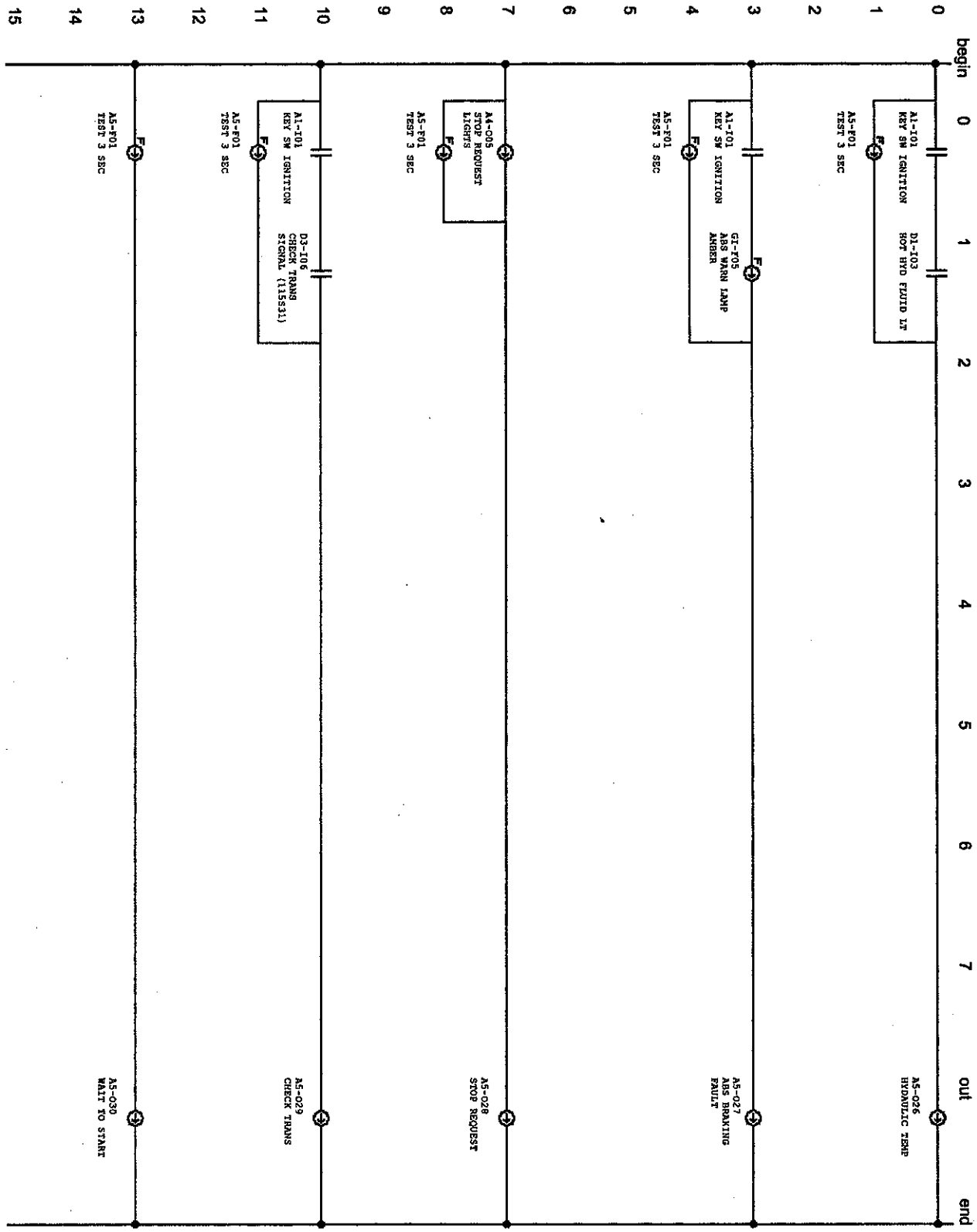
A5D04 M4RE COACH 40/45



A5D05 M4RE COACH 40/45

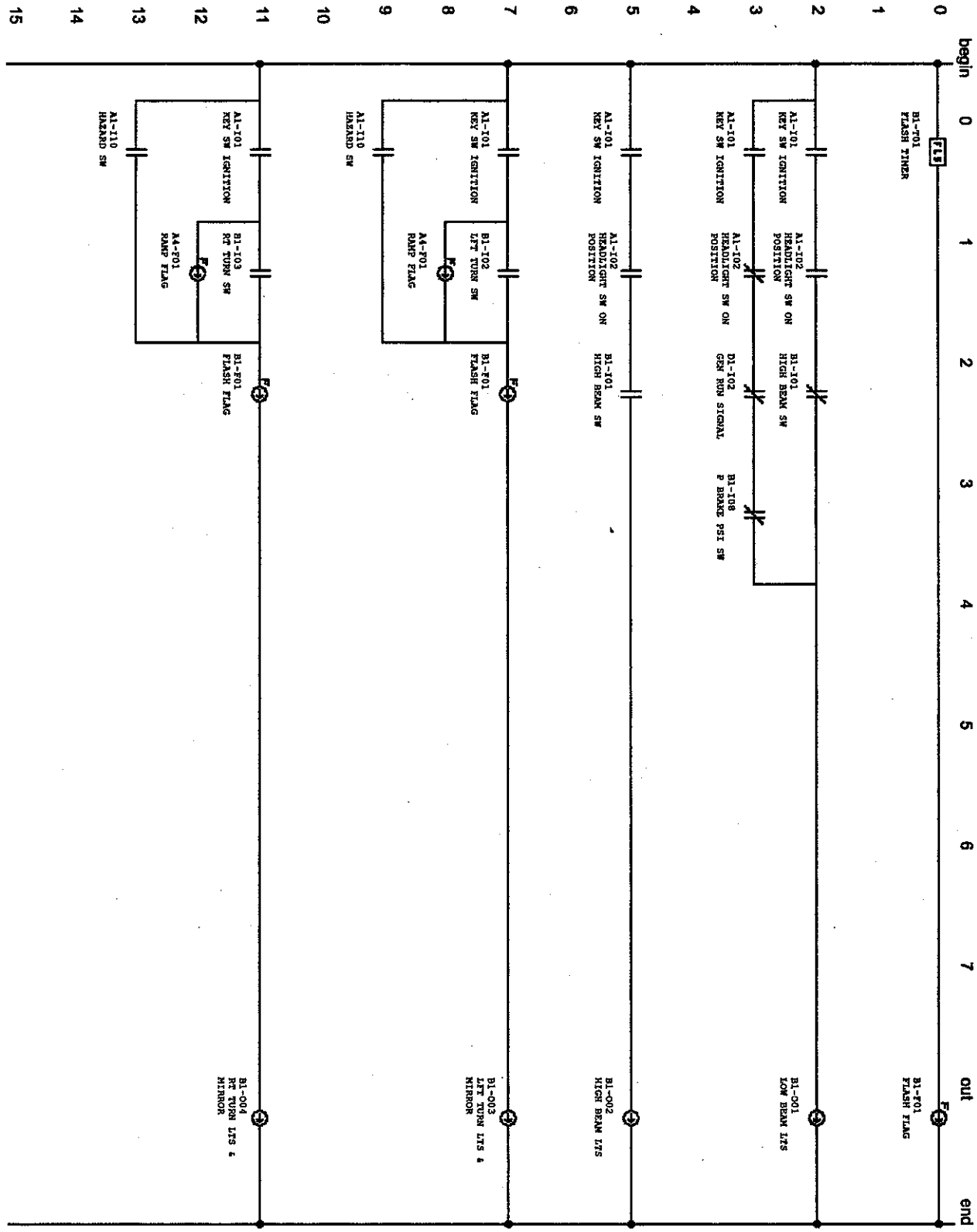


A5D06 M4RE COACH 40/45

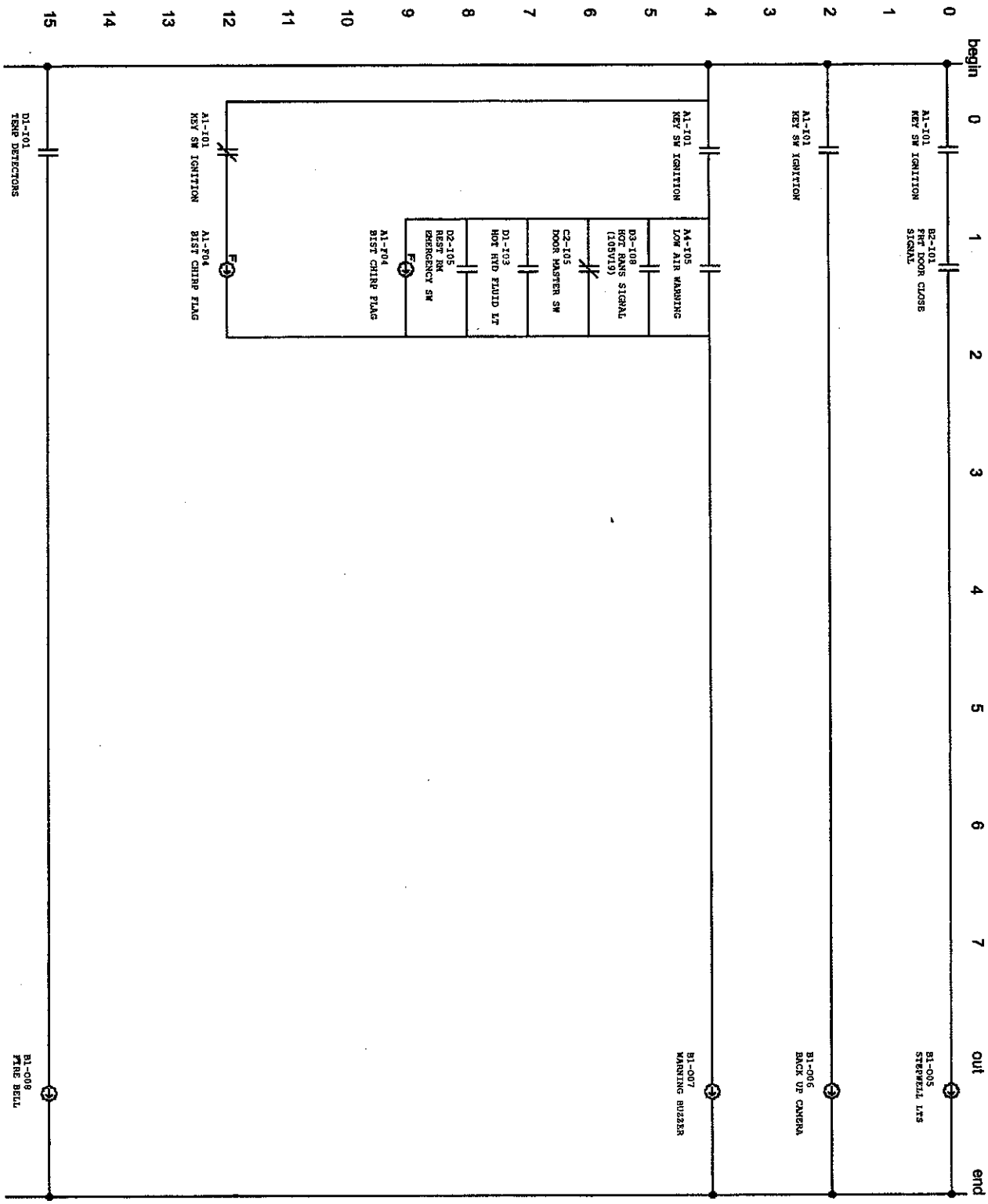


A5D07 M4RE COACH 40/45

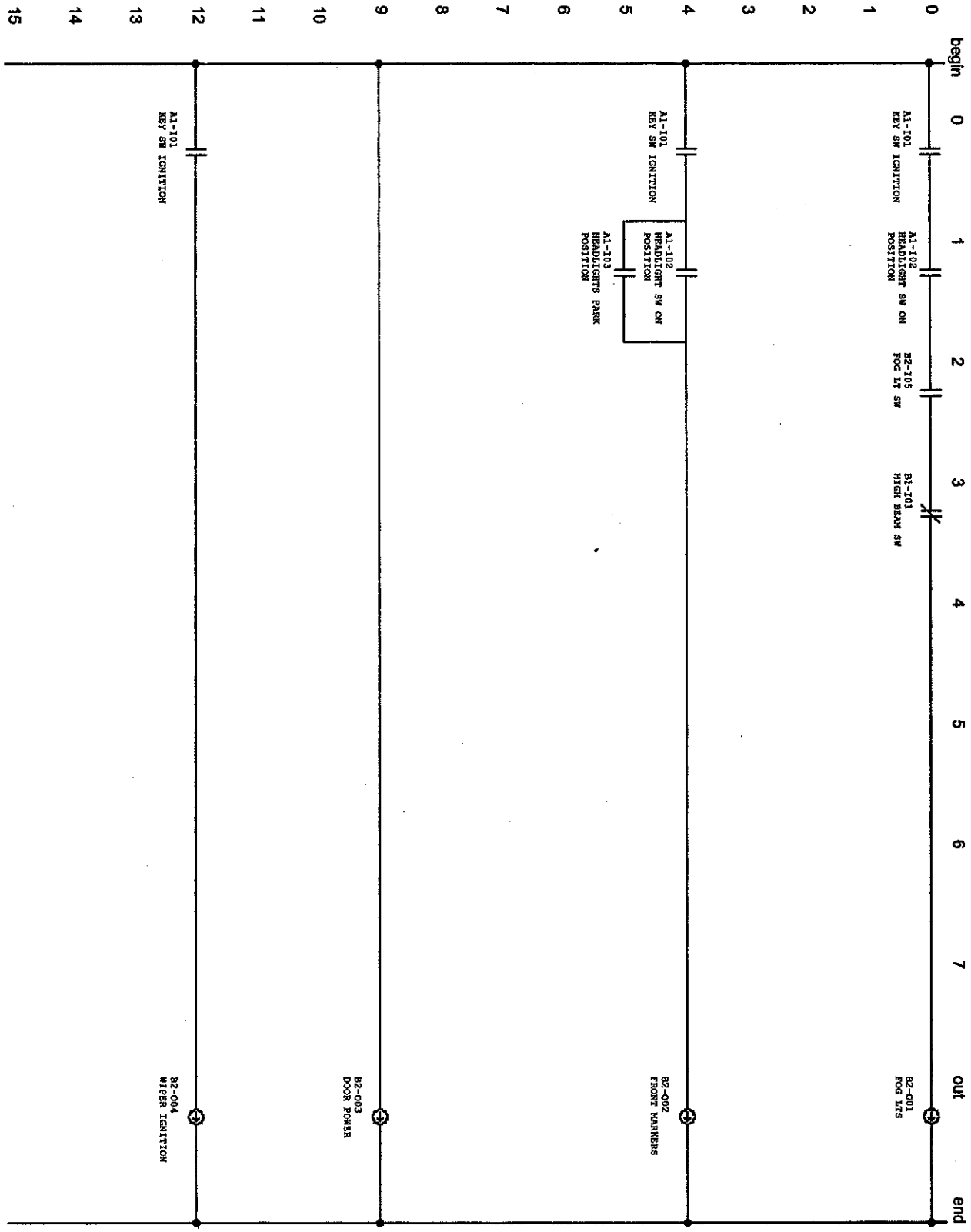
B1D01 M4RE COACH 40/45



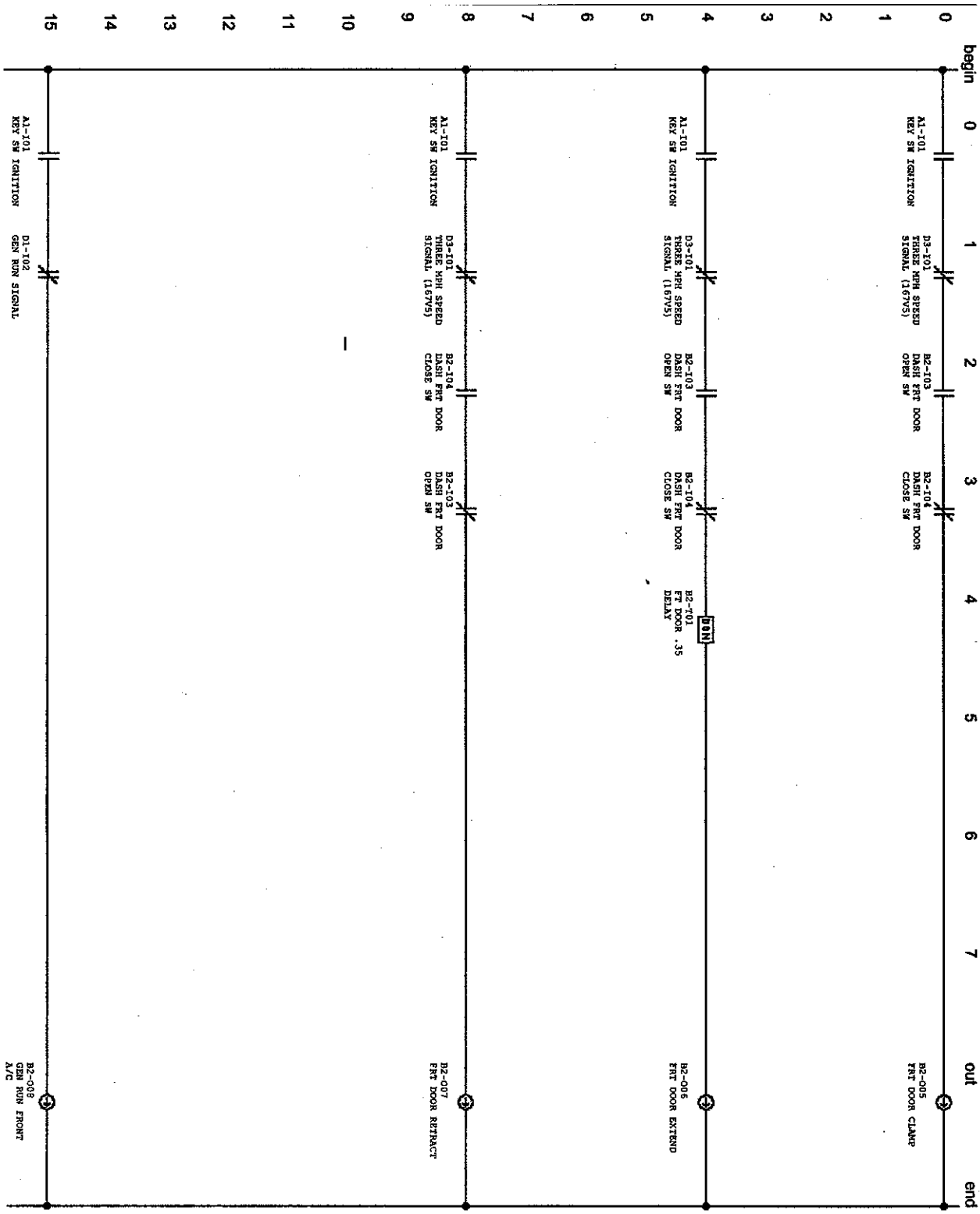
B1D02 M4RE COACH 40/45



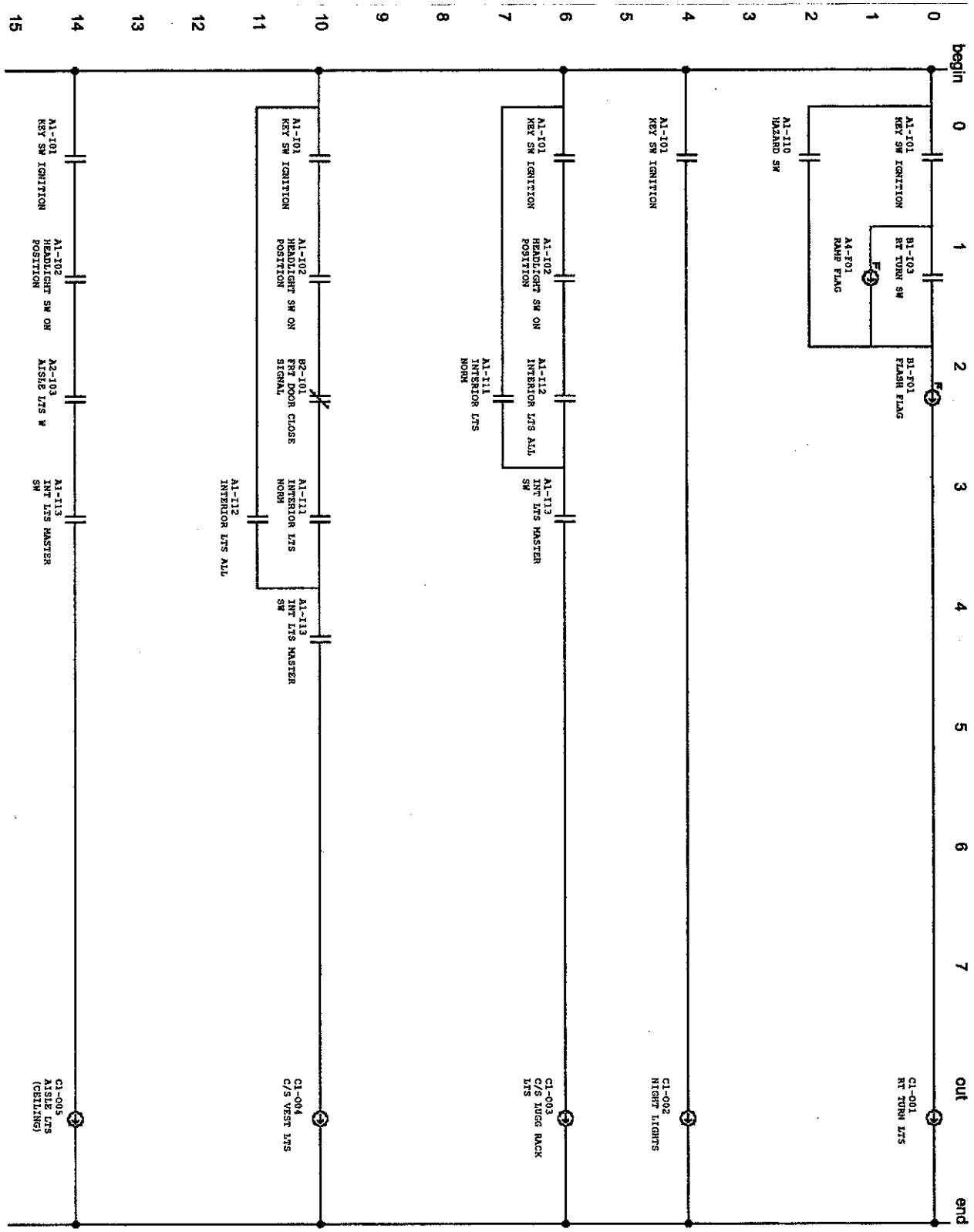
B2D01 M4RE COACH 40/45



B2D02 M4RE COACH 40/45



C1D01 M4RE COACH 40/45



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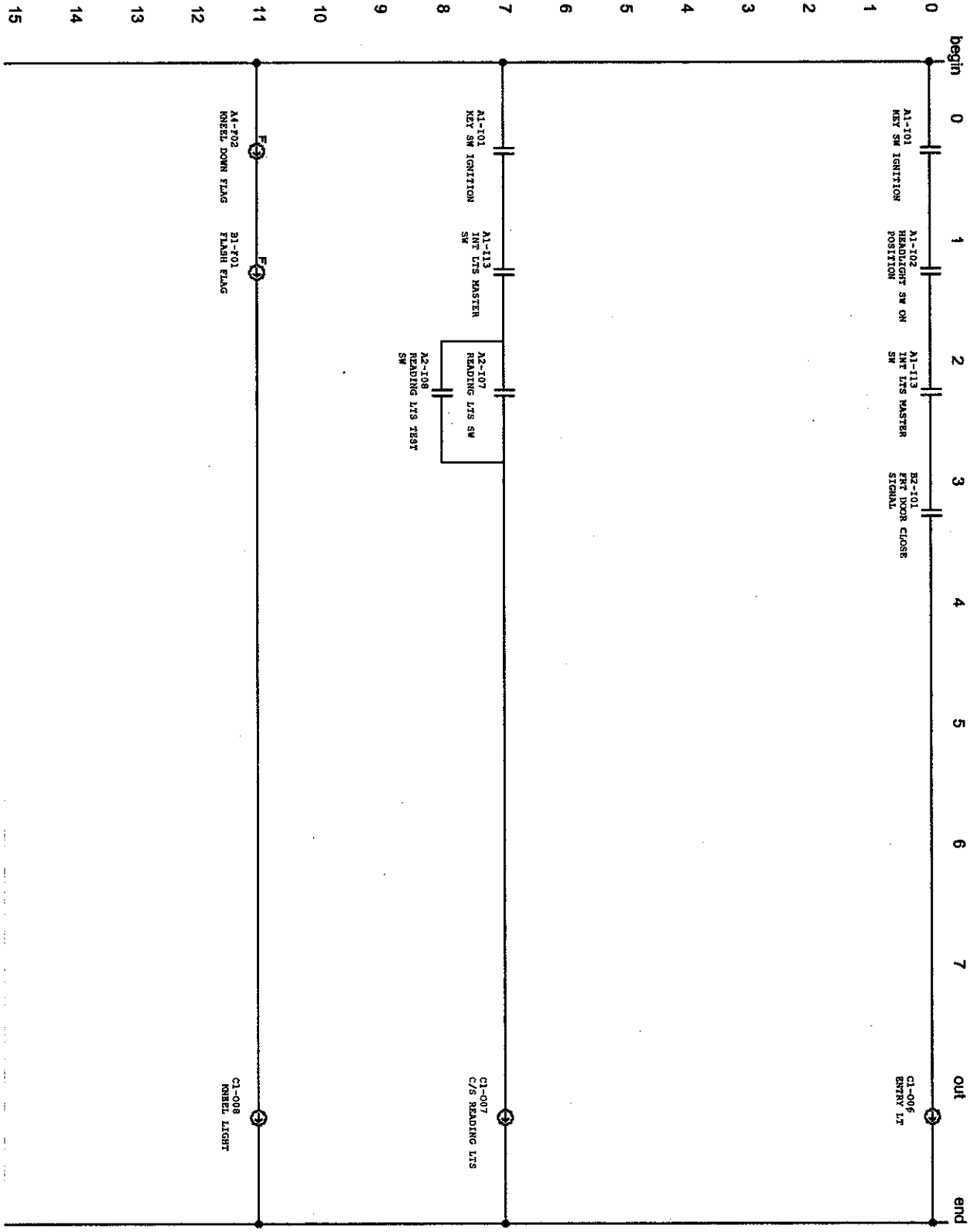

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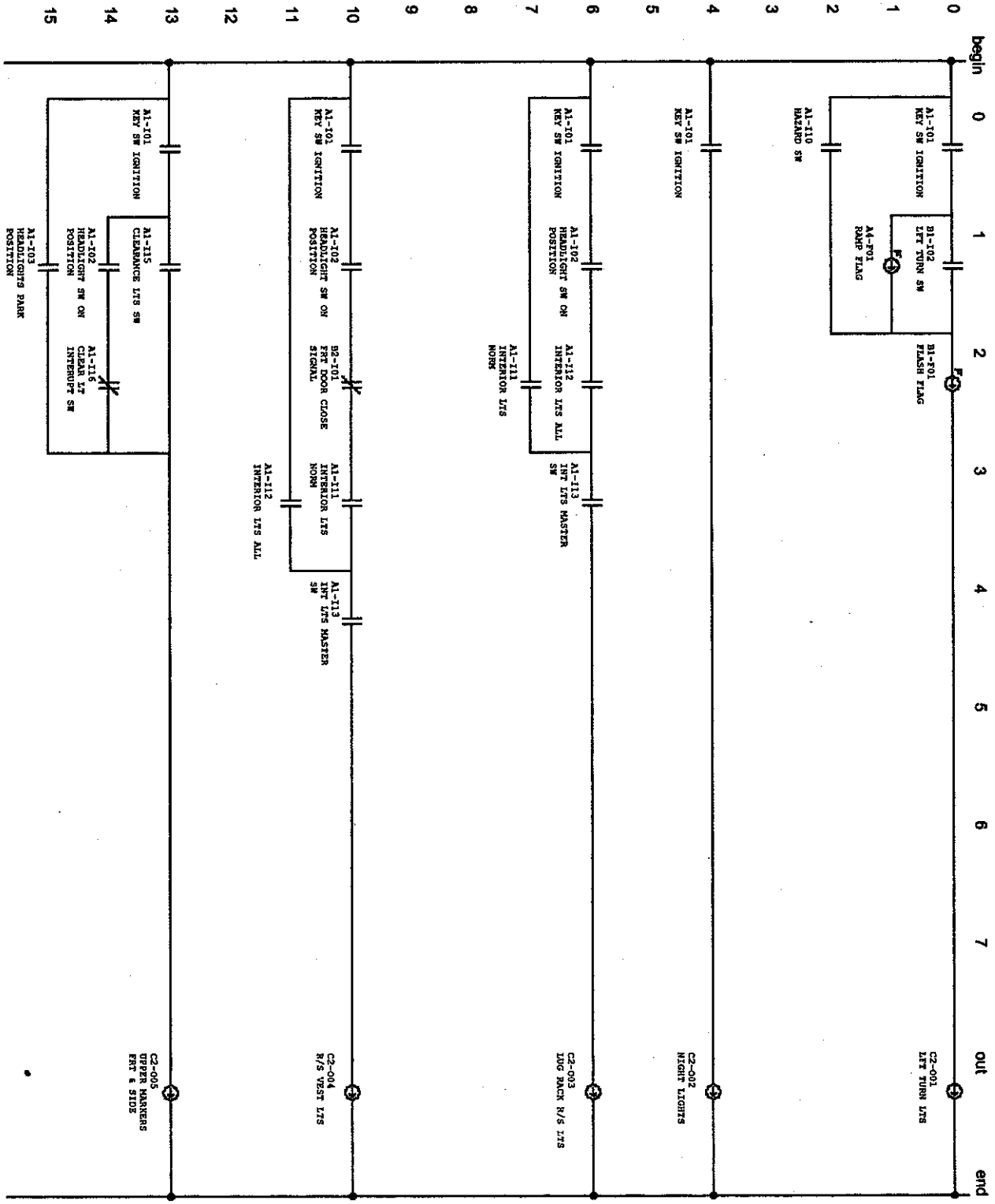

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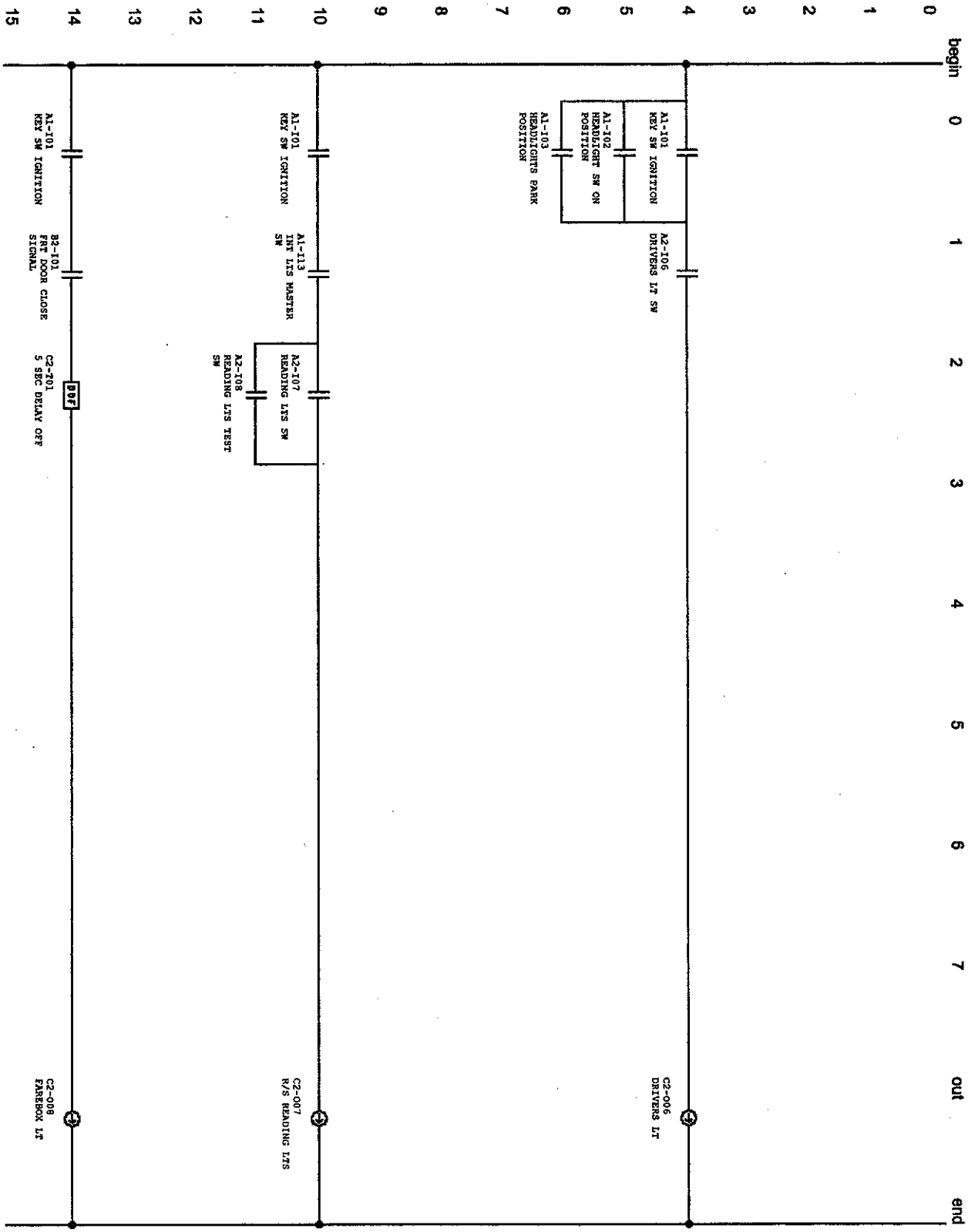

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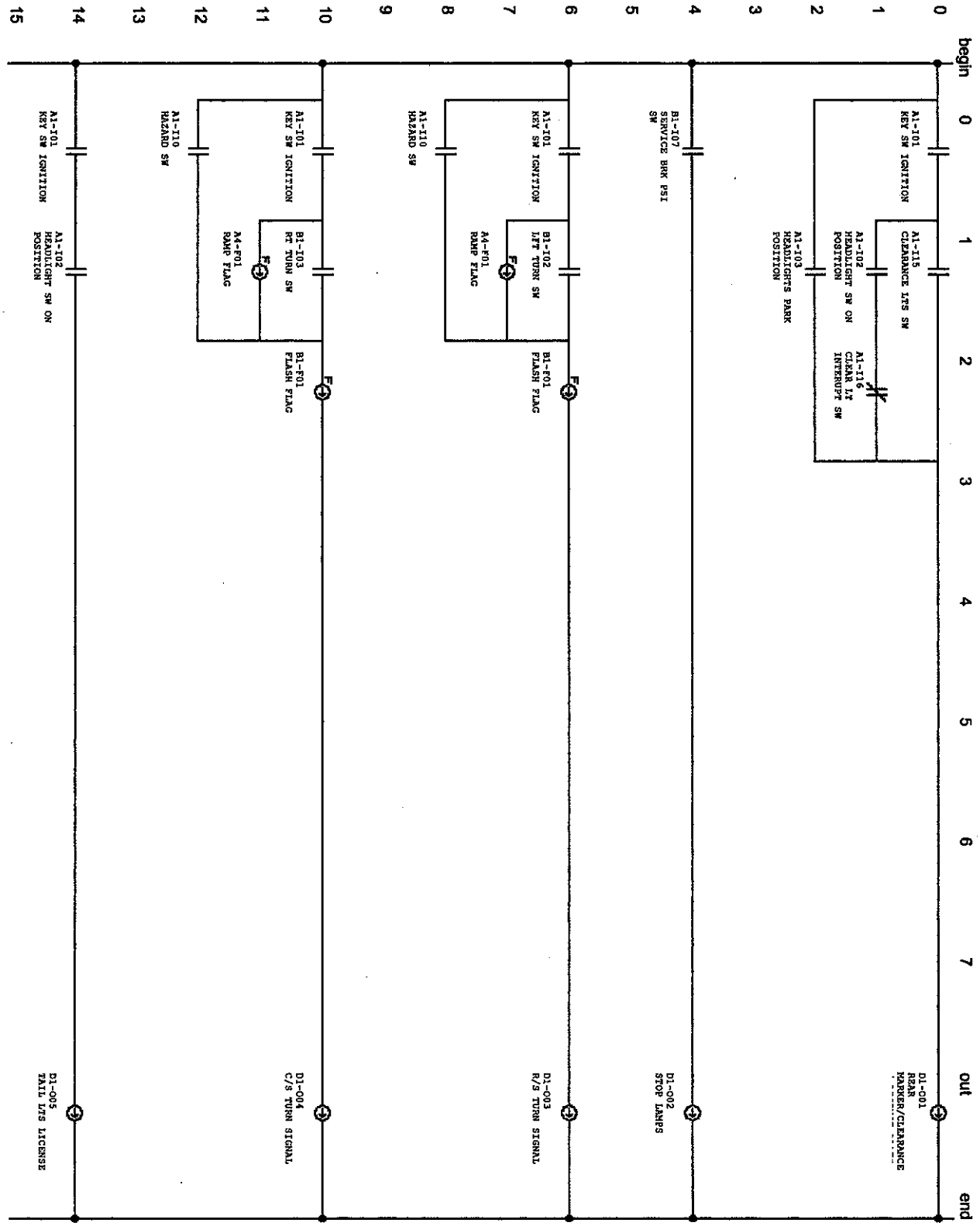

