

# Mini-Bus Multiplex System

## Application Installation and Trouble Shooting Guide

### SYSTEM OVERVIEW

The Mini-Bus Multiplex System is a flexible modular system intended for use in smaller buses with a limited number of electrical loads. A basic system contains a Master Module and a Switch Adapter Module. Additional modules can be added to allow up to sixteen independent loads to be controlled.

The heart of the system is the Master Module which provides the “traffic cop” and power distribution functions of the system. It includes fusing for 7 loads and solid-state switching for 4 loads. It also includes a timer to shut off the loads in the event they are inadvertently left on and low voltage detection to prevent the loads from running the battery so low it won't start the engine.

The Switch Adapter Module is always used with the Master to complete a basic system. It connects to the Master Module with three wires. These wires provide bi-directional multiplex signals, power and ground.

Other modules include a Door Control, Auxiliary Heater Fan Control, and Auxiliary Output Modules. All of these modules connect into the system using the same wires as the switch panel.

### MULTIPLEX COMMUNICATIONS

The system communicates between the modules using Intellitec's proprietary multiplex scheme. This particular system uses 16 channels to communicate between modules. Some of these channels are dedicated to basic functions, including the interior lights, auxiliary loads, heater fan control and door control. Other channels can be used for auxiliary functions that may be needed to perform other functions on the bus. (See *channel allocation table on Page 2*) Multiplexing reduces the number of wires for the switches from as many as 48 to 3.

### THE MASTER MODULE

The power from the battery is connected to the Master Module and switched there, eliminating the need for heavy wires at the switches. The Master Module provides automatic features to help manage the battery power on the bus.

The Master Module provides the signal that communicates with all of the modules. It also includes power distribution and fusing for all of the primary system outputs and solid-state switching for two interior lighting circuits and two auxiliary outputs. (See *drawing on Page 4*) Connections are made using Mate-N-Lok connectors.

Fuses for auxiliary outputs 3 thru 8 are located on the auxiliary output modules.

The Master Module contains a timer for the interior lights and a low voltage detector to prevent the interior lighting from running the battery down. If the interior light switches are left on, the interior lights will remain on for up to twenty minutes after the ignition switch is turned off. If the battery is low and ignition is off, the lights will go out in two minutes. This will prevent running the battery down any further. If the lights have been turned off by a timer or low voltage condition, the light switch must be turned off and then on, to recycle the lights for another time period. If the ignition is on, the timer or low voltage detector will not affect the lighting circuits. If the system is equipped with a door module, lighting output 1 will turn on when the door is open. If ignition is off, the lights will turn on for 20 minutes and then go out.

Auxiliary outputs 1 and 2 can be set to turn off by the timer, just as the lighting circuits do or with ignition via a dip switch or jumper setting on the switch adapter. All other auxiliary outputs will automatically turn off when the ignition is off.

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### SWITCH ADAPTER

The Switch Adapter communicates between up to six switches plugged into the Adapter and the Master, Fan Speed, Door Control and Auxiliary Output Modules, via the three wire multiplex cable. In a basic system, including only a Master and Switch Adapter, four switches will perform all the functions of the system. Two of these switches will control the interior lights and two can control two other loads connected to Aux 1 and Aux 2 outputs. The Switch Adapter includes a dip switch to set which group of channels it addresses and system options. A total of 12 switches can be installed using two switch adapters.

### FAN SPEED CONTROL MODULE

The Fan Speed Control Module provides three outputs to switch between the two or three inputs of the heater fan. It communicates with the switch adapter to provide remote switching of the fan speeds. More than one module can be used on a bus, each used to control a fan or water pump. Each module will be controlled from the same switch. Each module will respond to the signal from the switch adapter in the same way.

This module can also be used to operate a hot water booster pump.

### THE DOOR CONTROL MODULE

The Door Control Module provides a number of features to control the door and operate the stepwell light and the interior lighting. To operate the door, the "switch-adapter" mounted switch is flipped to the OPEN position. The door will travel to the end of travel and the controller will sense the motor over-current and shut off the power. The switching of the power is done with a solid-state switch to provide long life. If the door encounters an obstruction, motor current increases and the controller will stop. If the door has been opening, it will stay at that spot until the switch is cycled. If the door has been closing, potentially pinching someone or

something, it will reverse and open fully. To close the door, the switch needs to be cycled.

### AUXILIARY OUTPUT MODULE

The Auxiliary Output Modules communicate with a second Switch Adapter Module (B) over the multiplex wires, to provide three additional output channels per AUX module. This module includes jumpers that set the outputs to respond to channels 3 through 8. This allows the module to be used to power accessory loads, such as destination signs, audio equipment, 2 speed drivers fan, etc.

### CHANNEL ALLOCATION TABLE

<u>Channel</u>	<u>Function</u>		
1	Door 2 Ajar		
2	Door 2 Switch		
3	Aux 6		
4	Aux 5		
5	Aux 4	Controlled by Switch Module B	
6	Aux 3		
7	Aux 7		
8	Aux 8		
9	Door 1 Ajar		
10	Door 1 Switch		
11	Aux 2		Controlled by Switch Module A
12	Aux 1		
13	Lights 2		
14	Lights 1		
15	Fan Selection		
16	Fan Selection		

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### MASTER MODULE

Part No. 00-00778-000

### SPECIFICATIONS

#### MAXIMUM CURRENT

<u>Circuit Name</u>	<u>Fuse</u>	<u>Function</u>	<u>Multiplex Channel</u>	<u>Conn</u>	<u>Fuse</u>
Lighting Output 1	10 A	Switched	14	J1-1	F4
Lighting Output 2	10 A	Switched	13	J1-2	F3
Aux Output 1	10 A	Switched	12	J1-3	F2
Aux Output 2	10 A	Switched	11	J1-4	F1
Aux Heater	15 A	Constant		J6-1	F7
Door 1	20 A	Constant		J4-1	F5
Door 2	20 A	Constant		J5-1	F6
Switch Adapters	1 A	Constant		J7-1	F8

Temperature:	-40 C to 85 C ambient
Operating Voltage:	10.0 - 16.5 VDC
Over Voltage Protection:	24 VDC for 1 minute +150 V for 150 milliseconds - 300 V

### INSTALLATION

Select a weather protected location for the Master Module that will allow for easy replacement of the fuses for service and also allow easy connections to both the battery input and the loads. The location should also provide some amount of ventilation to provide cooling for the module. Mount the module with four, #8 screws through the holes in the cover.

Connect the battery cable to the 1/4" bolt on the top of the module using wire capable of safely carrying all the power to be distributed from this module (*typically # 4 gauge*). Be sure the lock washer is used and the nut is tight. Connect the two wire cable J2, that brings an ignition signal to the module and ground to the module. The ground connection is carrying module current that will not exceed 0.1 A. This completes the power connections to the module. The remainder of the connections are to feed the loads connected to the system.

Connect the three wire cable from the Switch Adapter to J7. Connect the wires to feed the loads to the remaining connectors.