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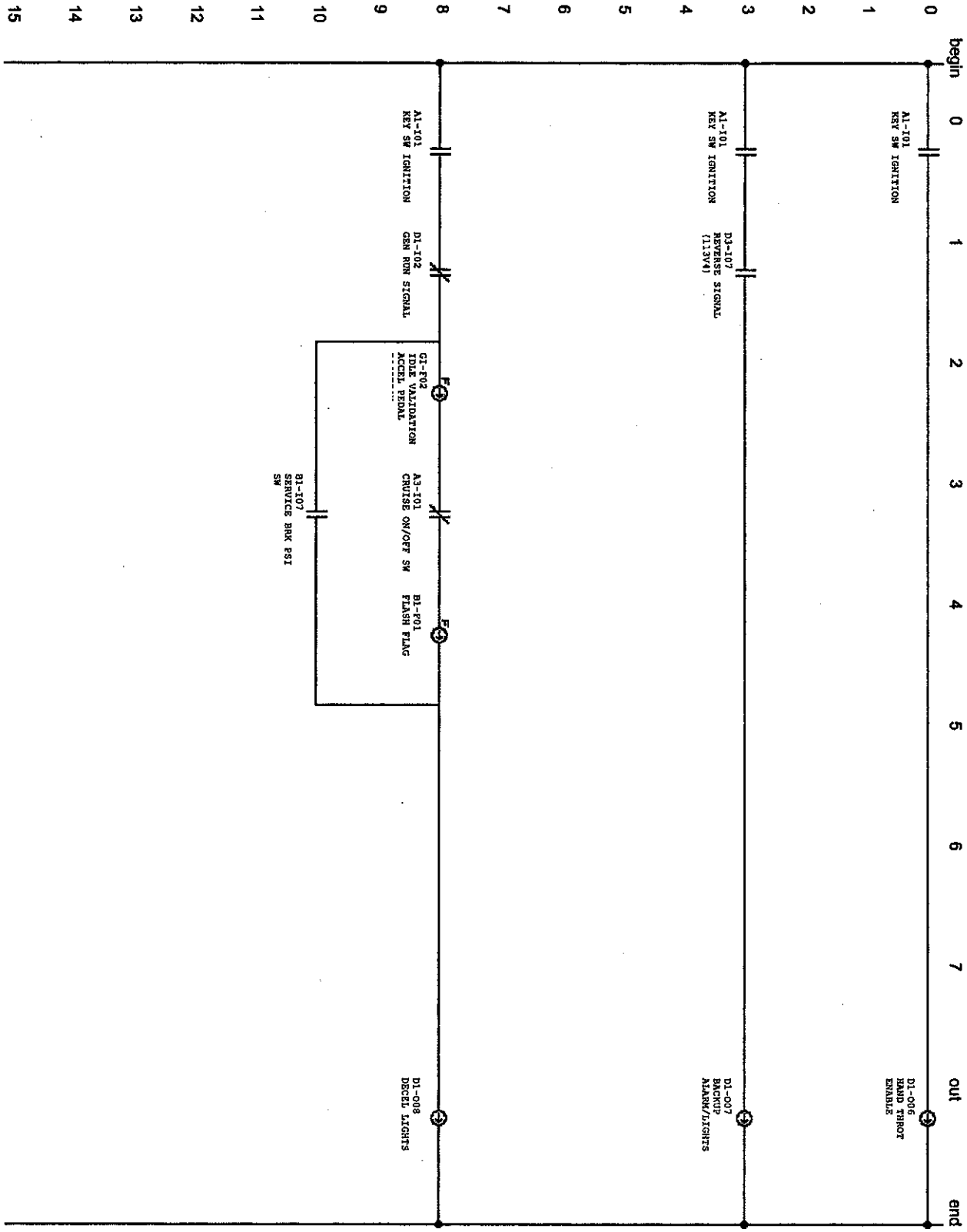

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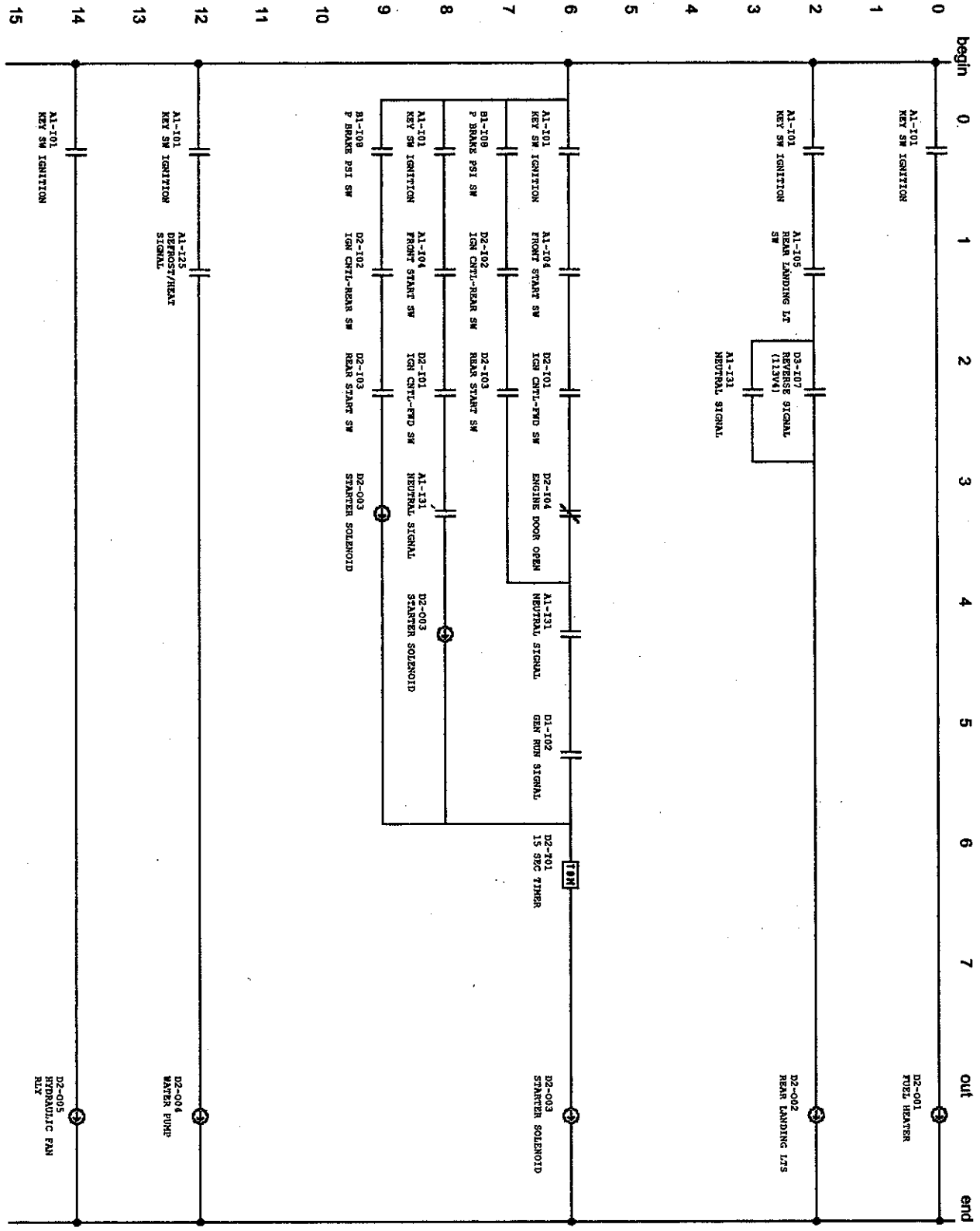
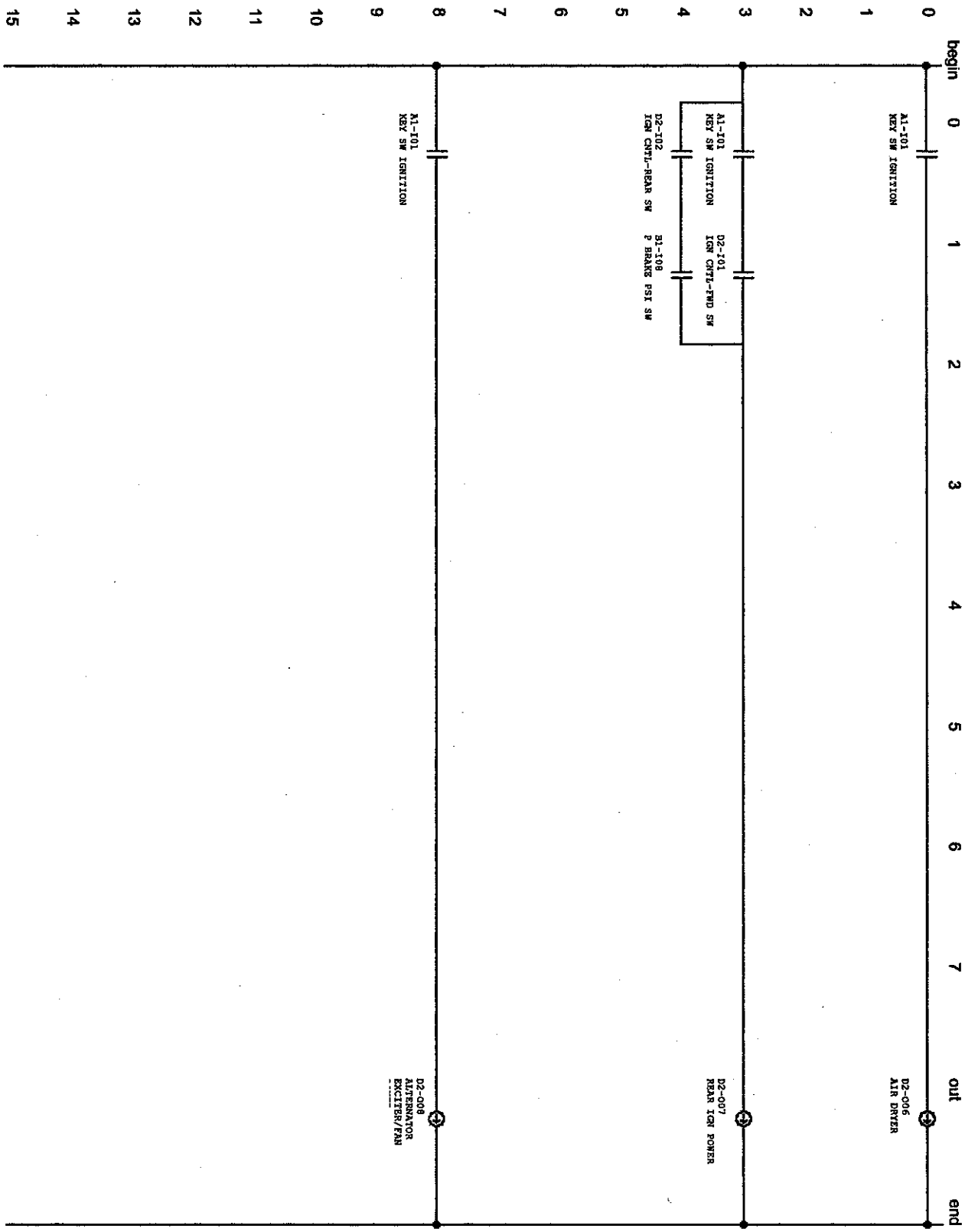
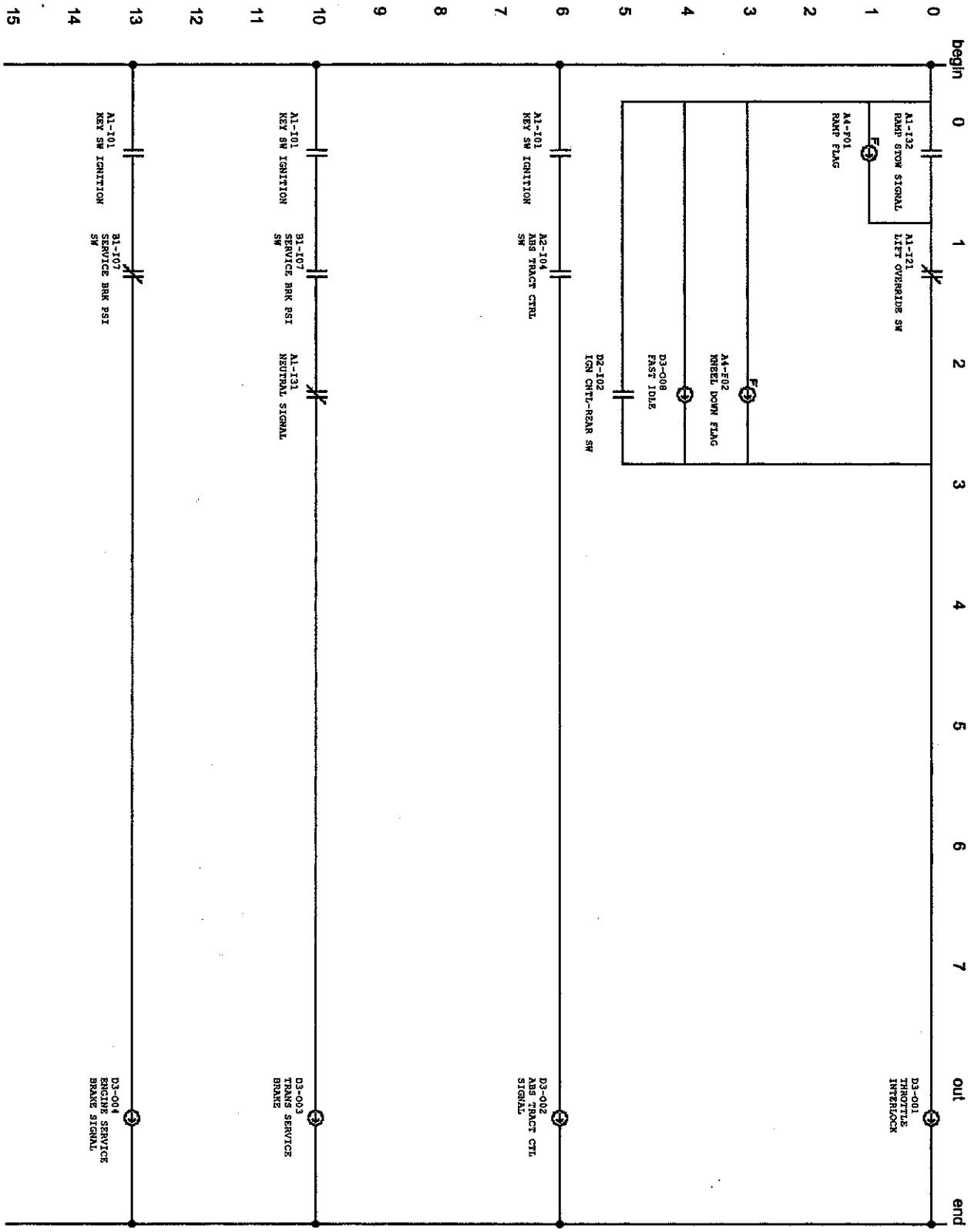


D2D02 M4RE COACH 40/45



D3D01 M4RE COACH 40/45



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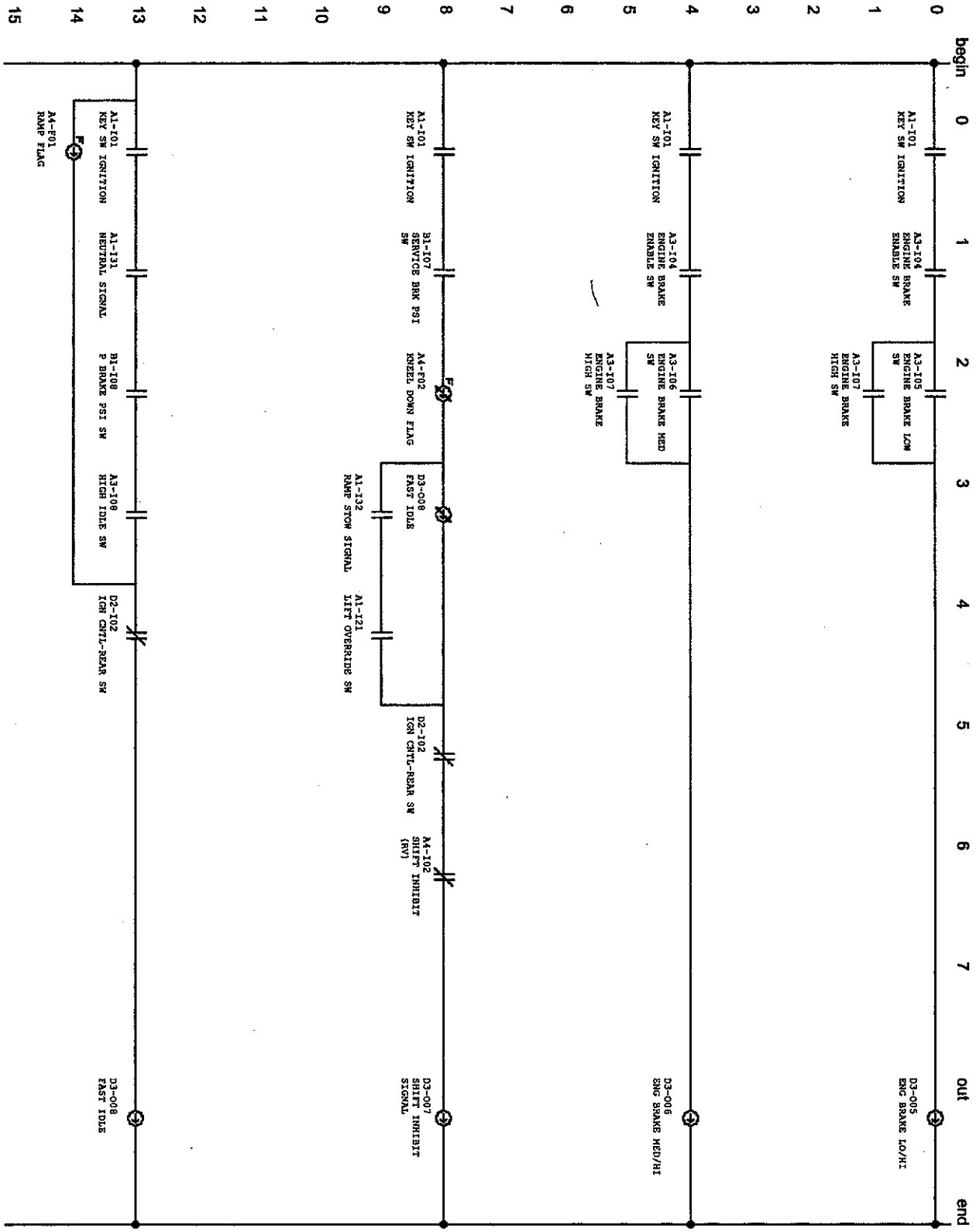
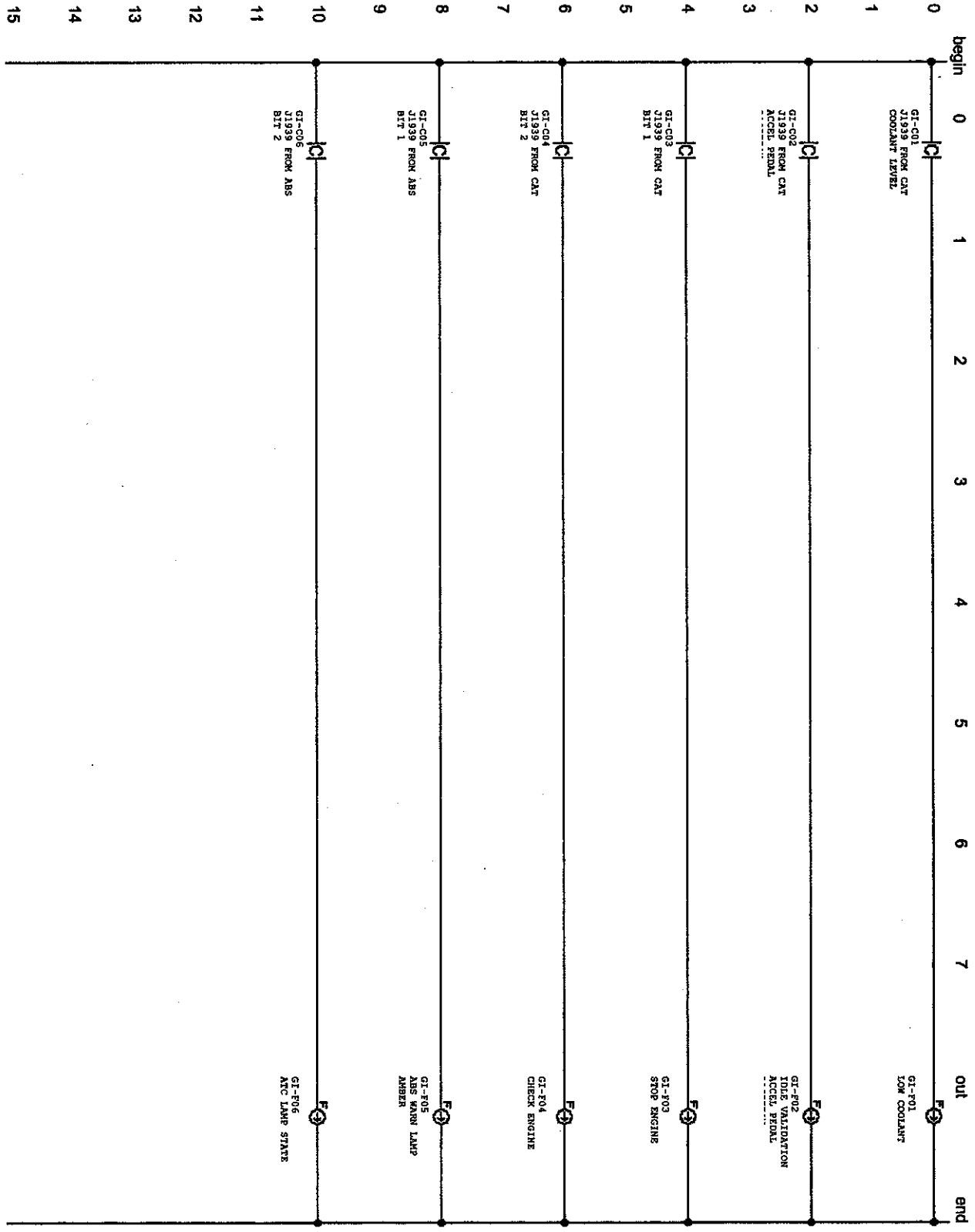
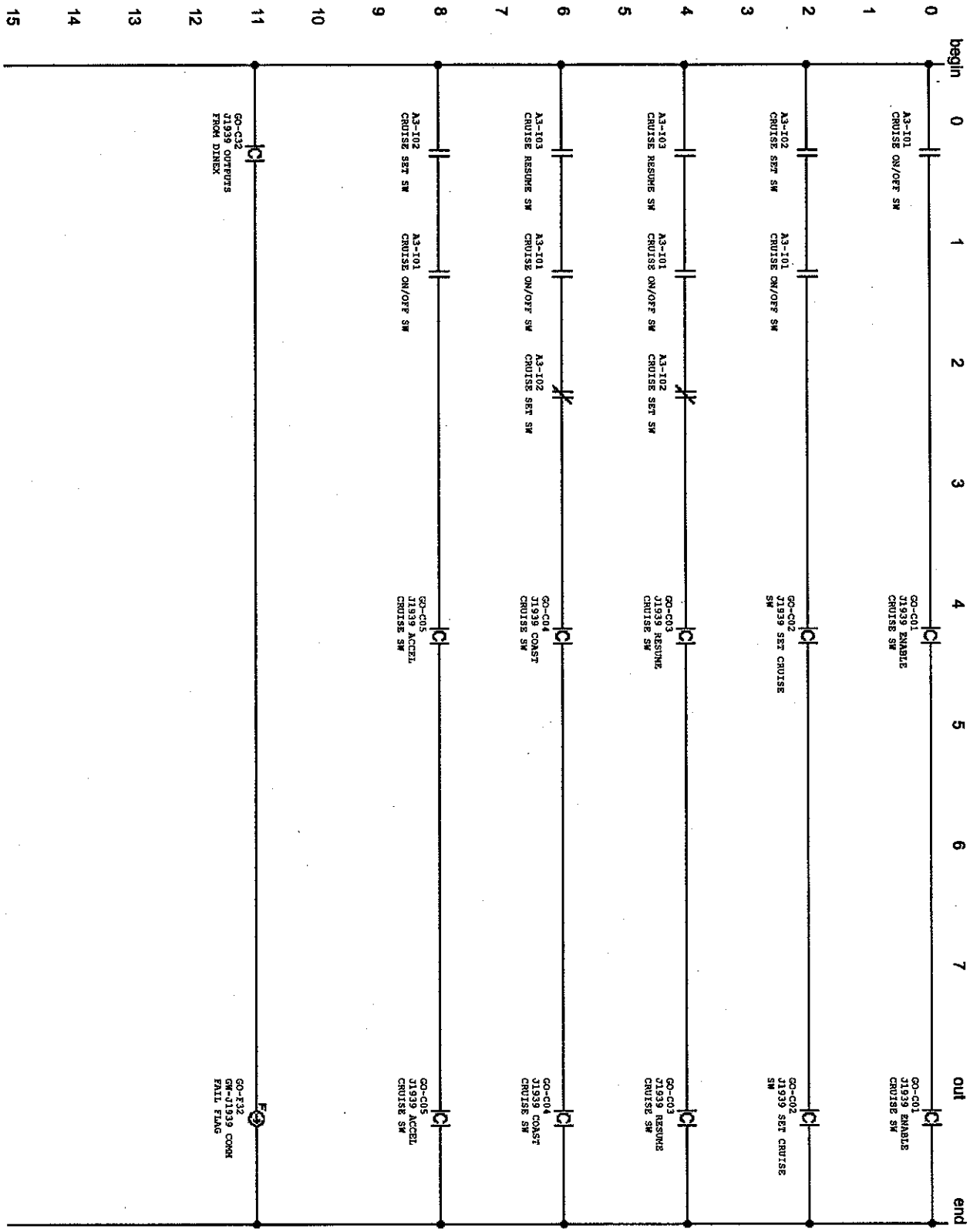


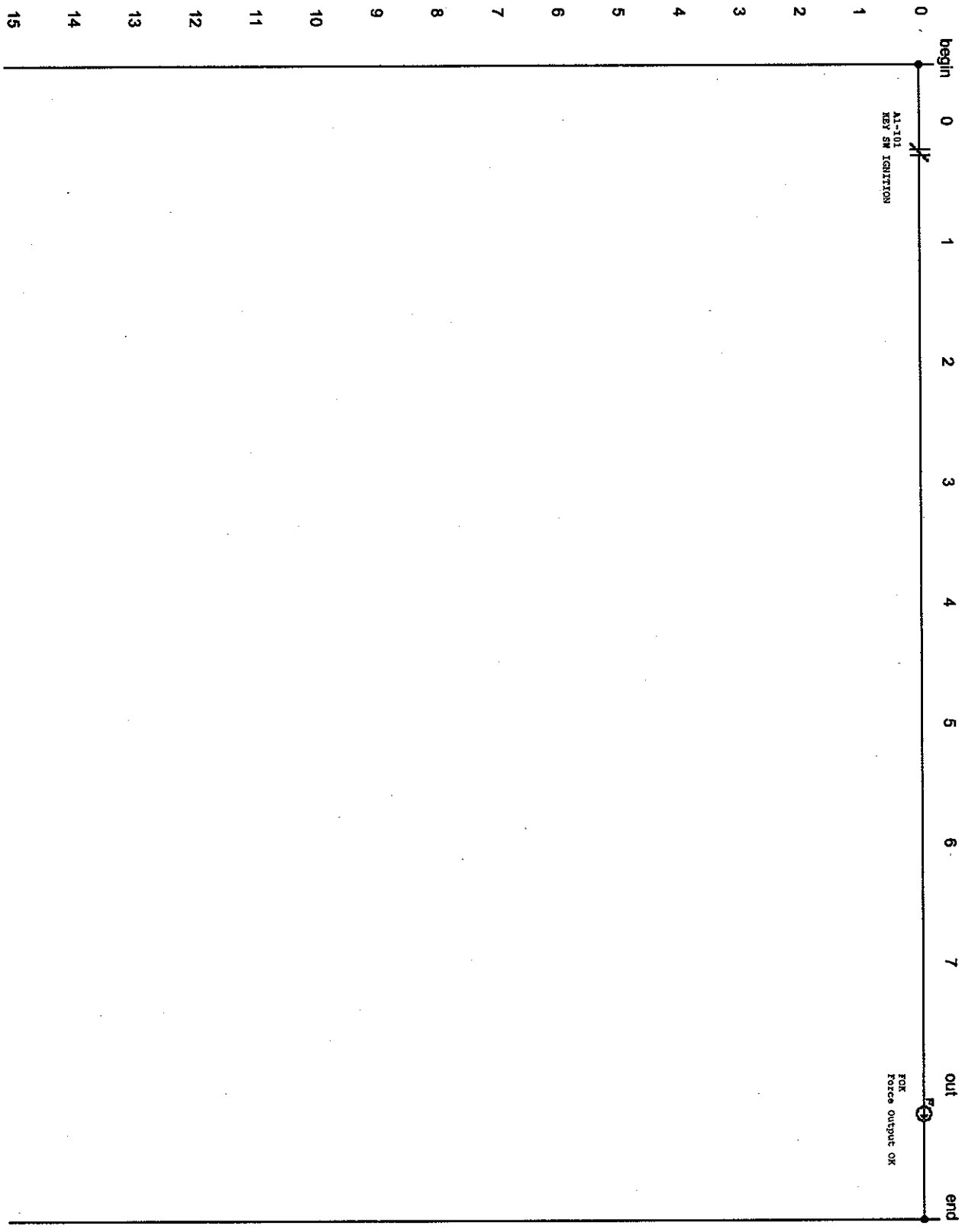
GI-D01 M4RE COACH 40/45



GO-D01 M4RE COACH 40/45



S1-D01 M4RE COACH 40/45



10-1 Authorized Service Centers

Authorized Blue Bird Wanderlodge Dealers and Service Centers

Blue Bird Wanderlodge
One Wanderlodge Way • P.O. Box 1259
Fort Valley, GA 31030
478-822-2400

Factory Sales – 478-822-2407 – Ronnie Lamb
Factory Service – 800-992-6337 – Mike Burkett and Kenny Rodgers
Product Technical Support – 800-992-6337 – Russell Borders and Bennie Collier
Factory Parts Sales – 800-495-7787 – Earl Davis and Ray Horne

Sales and Service

JOHN BLEAKLEY MOTORHOMES	**HOLLAND MOTOR HOMES**
www.bleakleyrv.com	www.holland-motorhomes.com
4411 Bankhead Highway	670 East 16th Street
Douglasville, GA 31034	Holland, MI 49423
(877) BIRDLXI (247-3594) Phone	(800) 221-7197 Phone
(770) 577-4949 Fax	(616) 396-1391 Fax
Owner: John Bleakley	GM / Sales Mgr.: John Dykstra
Sales Mgr.: Mike Martinkus	Service Mgr.: Mike Meulenberg
Service Mgr.: Dean Woodruff	
JOHN BLEAKLEY MOTORHOMES	**HOLLAND MOTOR HOMES**
www.bleakleyrv.com	www.holland-motorhomes.com
445 Bleakley Blvd.	7490 Copley Park Place
Unadilla, GA 31091	San Diego, CA 92111
(877) 456-3700 Phone	(800) 961-4464 Phone
(478) 627-3111 Fax	(858) 874-8484 Fax
Owner: John Bleakley	GM / Sales Mgr.: Mike Dykstra
Sales Mgr.: Bill Hamilton	Service Mgr.: Loren Swartz
Service Mgr.: Glenn McCormick	
DE MARTINI RV SALES	**NORTH TRAIL RV CENTER**
www.demartinirv.com	www.northtrailrvcenter.com
1305 E. Main Street	5270 Orange River Blvd.
Grass Valley, CA 95945	Fort Myers, FL 33905
(800) 576-1921 Phone	(800) 741-4383 Phone
(530) 272-9413 Fax	(941) 693-7229 Fax
Owner: Tim DeMartini	Owner: Albert Erp
Sales Mgr.: Jon DeMartini	Sales Mgr.: George Grimm
Service Mgr.: Brad Heward	Service Mgr.: Steve Graham
MARTY'S USRV (M380 Only)	**SHOREWOOD RV. CENTER**
www.martysusrv.com	www.shorewoodrv.com
71 County Street	8390 Highway 10 NW
Corner Route 140 & 79	Anoka, MN 55303
Berkley, MA 02779	(800) 784-2505 Phone
(800) 723-(USRV) 8778 Phone	(763) 506-0415 Fax
(508) 823-7583 Fax	Sales Mgr.: Tim Paulson
Owner: Marty Hanoud	Service Mgr.: Terry Morical
Sales Mgr.: Fernando Oliveira	
Service Mgr.: Ray Noriega	

Authorized Blue Bird Wanderlodge Service Centers

Full Service and Parts Only

Miller's RV
12912 Florida Boulevard • Baton Rouge, LA 70815
(504) 275-2940 • Fax: (504) 275-6807
Service – Doug Miller

Authorized Blue Bird Wanderlodge Service Centers
Detroit Diesel – Allison
And Associate DD-A Distributors

Chassis Service and Chassis Parts Only

ALABAMA
Birmingham
William Detroit Diesel -
Allison Southeast, Inc.
1160 Bankhead Hwy., West
P.O. Box 12566
Birmingham, AL 35202
Phone: 800-365-3780

ALASKA
Anchorage
Pacific Detroit Diesel -
Allison Co.
8001 Petersburg Street
Anchorage, AK 99507
Phone: 907-522-3434

ARIZONA
Phoenix
Williams Detroit Diesel -
Allison Southwest, Inc.
2602 S. 19th Ave.
(Zip 85009)
P.O. Box 3618
Phoenix, AZ 85030
Phone: 800-944-7375

Tucson
Williams Detroit Diesel -
Allison Southwest, Inc.
1375 W. Glenn
Tucson, AZ 85705
Phone: 800-624-8331

ARKANSAS
Little Rock
United Engines, Inc.
9401 I-30 (Zip 72209)
P.O. Box 192720
Little Rock, AR 72219
Phone: 501-562-5565

CALIFORNIA
Bakersfield
Valley Detroit Diesel -
Allison, Inc.
4000 Rosedale Hwy.
(Zip 93308)
P.O. Box 1848
Bakersfield, CA 93303
Phone: 805-325-9001

City of Industry
Valley Detroit Diesel -
Allison, Inc.
13644 E. Nelson Ave.
City of Industry, CA 91746
Phone: 818-333-1243

Fresno
Valley Detroit Diesel -
Allison, Inc.
2935 S. Orange Ave.
Fresno, CA 93725
Phone: 209-486-6900

Mira Loma
Valley Detroit Diesel -
Allison, Inc.
11300 Inland Avenue
Mira Loma, CA 91752
Phone: 909-681-9283

San Diego
Valley Detroit Diesel -
Allison, Inc.
5725 Eastgate Drive
San Diego, CA 92121
Phone: 619-447-2492

San Leandro
Sierra Detroit Diesel -
Allison, Inc.
1755 Adams Avenue
San Leandro, CA 94577
Phone: 510-635-8991

West Sacramento
Sierra Detroit Diesel -
Allison, Inc.
855 Stillwater Road
West Sacramento,
CA 95691
Phone: 916-372-5078

COLORADO
Commerce City
Stewart & Stevenson
Power, Inc.
5840 Dahlia Street (Denver)
P.O. Box 220
Commerce City, CO 80022
Phone: 303-287-7441

CONNECTICUT
Middletown
Atlantic Detroit Diesel -
Allison, Inc.
300 Smith Street
P.O. Box 2781
Middletown, CT 06457
Phone: 203-632-0218

CONNECTICUT cont.

Noank
Atlantic Detroit Diesel - Allison, Inc.
Noank Shipyard
Pearl Street
Noank, CT 06340
Phone: 203-536-6726

FLORIDA

Ft. Myers
Florida Detroit Diesel - Allison, Inc.
2305 Rockfille Road
Ft. Myers, FL 33916
Phone: 813-332-3100

Ft. Pierce
Florida Detroit Diesel - Allison, Inc.
3885 Selvitz Road
Ft. Pierce, FL 34954
Phone: 407-464-6006

Jacksonville
Florida Detroit Diesel - Allison North, Inc.
5040 University Blvd. West
(Zip 32216)
Jacksonville, FL 32245-6595
Phone: 904-737-7330

Miami
Florida Detroit Diesel - Allison, Inc.
2277 N.W. 14th Street
(Zip: 33125)
P.O. Box 350010
Miami, FL 33195
Phone: 305-638-5300

Ocala
Florida Detroit Diesel - Allison North Inc.
224 S. W. 52nd Ave.
Ocala, FL 32674
Phone: 904-237-7977

Orlando
Florida Detroit Diesel - Allison North, Inc.
6850 Presidents Drive
Orlando, FL 32809
Phone: 407-888-1700

Tampa
Florida Detroit Diesel - Allison North, Inc.
8411 Adamo Drive
Tampa, FL 33619
Phone: 813-621-5651

GEORGIA

Albany
Williams Detroit Diesel - Allison Southeast, Inc.
1803 West Oakridge Drive
Albany, GA 31707
Phone: 800-736-1952

Atlanta
Williams Detroit Diesel - Allison Southeast, Inc.
2849 Moreland Ave. S.E.
P.O. Box 12537
Atlanta, GA 30315
Phone: 800-545-7116

Ringgold
Covington Detroit Diesel
102 Gateway Avenue
P.O. Box 1088
Ringgold, GA 30736
Phone: 706-965-7000

Savannah
Williams Detroit Diesel - Allison Southeast, Inc.
14 West Gate Blvd.
P.O. Box 23209
Savannah, GA 31405
Phone: 800-283-9332

IDAHO

Boise
Smith Detroit Diesel - Allison, Inc.
4045 Transport Street
P.O. Box 5715
Boise, ID 83705
Phone: 208-345-1500

ILLINOIS

Addison
Inland Detroit Diesel - Allison, Inc.
500 S. Lombard Road
(Chicago)
Addison, IL 60101
Phone: 708-620-2000

Rock Island
Interstate Detroit Diesel, Inc.
3806 78th Ave., West
Rock Island, IL 61201
Phone: 309-787-4601

INDIANA

Fort Wayne
Clarke Detroit Diesel - Allison, Inc.
2610 Independence Drive
Fort Wayne, IN 46825
Phone: 219-482-9185

Gary
Inland Detroit Diesel - Allison, Inc.
2601 E. 15th Street
Gary, IN 46401
Phone: 219-882-0421

Indianapolis
Clarke Detroit Diesel - Allison, Inc.
1340 Terminal Road
Indianapolis, IN 46217
Phone: 317-783-6651

IOWA

Des Moines
Interstate Detroit Diesel, Inc.
Interstate Hwys. 80 & 35 at
2nd Avenue
P.O. Box 4007
Des Moines, IA 50333
Phone: 515-286-4800

KANSAS

Colby
Central Detroit Diesel - Allison, Inc.
1920 Thielen Ave.
P.O. Box 445
Colby, KS 67701
Phone: 913-462-8211

Great Bend
Central Detroit Diesel - Allison, Inc.
625 E. 10th Street
P.O. Box 691
Great Bend, KS 67530
Phone: 316-792-1361

Liberal
Central Detroit Diesel - Allison, Inc.
East Hwy. 54
P.O. Box 177
Liberal, KS 67901
Phone: 316-624-7274

Salina
Central Detroit Diesel - Allison, Inc.
1944-B N. 9th Street
P.O. Box 1271
Salina, KS 67401
Phone: 913-825-8291

KANSAS cont.

Wichita
Central Detroit Diesel - Allison, Inc.
4501 W. Irving
Wichita, KS 67201
Phone: 316-943-1231

KENTUCKY

Henderson
Clarke Detroit Diesel - Allison, Inc.
751 U.S. 41 South
Henderson, KY 42420
Phone: 502-827-4600

Lost Creek
Western Brance Diesel, Inc.
14701 Highway 15 South
Lost Creek, KY 41348
Phone: 606-666-4981

Louisville
Clarke Detroit Diesel - Allison, Inc.
2697 Gassland Avenue
Louisville, KY 40299
Phone: 502-491-2021

LOUISIANA

Harvey
Stewart & Stevenson Services, Inc.
1401 Destrehan Ave.
P.O. Box 8
Harvey, LA 70059
Phone: 504-347-4326

Shreveport
United Engines, Inc.
7255 Greenwood Road
P.O. Box 37270
Shreveport, LA 71133
Phone: 318-635-8022

MAINE

Portland
New England Detroit Diesel - Allison, Inc.
432 Warren Avenue
Portland, ME 04103
Phone: 207-797-5950
Fax: 207-797-5953

MARYLAND

Baltimore
Johnson & Towers, Inc.
500 Wilson Point Road
Baltimore, MD 21220
Phone: 410-687-0500

Beltsville
Johnson & Towers, Inc.
6861 Distribution Drive
Beltsville, MD 20705
Phone: 301-937-8700

MASSACHUSETTS

Wakefield
New England Detroit Diesel Allison, Inc.
90 Bay State Road
(Boston)
Wakefield, MA 01880
Phone: 617-246-1810

MICHIGAN

Dearborn
Williams Detroit Diesel - Allison Midwest, Inc.
4000 Stecker Avenue
Dearborn, MI 48126-6150
Phone: 313-584-6150
(24 Hr.)

Grand Rapids
Williams Detroit Diesel - Allison Midwest, Inc.
2940 Clydon Ave. S.W.
Grand Rapids, MI 49509
Phone: 800-701-9993

Iron Mountain
Inland Diesel, Inc.
600 Industrial Park Drive
Iron Mountain, MI 49801
Phone: 906-774-9707

Saginaw
Williams Detroit Diesel - Allison Midwest, Inc.
715 S. Outer Drive
Saginaw, MI 48601
Phone: 800-906-4235

MINNESOTA

Minneapolis
Interstate Detroit Diesel, Inc.
2501 E. 80th Street
Minneapolis, MN 55425
Phone: 612-854-5511

Virginia
Interstate Dietroit Diesel, Inc.
1921 16th Ave., West
Virginia, MN 55792
Phone: 218-749-4484

MISSISSIPPI

Jackson
Clarke Detroit Diesel - Allison
620 Hwy. 49 South
(Zip: 39218)
P.O. Box 6274
Jackson, MS 39288
Phone: 601-932-2424

MISSOURI

Liberty
Central Detroit Diesel - Allison, Inc.
9200 Liberty Drive
P.O. Box 490
Liberty, MO 64068
Phone: 816-781-8070

St. Louis
Clarke Detroit Diesel - Allison, Inc.
1424 Ashby Road
P.O. Box 21593
St. Louis, MO 83132
Phone: 314-429-2131

MONTANA

Billings
Interstate Detroit Diesel, Inc.
1140 Main
P.O. Box 30518
Billings, MT 59107
Phone: 406-252-4191

Missoula
Interstate Detroit Diesel, Inc.
3757 N. Reserve Street
P.O. Box 8125
Missoula, MT 59807
Phone: 406-728-7600

NEBRASKA

Omaha
Interstate Detroit Diesel, Inc.
6969 S. 107th Street
Omaha, NE 68128
Phone: 402-331-4104

NEVADA

Battle Mountain
Smith Detroit Diesel -
Allison, Inc.
680 W. Front Street
P.O. Box 1288
Battle Mountain, NV 89820
Phone: 702-635-5477

Elko
Smith Detroit Diesel -
Allison, Inc.
4900 E. Idaho
Elko, NV 89801
Phone: 702-738-7154

North Las Vegas
Williams Detroit Diesel -
Allison Southwest, Inc.
2680 Losee Road
North Las Vegas, NV 89030
Phone: 702-399-1890

Sparks
Smith Detroit Diesel -
Allison, Inc.
8 Glendale Avenue
P.O. Box 1167
Sparks, NV 89431
Phone: 702-359-1713

NEW JERSEY

Lodi
Atlantic Detroit Diesel -
180 Route 17 South
P.O. Box 950
Lodi, NJ 07644
Phone: 201-489-5800 NJ
Phone: 212-665-1500 NY

Mount Laurel
Johnson & Towers, Inc.
2021 Briggs Road
P.O. Box 4000
Mount Laurel, NJ 08054
Phone: 609-234-6990

Piscataway
Atlantic Detroit Diesel -
Allison, Inc.
169 Old New Brunswick Rd.
Piscataway, NJ 08854
Phone: 908-752-7100

Pleasantville
Johnson & Towers, Inc.
740 Delilah Road
(Rear Bldg.)
Pleasantville, NJ 08232
Phone: 609-272-1415

NEW MEXICO

Albuquerque
Stewart & Stevenson
Power, Inc.
2929 Vassar Drive N.E.
Albuquerque, NM 87107
Phone: 505-881-3511

Farmington
Stewart & Stevenson
Power, Inc.
1515 West Murray Drive
Farmington, NM 87401
Phone: 505-325-5071

NEW YORK

Albany
Atlantic Detroit Diesel -
Allison, Inc.
17 Commercial Avenue
Albany, NY 12205
Phone: 518-438-5961

Buffalo
Penn Detroit Diesel -
Allison, Inc.
350 Bailey Avenue
Buffalo, NY 14210
Phone: 716-823-7242

Ronkonkoma, Long Island
Atlantic Detroit Diesel -
Allison, Inc.
3025 Veterans Memorial Hwy.
Ronkonkoma, Long Island,
NY 11779
Phone: 516-981-5800

Syracuse
Penn Detroit Diesel -
Allison, Inc.
7044 Interstate Island Rd.
Syracuse, NY 13209
Phone: 315-451-3840

NORTH CAROLINA

Charlotte
Covington Detroit Diesel -
1815 Starita Road
P.O. Box 26653
Charlotte, NC 28213
Phone: 704-596-8000

Greensboro
Covington Detroit Diesel -
6200 Swiggett Road
P.O. Box 18949
Greensboro, NC 27419-8949
Phone: 910-292-9240

Morehead City
Covington Detroit Diesel -
210 Arendell Street
Morehead City, NC 28557
Phone: 919-726-9881

New Bern
Covington Detroit Diesel -
U.S. Hwy. 17 South
P.O. Box 12626
New Bern, NC 28560
Phone: 919-638-3161

Wilmington
Covington Detroit Diesel
6725 Netherlands Drive
Wilmington, NC 28405
Phone: 919-392-7220

NORTH DAKOTA

Bismarck
Interstate Detroit Diesel, Inc.
3801 Commerce Drive
Bismarck, ND 58501
Phone: 701-258-2303

Fargo
Interstate Detroit Diesel, Inc.
3902 12th Ave. North
Fargo, ND 58102
Phone: 701-282-6558

Grand Forks
Interstate Detroit Diesel, Inc.
1003 South 48th St.
Grand Forks, ND 58201
Phone: 701-746-0354

Williston
Interstate Detroit Diesel, Inc.
3805 4th Avenue West
P.O. Box 880
Williston, ND 58801
Phone: 701-572-2000

OHIO

Akron
Williams Detroit Diesel - Allison Midwest, Inc.
1395 Triplett Blvd.
Akron, OH 44306
Phone: 216-794-1535

Brunswick
Williams Detroit Diesel - Allison Midwest, Inc.
1176 Industrial Pwky. N
Brunswick, OH 44212-2342
Phone: 216-225-7751

Canton
Western Branch Diesel, Inc.
1616 Metric Ave., S.W.
Canton, OH 44706
Phone: 216-454-8800

Cincinnati
Clarke Detroit Diesel - Allison, Inc.
3133 E. Kemper Rd.
(Sharonville)
Cincinnati, OH 45241
Phone: 513-771-2200

Hubbard
Williams Detroit Diesel - Allison Midwest, Inc.
7125 Masury Rd. Southeast
(Youngstown)
P.O. Box 71
Hubbard, OH 44425
Phone: 216-534-1161

Lemoyne
Williams Detroit Diesel - Allison Midwest, Inc.
3325 Libby Road (Toledo)
P.O. Box 427
Lemoyne, OH 43441
Phone: 419-837-5067

Wintersville
Western Branch Diesel, Inc.
286 Luray Drive
(Steubenville)
P.O. Box 2069
Wintersville, OH 43952
Phone: 614-264-7121

OKLAHOMA

Oklahoma City
United Engines, Inc.
5555 W. Reno Street
(Zip 73127)
P.O. Box 75079
Oklahoma City, OK 73147
Phone: 405-947-3321

Tulsa
United Engines, Inc.
7454 E. 41st Street
Tulsa, OK 74145
Phone: 918-627-8080

Woodward
Central Detroit Diesel - Allison, Inc.
U.S. Hwy. 270 N.W.
P.O. Box 1145
Woodward, OK 73802
Phone: 405-256-6014

OREGON

Medford
Pacific Detroit Diesel - Allison Co.
1493 Kingsley Drive
Medford, OR 97504
Phone: 503-779-4622

Portland
Pacific Detroit Diesel - Allison Co.
5061 N. Lagoon Ave.
Swan Island
Portland, OR 97217-7694
Phone: 503-283-0505

Springfield
Pacific Detroit Diesel - Allison Co.
3436 Olympic Street
Springfield, OR 97477
Phone: 503-746-1661

PENNSYLVANIA

Bedford
Penn Detroit Diesel - Allison, Inc.
Route 220 North
P.O. Box 147
Bedford, PA 15522
Phone: 814-623-6171

Fleetwood
Penn Detroit Diesel - Allison, Inc.
Route 222
P.O. Box 187
Fleetwood, PA 19522
Phone: 215-944-0451

Philadelphia
Penn Detroit Diesel - Allison, Inc.
8330 State Road
Philadelphia, PA 19136-2996
Phone: 215-335-0500

York Haven
Penn Detroit Diesel - Allison, Inc.
Sipe Rd., R.D. 1
(Exit 13 - I-83)
York Haven, PA 17370
Phone: 717-938-5141

Zelienople
Penn Detroit Diesel - Allison, Inc.
11 Progress Road
(U.S. Hwy. 19th North)
(Pittsburgh)
Zelienople, PA 16063
Phone: 412-776-3237

SOUTH CAROLINA

Greer
Williams Detroit Diesel - Allison Southeast, Inc.
1835 S. Highway 101
Greer, SC 29651
Phone: 803-877-0935

West Columbia
Williams Detroit Diesel - Allison Southeast, Inc.
2610 Augusta Hwy.
(U.S. 1 7 I-26)
West Columbia, SC 29169
Phone: 800-452-8479

SOUTH DAKOTA

Rapid City
Interstate Detroit Diesel, Inc.
1947 Deadwood Ave.
P.O. Box 508
Rapid City, SD 57709
Phone: 605-348-0374

TENNESSEE

Kingsport
Covington Detroit Diesel
Hwy. 137 & Rock
Springs Rd.
P.O. Box 5417
Kingsport, TN 37663
Phone: 615-349-6141

Knoxville
Covington Detroit Diesel
1500 Breda Drive
(Zip 37918)
P.O. Box 18560
Knoxville, TN 37928
Phone: 615-689-3722

TENNESSEE cont.

Memphis
Clarke Detroit Diesel - Allison
3070 Sandbrook St.
(Zip 38116)
P.O. Box 16260
Memphis, TN 38186-0260
Phone: 901-396-7320

Nashville
Covington Detroit Diesel
80 Cleveland Street
Nashville, TN 37210
Phone: 615-262-4141

TEXAS

Amarillo
Stewart & Stevenson Power, Inc.
I-10 at Pullman Road
P.O. box 31986
Amarillo, TX 79120-1986
Phone: 806-335-2828

Beaumont
Stewart & Stevenson Services. Inc.
U.S. Hwy. 69 South & Beauxart Garden Rd.
Route 4, Box 89
Beaumont, TX 77705
Phone: 409-727-1436 (24 Hr.)

Corpus Christi
Stewart & Stevenson Services, Inc.
6530 Agnes St.
P.O. Box 4975
Corpus Christi, TX 78469-4975
Phone: 512-289-5350 (24 Hr.)

Dallas
Stewart & Stevenson Services, Inc.
3919 Irving Blvd.
P.O. Box 560343
Dallas, TX 75356-0343
Phone: 214-631-5370 (24 Hr.)

Houston
Stewart & Stevenson Services, Inc.
2707 N. Loop West
P.O. Box 1637
Houston, TX 77251-1637
Phone: 713-868-7700

Houston
Stewart & Stevenson Services, Inc.
8631 E. Freeway
Houston TX 77029
Phone: 713-671-6220

Lubbock
Stewart & Stevenson Power, Inc.
2000 Station Hwy.
P.O. Box 2529
Lubbock, TX 79408
Phone: 806-745-4224

Odessa
Stewart & Stevenson Power, Inc.
11120 W. Hwy. 80 East
(Zip 79765)
P.O. Box 2848
Odessa, TX 79760
Phone: 915-563-4800

San Antonio
Stewart & Stevenson Services, Inc.
5717 I-10 East
P.O. Box 201330
San Antonio, TX 78220-8330
Phone: 210-662-1000

Wichita Falls
Stewart & Stevenson Services, Inc.
2301 Central Freeway East
(Zip 76302)
P.O. Box 839
Wichita Falls, TX 76307-0839
Phone: 817-322-5227

UTAH

Salt Lake City
Smith Detroit Diesel - Allison, Inc.
250 W. 3900 S.
(Zip 84107)
P.O. Box 27527
Salt Lake City, UT 84127
Phone: 801-262-2831

Vernal
Smith Detroit Diesel - Allison, Inc.
U.S. Hwy. 40 East
P.O. Box 1122
Vernal, UT 84078
Phone: 801-789-1860

VIRGINIA

Portsmouth
Western Branch Diesel, Inc.
3504 Shipwright Street
(Zip 23703)
P.O. Box 7788
Portsmouth, VA 23707-0788
Phone: 804-484-6230

Richmond
Western Branch Diesel, Inc.
(I-95 North at Atlee Road)
(Ashland, VA 23005)
P.O. Box 9730
Richmond, VA 23228
Phone: 804-550-2816

Roanoke
Western Branch Diesel, Inc.
4546 Thirlane Road, Northwest
Roanoke, VA 24019
Phone: 703-362-1608

Springfield
Western Branch Diesel, Inc.
8102 Alban Road
Springfield, VA 22150
Phone: 703-569-5650

WASHINGTON

Kent
Pacific Detroit Diesel - Allison, Co.
7215 S. 228th Street
Kent, WA 98032
Phone: 206-854-0505

Pasco
Spokane Detroit Diesel Allison
1810 E. James
Pasco, WA 99301
Phone: 509-547-1611

Spokane
Spokane Detroit Diesel Allison
6615 E. Mallon Street
(Zip 99212)
P.O. Box 3167
Terminal Annex
Spokane, WA 99220
Phone: 509-535-3663

WEST VIRGINIA
South Charleston
Western Branch Diesel, Inc.
3100 MacCorkle Ave., SW
P.O. Box 8245
South Charleston, WV
25303-8245
Phone: 304-744-1511
(24 Hr.)
WISCONSIN
Butler
Inland Diesel, Inc.
13015 W. Custer Avenue
(Milwaukee)
P.O. Box 916
Butler, WI 53007-0916
Phone: 414-781-7100

WYOMING
Casper
Stewart & Associates
Power, Inc.
1850 East "F" Street
Casper, WY 82601
Phone: 307-234-6975
Gillette
Interstate Detroit Diesel, Inc.
210 Limestone Avenue
P.O. Box 1355
Gillette, WY 82716
Phone: 307-682-8596
Rock Springs
Smith Detroit Diesel -
Allison, Inc.
20 Bowker Road
(Zip 82901)
P.O. Box 1868
Rock Springs, WY 82902
Phone: 307-382-4330

Authorized Blue Bird Wanderlodge Service Centers

Chassis Service Only

Prèvost Car Inc., FL
6391 Business Park Blvd.
N. Jacksonville, FL 32256
800-874-7740
904-886-4555
FAX: 904-886-0092
Parts FAX: 904-886-0093

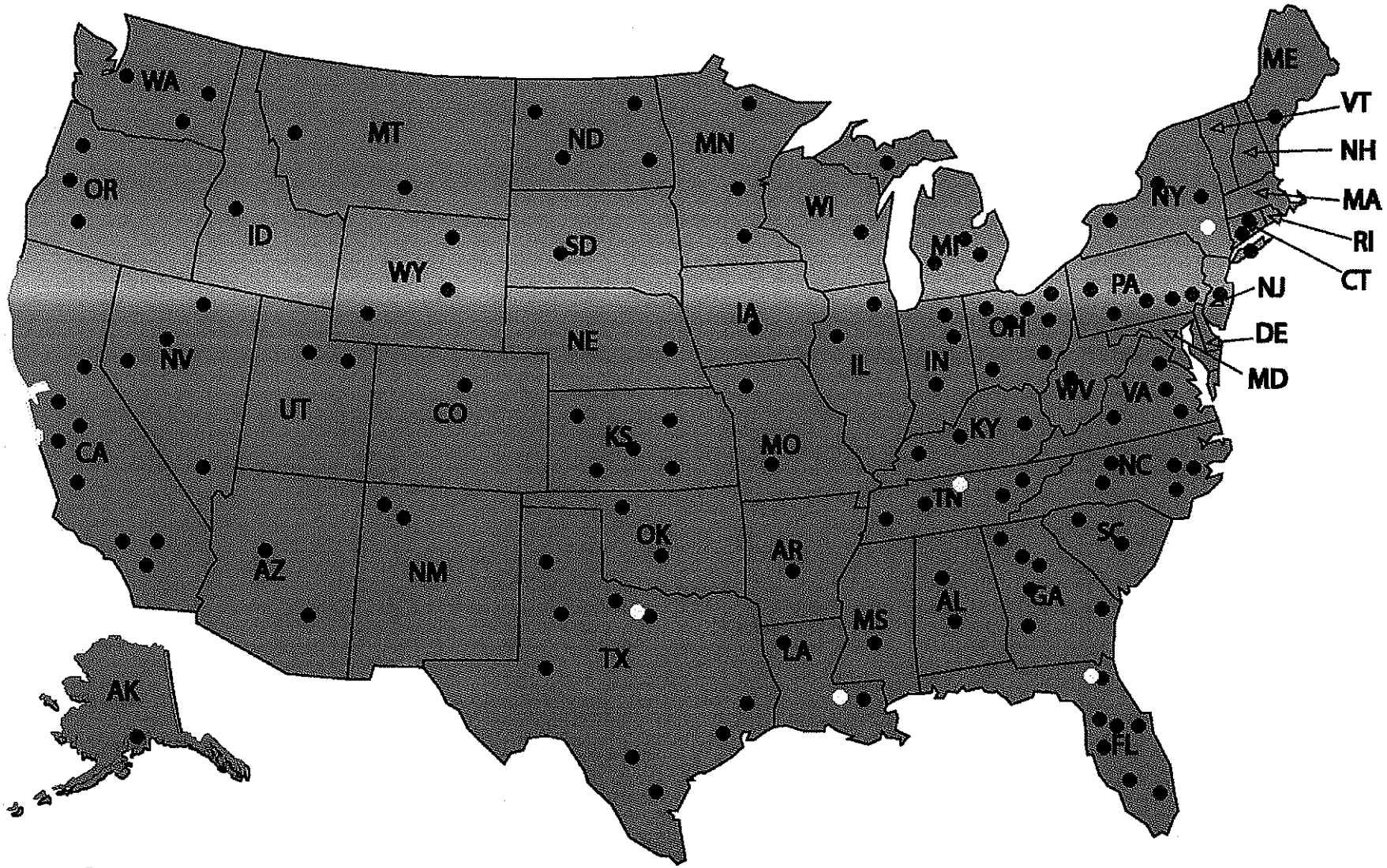
Prèvost Car Inc., TN
529 Hickory Hill Blvd.
Whites Creek, TN 37189
877-299-8881
615-299-8881
FAX: 615-299-8865

Prèvost Car Inc., TX
15200 Frye Road
Fort Worth, TX 76155
866-773-7678
817-685-0475
FAX: 817-685-0460

Service Only

Holiday on Wheels, Inc.
50 John Barrett Road
Patterson, NY 12563
800-416-0544
845-878-9400
FAX: 845-878-3647

Miller's RV
12912 Florida Blvd.
Baton Rouge, LA 70815
225-275-2940
FAX: 225-275-6807



● = Authorized Blue Bird Wanderlodge Service Centers Detroit Diesel - Allison. Chassis Service and Chassis Parts Only

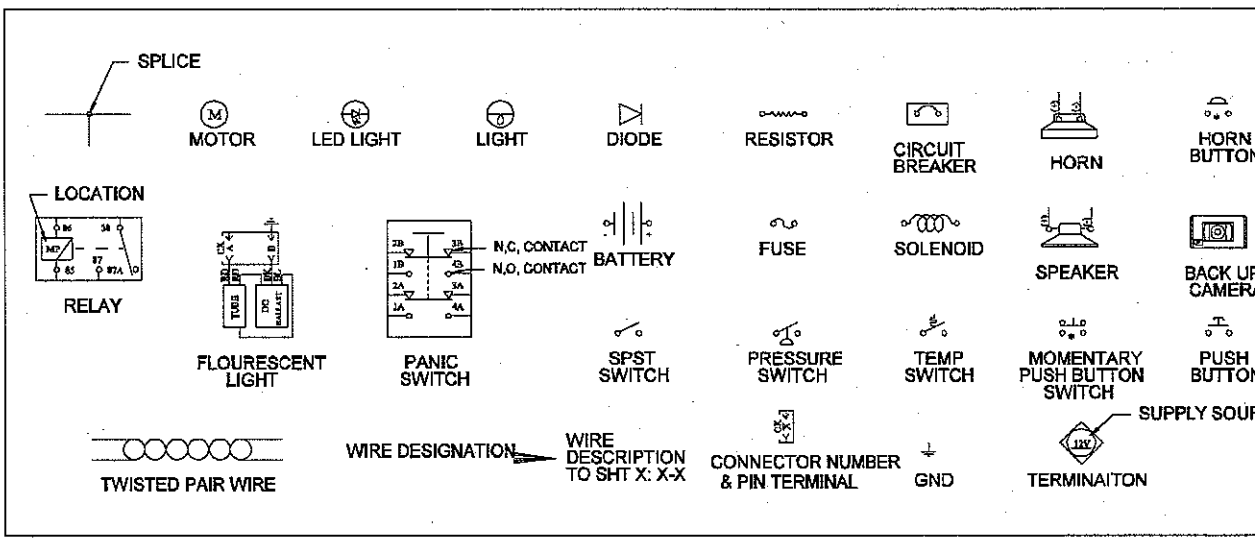
= Authorized Blue Bird Wanderlodge Service Centers Chassis Service Only

Index Wiring Schematic Blue Bird Part No. 0065553

M4RE
WIRING SCHEMATIC IN

DESCRIPTION	SHEET	BB #	REV
INDEX	1	0065553	-
POWER DISTRIBUTION	2	0065554	-
CAT 12 ENGINE	3	0065555	-
TRANSMISSION,ALLISON B500	4	0065556	-
MBC MODULE	5	0065557	-
A-2 MODULE	6	0065558	-
A-3 MODULE	7	0065559	-
A-4 MODULE	8	0065560	-
B-1 MODULE	9	0065561	-
B-2 MODULE	10	0065562	-
C-1 MODULE	11	0065563	-
C-2 MODULE	12	0065564	-
D-1 MODULE	13	0065565	-
D-2 MODULE	14	0065566	-
D-3 MODULE	15	0065567	-
J1587 AND J1939 DATALINK	16	0065568	-
RICON,LIFT	17	0065569	-
WIPER SYS AND STRG COLUMN SW	18	0065570	-
DATALOOPS AND MBC POWER	19	0065571	-
CARRIER,HVAC - ROOF	20	0065572	-
BERSTROM,FRONT HVAC	21	0065573	-
MIRRORS AND WEBASTO HEATER	22	0065574	-
ENGINE CONTROL BOX	23	0065575	-
BENDIX,6S/6M ABS SYSTEM	24	0065576	-
DASH GAUGES	25	0065577	-
VISION,SIGN SYSTEM	26	0065578	-
BACK UP CAMERA SYSTEM	27	0065579	-
REI,SYSTEM 2000	28	0065580	-
RESTROOM	29	0065581	-
LUGG BAY LOCKS AND LIGHTS	30	0065582	-
HATCH FAN,VISOR AND LAPTOP	31	0065583	-

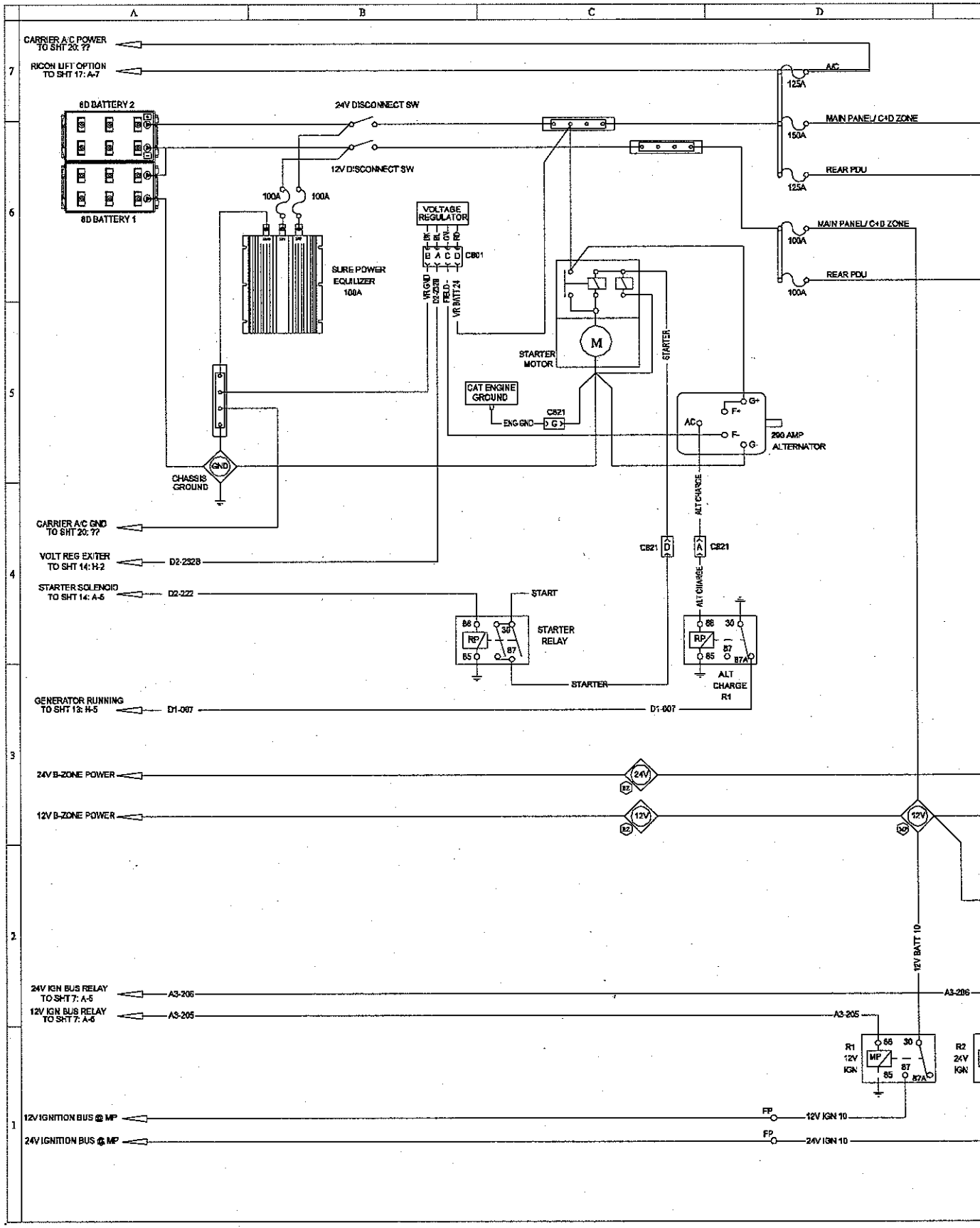
SCHEMATIC SYMBOLS



Rev. "-"

Power Distribution Wiring Schematic

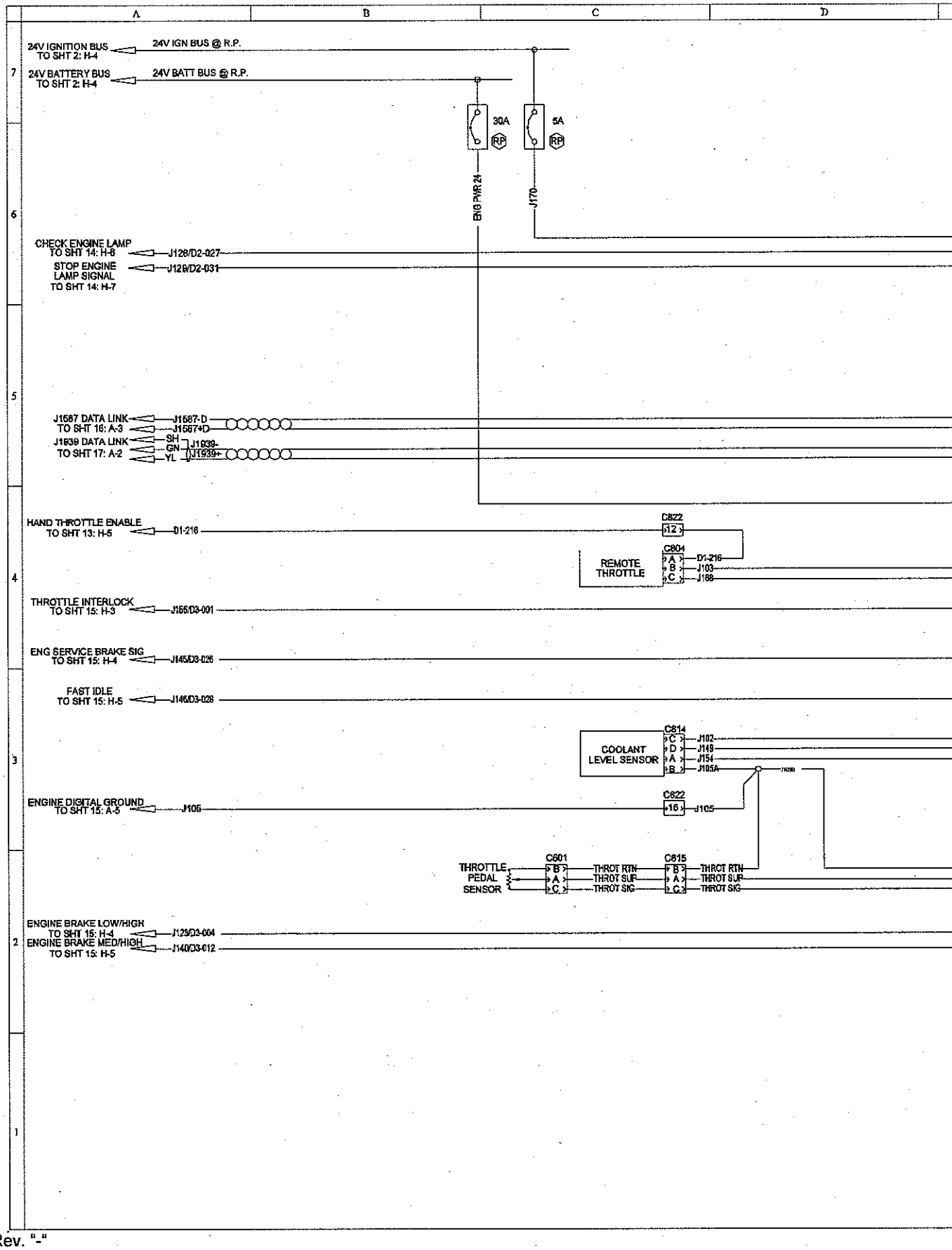
Blue Bird Part No. 0065554



Rev. "-"