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### J1 Main Lighting Outputs

Mating Connector - AMP 1-480702-0  
 J1-1 Lighting Output 1  
 J1-2 Lighting Output 2  
 J1-3 Aux Output 1  
 J1-4 Aux Output 2

### J2 Ignition and Ground

Mating Connector - AMP 1-480698-0  
 J2-1 Ignition Input  
 J2-2 Chassis Ground

### J3 Aux Output

Mating Connector - AMP 1-480700-0  
 J3-1 No Connection  
 J3-2 IPX Signal  
 J3-3 Signal Ground

### J4 Door 1

Mating Connector - AMP 1-480700-0  
 J4-1 +12 V out (F5)  
 J4-2 IPX Signal  
 J4-3 Signal Ground

### J5 Door 2

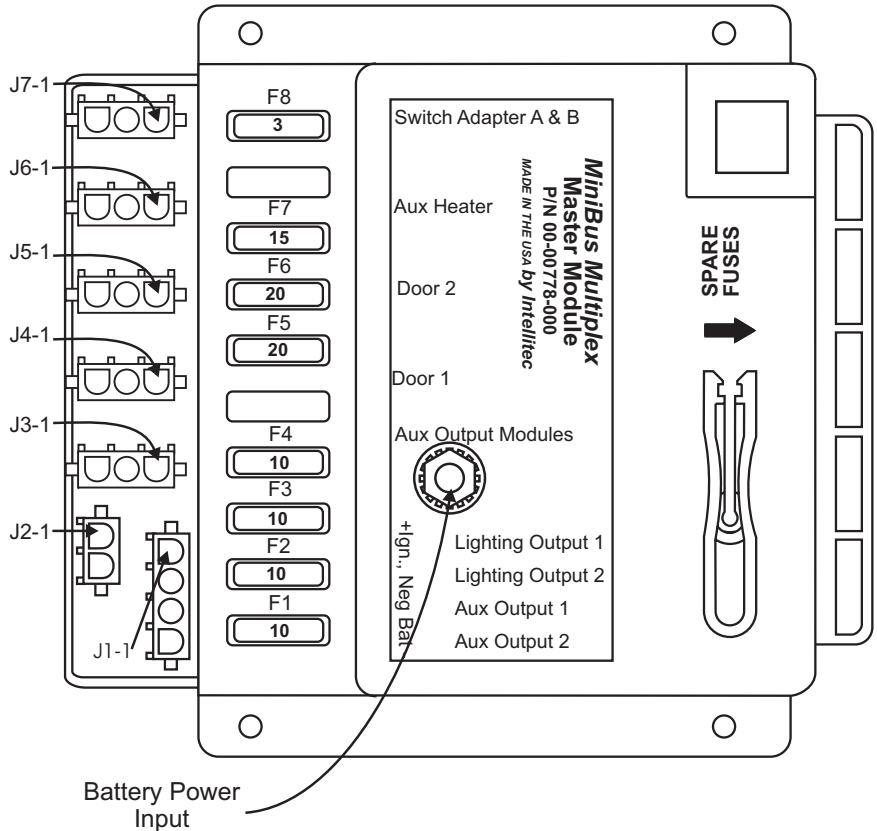
Mating Connector - AMP 1-480700-0  
 J5-1 +12 V out (F6)  
 J5-2 IPX Signal  
 J5-3 Signal Ground

### J6 Aux Heater

Mating Connector - AMP 1-480700-0  
 J6-1 +12 V out (F7)  
 J6-2 IPX Signal  
 J6-3 Signal Ground

### J7 Switch Adapter

Mating Connector - AMP 1-480700-0  
 J7-1 +12 V out (F8)  
 J7-2 IPX Signal  
 J7-3 Signal Ground



### AMP CONTACTS

14-18 AWG	10-12 AWG
350919-3	640310.3

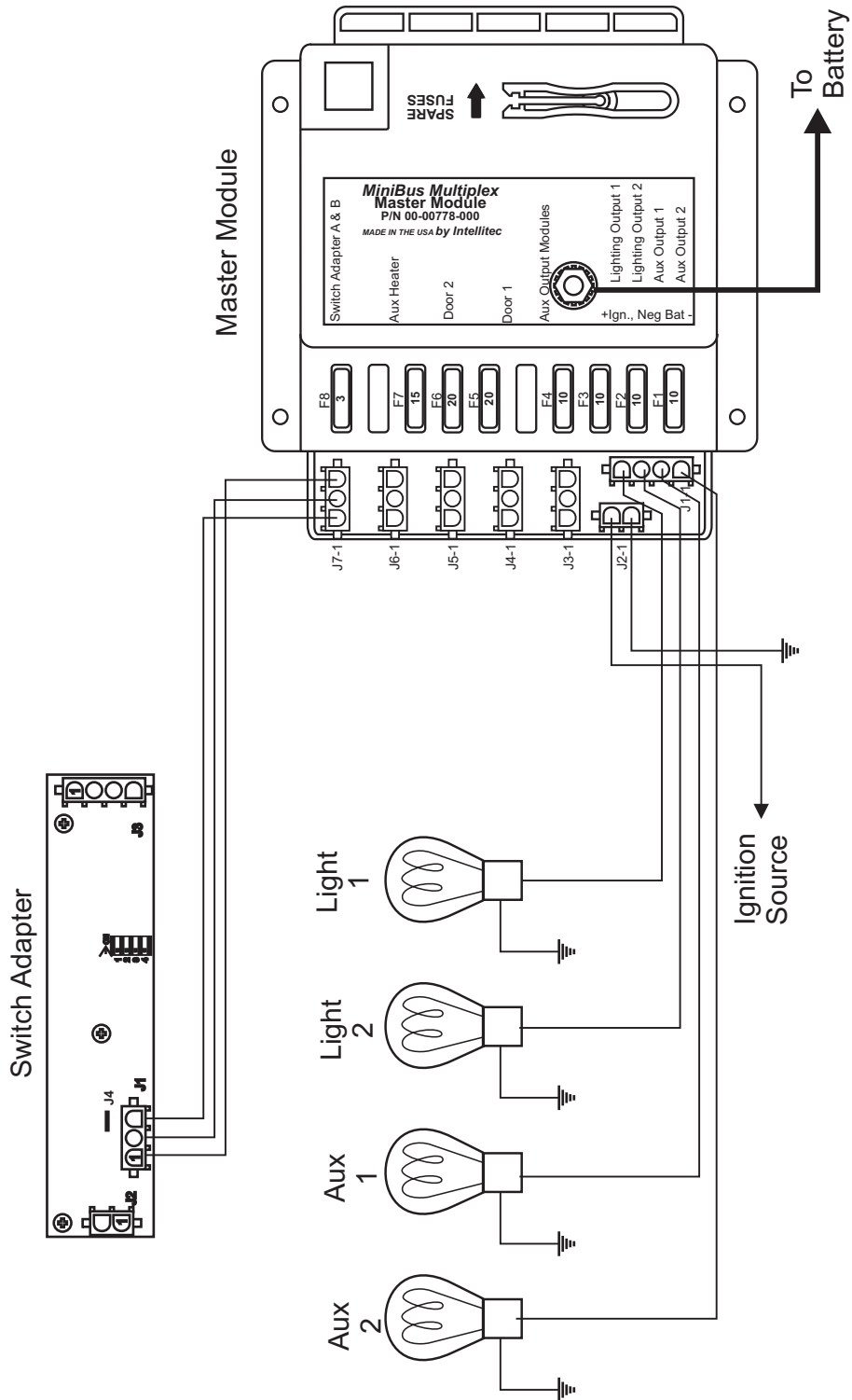
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### BASIC SYSTEM WIRING DIAGRAM



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### AUXILIARY HEATER FAN CONTROL

Part No. 00-00771-000

#### SPECIFICATIONS

#### MAXIMUM CURRENT

<u>Circuit Name</u>	<u>Max Current</u>	<u>Function</u>	<u>Channel</u>	<u>Conn</u>
Output C	10 A	No Conn.		J2-1
Output B	10 A	Switched	15 & 16	J2-2
Output A	10 A	Switched	15	J2-3
		Switched	16	J2-4

Temperature:	-40 C to 85 C ambient
Operating Voltage:	10.0 - 16.5 VDC
Over Voltage Protection:	24 VDC for 1 minute +150 V for 150 milliseconds - 300 V

The Auxiliary Heater Fan Control can be used to operate a two or three speed fan. It provides three 12 volt independent outputs to select the speed of the fan. If the fan is a two speed unit, a three position rocker switch can be installed in the Switch Adapter to select between the two speeds and off. Using this switch, the fan should be connected to Outputs A & B. If a three speed fan is used, a four position rotary switch will have to be connected to the 4 pin Mate-N-Lok on the Switch Adapter. This will allow the selection of three speeds. If the Switch Adapter sends a signal out on Channel 16, Output A will supply power. If the Switch Adapter sends a signal out on Channel 15, Output B will supply power. If the Switch Adapter sends signals out on Channels 15 & 16 simultaneously, Output C will supply power.