CAT 12 Engine Wiring Schematic

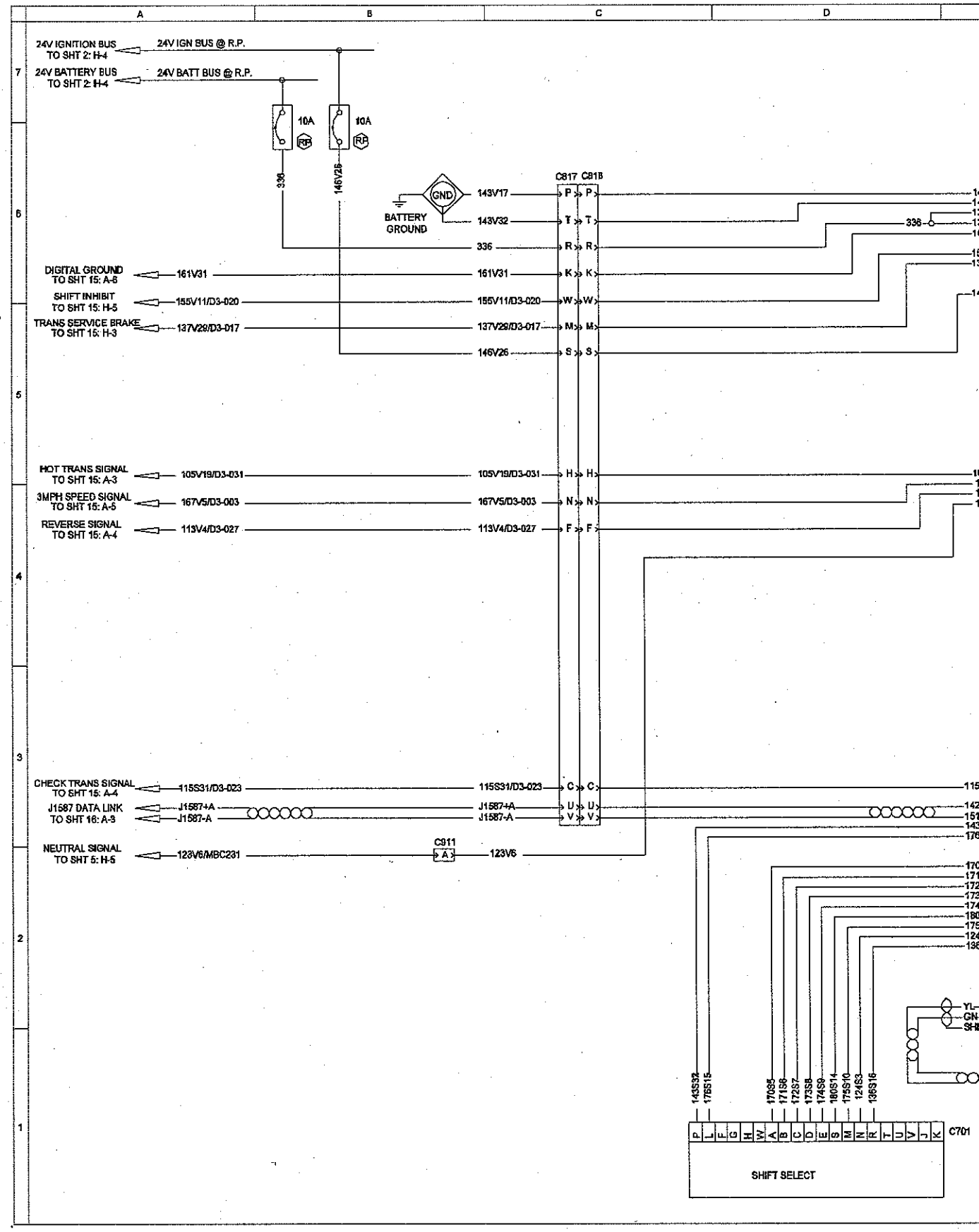
Blue Bird Part No. 0065555



Rev. "-"

Allison B500 Transmission Wiring Schematic

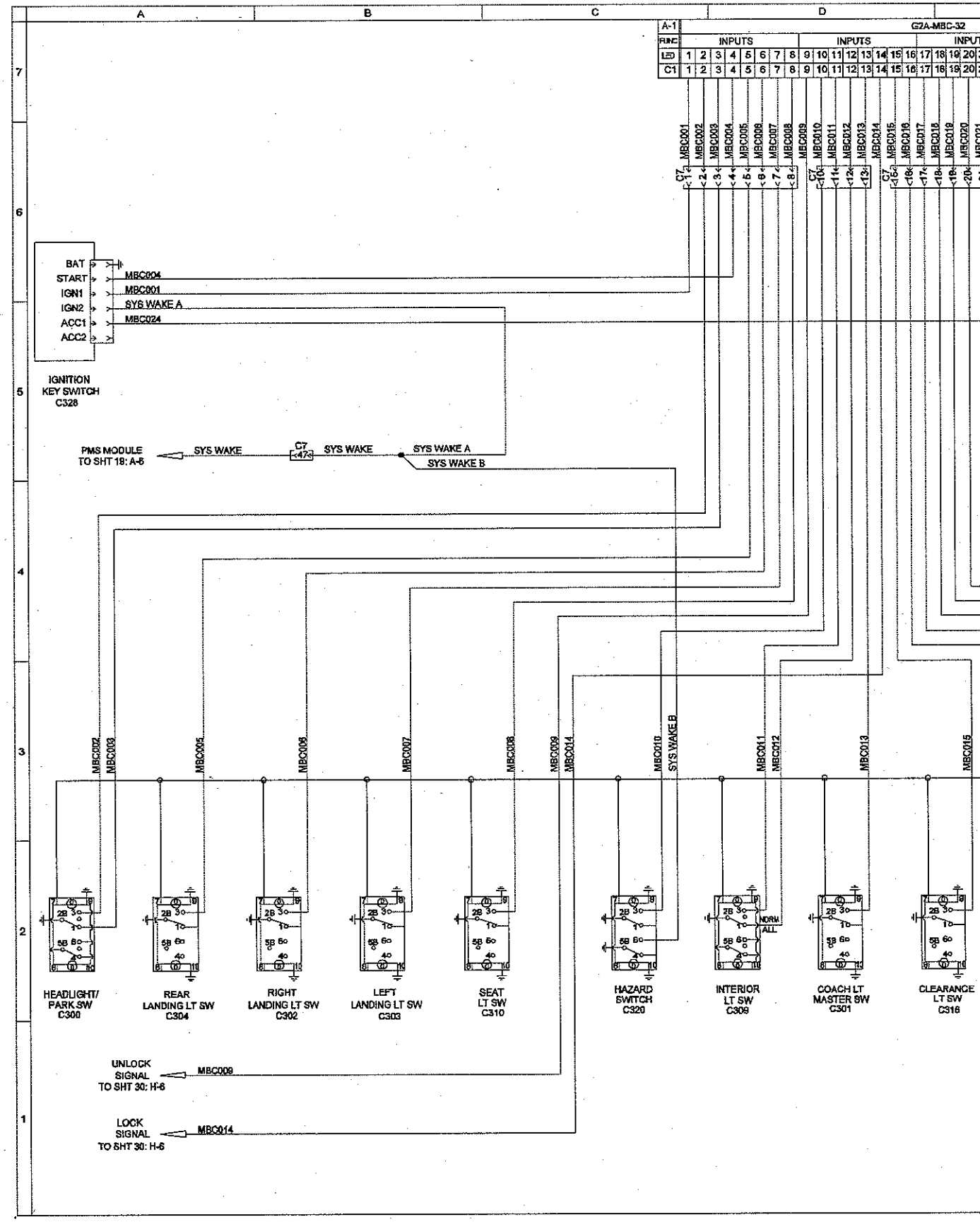
Blue Bird Part No. 0065556



Rev. "-"

MBC Module Wiring Schematic

Blue Bird Part No. 0065557



Rev. "-"

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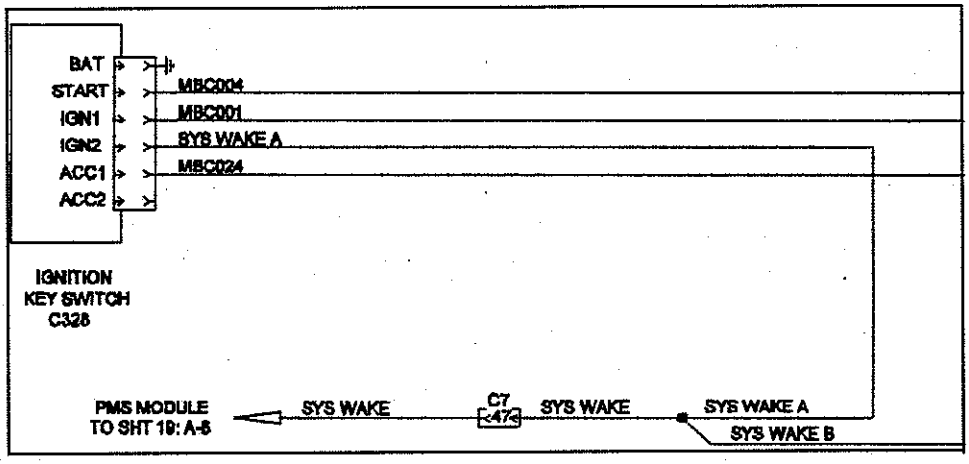
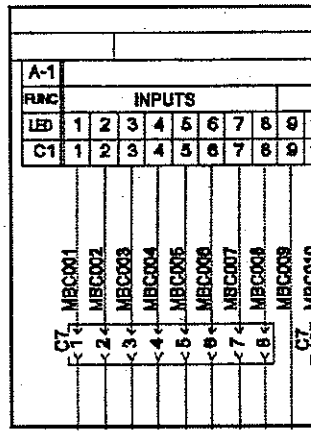
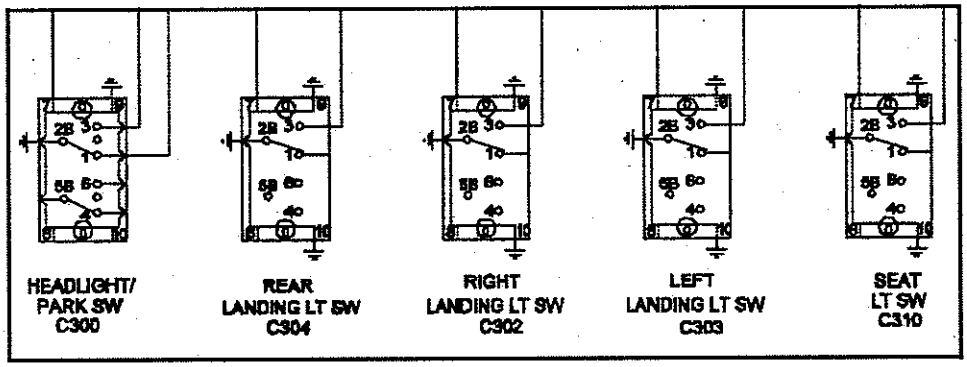
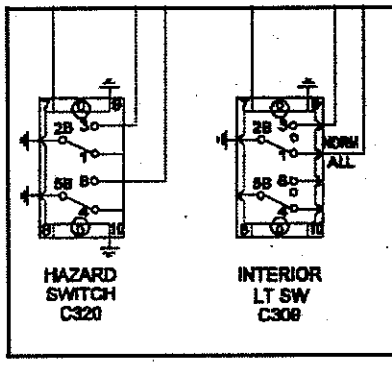
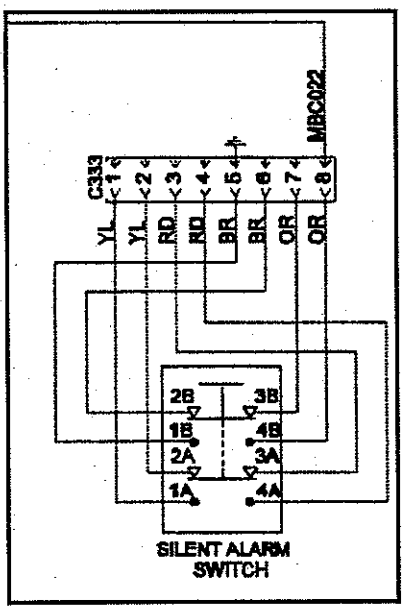




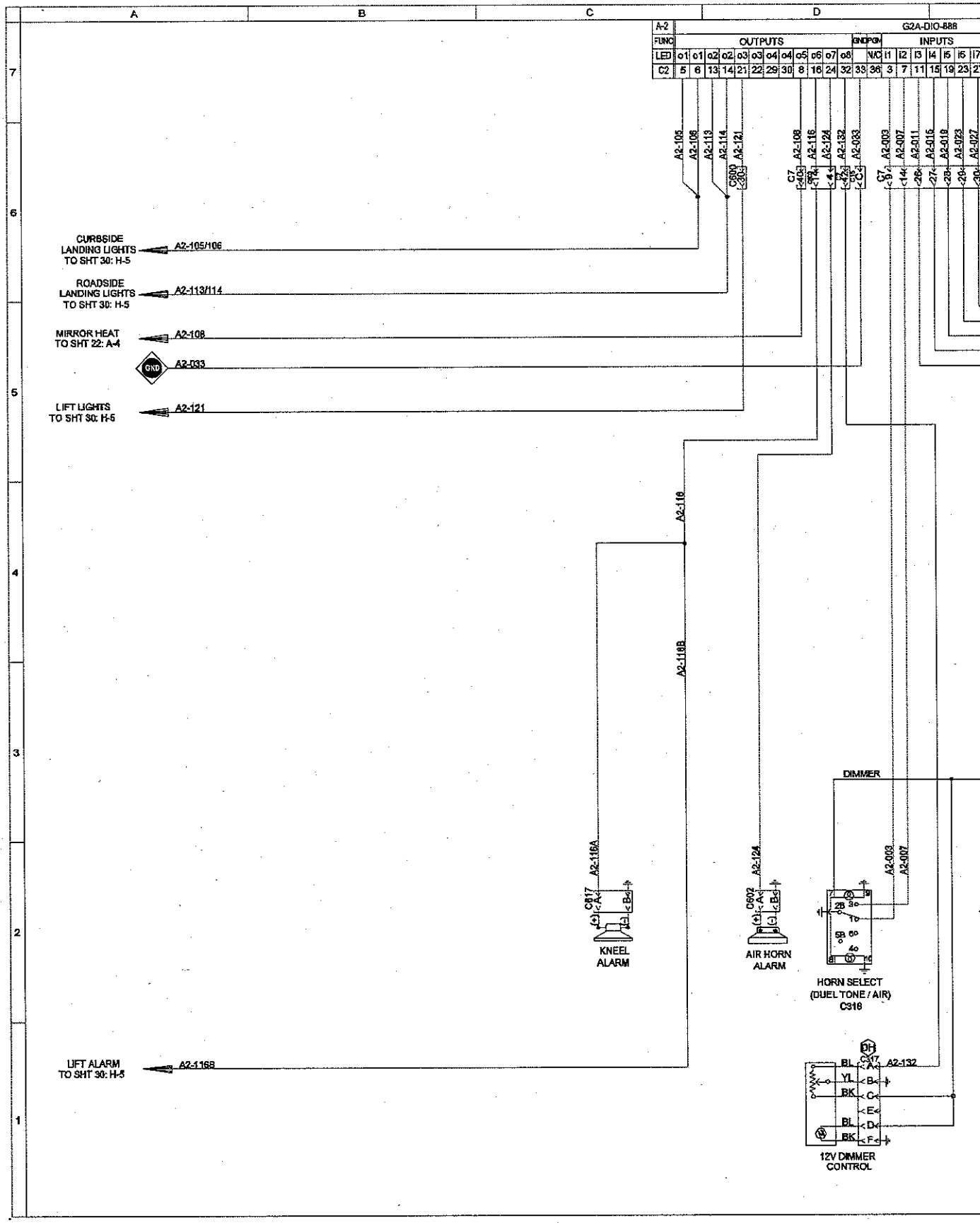






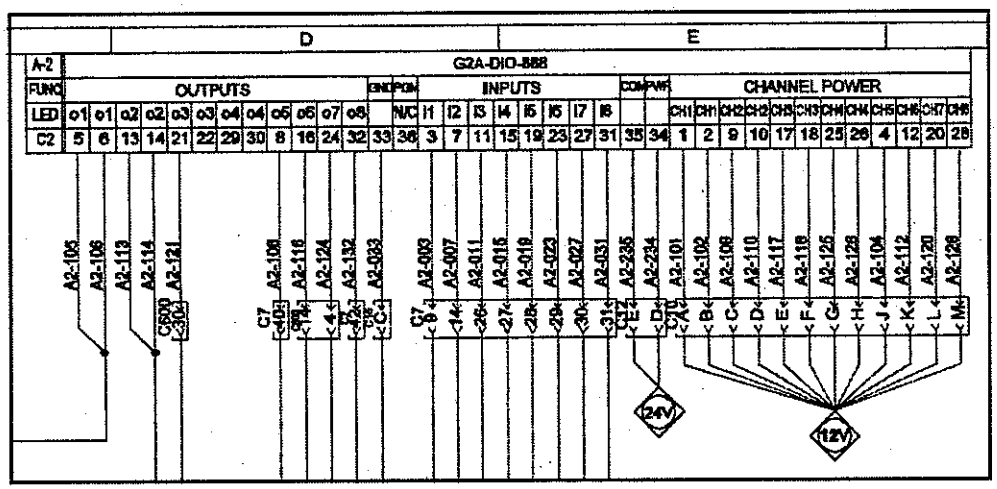
A-2 Module Wiring Schematic

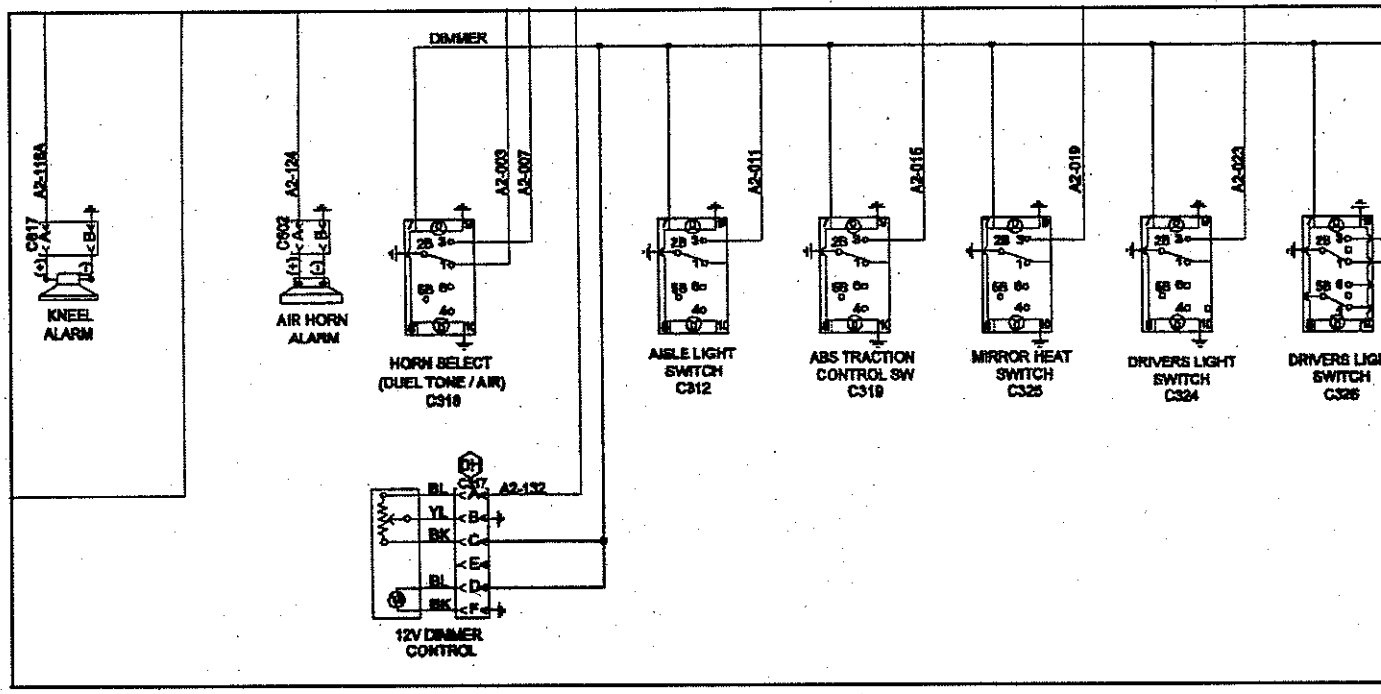
Blue Bird Part No. 0065558



Rev. "-"

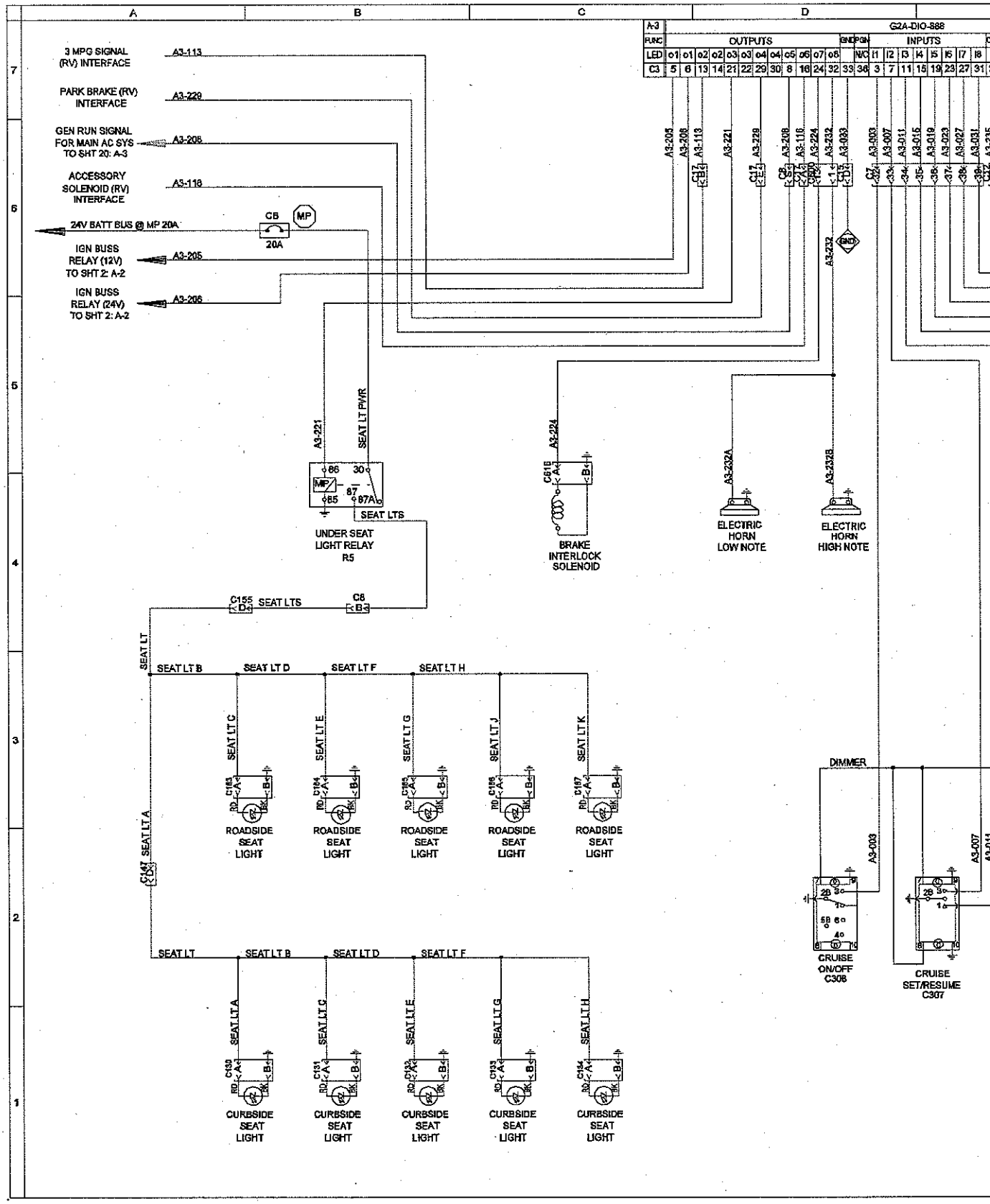
Exploded Views of 006558





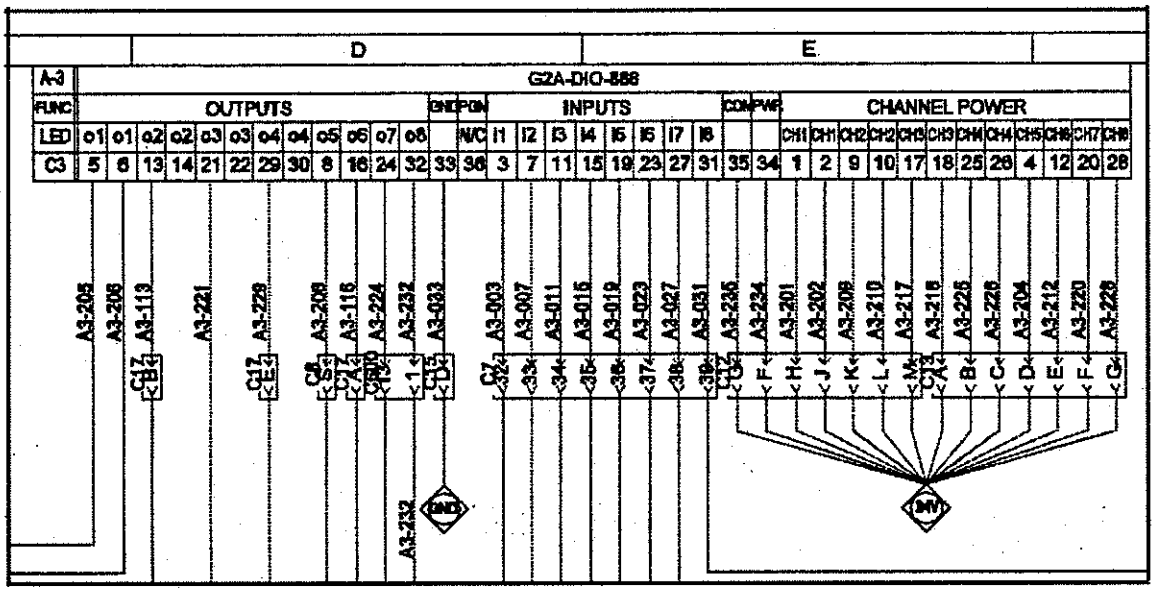
A-3 Wiring Schematic

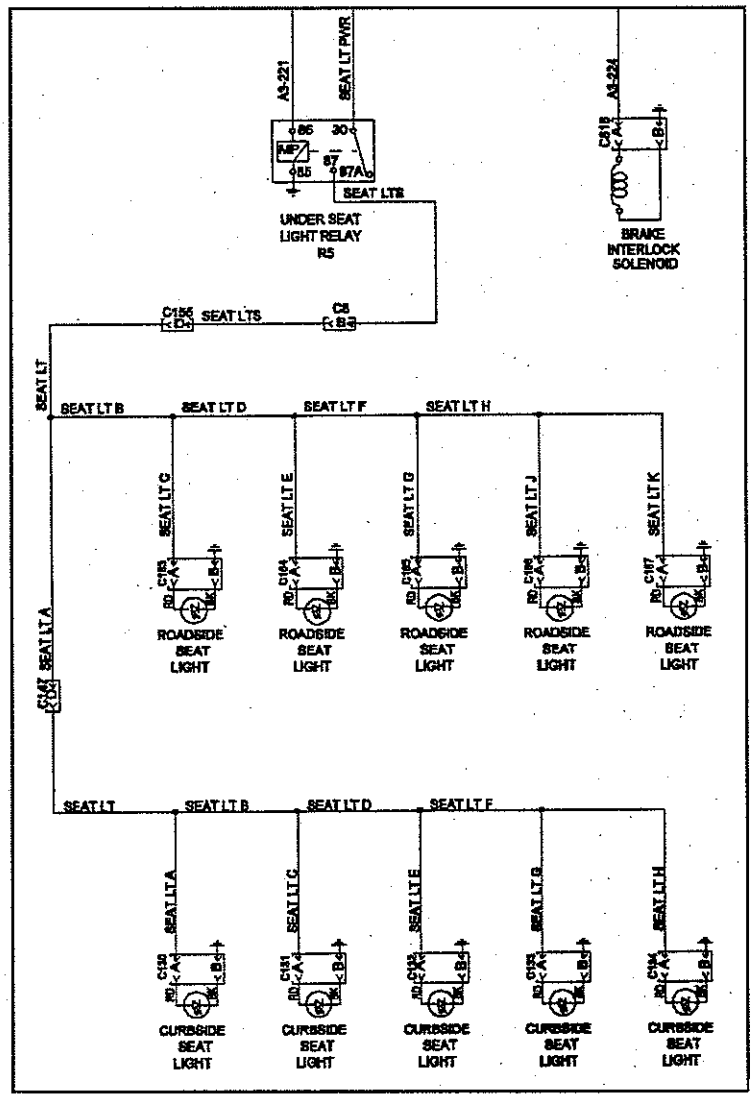
Blue Bird Part No. 0065559



Rev. "-"

Exploded Views of 0065559

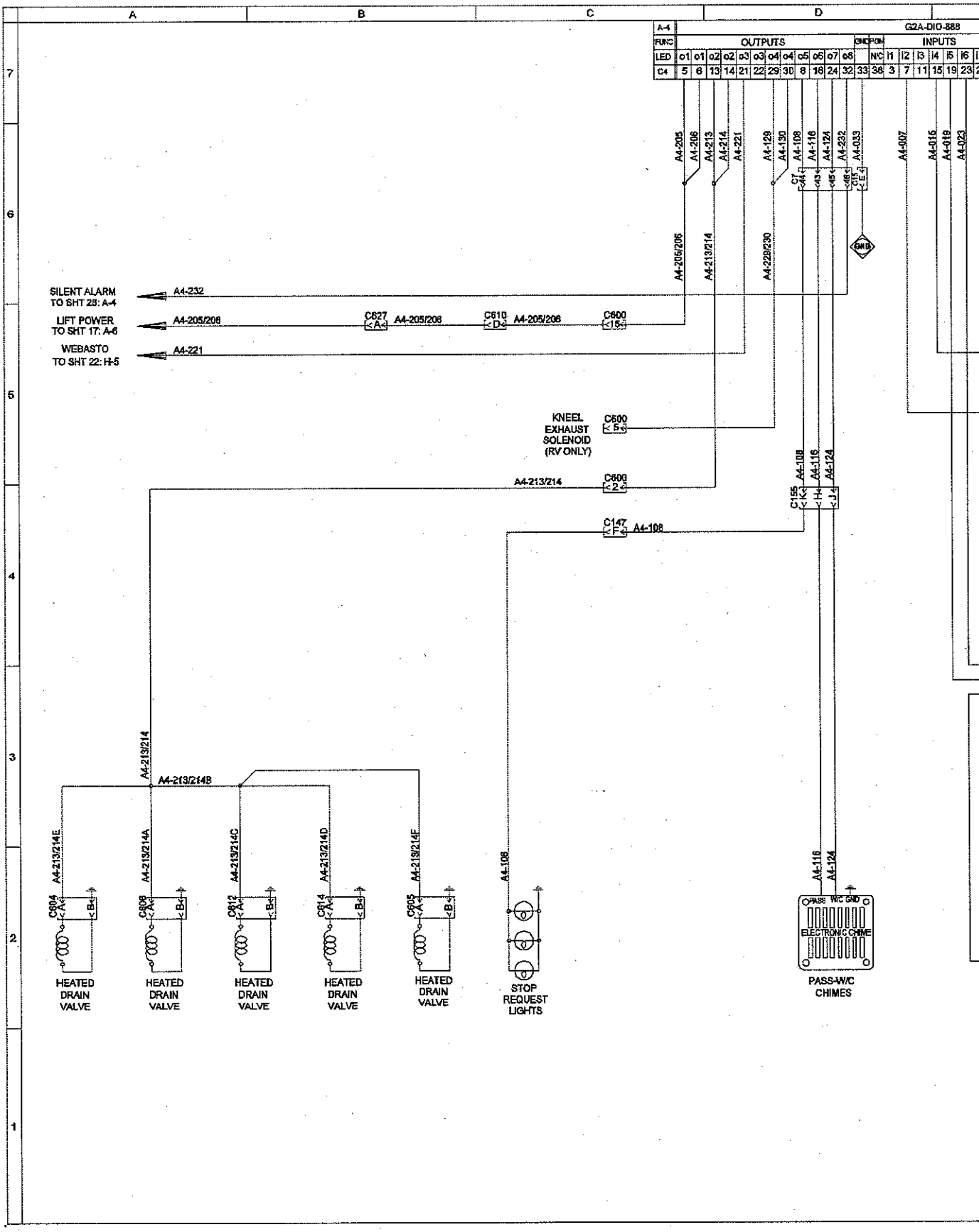




Rev. "-"

A-4 Module Wiring Schematic

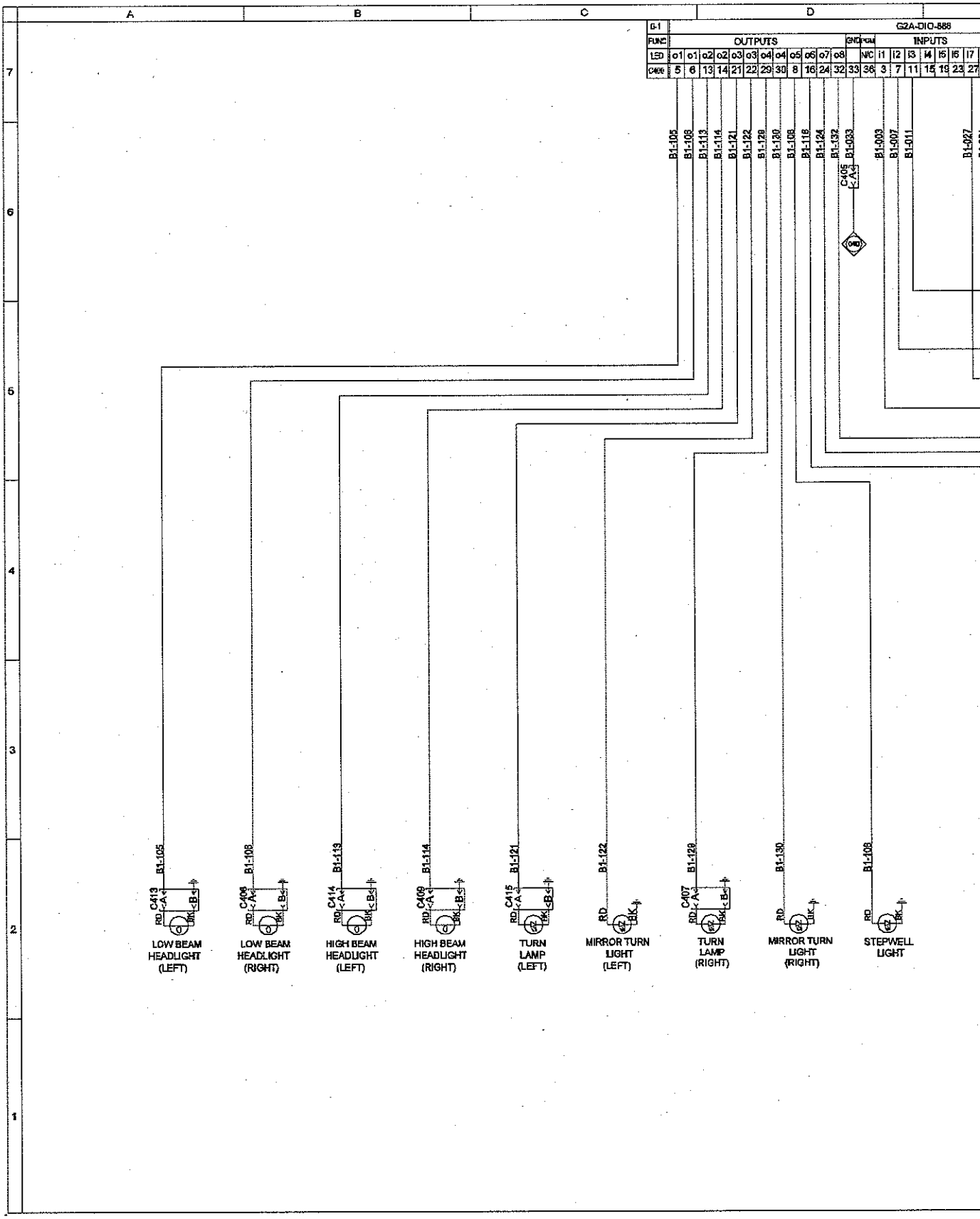
Blue Bird Part No. 0065560



Rev. "-"