#### MULTIPLE HEATER APPLICATIONS

Multiple Auxiliary Heater Fan Controls can be used in applications that require more than one heater fan. Each controller should have "Signal" and "Signal Ground" (J1 -2 and J1-3) connections from the Master Module. Power to each Controller should be supplied from a separate fused source. Each fan will respond to the signal from the Switch Adapter in the same way. (See page 27 for wiring diagrams)

#### BOOSTER PUMP AND OR HEAT VALVE APPLICATIONS

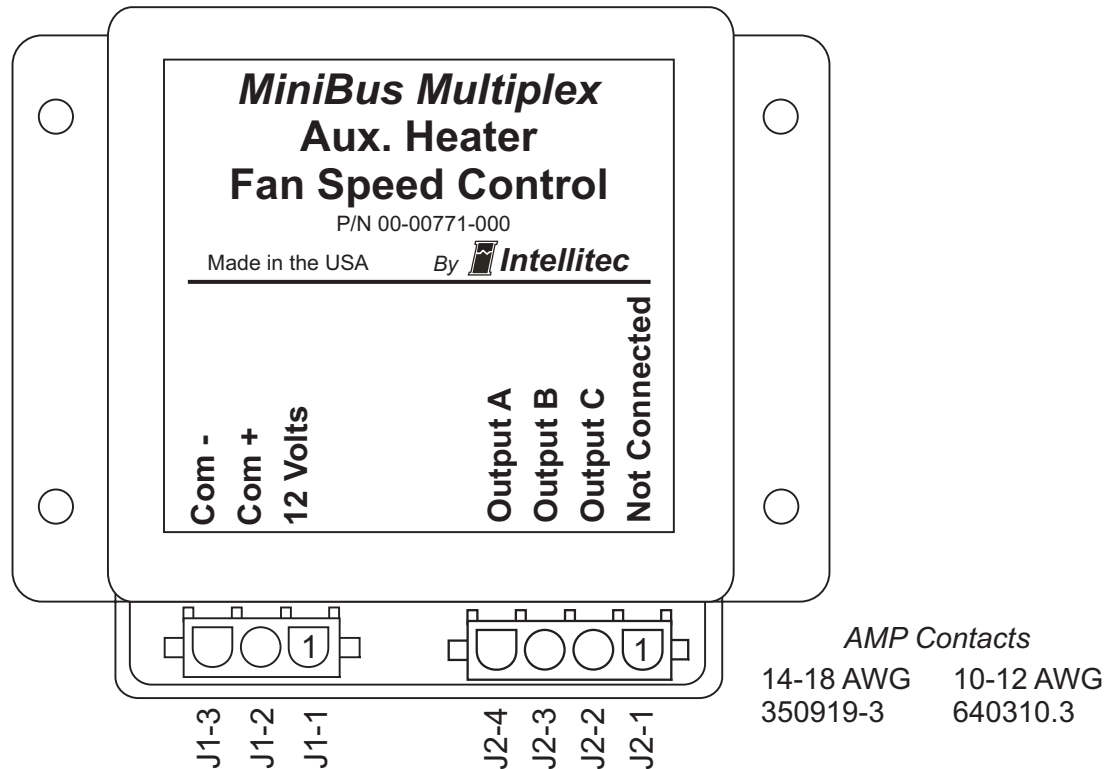
The outputs A, B, and C can be tied together in parallel to operate a circulating pump or heat valve that will operate at any speed of the fan. If using the 00-00853 or 00-00862 switch adapter, you will find a tab terminal connection on the switch adapter. This connection provides a 0.4A output that can also be used to run a heat solenoid valve when the heater fan switch is in the "on" position.

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### J1 Inputs

Mating Connector - AMP 1-480700-0  
J1-1 +12 Volts Input Power  
J1-2 Multiplex Signal  
J1-3 Multiplex Signal Ground

### J2 Outputs

Mating Connector - AMP 1-480702-0  
J2- 1 No Connection  
J2-2 High Speed for 3 speed fan, *not used for 2 speed fan*  
J2-3 Med Speed for 3 speed fan, *High for 2 speed fan*  
J2-4 Low Speed

## **INSTALLATION**

Select a location for the Auxiliary Heater Fan Control that will minimize the heavy wiring, allow access for servicing and some amount of ventilation. Typically, it will mount near the heater. Mount the module with four #8 screws through the holes in the cover. Plug the power wires from the fan motor into J2. Ground the fan motor.

Connect a three wire cable from J6 on the Master Module to J1 on the Aux. Heater Module. The wire connecting pin 1 will carry the fan current and must be sized to safely carry the current of the fan.

If the control is to be used to operate a circulating pump, outputs from J2-2, J2-3, and J2-4 should be connected together to feed power to the pump.

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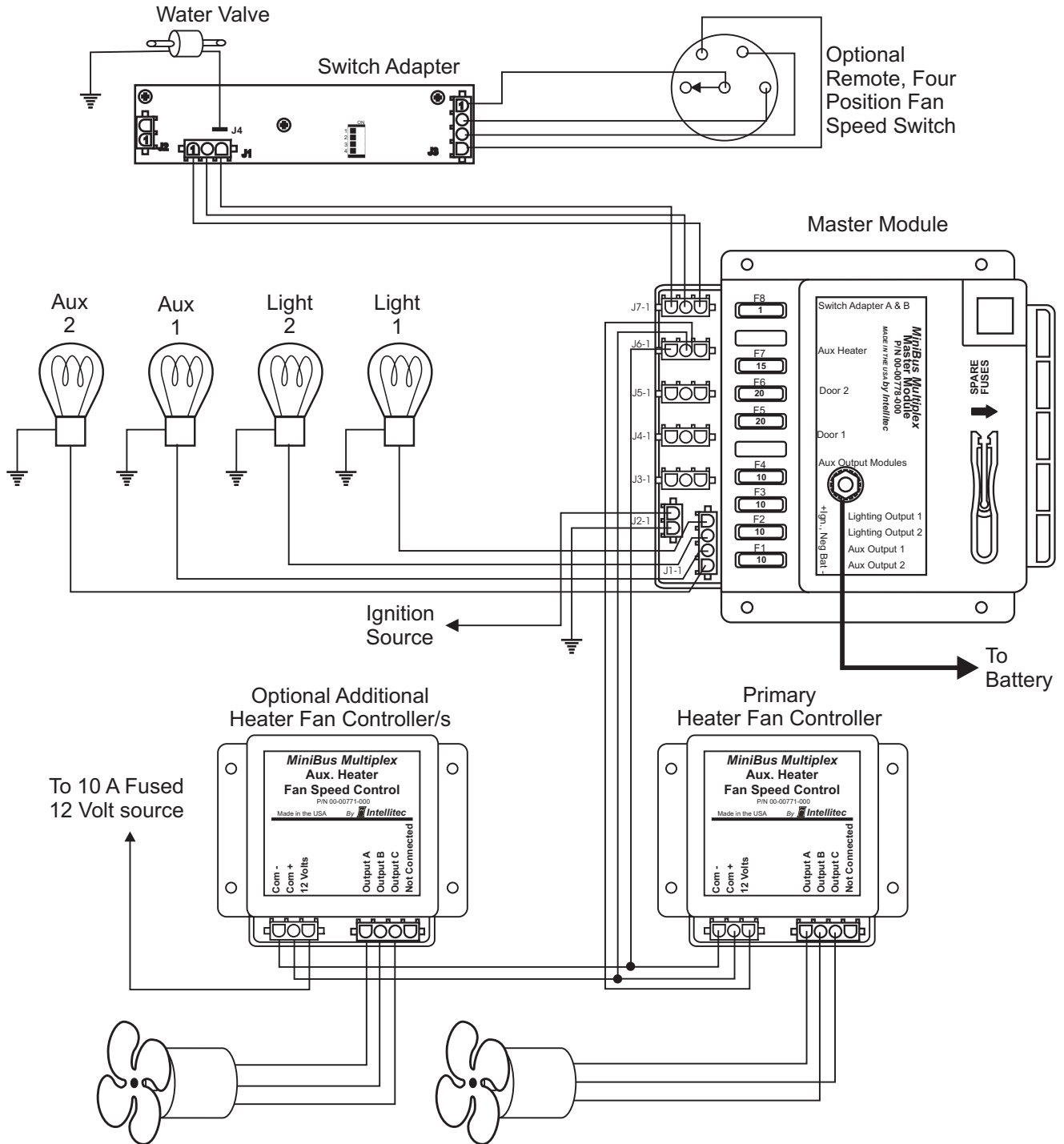
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### SYSTEM WIRING DIAGRAM with FAN CONTROL MODULE



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### DOOR MODULE

The Door Module provides solid-state switching and logic control for an electrically operated door motor. Solid-state switching eliminates failures from burned relay contacts. (Relays are used for direction control, but do not switch the current.) *Contact Intellitec for information on the use of this controller for pneumatically operated doors.*

The module controls the door, interior lights and the step-well light, as well as providing for an external key switch and sensitive edge input. Two or more door modules may be used per system. The module may be configured as an "A" or "B" module by a jumper setting. Each module that has its jumper set in position "A", will be operated by the door switch located on switch adapter "A". Each module that has its jumper set in position "B" will be operated by the door switch on switch adapter "B". A vehicle may use as many door modules as required. This module may also be used as a stand-alone device.

When the door module receives a signal from the switch adapter, or key switch to open the door, it will start the door motor. Simultaneously, a timer is started that limits the time the motor will run. The module will sense end of travel or an obstruction, when the motor stalls. When the stall current reaches the adjustable limit, it will shut down the power to the door motor. If the over-current limit is not reached while the timer is running, the timer will turn off the motor. This will protect the motor, should the over-current limit be set incorrectly.

The over-current shut down eliminates the need for a door open limit switch and provides the additional function of stopping the door should it encounter an obstruction (such as a curb, or sign).

### SIMULATED SENSITIVE EDGE

If while the door is closing, the module senses stall current (a door obstruction) and the "door closed" switch has not been activated, the door will open. This feature simulates a sensitive edge on the door. When the obstruction has been cleared, the

Operator must operate the switch again to close the door. The "door closed" switch adjustment is non-critical and only needs to be set within the last few inches of travel.

### SENSITIVE EDGE

In the event that the door has a sensitive edge switch, the module contains an input connection for the switch. When the sensitive edge switch is operated, the door will behave as described in the paragraph above.

### EXTERIOR KEY SWITCH

The door module has an input connection for a SPST switch, which can also be used to open and close the door. A key switch that allows removal of the key in either position should be used. This input may also be used if the module is used outside the Mini-Bus system. Motor current does not flow through the key switch contacts.

### DOOR MODULE LIGHT FUNCTIONS

When the door module receives a signal to open the door, the step well light output located on the door module, interior lighting circuit and door ajar light, will turn on. The interior lights will remain on, as long as the door is open and ignition is on. The step well light will turn off after approximately 20 minutes.

When the door closes, the step well light will turn off after a 10-second delay. If the door is left open and ignition is off, the interior lights will turn off after 20 minutes. The step well lights will remain on, unless the battery goes low. If the battery voltage drops to a predetermined level, these lights will go out to prevent running the battery down further, leaving it strong enough to start the engine.

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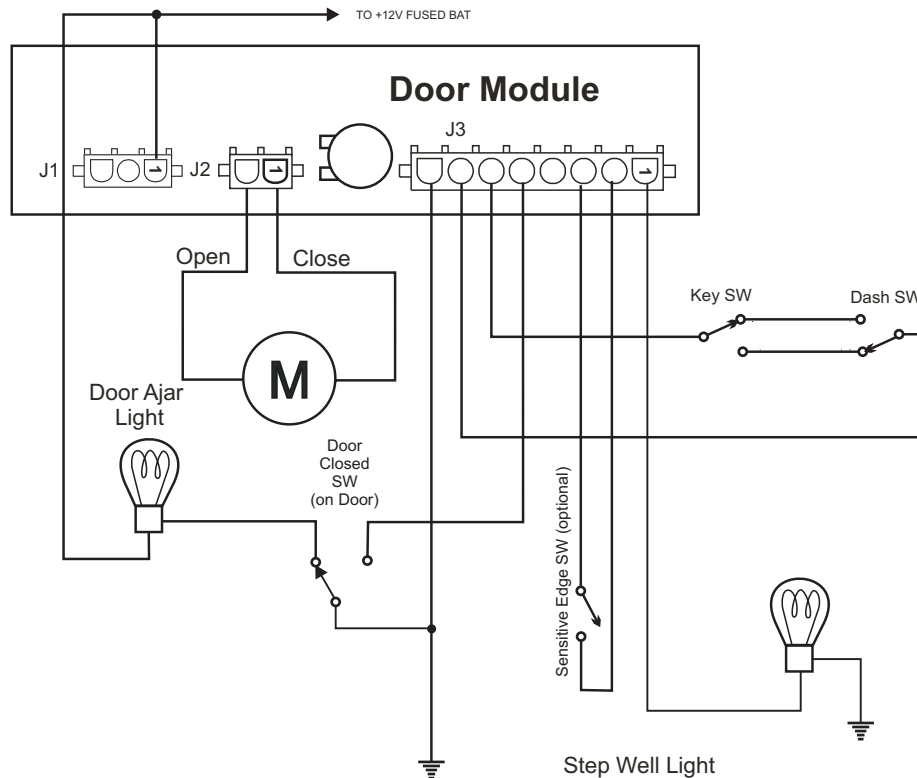
### SIGNAL LIGHT

When the door is open, the module sends a signal back to the respective switch panel to light an indicator for the driver. If the door experiences an obstruction and does not close, the light will indicate this to the driver.

### SENSITIVE EDGE CURRENT THRESHOLD ADJUSTMENT

Once the Door Module has been installed, the current threshold may have to be adjusted to suit the particular installation. To do this, the door system must be fully installed and operational. Start with the control adjusted to minimum current setting (fully counter-clockwise). Operate the door to close it. The door will probably not fully close before the controller will turn it off. If this is the case, turn the control 1/8 of a turn and repeat the open and close cycle to check the operation. Once the door operates fully in both directions, turn the control an additional 1/8 turn. This completes the adjustment. **(WARNING!! DO NOT ADJUST THE CONTROL MORE THAN IS REQUIRED FOR PROPER OPERATION. DOING SO DEFEATS THE SIMULATED SENSITIVE EDGE FEATURE)**

**DOOR MODULE WIRING DIAGRAM**  
(For use independent of MiniBus System ONLY)



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### DOOR CONTROL Part No. 00-00787-000

#### SPECIFICATION

#### MAXIMUM CURRENT

<u>Circuit Name</u>	<u>Max Run Current</u>	<u>Function</u>	<u>Channel</u>	<u>Conn</u>
Output 1	10 A	Switched	15 & 16	J1-2
Output 2	10 A	Switched	15	J1-3

Temperature:	-40 C to 85 C ambient
Operating Voltage:	10.0 - 16.5 VDC
Over Voltage Protection:	24 VDC for 1 minute +150 V for 150 milliseconds - 300 V

#### INSTALLATION

The Door Control Module can be operated with the Multiplex System, or it can operate as a stand-alone control. When used with the Multiplex System, the door control switch should be installed in the Switch Adapter. When used as a stand-alone control, a SPST switch can be used to control the door.

#### MULTIPLEX SYSTEM INSTALLATION

Mount the module in the compartment of the door motor, or another suitable location. Connect +12 volt power to J1-1. This should be from a fused source, such as the Minibus Master, capable of powering the door motor. Connect the Communications wires to J1-2 and J1-3, observing polarity from the Master Module. Connect the two door motor leads to J2-1 & 2. Be sure the connections are as shown with the lead connected to J2-1, which should be +12 V to close the door and the lead connected to J2-2, which should be +12 V to open the door. Continue the wiring by connecting a power ground to J3-8.

A "door closed" switch is connected to J3-4 & 5. The position of this switch is not critical, but the contacts need to close just prior to the door reaching a fully closed position. This switch will only carry signal currents and can be either mechanical or magnetic. This switch is used to "tell" the control the position of the door when an over load is sensed. (Door obstruction) When the control senses an over load, if the door limit switch is in the CLOSED position, the controller "knows" that the door is closed. If the control senses an over load before the door switch is closed, the control thinks the door has hit an obstruction and reverses the direction of the door.