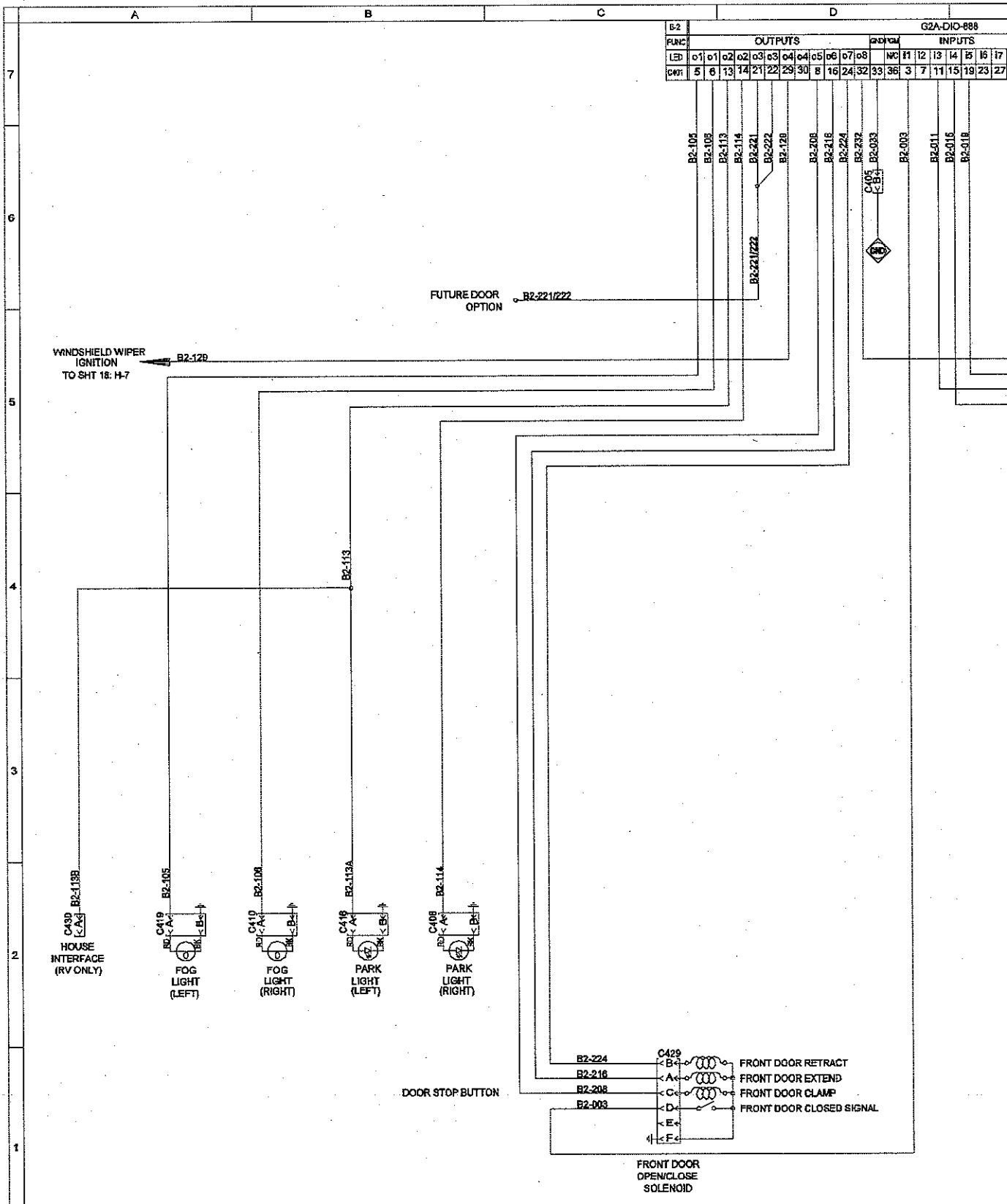
B-1 Module Wiring Schematic

Blue Bird Part No. 0065561



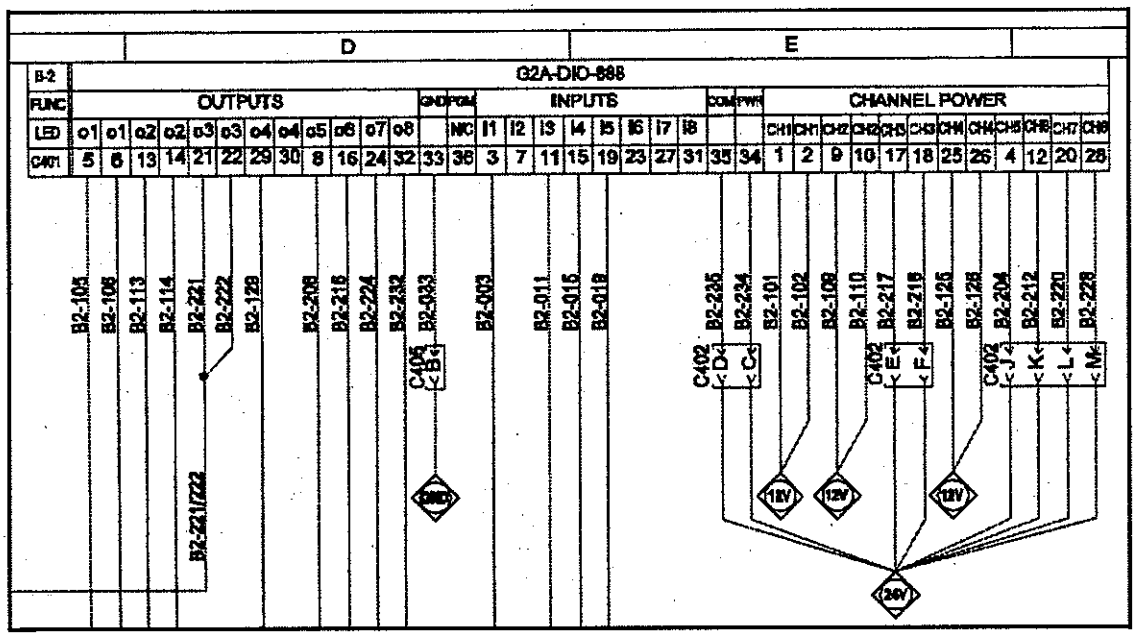
B-2 Module Wiring Schematic

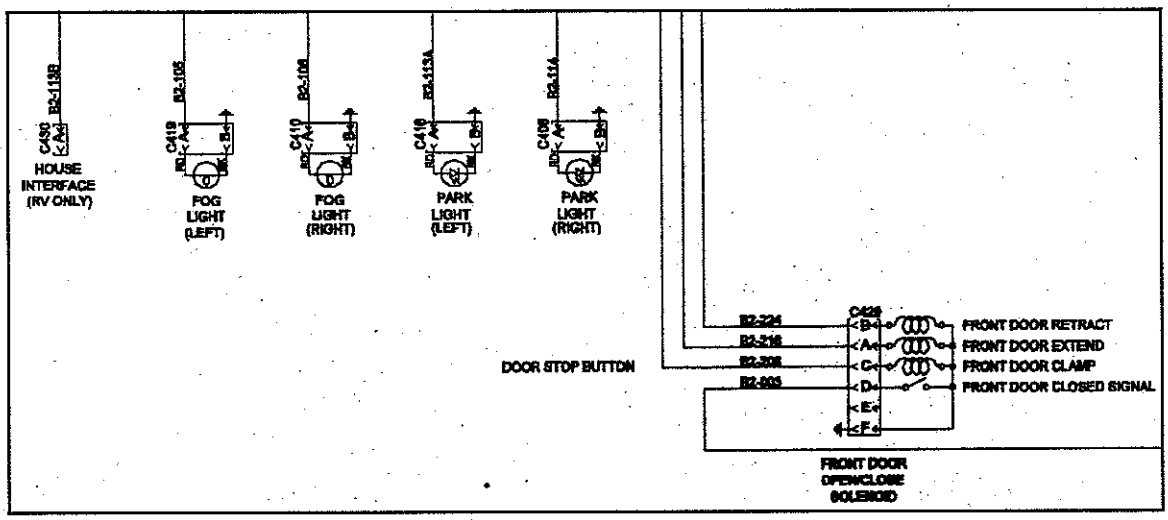
Blue Bird Part No. 0065562

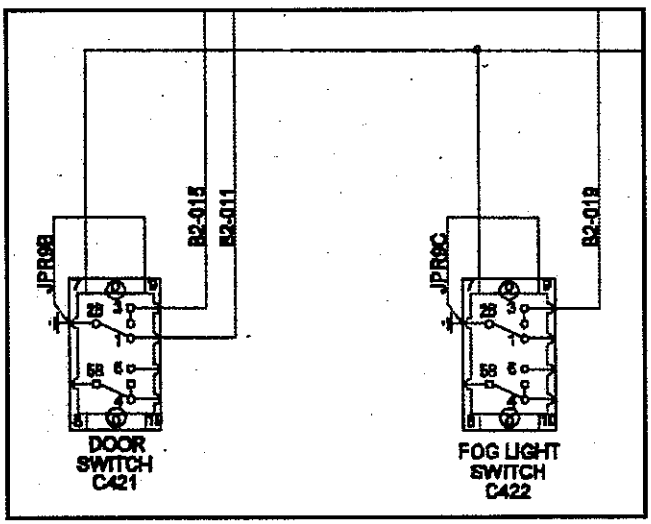


Rev. "-"

Exploded Views of 0065562

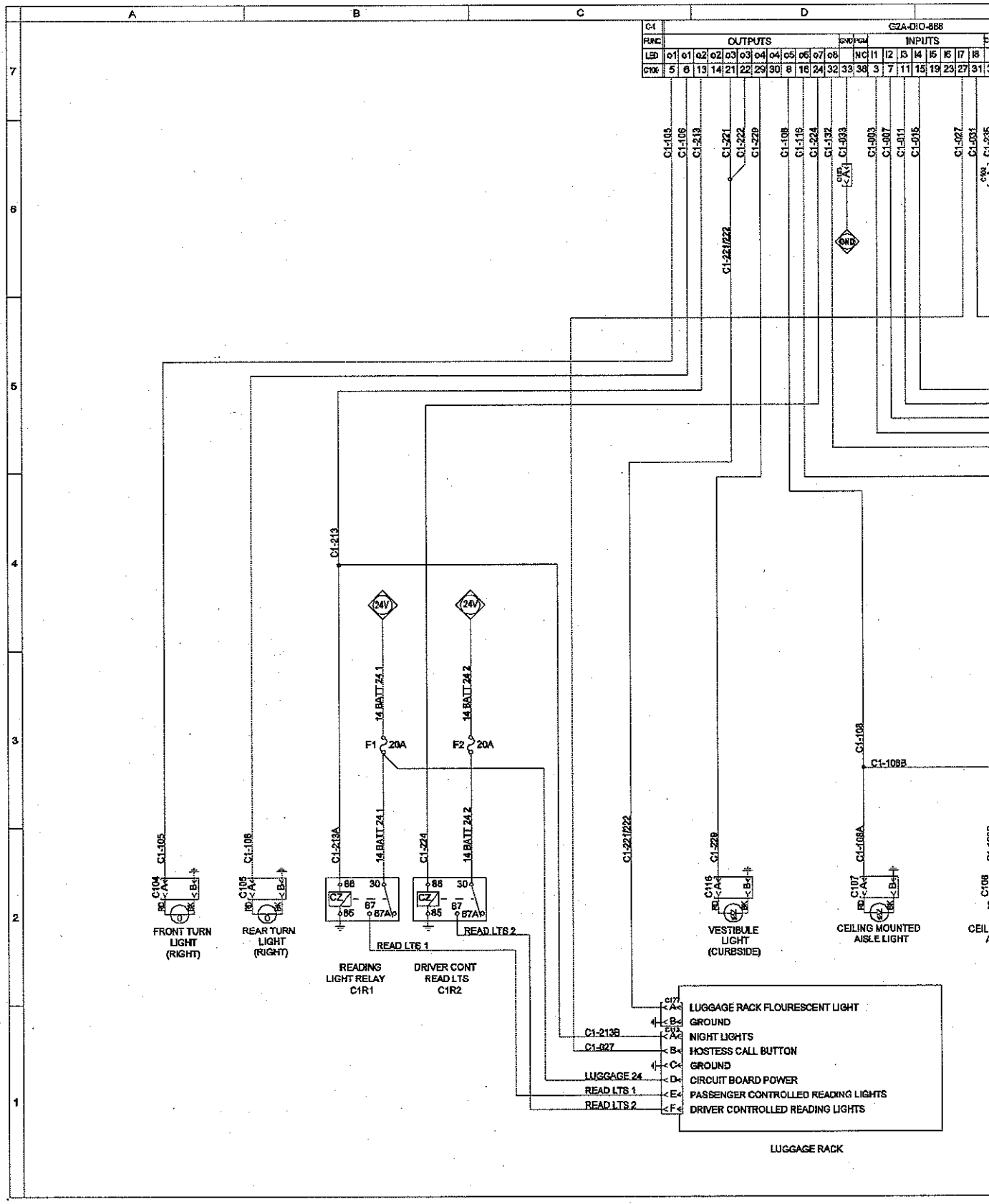






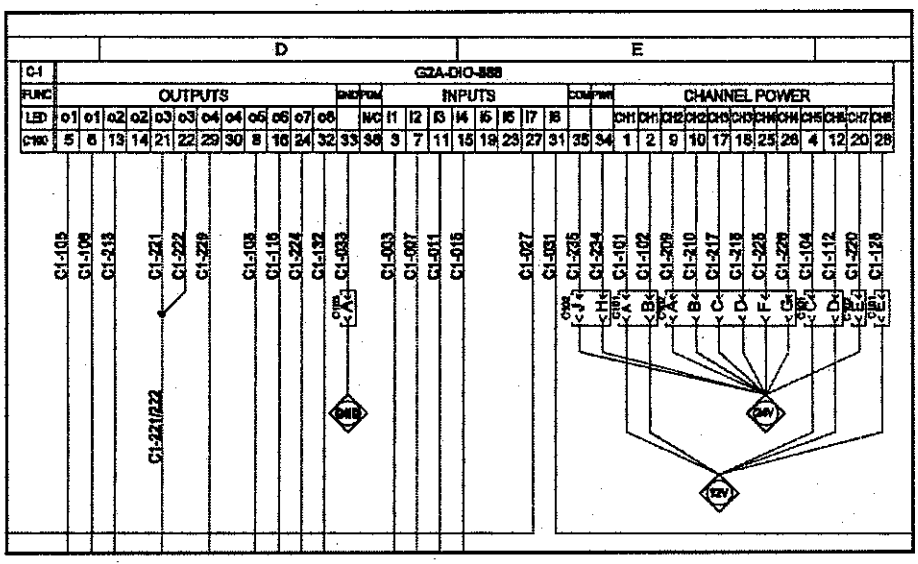
C-1 Module Wiring Schematic

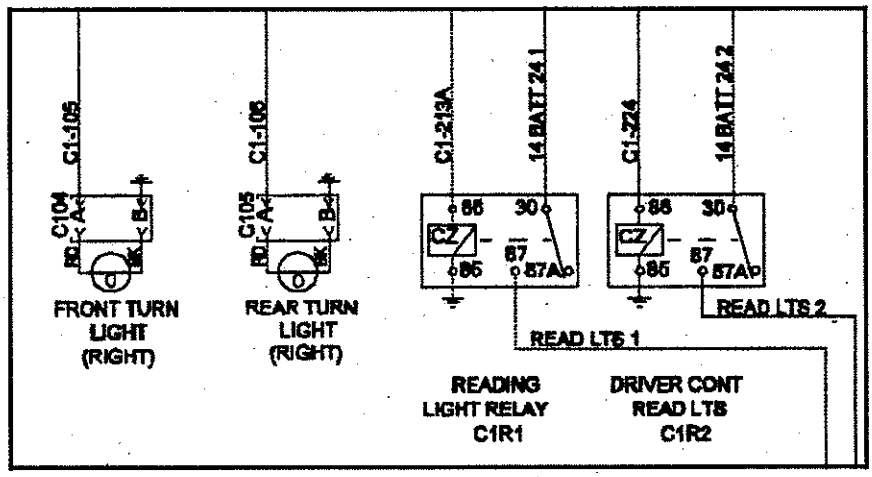
Blue Bird Part No. 0065563



Rev. "-"

Exploded Views of 0065563





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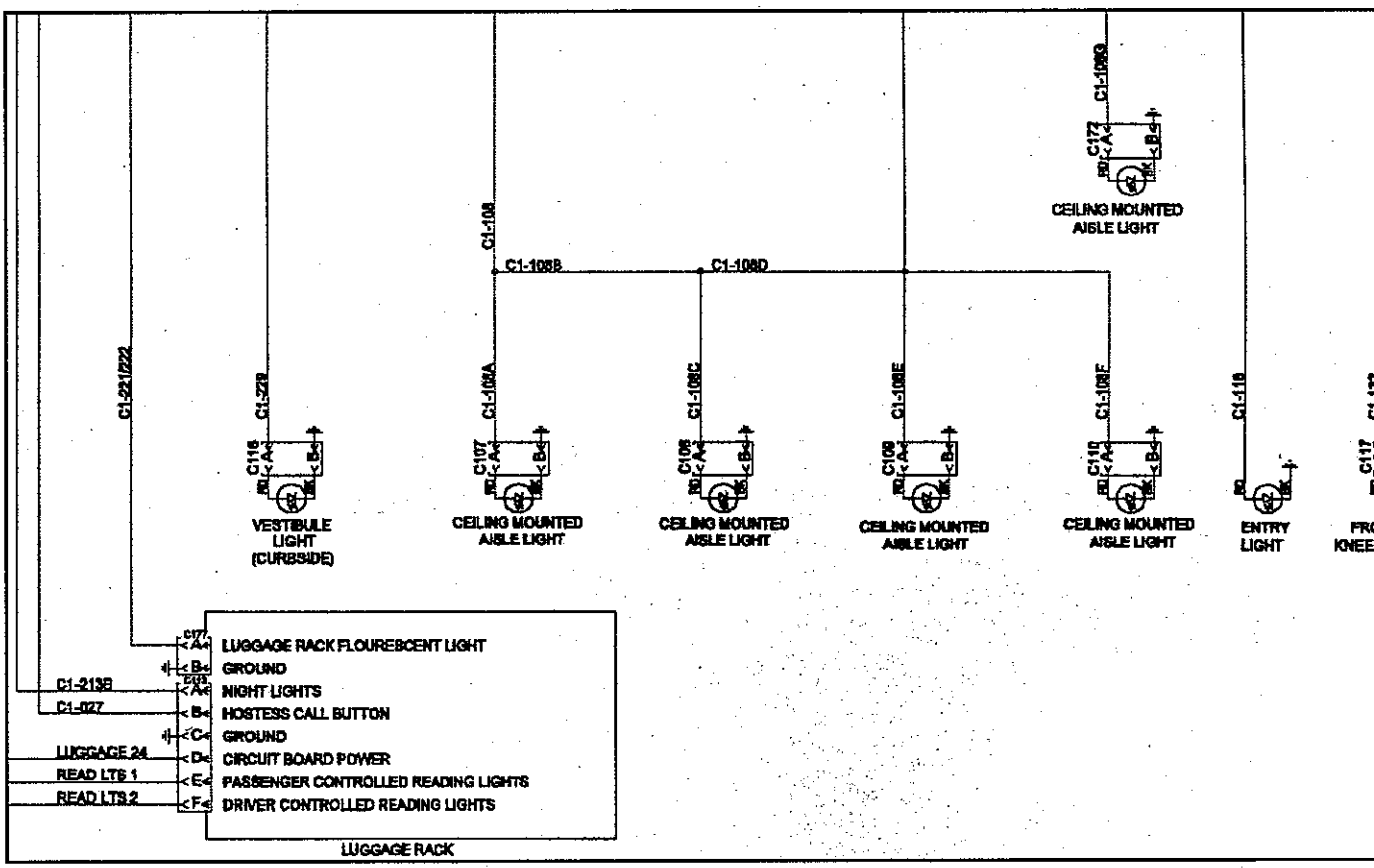
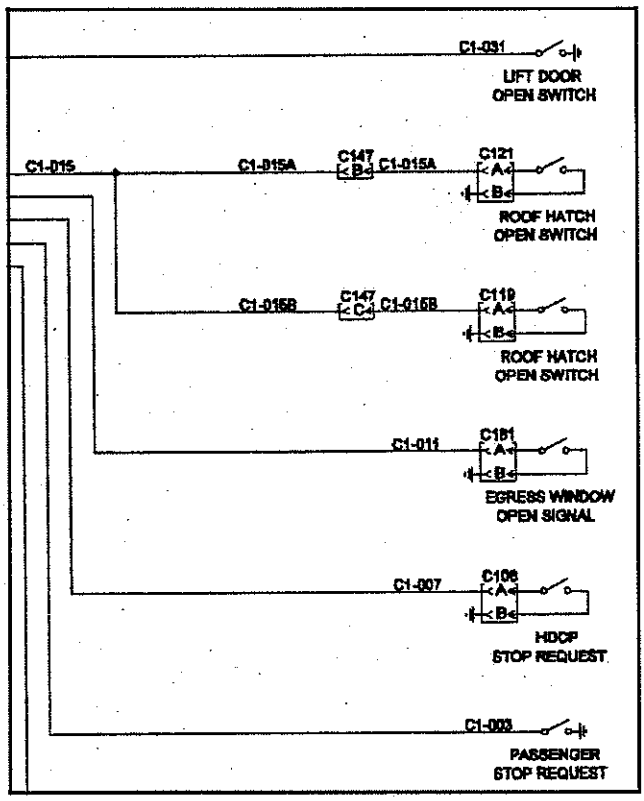
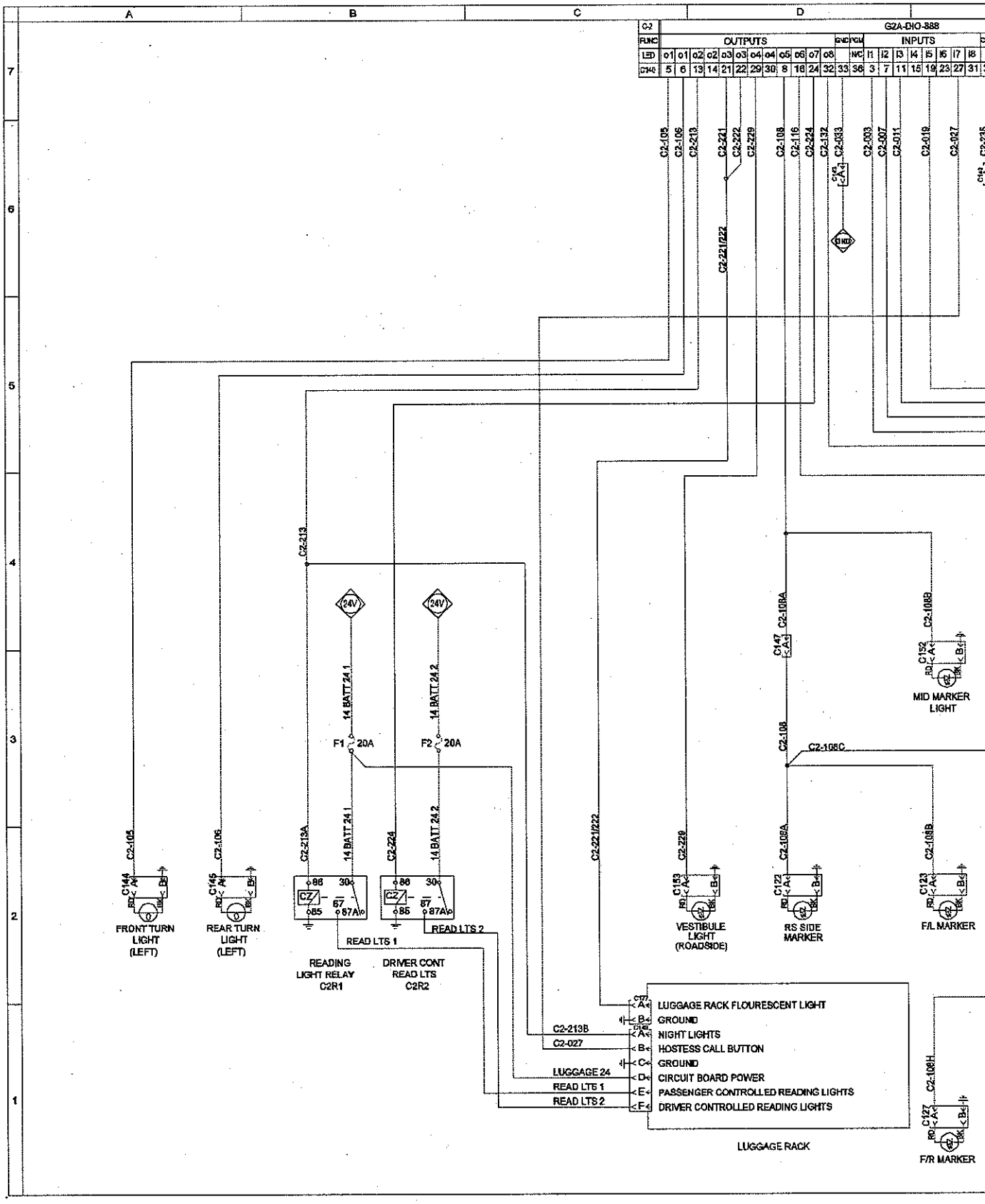




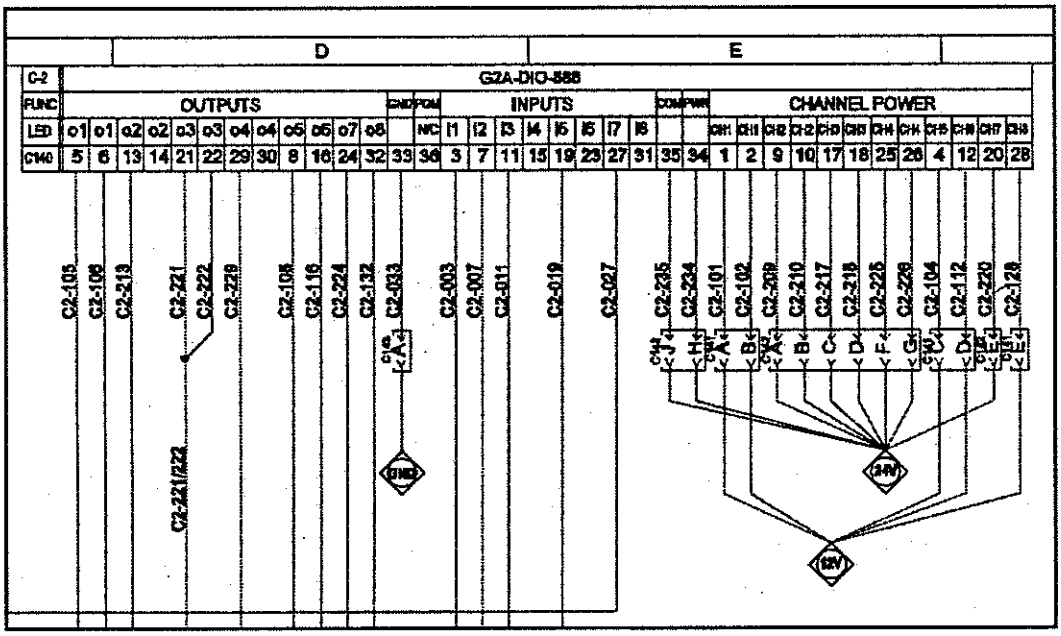
C-2 Module Wiring Schematic

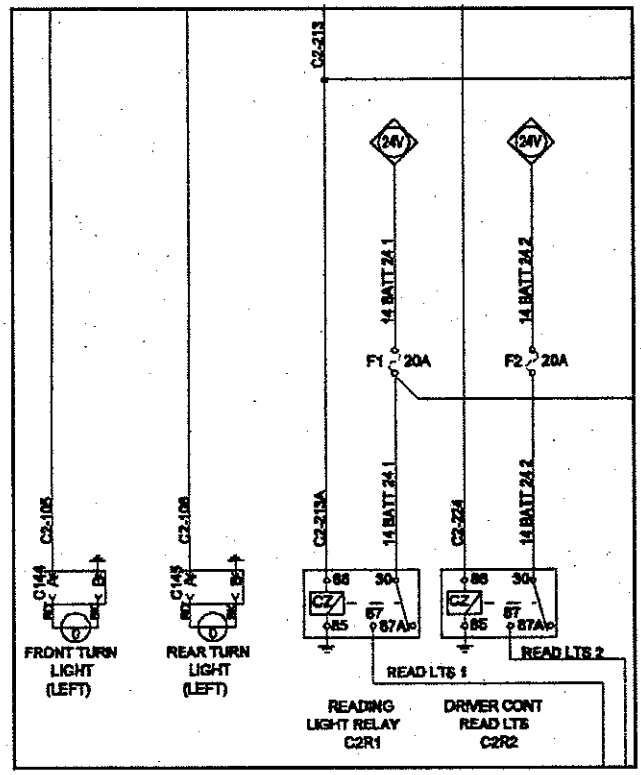
Blue Bird Part No. 0065564



Rev. "-"

Exploded Views of 0065564





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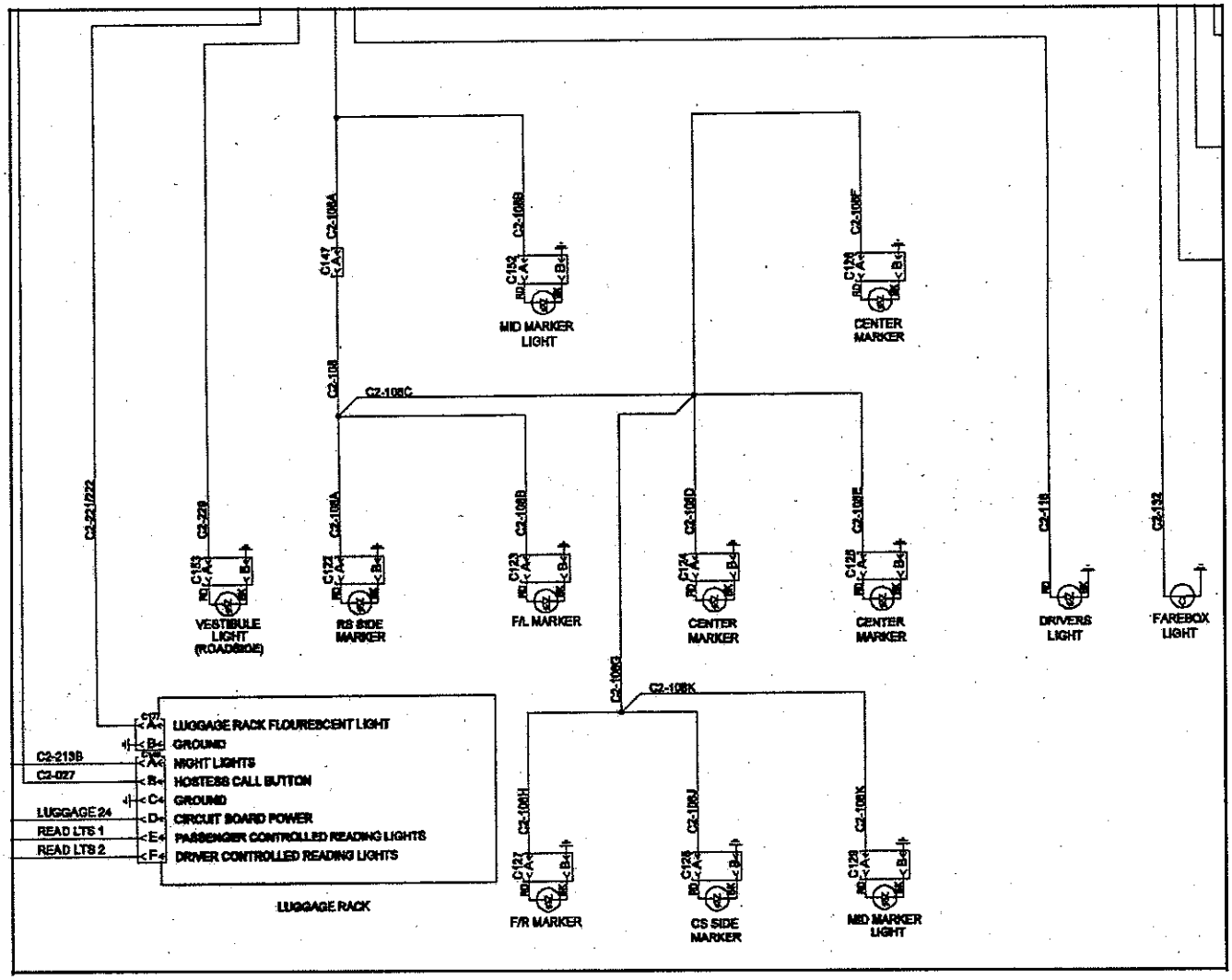
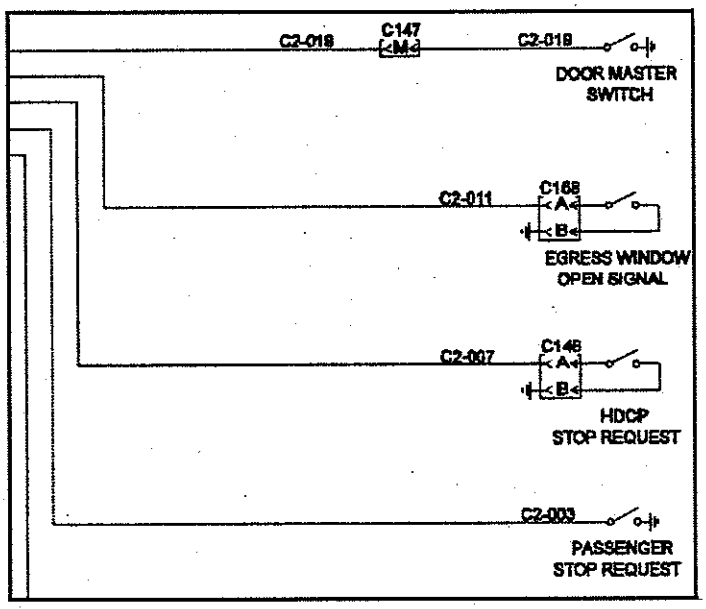
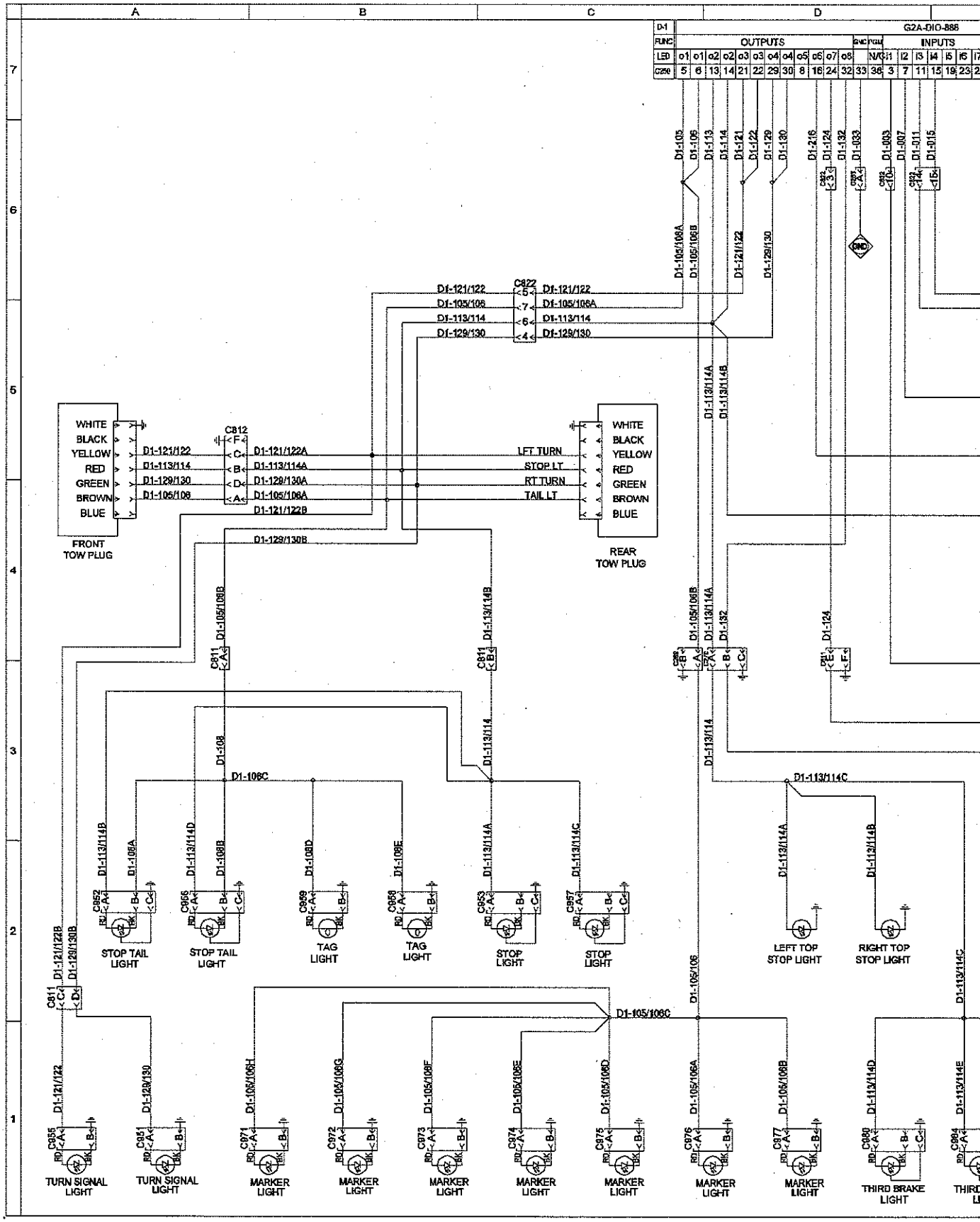




Rev. "-"

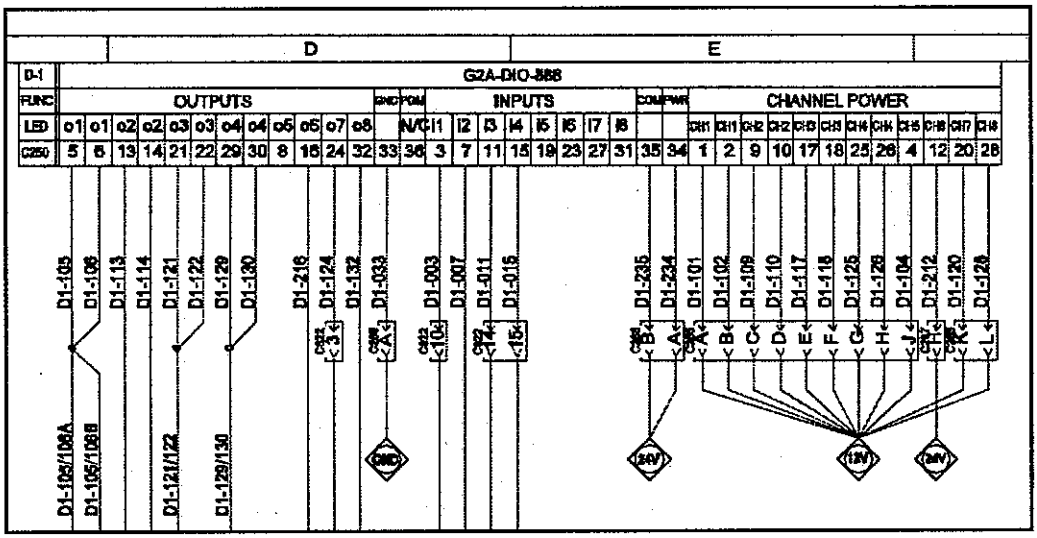
D-1 Module Wiring Schematic

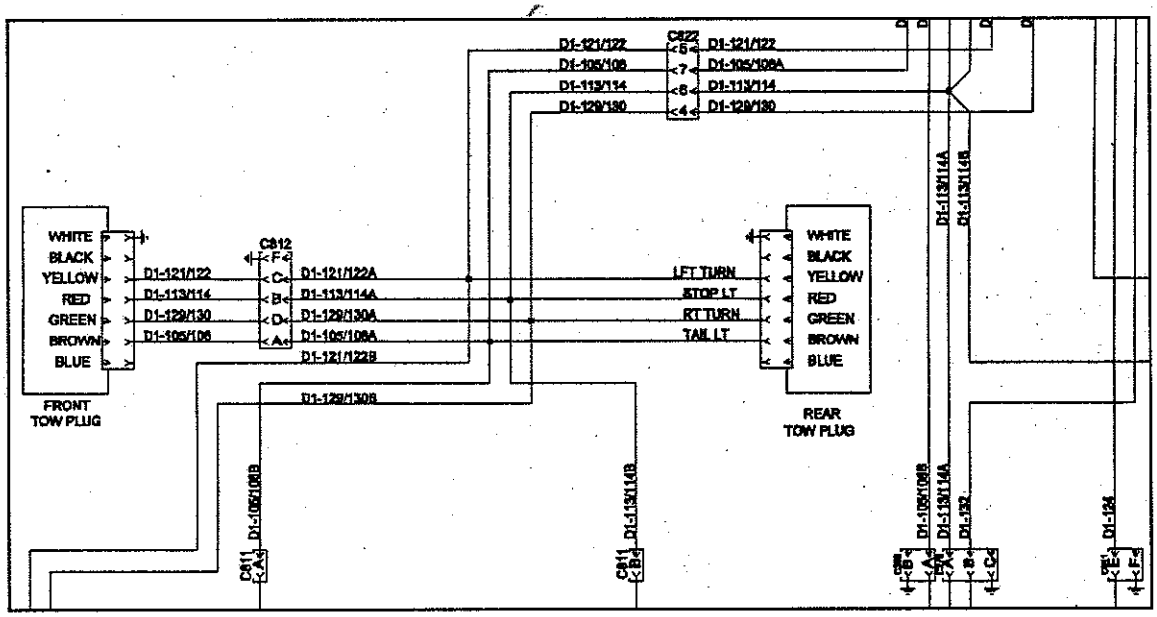
Blue Bird Part No. 0065565



Rev. "-"

Exploded Views of 0065565





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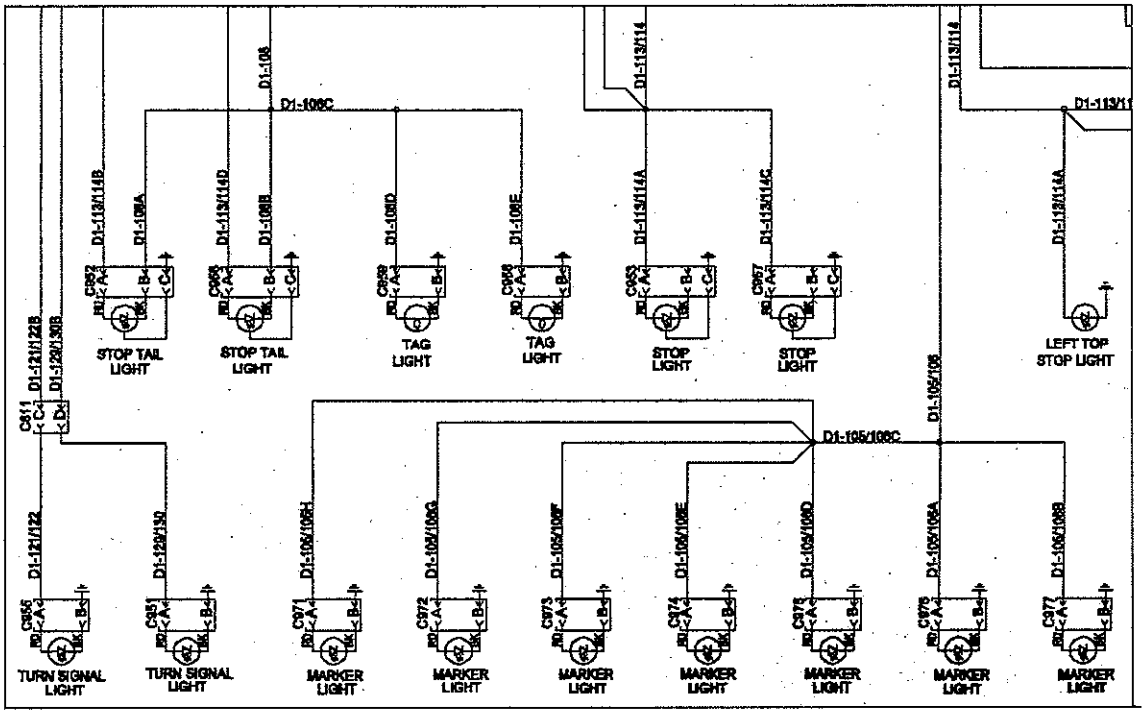
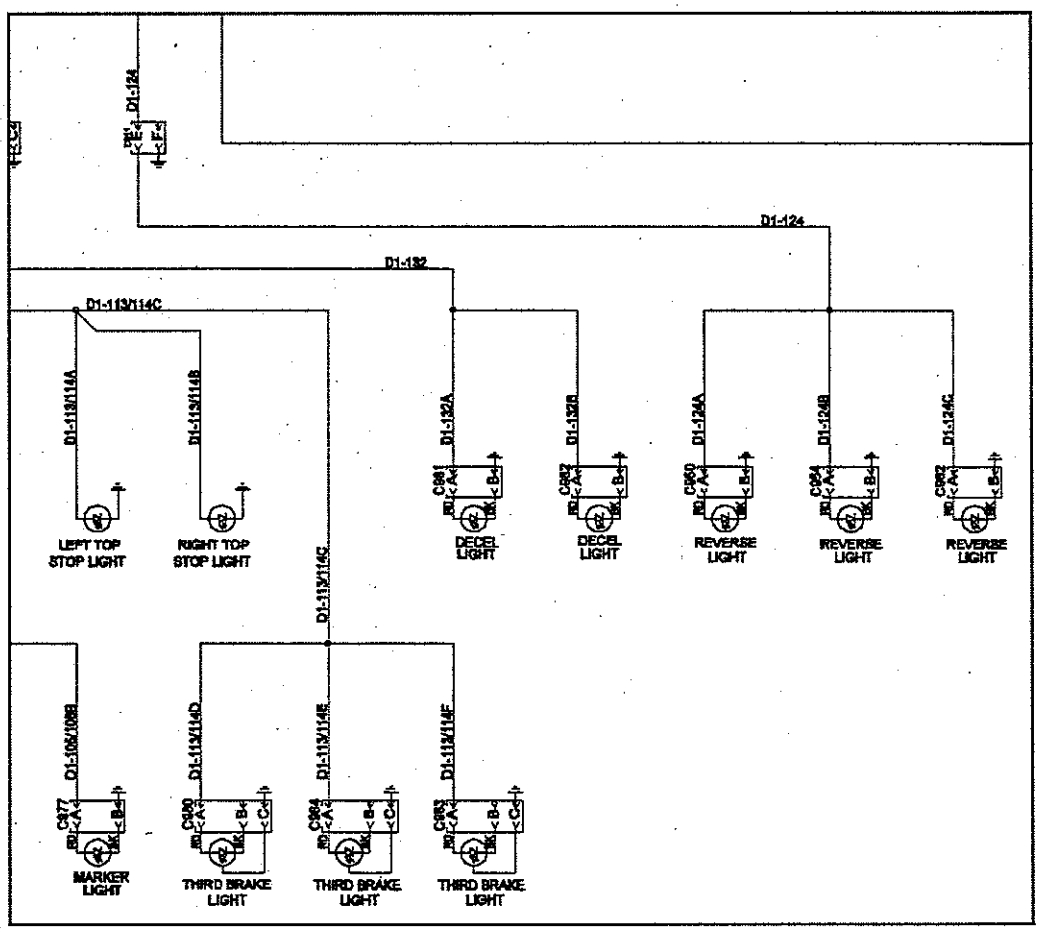
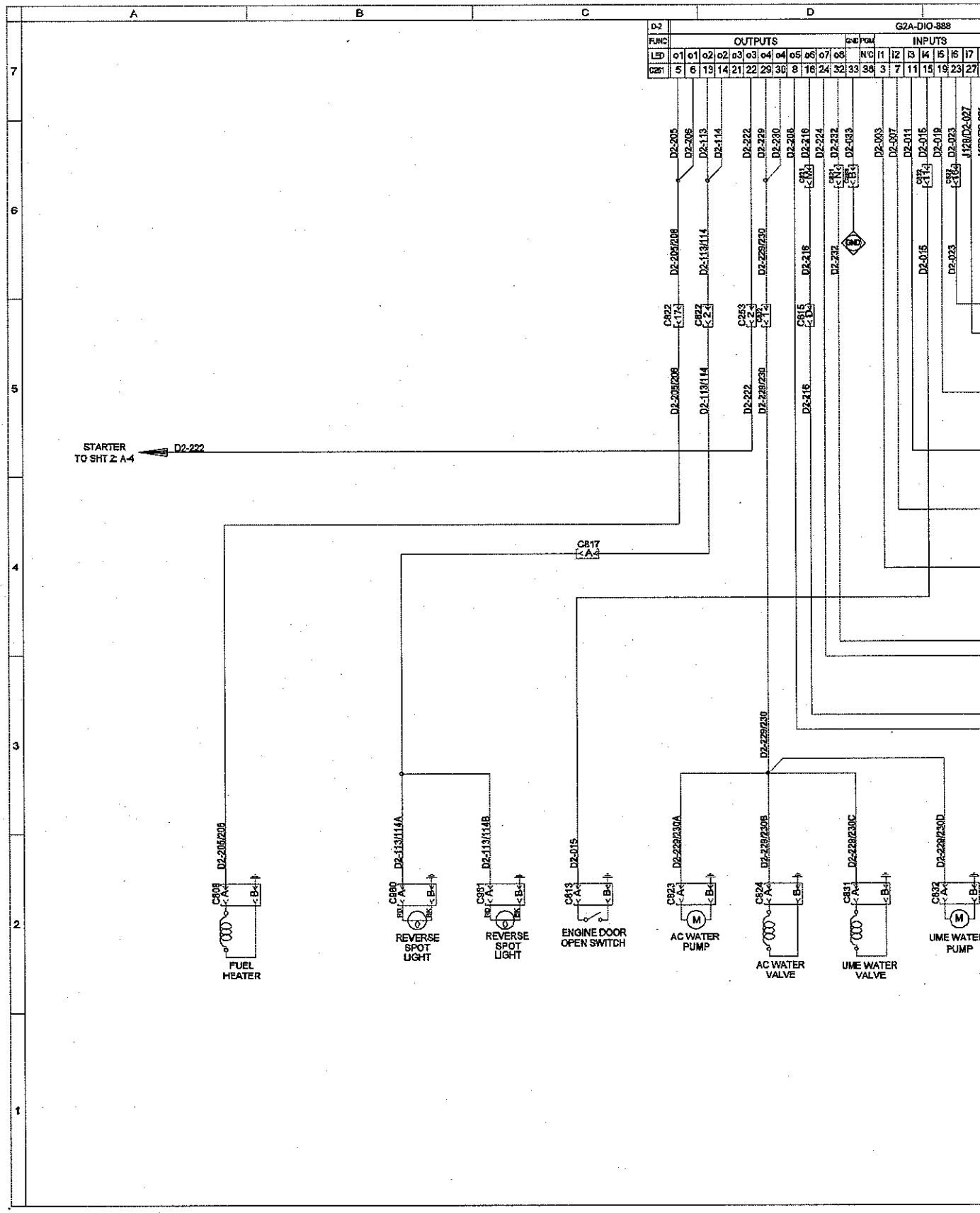


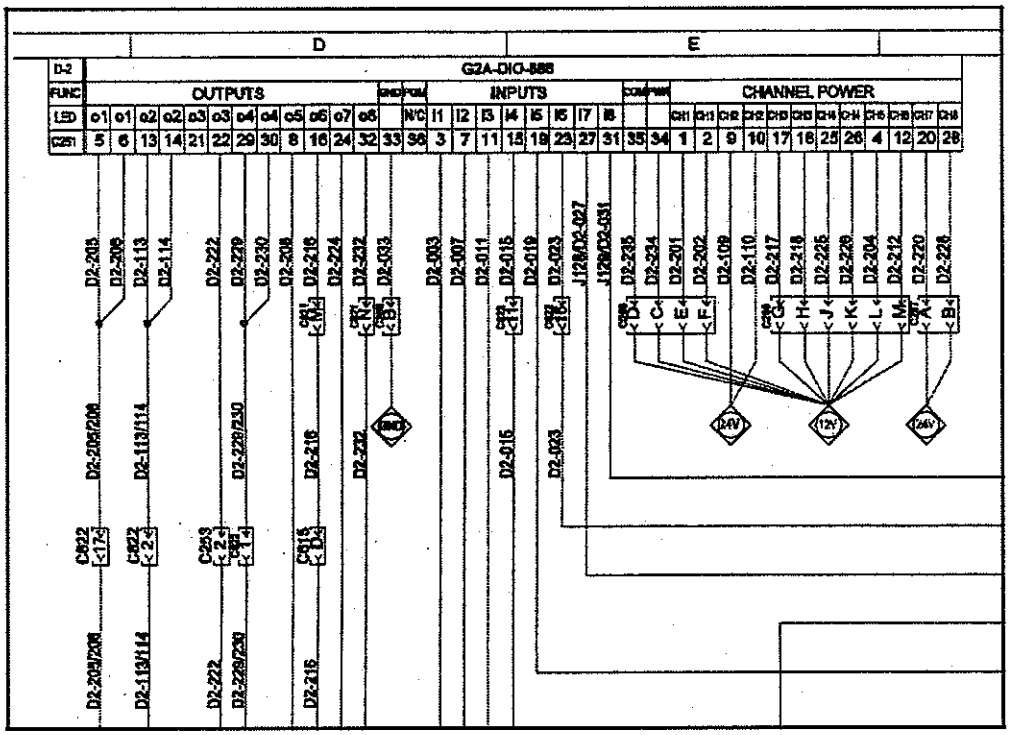


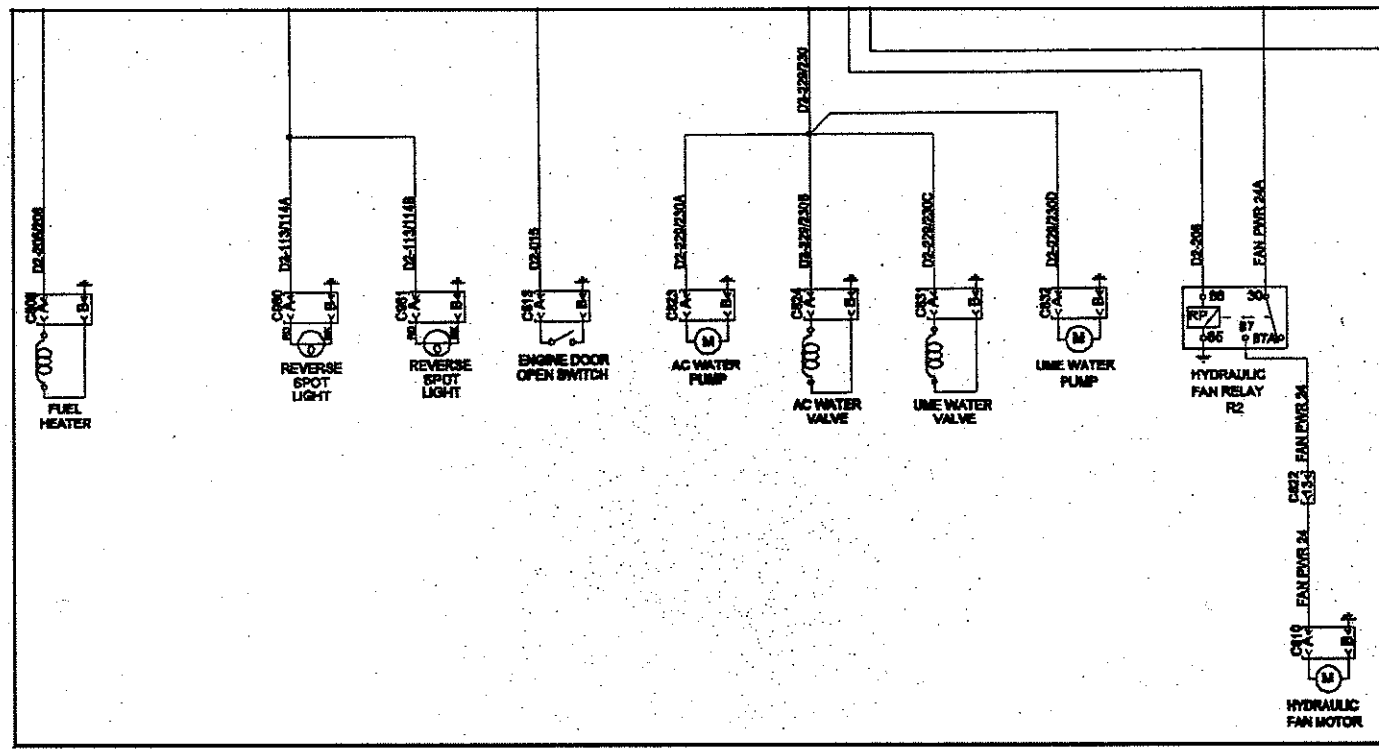
D-2 Module Wiring Schematic

Blue Bird Part No. 0065566

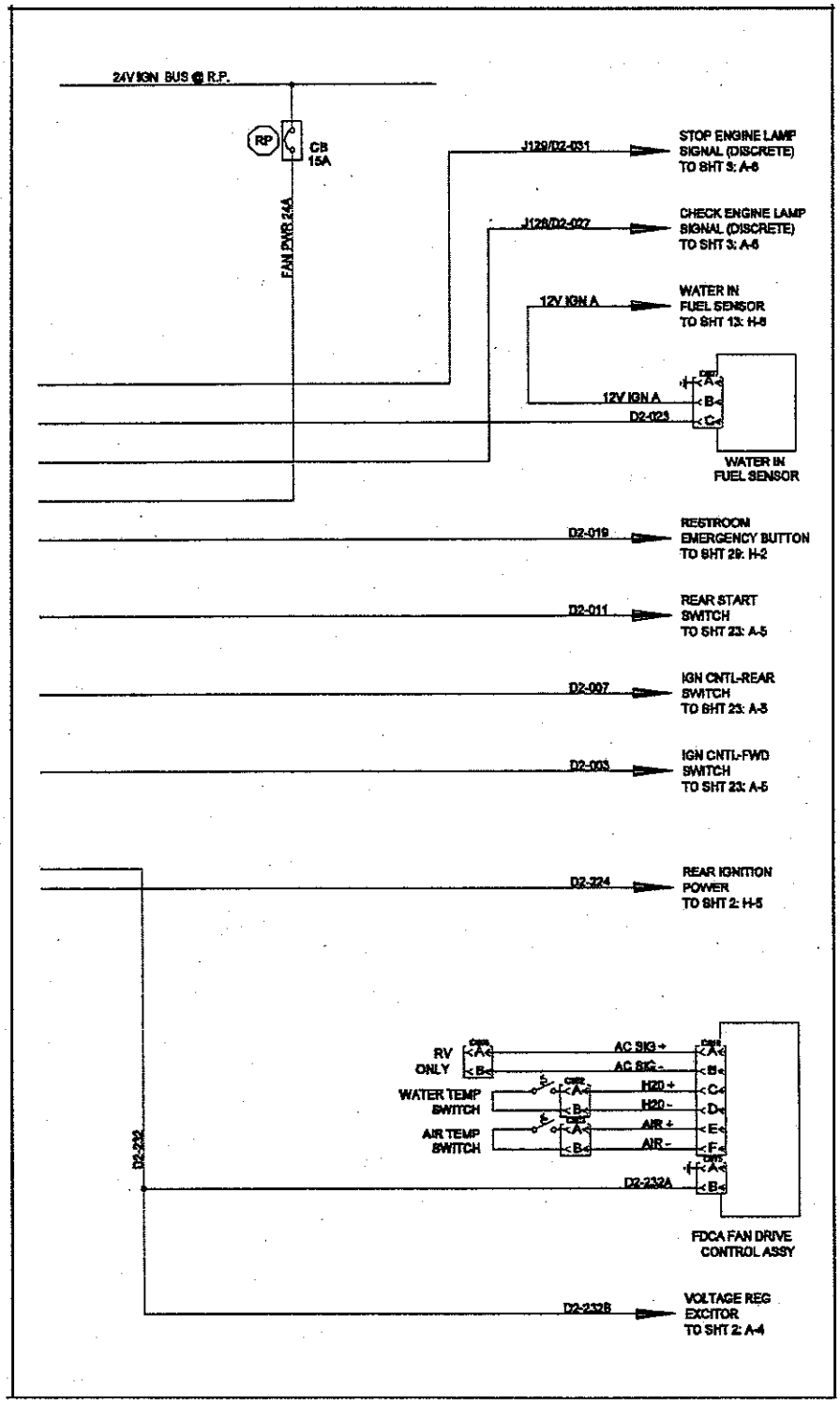


Exploded Views of 0065566



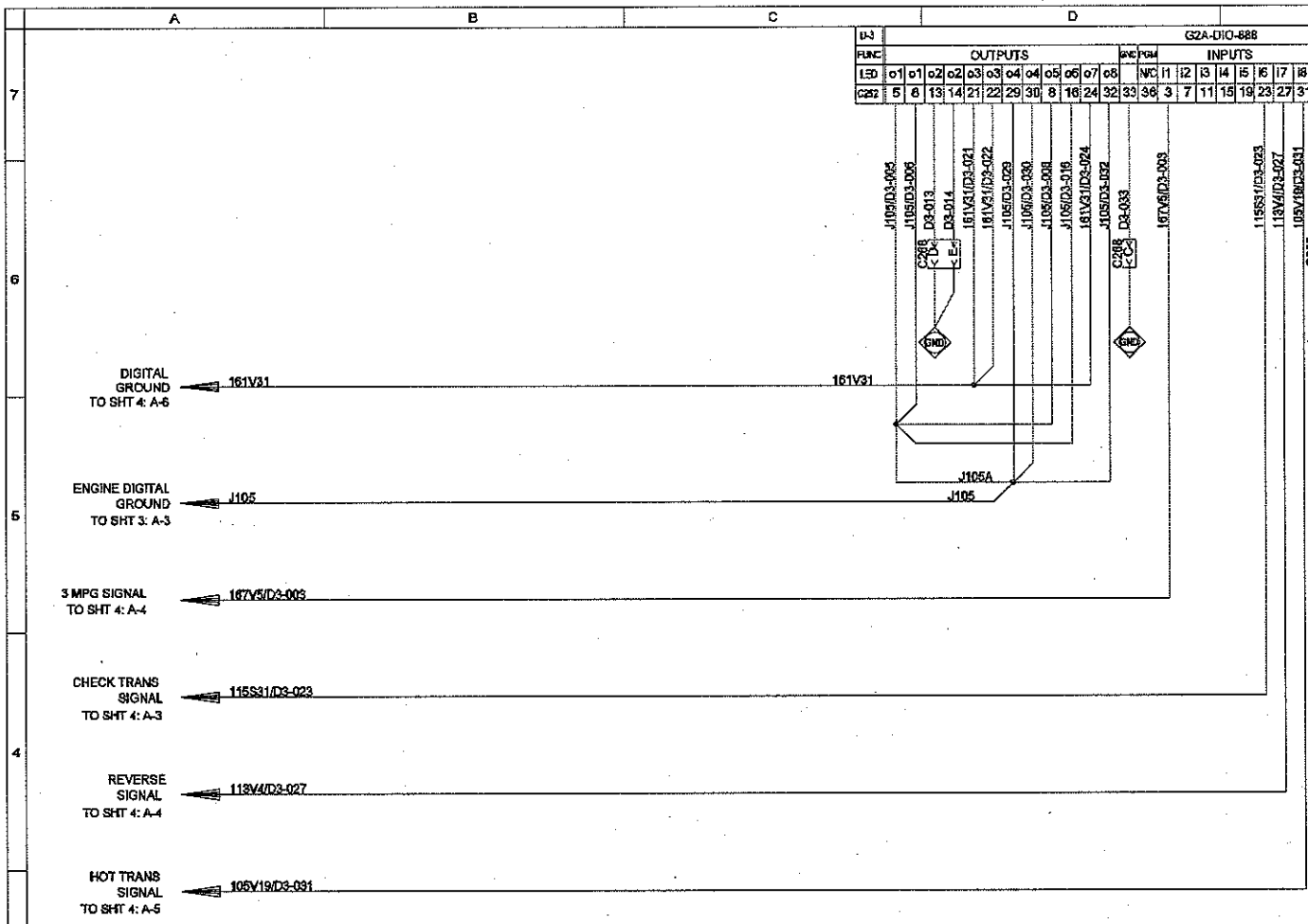


Exploded Views of 0065566 continued



D-3 Module Wiring Schematic

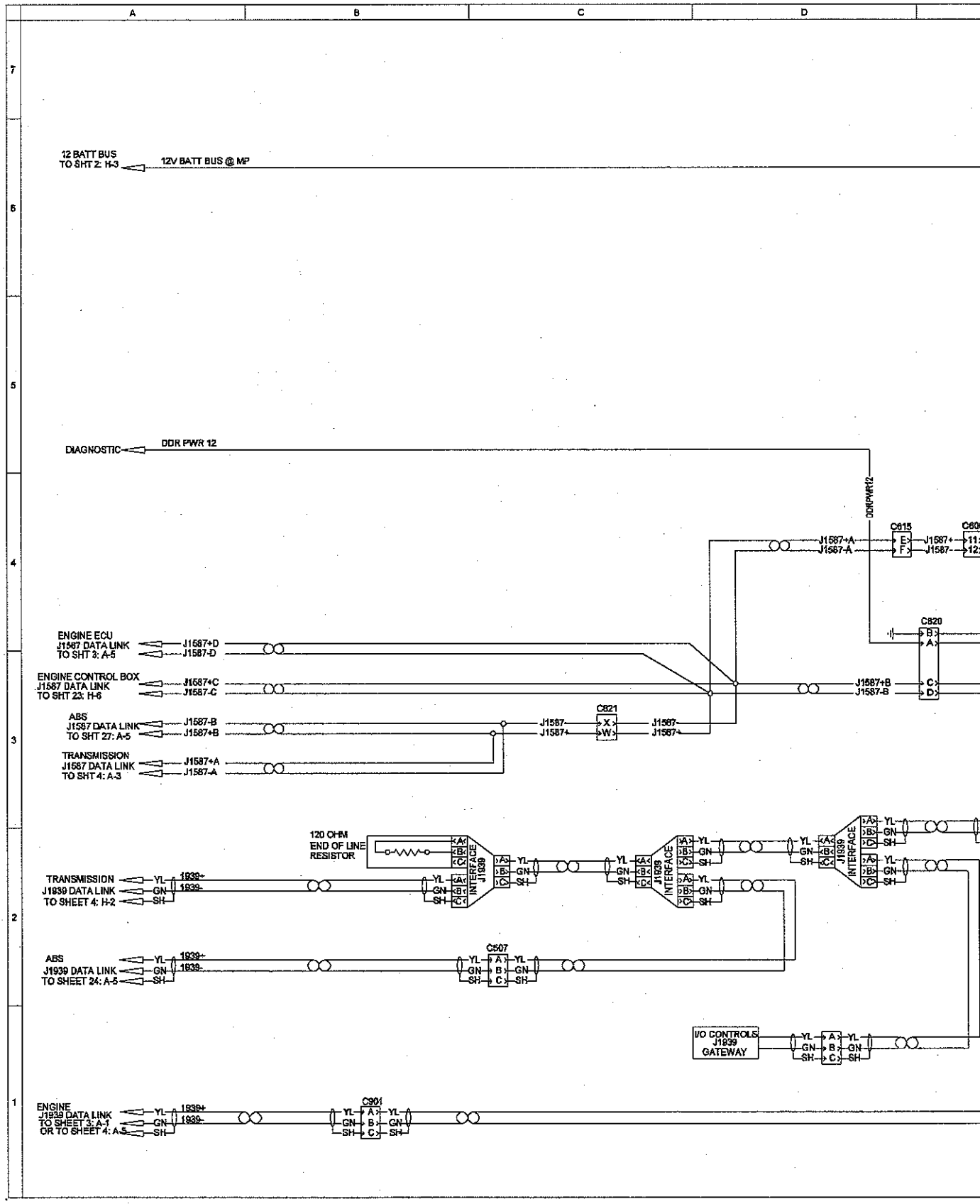
Blue Bird Part No. 0065567



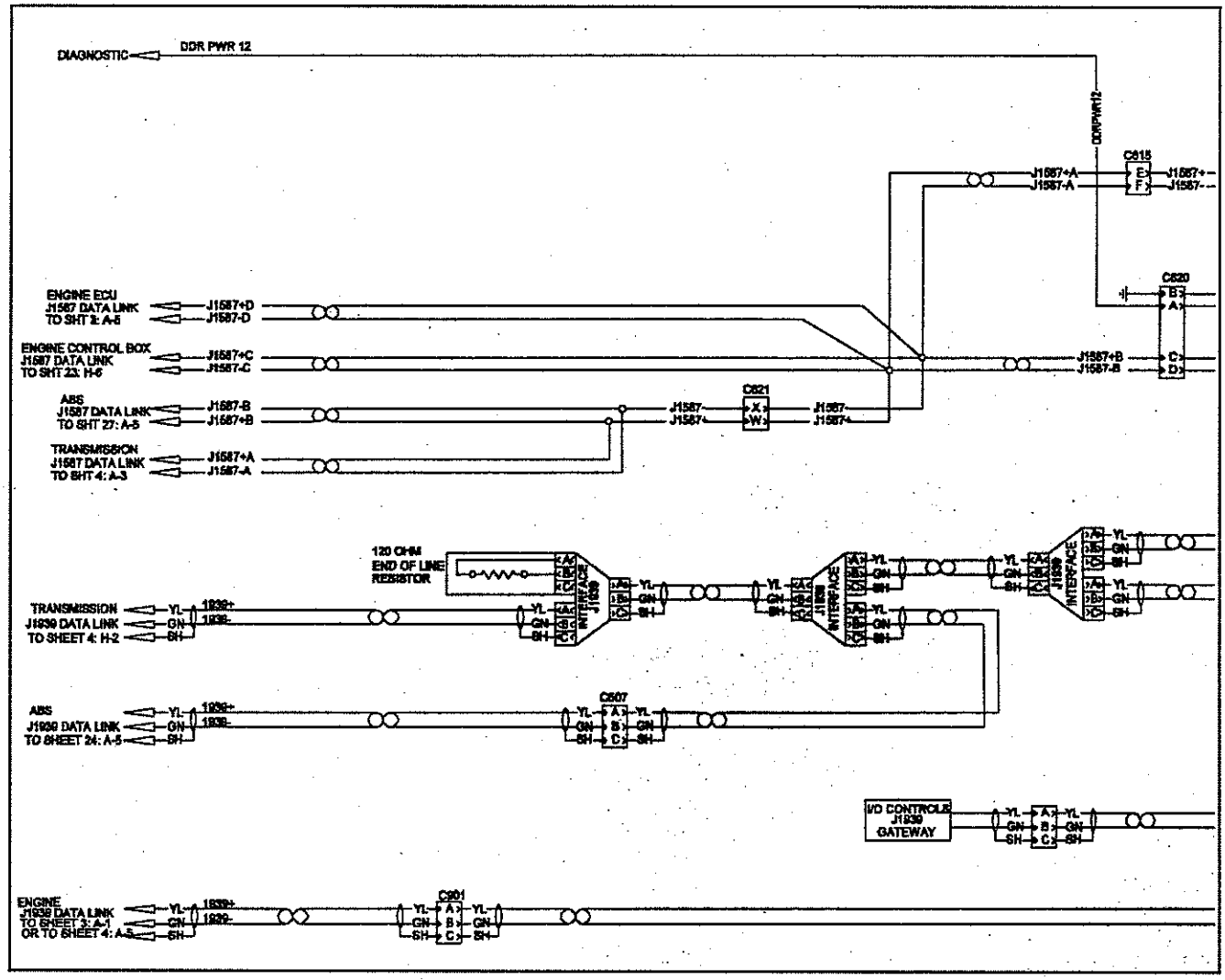
Rev. "-"