A SPST key switch, that can have the key removed in either position, can be installed next to the entry door. This switch is used to operate the door from the outside of the bus. This switch only carries signal current. Motor current does not flow through the key switch.

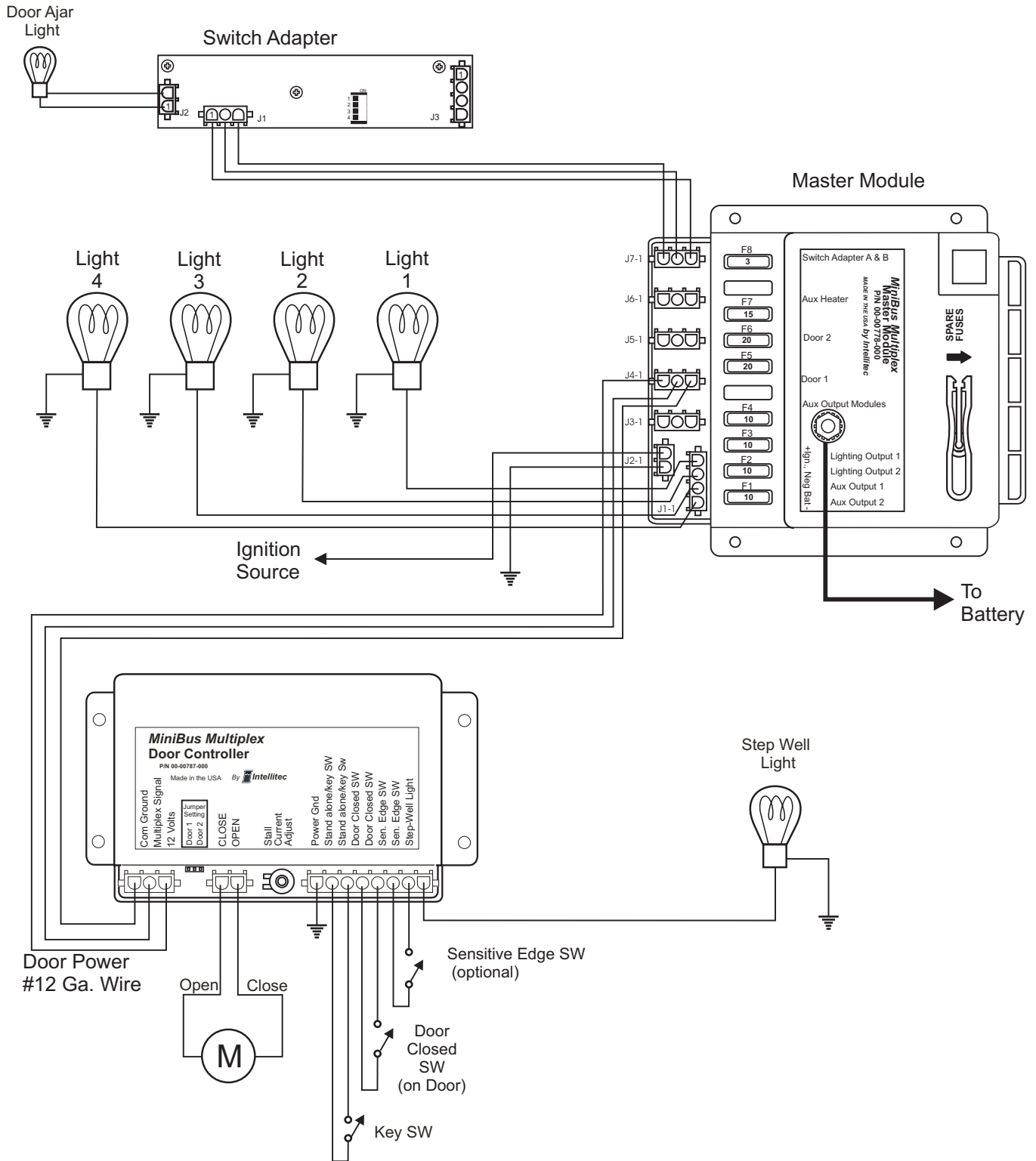
If the door is equipped with a sensitive edge switch, it should be connected to the control to provide that input. If the sensitive edge switch is closed, the door will behave in the same manner as the simulated sensitive edge.

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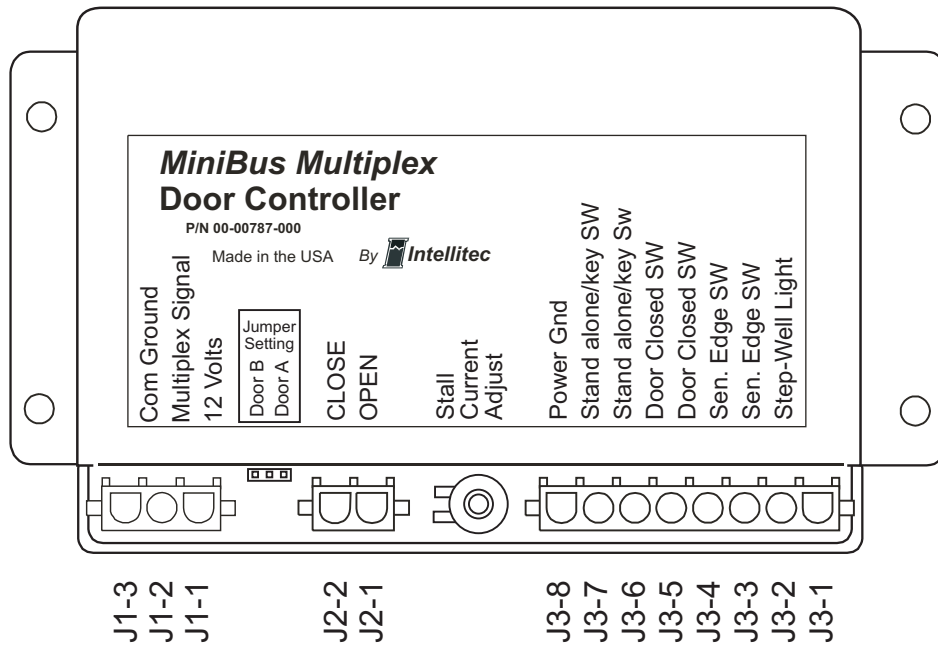


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### CONNECTIONS

#### J1 Input

Mating Connector - AMP 1-480700-0

- J1-1 +12 V Input (door power)
- J1-2 IPX Signal
- J1-3 Signal Ground

#### J2 Motor

Mating Connector - AMP 1-480698-0

- J2-1 Motor (+12 V for Close)
- J2-2 Motor (+12 V for Open)

#### J3 Switches & Light

Mating Connector - AMP 640586-1

- J3-1 Step-Well Light
- J3-2 Sensitive Edge Switch Gnd
- J3-3 Sensitive Edge Switch
- J3-4 Door Closed Switch Gnd
- J3-5 Door Closed Switch
- J3-6 Stand-Alone/Key Switch Gnd
- J3-7 Stand-Alone/Key Switch
- J3-8 Power Gnd

#### Jumper Settings - JP1

- Door A 2-3
- Door B 1-2

#### AMP Contacts

- |           |           |
|-----------|-----------|
| 14-18 AWG | 10-12 AWG |
| 350919-3  | 640310.3  |

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### SWITCH ADAPTER

Part No. 00-00853-000 & 00-00862-000

The Switch Adapter is designed to be used with Carling *Contura II* Series Switches. A total of six switches can be used in each Switch Adapter. The 853 switch adapter arranges the 6 switches on 1.00 inch centers. The 862 adapter arranges the switches on 1.03 inch centers and will fit Carling "mounting panels.

When using the adapter with a door module, Lighting output 1 will turn on when the door is open. Lighting circuit 2 will remain off.