J1587 and J1939 Datalink Wiring Schematic

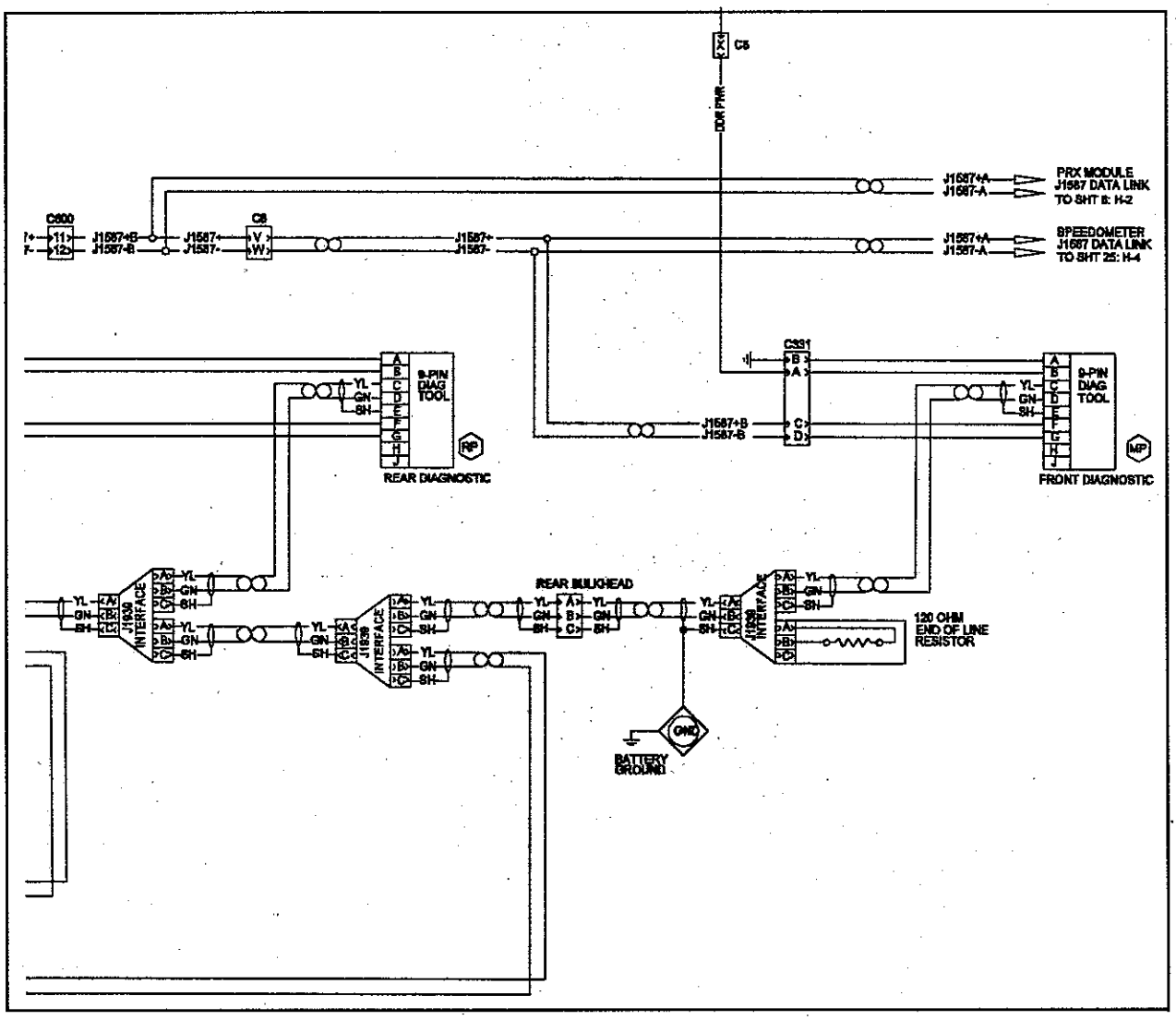
Blue Bird Part No. 0065568



Exploded Views of 0065568

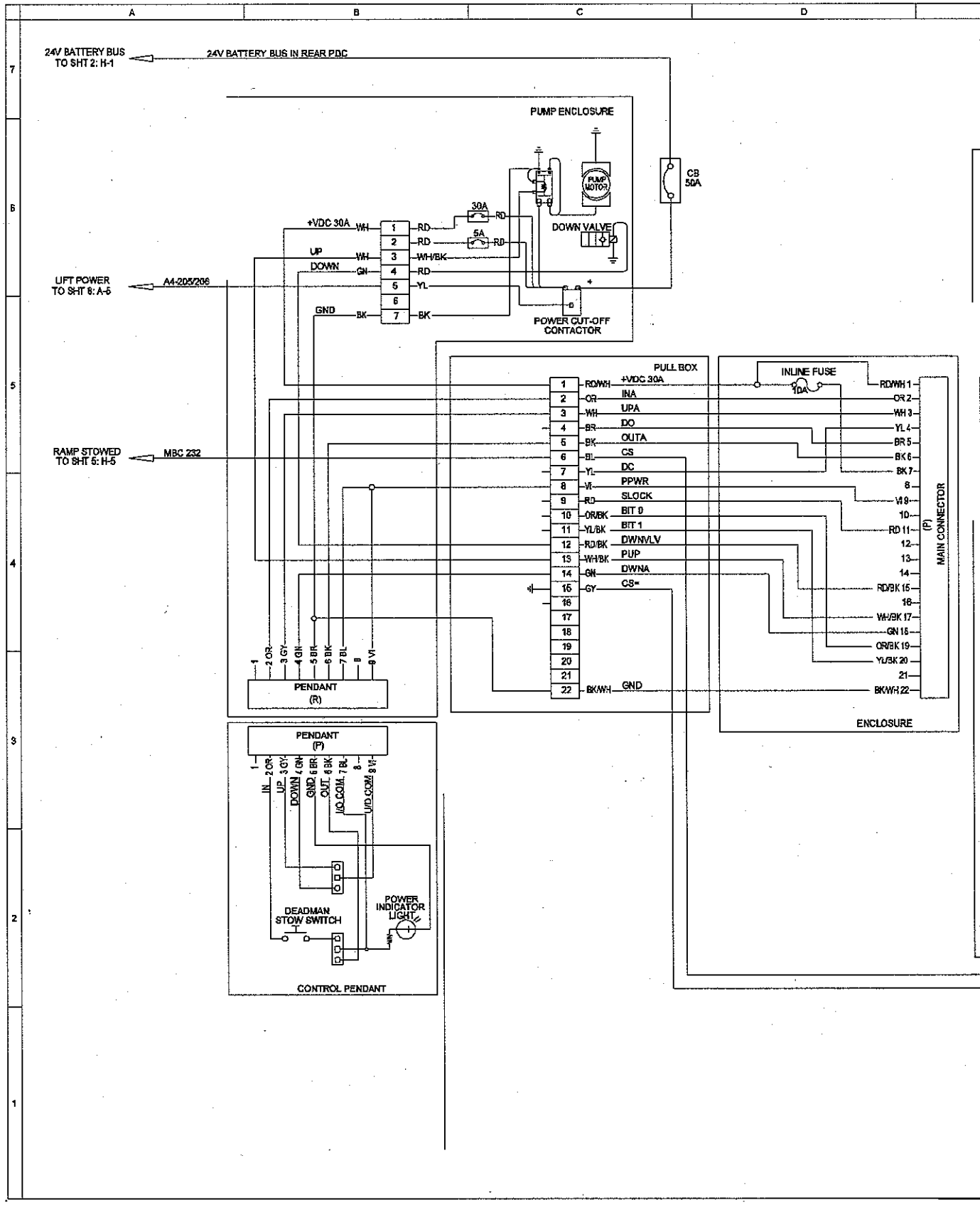


Exploded Views of 0065568 continued



Ricon Lift Wiring Schematic

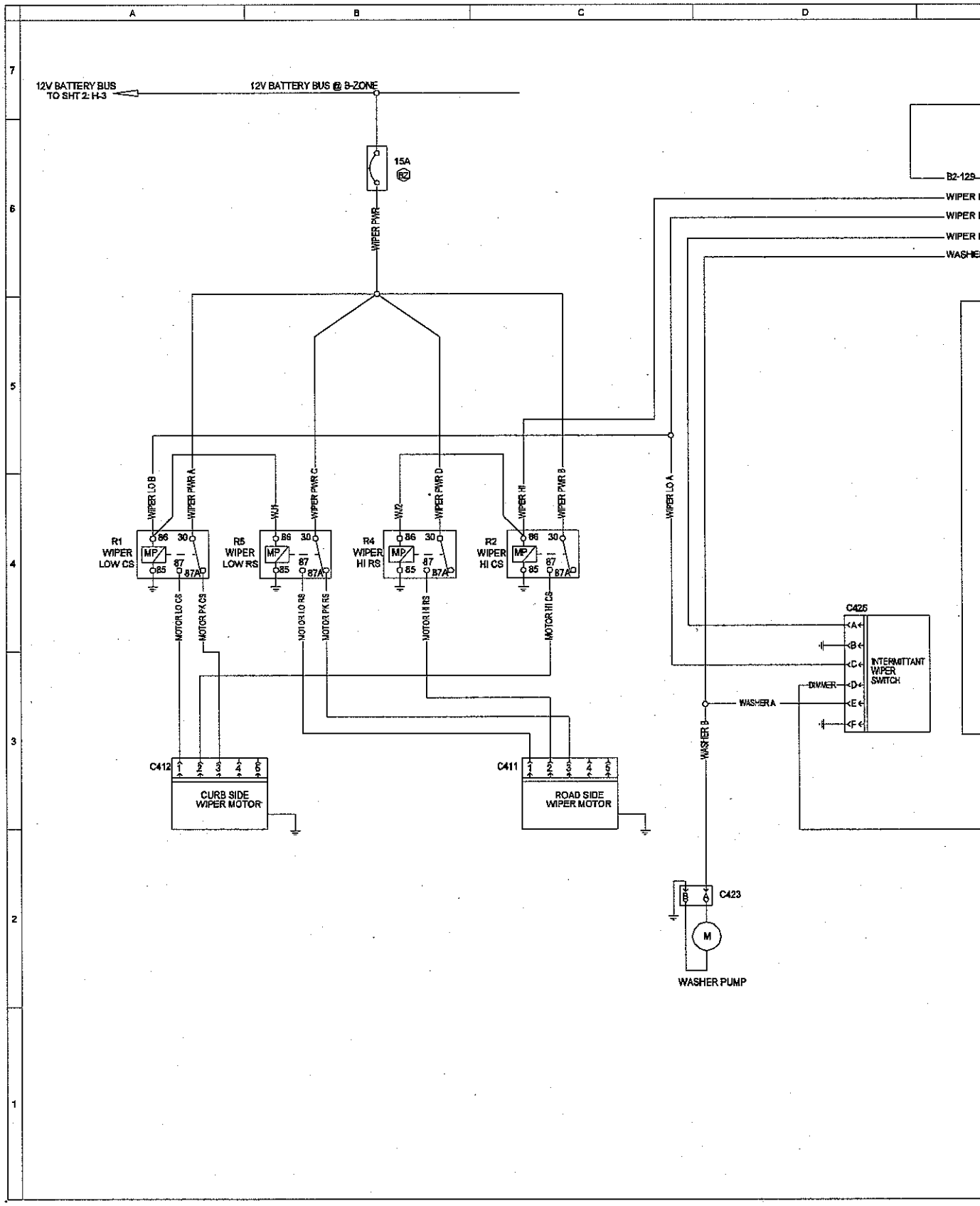
Blue Bird Part No. 0065569



Rev. "-"

Wiper and Steering Column SW Wiring Schematic

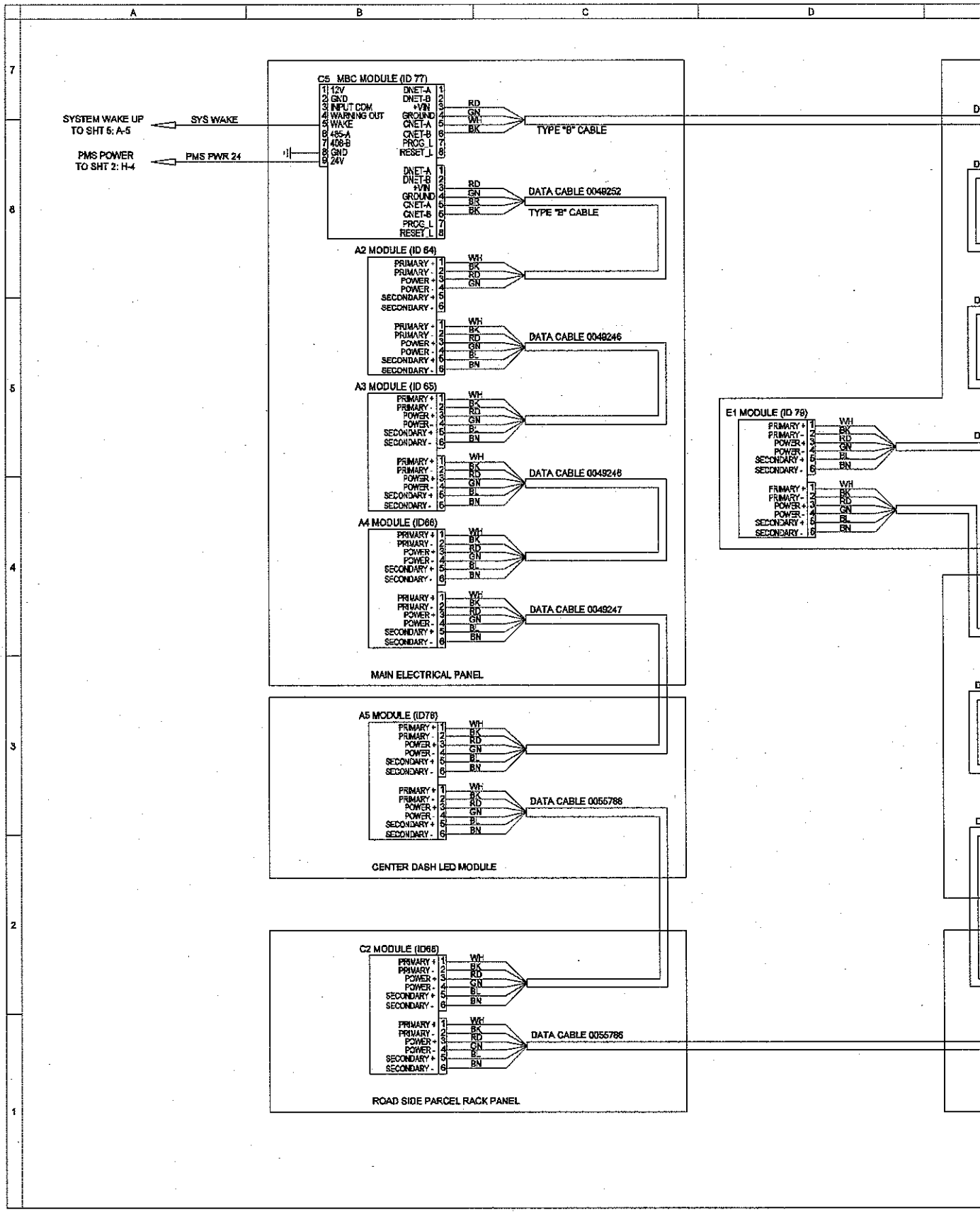
Blue Bird Part No. 0065570



Rev. "-"

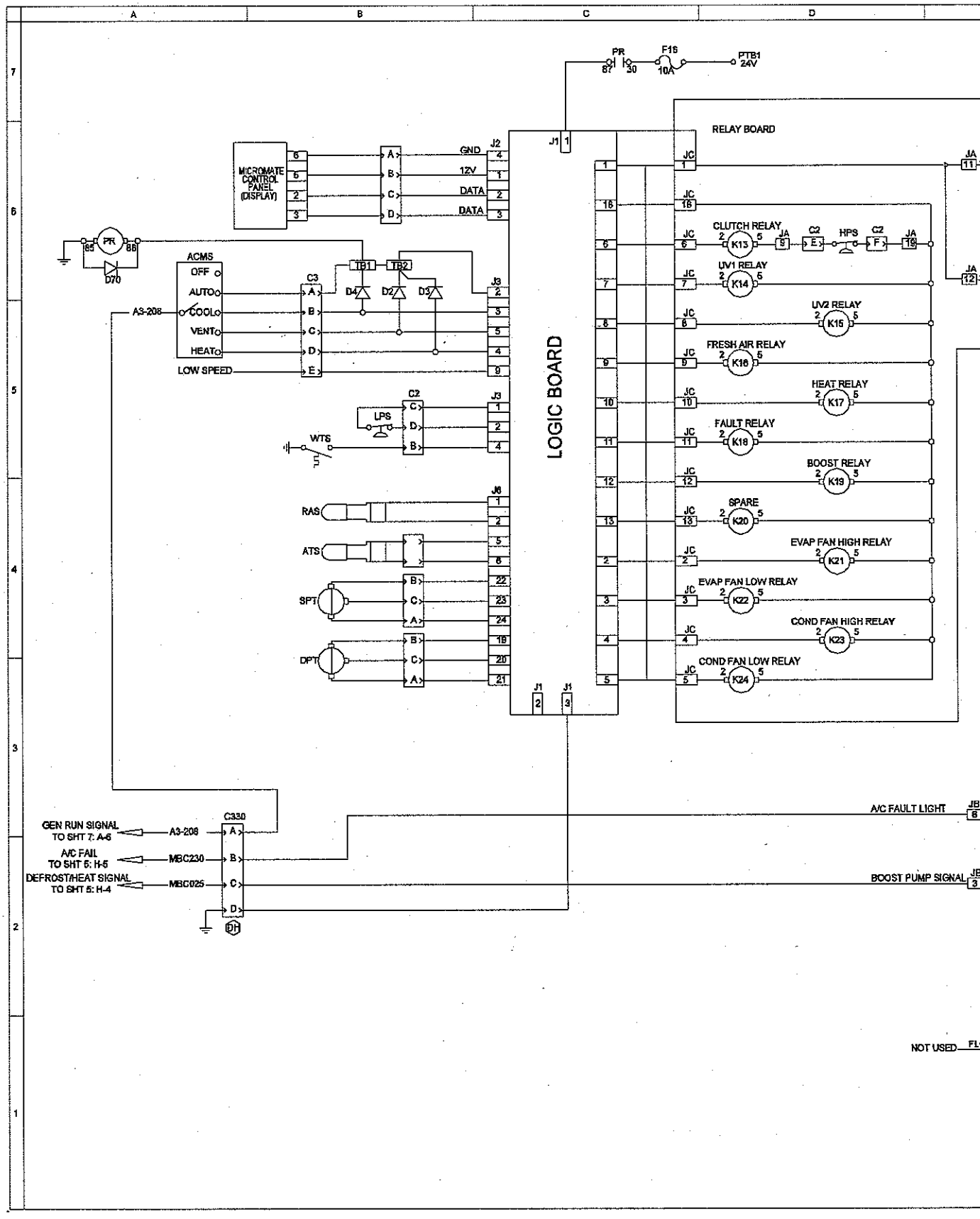
Dataloops and MBC Power Wiring Schematic

Blue Bird Part No. 0065571



Carrier HVAC Roof Wiring Schematic

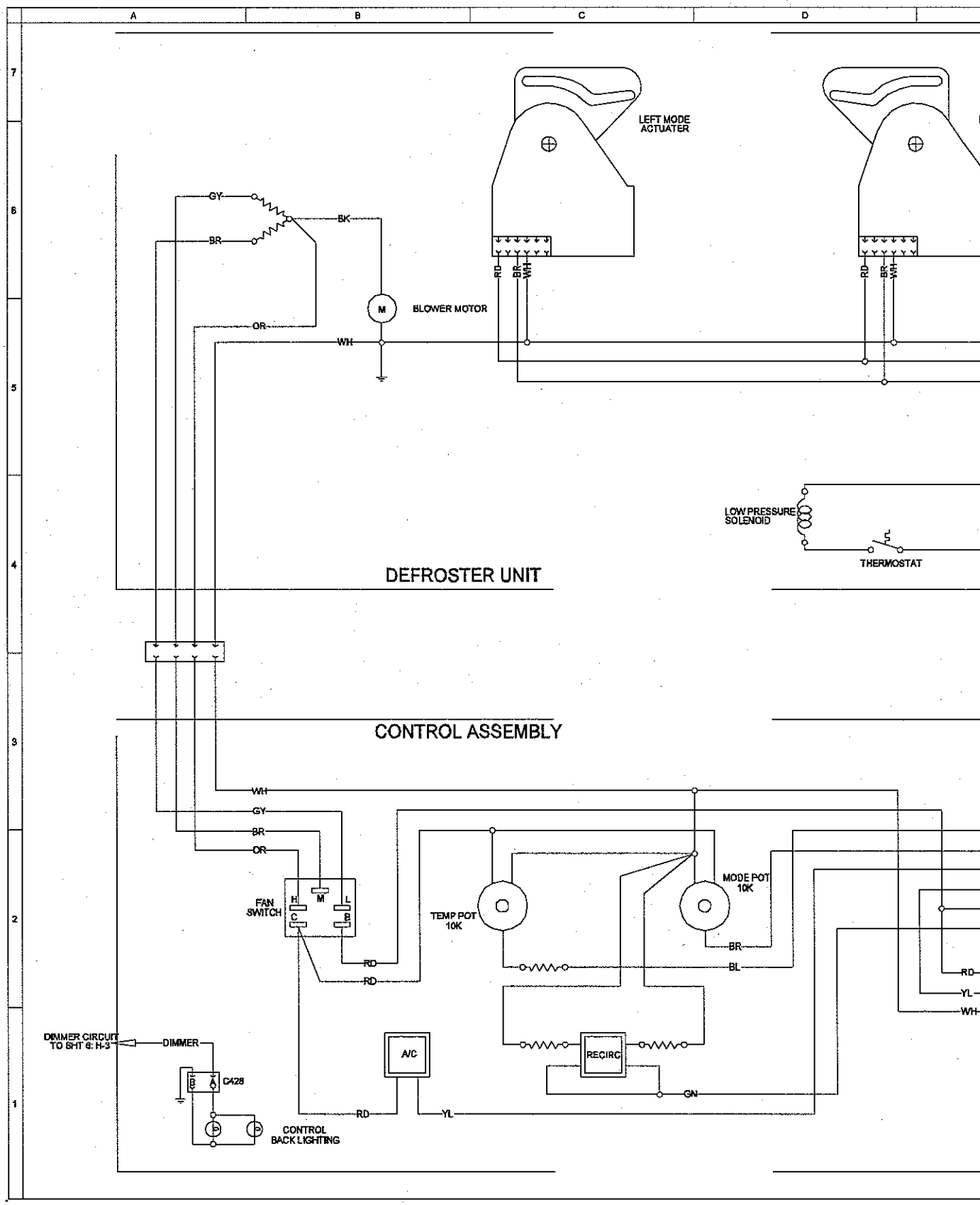
Blue Bird Part No. 0065572



Rev. "-"

Berstrom Front HVAC Wiring Schematic

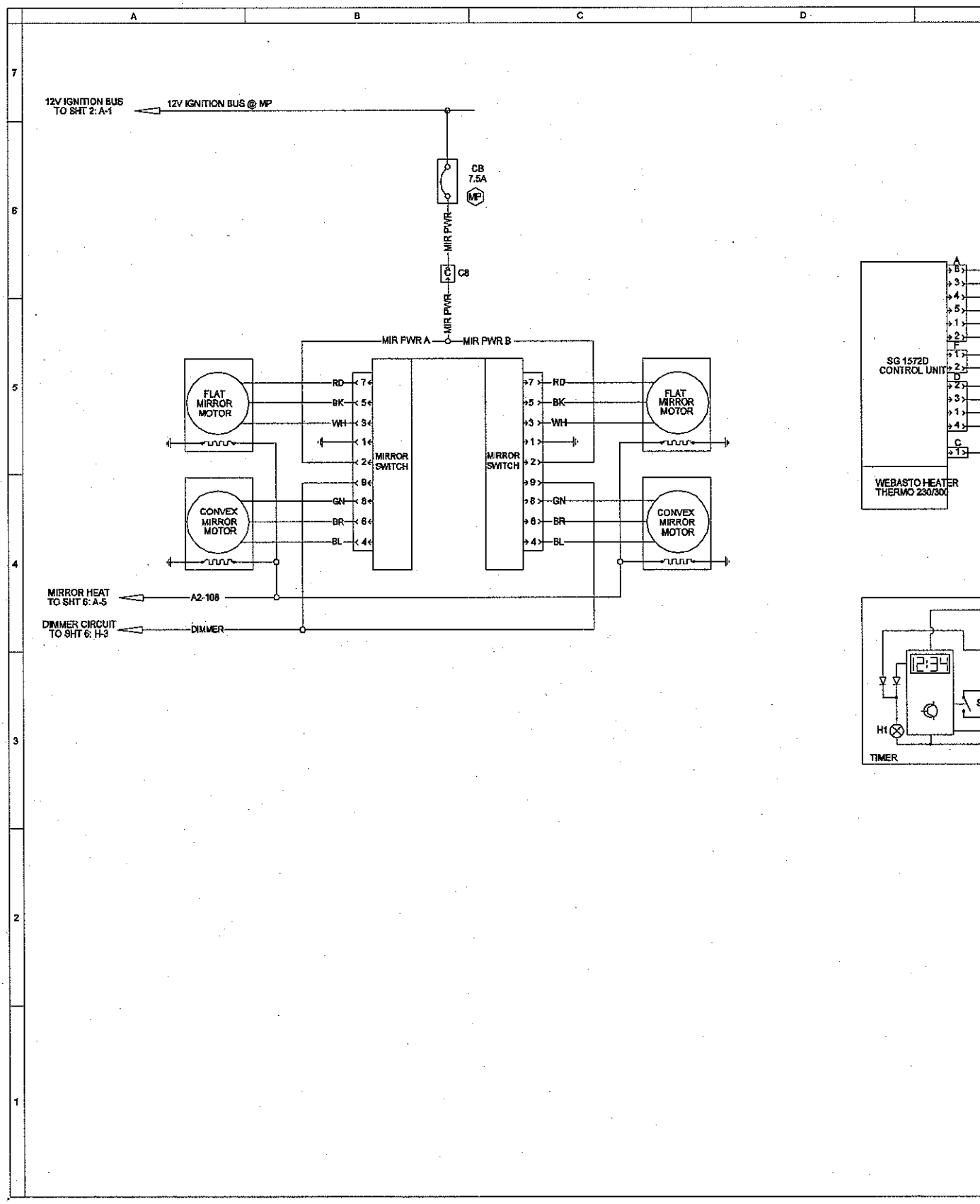
Blue Bird Part No. 0065573



Rev. "-"

Mirrors and Webasto Heater Wiring Schematic

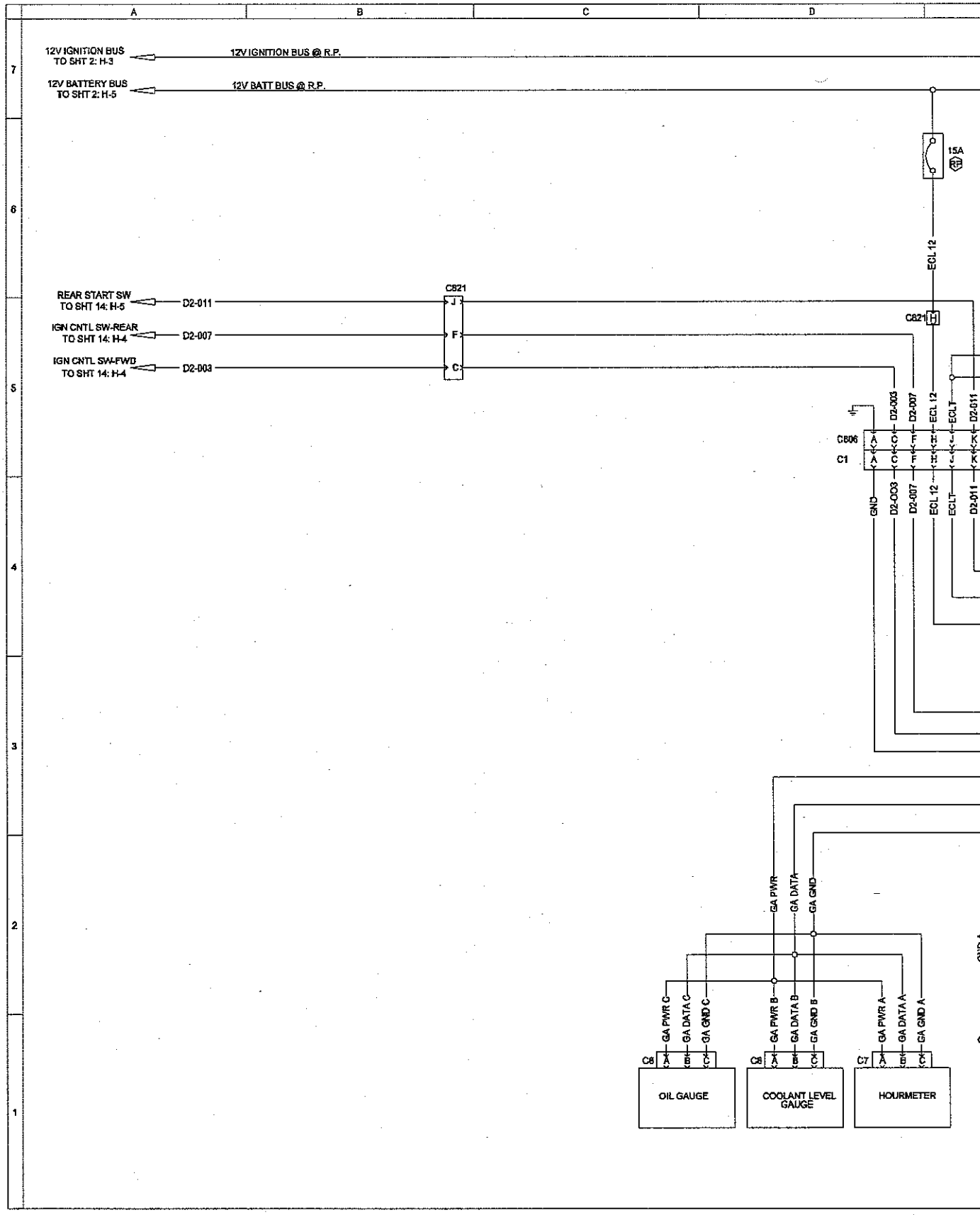
Blue Bird Part No. 0065574



Rev. "-"

Engine Control Box Wiring Schematic

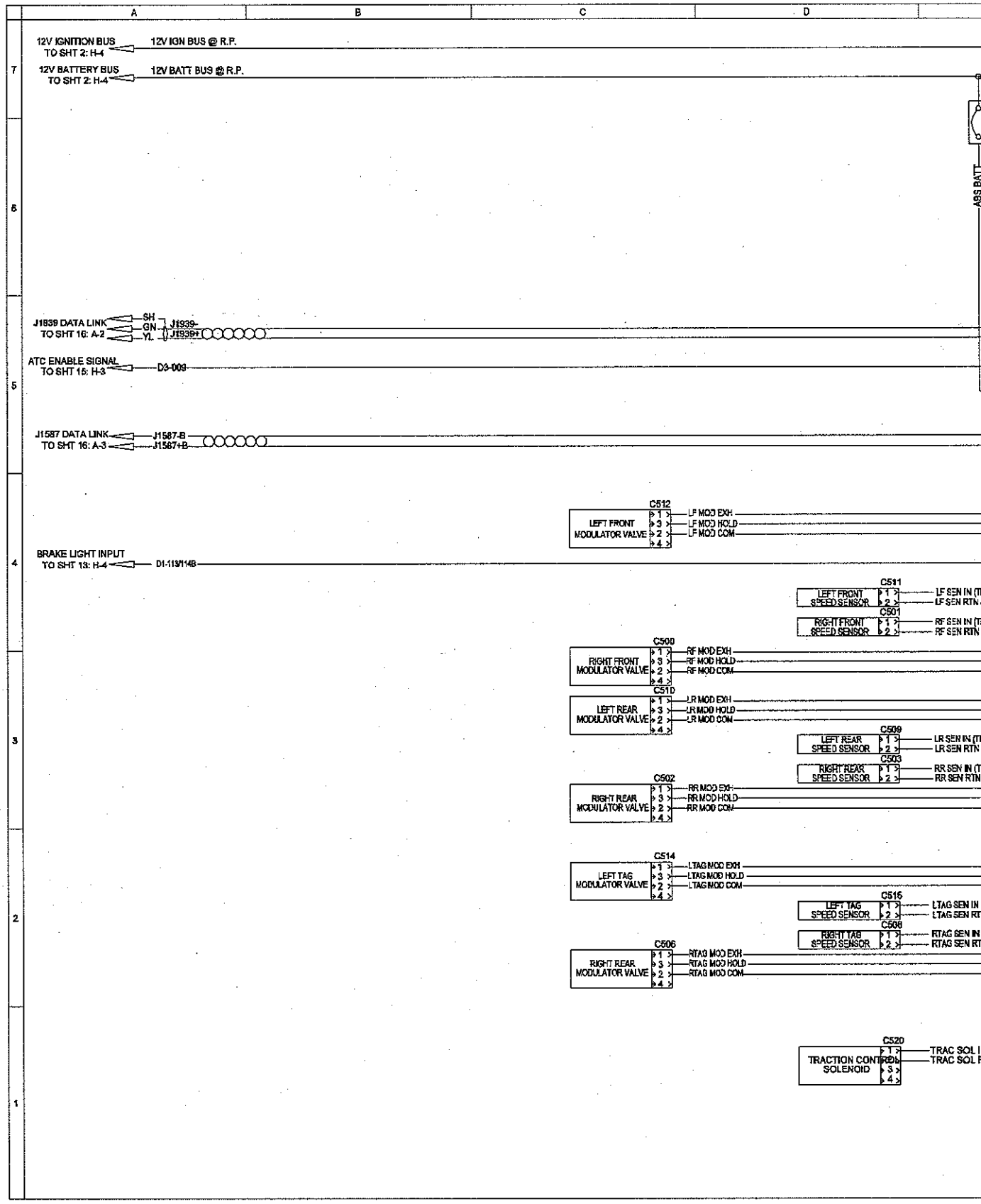
Blue Bird Part No. 0065575



Rev. "-"

Bendix 6S/6M ABS System Wiring Schematic

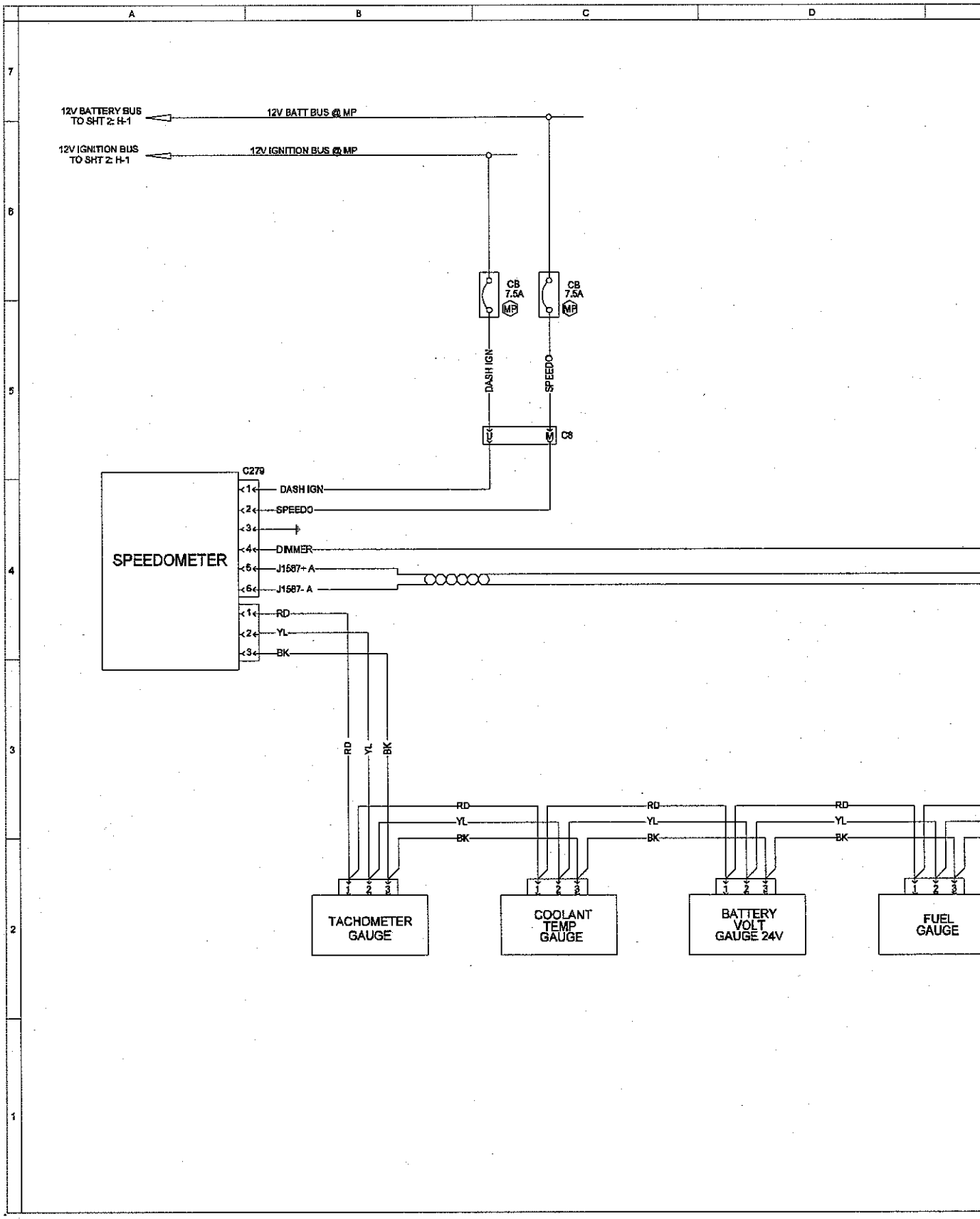
Blue Bird Part No. 0065576



Rev. "-"

Dash Gauges Wiring Schematic

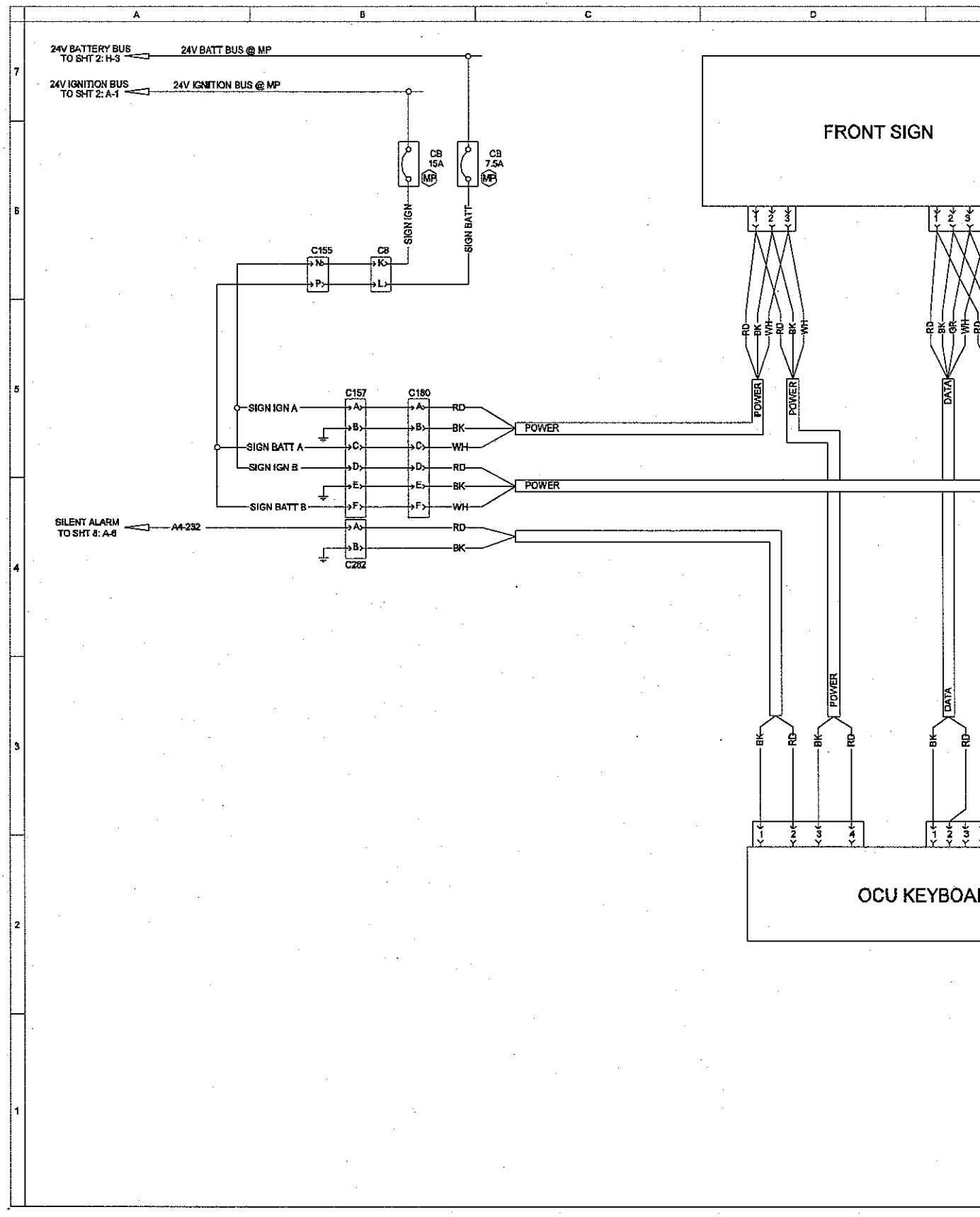
Blue Bird Part No. 0065577



Rev. "-"

Vision Sign System Wiring Schematic

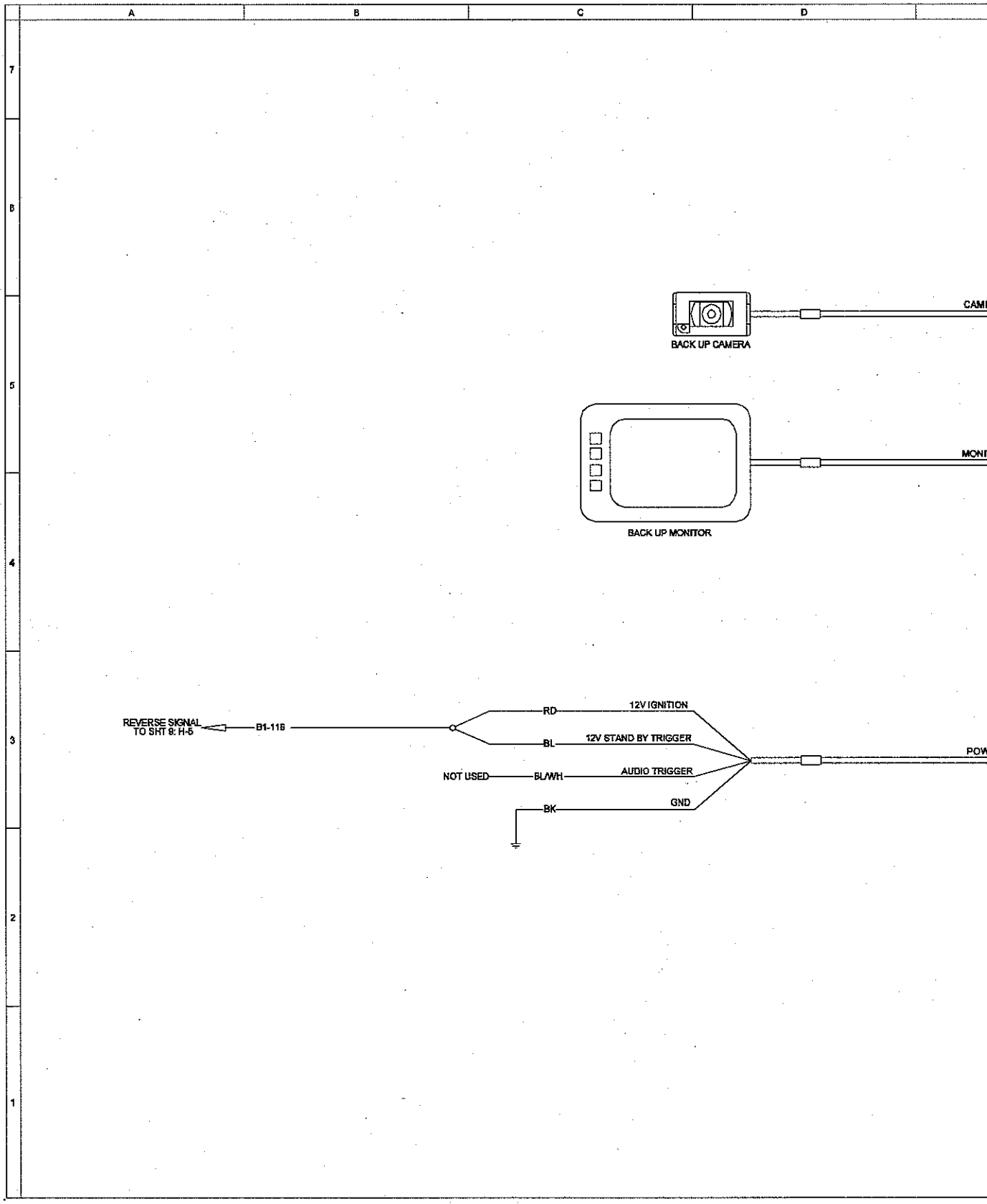
Blue Bird Part No. 0065578



Rev. "-"

Back Up Camera Wiring Schematic

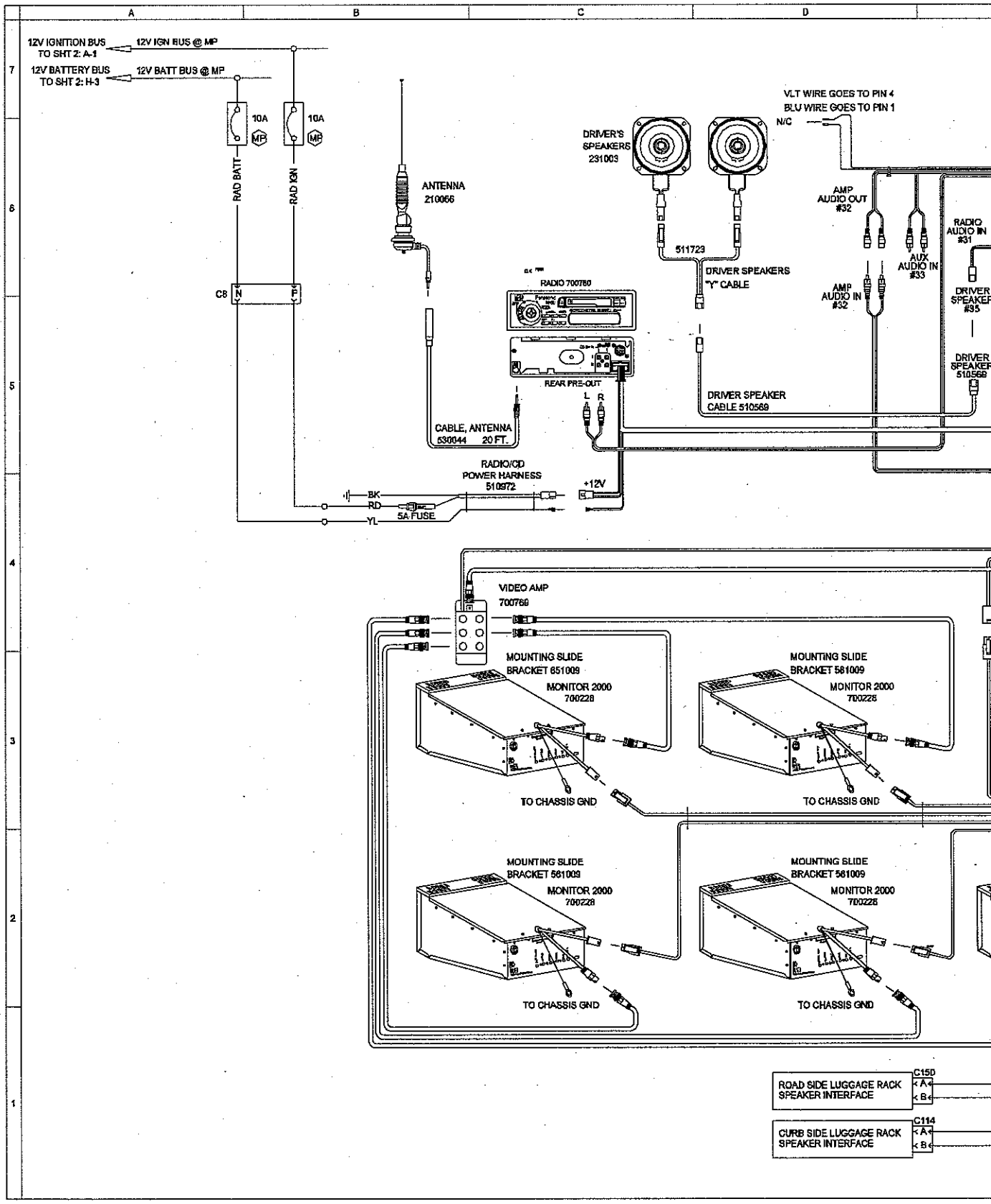
Blue Bird Part No. 0065579



Rev. "-"

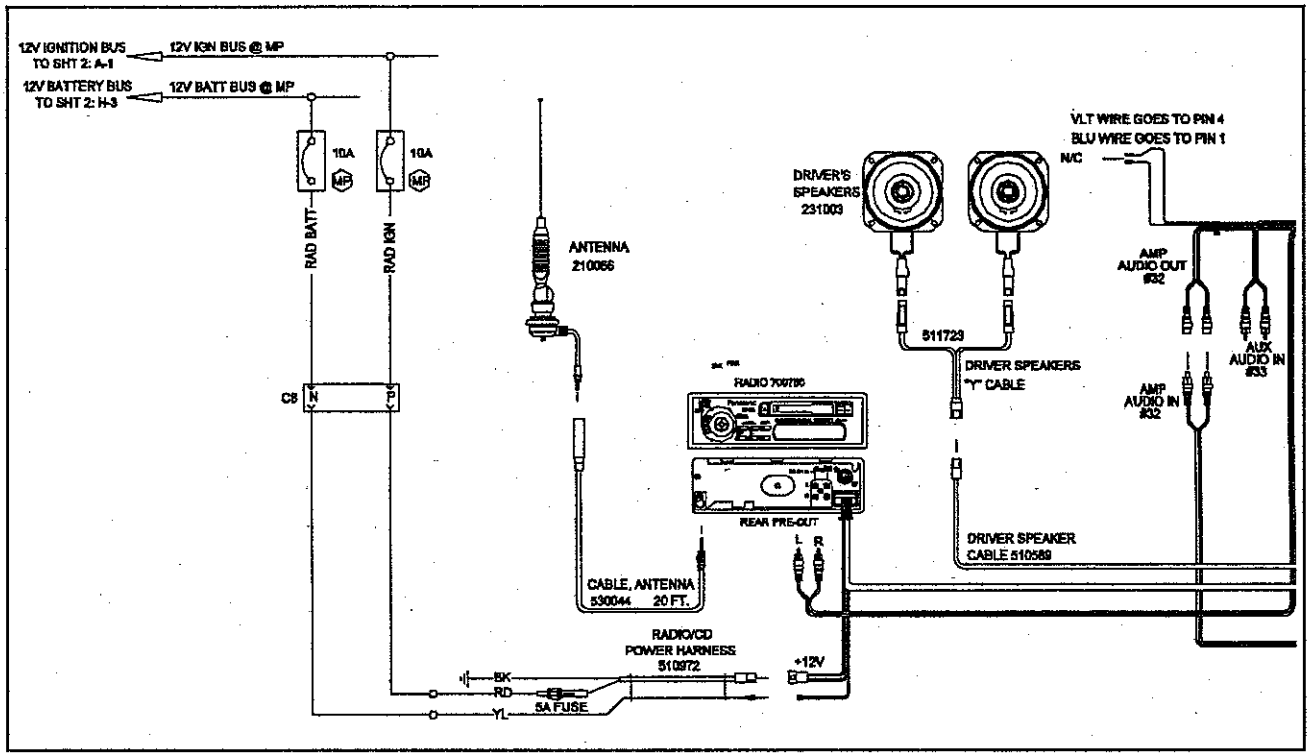
REI System 2000 Wiring Schematic

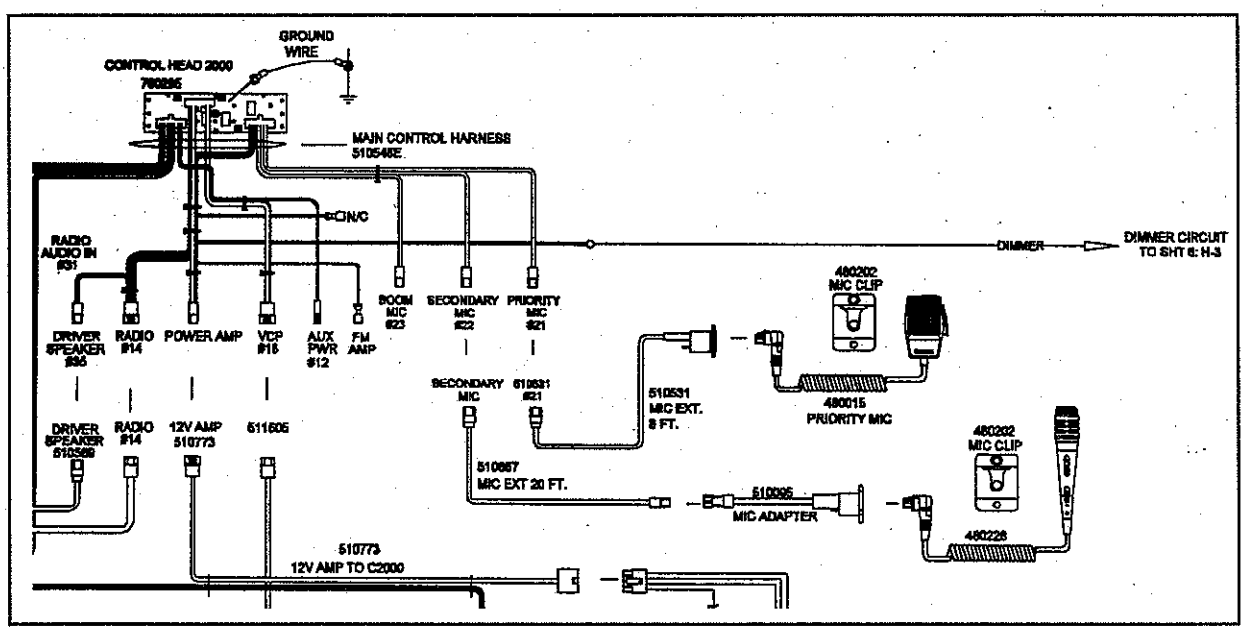
Blue Bird Part No. 0065580



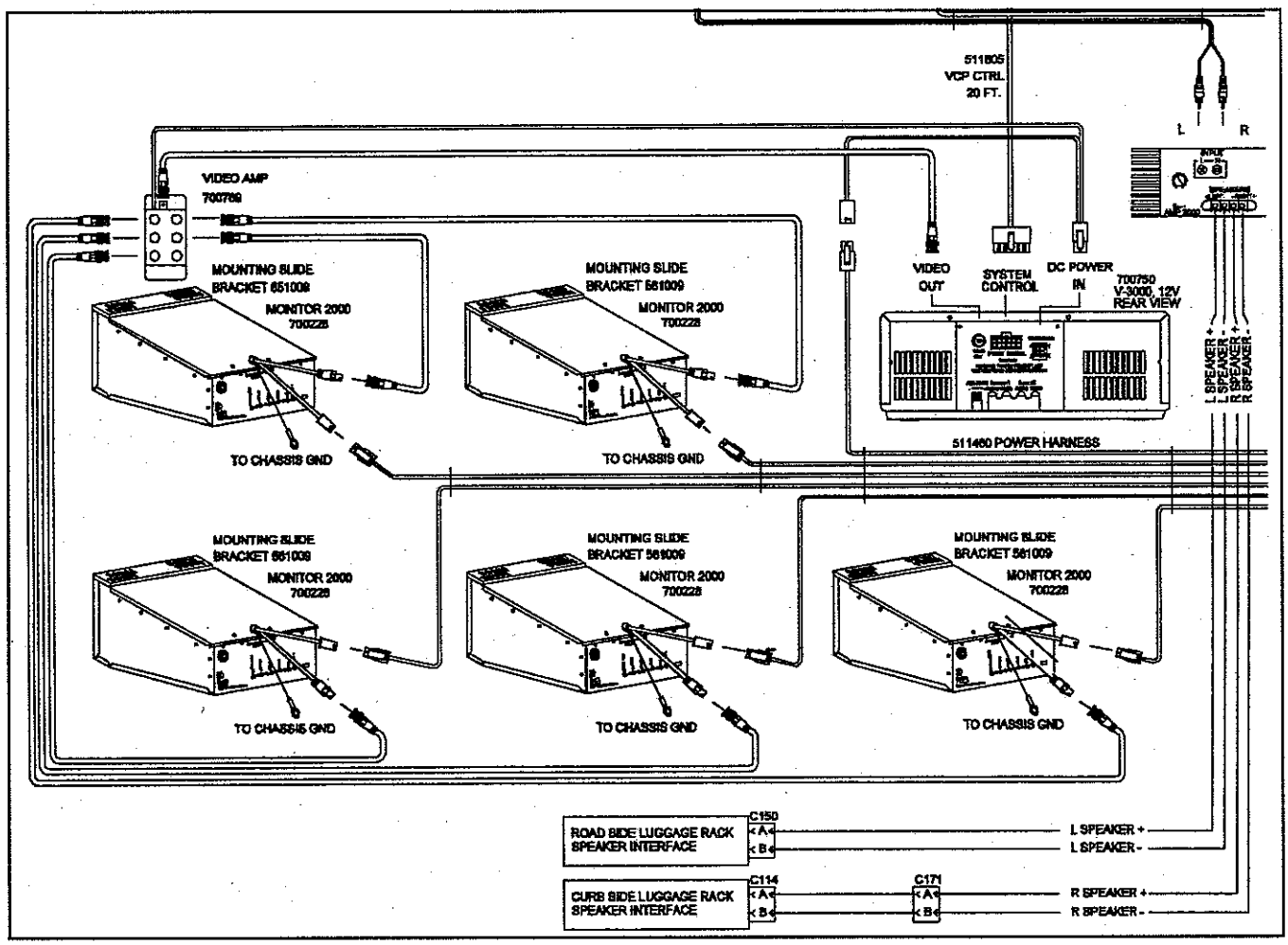
Rev. "-"

Exploded Views of 0065580



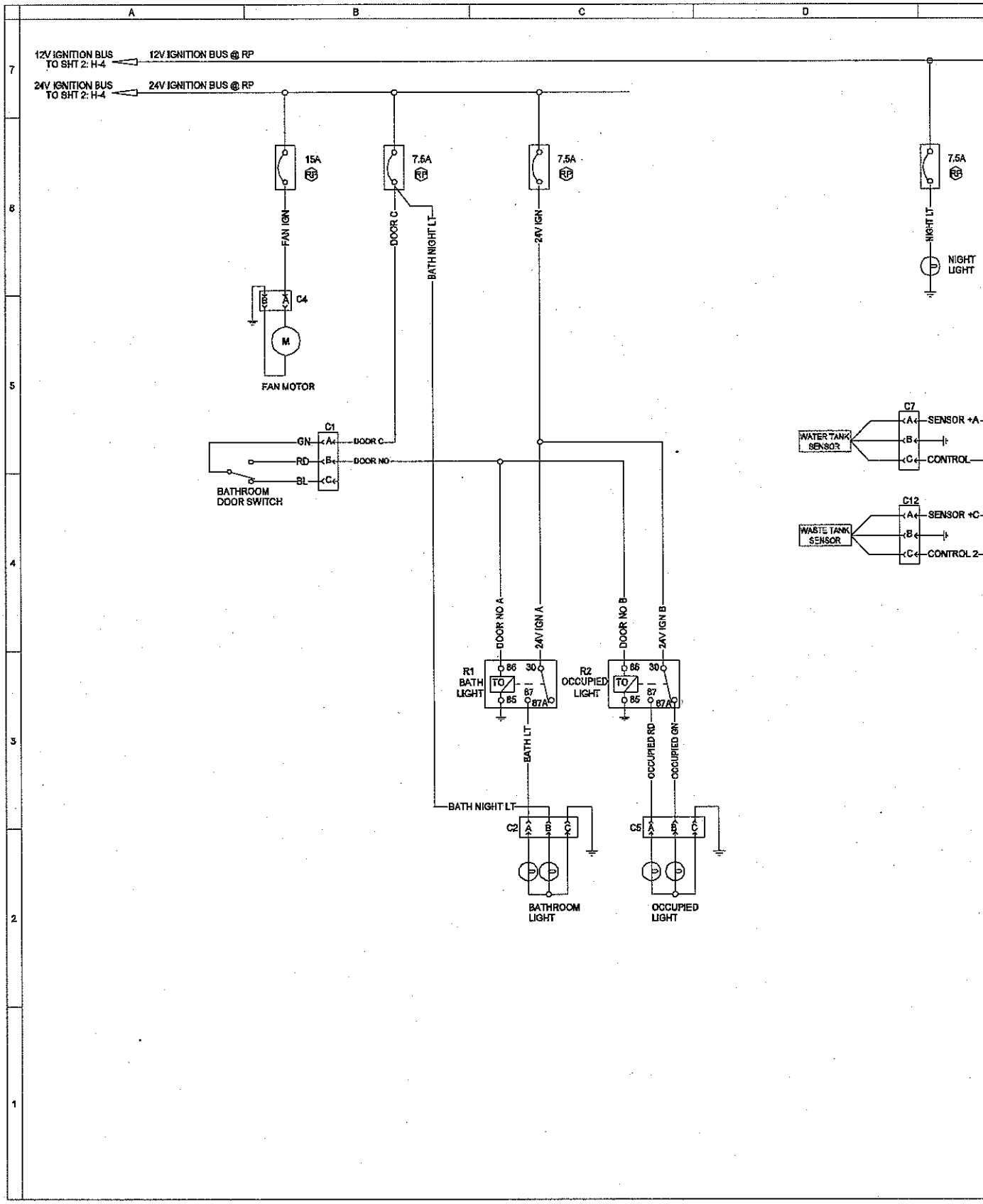


Exploded Views of 0065580 continued



Restroom Wiring Schematic

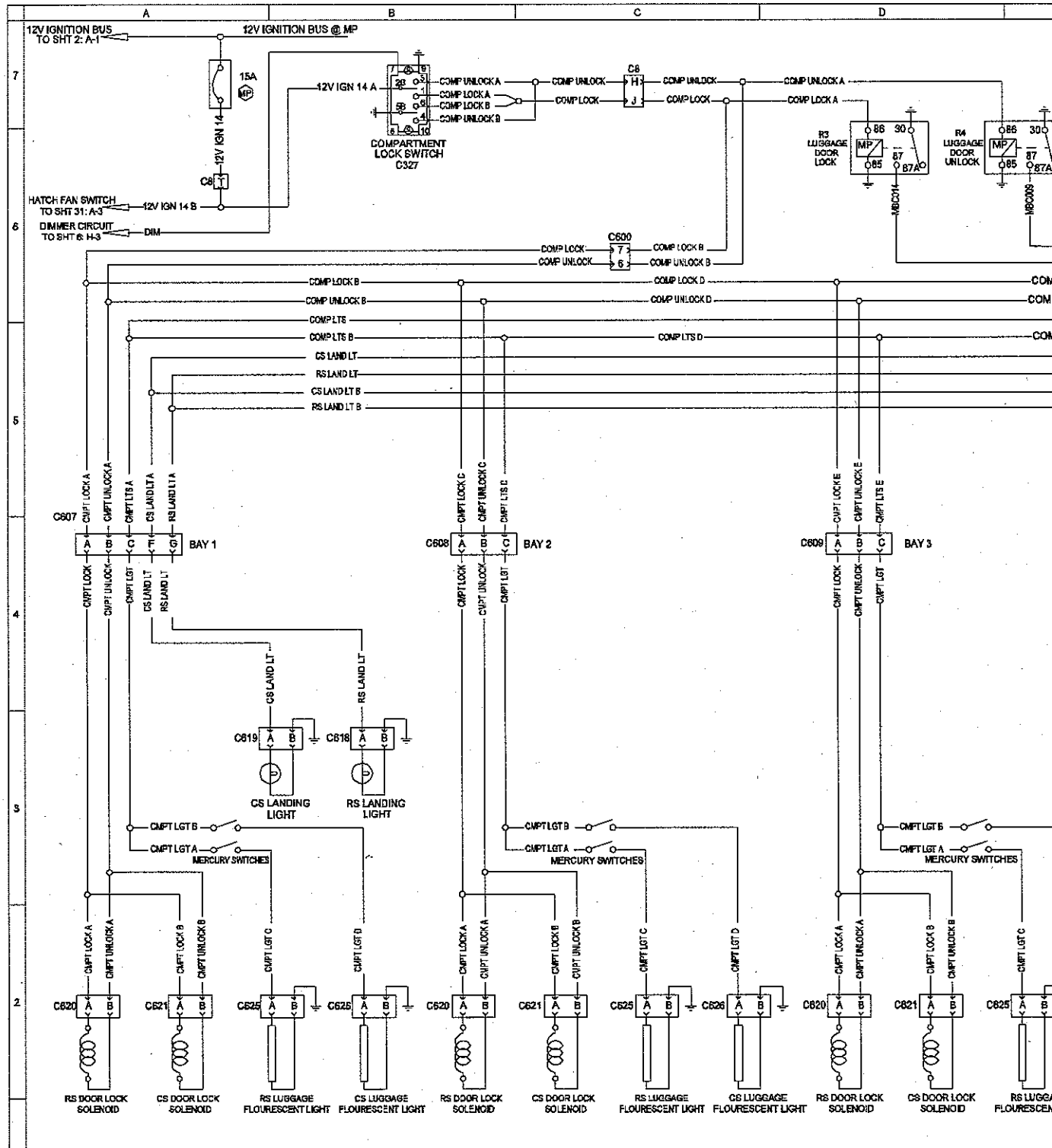
Blue Bird Part No. 0065581



Rev. "-"

Luggage Bay Locks and Lights Wiring Schematic

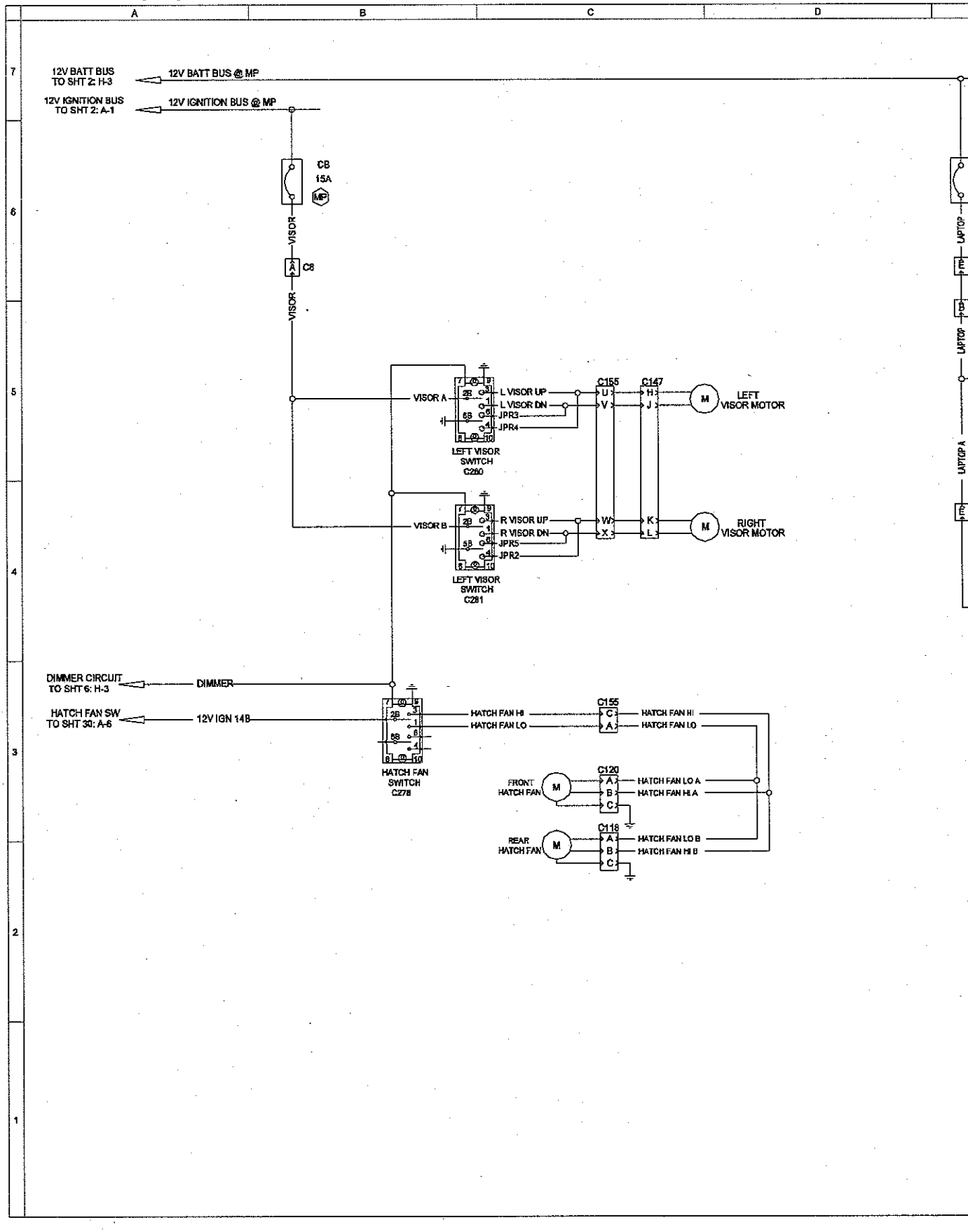
Blue Bird Part No. 0065582



Rev. "-"

Visor and Laptop Hatch Fan Wiring Schematic

Blue Bird Part No. 0065583



Rev. "-"