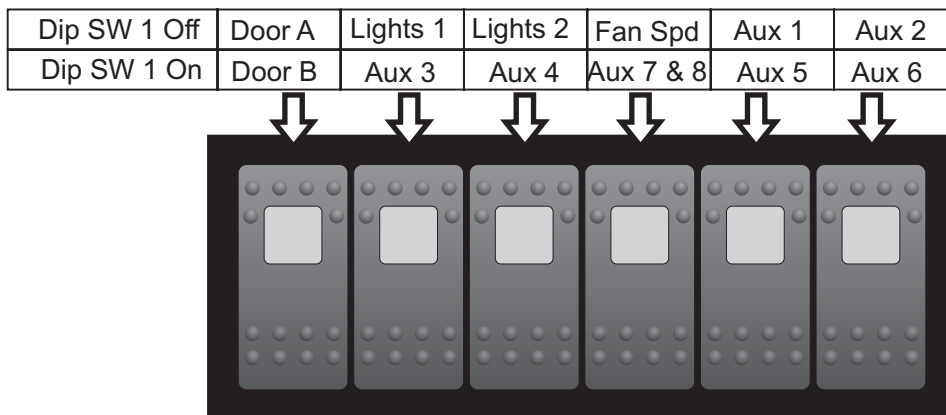
Four of the switches on the adapter are used to control loads such as lighting, wheel chair power and destination signs. One switch is used to operate one or more doors and a 3-position switch is used to control a two speed fan.

The Switch Adapter communicates with the various modules in the system and gives the driver control of all the functions. Two switch adapters with as many as 12 switches can be connected to the minibus system. Multiplexing allows all 12 switches to communicate over the same wire. The switches do not carry the actual load current, they simply provide an electronic signal to the Master.

The adapter includes a 4-position dip switch allowing the adapter to be configured in different ways. The dip switch is located on the rear board of the Adapter. (See the diagram). Dip switch position one is set to determine which door module and which outputs will respond to the switches. To make the door switch operate Door module A, set dip switch one to the OFF position. To make the door switch operate Door module B, set dip switch one to the ON position. Dip switch one also sets the group of channels that the adapter will "transmit" on. When the switch is set in the ON position it will send on channels 3 through 8 to turn on the 6 outputs of the Auxiliary Output Modules and door module B. When dip switch one is set to the OFF position, it will send on channels 11 through 16 to turn on lighting 1 and 2 circuits, Aux 1 and Aux 2 on the Master Module, operate the Fan Speed Module, and Door Module A.

Dip switch 2 is used to determine if the door switch will work when ignition is Off. When dip switch two is set to the on position, the door switch is always active whether ignition is on or not. When set to the off position, the door switch will only work when ignition is on.

Dip switch three and four are set to make the Aux 1 and Aux 2 outputs go off with the ignition, or stay "hot" for up to 20 minutes after the ignition is turned off. (If the Aux 1 or Aux 2 rocker switch is left on when ignition is turned off.) See the following and the next page for dip switch settings.



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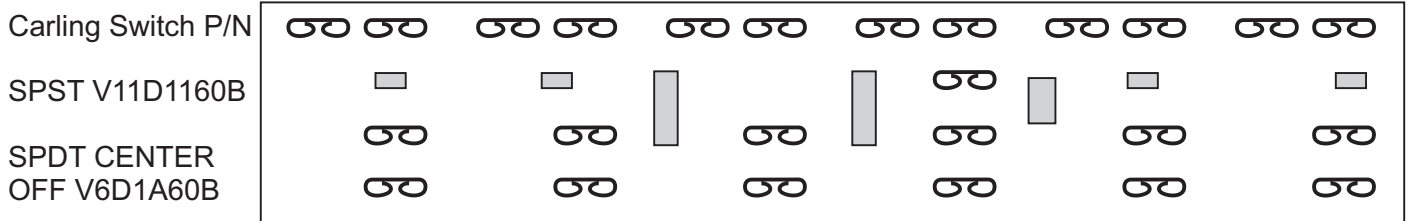
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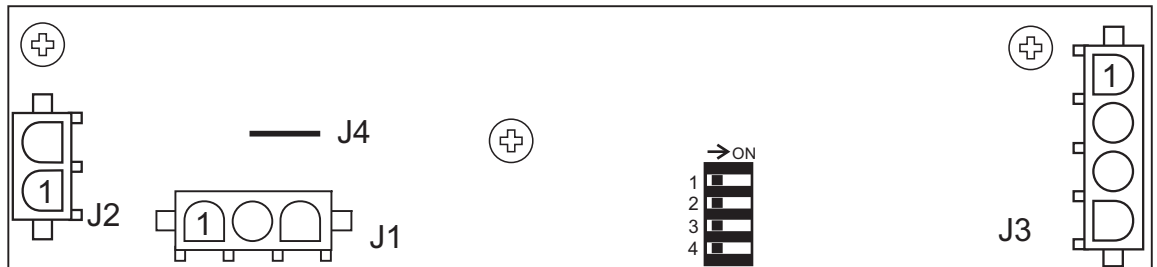
### SWITCH ADAPTER (continued)

To configure switches set dip switch position 1 as follows:

Dip Sw 1 OFF	Door A	Lights 1	Lights 2	Fan Spd	Aux 1	Aux 2
Dip Sw 1 ON	Door B	Aux 3	Aux 4	Aux 7 & 8	Aux 5	Aux 6



Switches may be plugged directly into the adapter. If a different switch pattern is desired, wire leads, using a male and female tab terminal, may run between the adapter and the switches.



### CONNECTIONS

#### J1 Mating Connector - AMP 1-480700-0

- J1-1 Ign sig From Master
- J1-2 Signal + From master
- J1-3 Signal - From Master

#### J2 Mating Connector - AMP 1-480698-0

- J2-1 Door Ajar Light
- J2-1 Door Ajar Light

#### J3 Mating Connector - AMP 1-480702-0

- Controls 3 speed Aux heater fan
- J3-1 Common Switch
- J3-2 Low Speed Switch
- J3-3 Medium Speed Switch
- J3-4 High Speed Switch

#### AMP Contacts

- J4 .250 Tab Terminal 350919-3 14-18 AWG 640310.3 10-12 AWG
- Controls Heater valve 400ma Max

### DIP SWITCH SETTINGS

Position      Function

#### DIP SW1 - Door/channel select

- OFF Door A,L1,L2,Aux 1,Aux2, Heater fan
- ON Door B, Aux 3,4,5,6,7/8

#### DIP SW 2

- OFF Door switch works only with ignition ON
- ON Door switch is always active

#### DIP SW 3 -Aux 2 (If rocker switch is left on)

- OFF Aux 2 output will turn off with ignition"
- ON Aux 2 output Off 20 min after ign off

#### DIP SW 4 -Aux 1 (If rocker switch is left on)

- OFF Aux 1 output will turn off with ignition"
- ON Aux 1 output off 20 min after ign. Off

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### INPUT MODULES

Part Nos.

00-00813-000 "A" Module

00-00813-100 "B" Module

The Input Modules are designed to be used as input "ports" to the system. They can be used with any variety of switches and are an alternative to the switch adapter. Intellitec can provide harnesses to interface with certain popular brands of panel switches to ease installation. (See the following pages for harnesses to work with Carling switches.) The Input Module communicates with the various modules in the system to give the driver full control of all the functions, via the multiplex system. Its functions are similar to the Switch Adapter, but allows more flexibility in the location, installation of switches and accepting of other input signals. For example, you may wish to use an Auxiliary output to operate marker lights when the head lights switch on.

### USE WITH SWITCHES

A total of six switches can be used with each Module. There are two versions of this module; one (00-00813-000) to communicate to the "A" door module, the Master Module, and the main Fan Speed Module. The other (00-00813-100) is to communicate with the "B" door module, Auxiliary Output Modules and/or an optional secondary fan speed module. The "A" module will turn on the lighting circuits and auxiliary 1 and 2 on the Master Module, operate the Fan Speed Module and the Door A Control Module. The "B" module will turn on Auxiliary outputs 3, 4, 5, 6, 7, and 8 on the aux output modules and the B door module, if switches are used.

The Input Module includes two jumpers that allow the Module to be used in a number of different ways. The jumpers are located on the edge of the Module, between plugs J6 and J7 (See diagram). The jumper closest to J6 is JP5. The jumper closest to J7 is JP6. These jumpers can be set to have the Aux 1 and Aux 2 outputs go off with the ignition, or stay "hot" for up to 20 minutes after the ignition is turned off. Setting the jumpers closest to the module cover will cause the loads to respond to the ignition. Setting them toward the edge of the module will cause them to stay "hot" for 20 minutes after the ignition is turned off.

**Care should be taken when setting these jumpers to be sure they are over the two pins and seated, so they will not become intermittent.**

### USE WITH ELECTRICAL INPUTS

The Input Module can also be used to accept a positive switched signal from any 12 volt source; such as a head light, brake signal, or other +12V chassis circuit and use that input to switch power from an output on the Master Module or an Auxiliary Output Module. To do this, the input signal from the switched source is connected to one of the inputs on the module through the input plugs, J1 through J6.

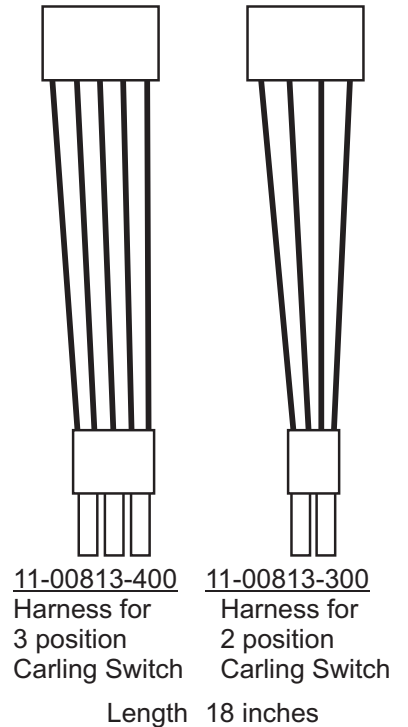
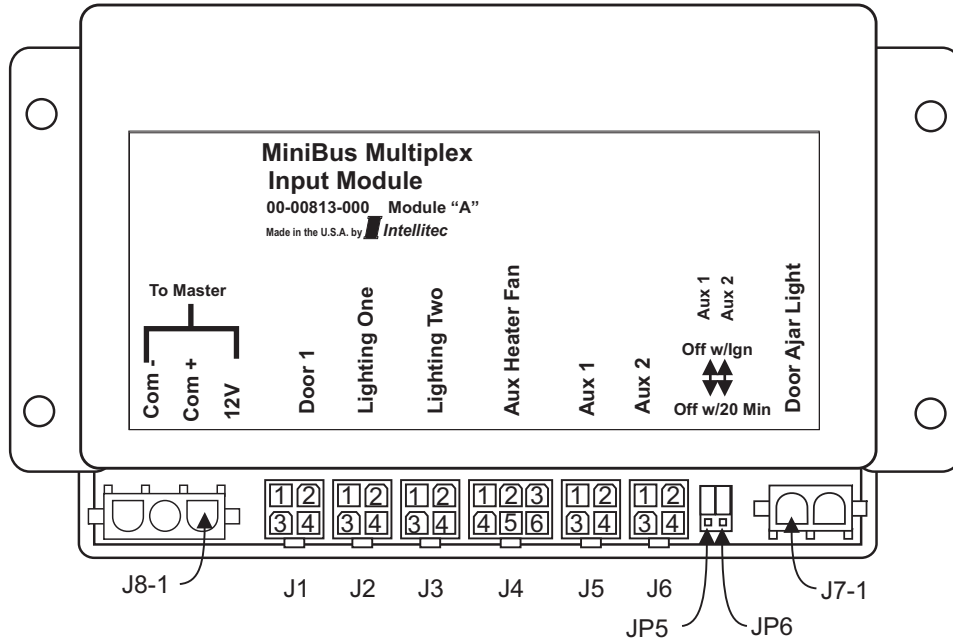
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# Mini-Bus Multiplex System

## Application Installation and Trouble Shooting Guide

### INPUT MODULE "A"



### CONNECTIONS

#### J1 Door Switch

- J1 - 1 Input
- J1 - 2 +12V source
- J1 - 3 Indicator Power Source
- J1 - 4 Indicator Lamp

#### J2 Lights 1

- J2 - 1 Input
- J2 - 2 +12V source
- J2 - 3 Indicator Power Source
- J2 - 4 Indicator Lamp

#### J3 Lights 2

- J3 - 1 Input
- J3 - 2 +12V source
- J3 - 3 Indicator Power Source
- J3 - 4 Indicator Lamp

#### J4 Fan Speed

- J4 - 1 Common
- J4 - 2 Low Spd/Input 15
- J4 - 3 Med Spd/Input 16
- J4 - 4 High Spd/Inputs 15&16
- J4 - 5 Indicator Power Source
- J4 - 6 Indicator Lamp

#### J5 Aux Output 1

- J5 - 1 Input
- J5 - 2 +12V source
- J5 - 3 Indicator Power Source
- J5 - 4 Indicator Lamp

#### J6 Aux Output 2

- J6 - 1 Input
- J6 - 2 +12V source
- J6 - 3 Indicator Power Source
- J6 - 4 Indicator Lamp

#### J7 Door Ajar Light 1

- Mating Connector:  
AMP 1-480698-0
- J7 - 1 Indicator Lamp Source
- J7 - 2 Indicator Lamp

#### J8 Input

- Mating Connector:  
AMP 1-480700-0
- J1 - 1 12 V
- J1 - 2 Com Signal +
- J1 - 3 Com -

- 4 pin Mating Connector - Molex WM3701
- 6 pin Mating Connector - Molex WM3702

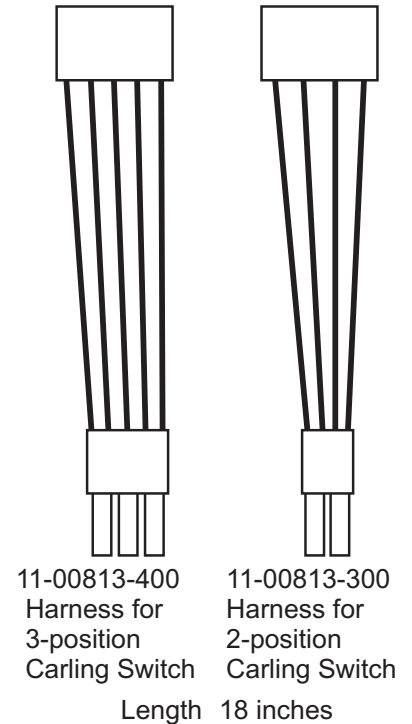
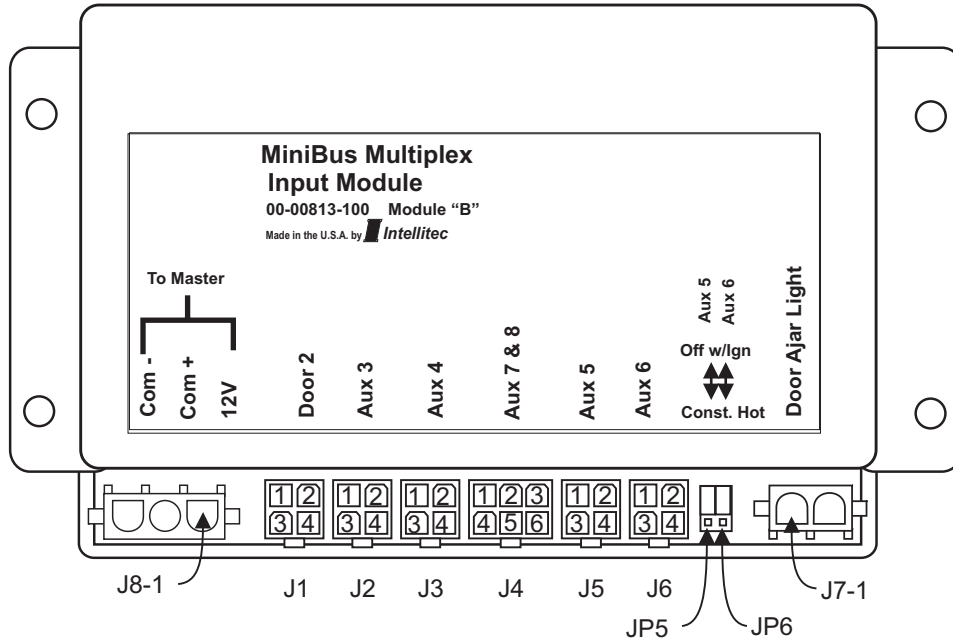
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# Mini-Bus Multiplex System

## Application Installation and Trouble Shooting Guide

### INPUT MODULE "B"



### CONNECTIONS

#### J1 Door Switch 2

- J1 - 1 Input
- J1 - 2 +12V source
- J1 - 3 Indicator Power Source
- J1 - 4 Indicator Lamp

#### J2 Aux 3

- J2 - 1 Input
- J2 - 2 +12V source
- J2 - 3 Indicator Power Source
- J2 - 4 Indicator Lamp

#### J3 Aux 4

- J3 - 1 Input
- J3 - 2 +12V source
- J3 - 3 Indicator Power Source
- J3 - 4 Indicator Lamp

#### J4 Aux 7 & 8 Or Fan Speed

- J4 - 1 Common
- J4 - 2 Input Aux 7/Low Spd
- J4 - 3 Input Aux 8/Med Spd
- J4 - 4 Aux 7 & 8/Hi Spd
- J4 - 5 Indicator Power Source
- J4 - 6 Indicator Lamp

#### J5 Aux 5

- J5 - 1 Input
- J5 - 2 +12V source
- J5 - 3 Indicator Power Source
- J5 - 4 Indicator Lamp

#### J6 Aux 6

- J6 - 1 Input
- J6 - 2 +12V source
- J6 - 3 Indicator Power Source
- J6 - 4 Indicator Lamp

#### J7 Door Ajar Light 2

- Mating Connector:  
AMP 1-480698-0
- J7 - 1 Indicator Lamp Source
- J7 - 2 Indicator Lamp

#### J8 Input

- Mating Connector:  
AMP 1-480700-0
- J1 - 1 12 Volts
- J1 - 2 Com Signal +
- J1 - 3 Com -
- 4 pin Mating Connector - Molex WM3701
- 6 pin Mating Connector - Molex WM3702

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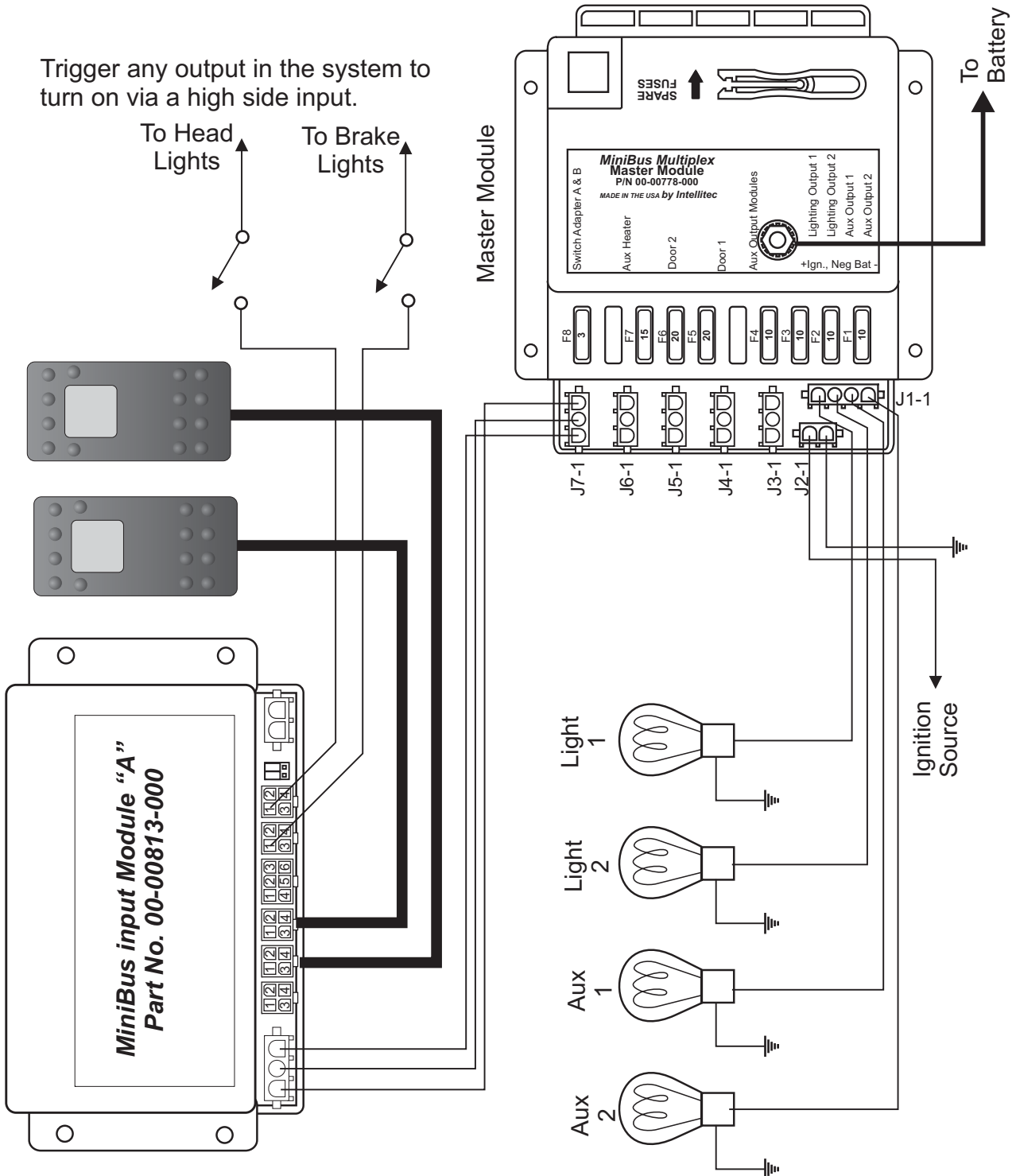
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# Mini-Bus Multiplex System

## Application Installation and Trouble Shooting Guide

### INPUT MODULES

Trigger any output in the system to turn on via a high side input.



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# Mini-Bus Multiplex System

## Application Installation and Trouble Shooting Guide

### AUXILIARY OUTPUT MODULE

Part No. 00-00785-000

The Auxiliary Output Module is used when the system requires more than the four loads that can be switched by the Master Module. The aux output module can switch up to three 10 Amp loads. It includes jumpers that allow you to select the channel that will control each of the three outputs. An additional Switch Module is required to address this module. Two of these modules can be used with the additional switch panel set to "B". This allow up to six additional loads to be switched in addition to those on the master.

Any number of these outputs can be set to respond to the same switch, offering distributed switching ,*such as left side/right side bank switching*, or the outputs of two modules can be paralleled to provide more current for a single load. (20-30Amps)

### SPECIFICATIONS

#### MAXIMUM CURRENT

<u>Circuit Name</u>	<u>Fuse</u>	<u>Function</u>	<u>Channel</u>	<u>Conn</u>	<u>Fuse</u>
Output 1	10 A	Switched	3 or 6	J2-2	F1
Output 2	10 A	Switched	4 or 7	J2-3	F2
Output 3	10 A	Switched1	5 or 8	J2-4	F3

Temperature:	-40 C to 85 C ambient
Operating Voltage:	10.0 - 16.5 VDC
Over Voltage Protection:	24 VDC for 1 minute +150 V for 150 milliseconds - 300 V

### INSTALLATION

Select a location for the Auxiliary Module that will allow for easy replacement of the fuses for service and easy connections to both the battery input and the loads. The location should also provide sufficient air space to provide cooling for the module. Mount the module with four, #8 screws through the holes in the cover. Connect the battery input lead to the Power stud.

***Be sure the wire feeding the module will safely carry the total current to be drawn from the module.***

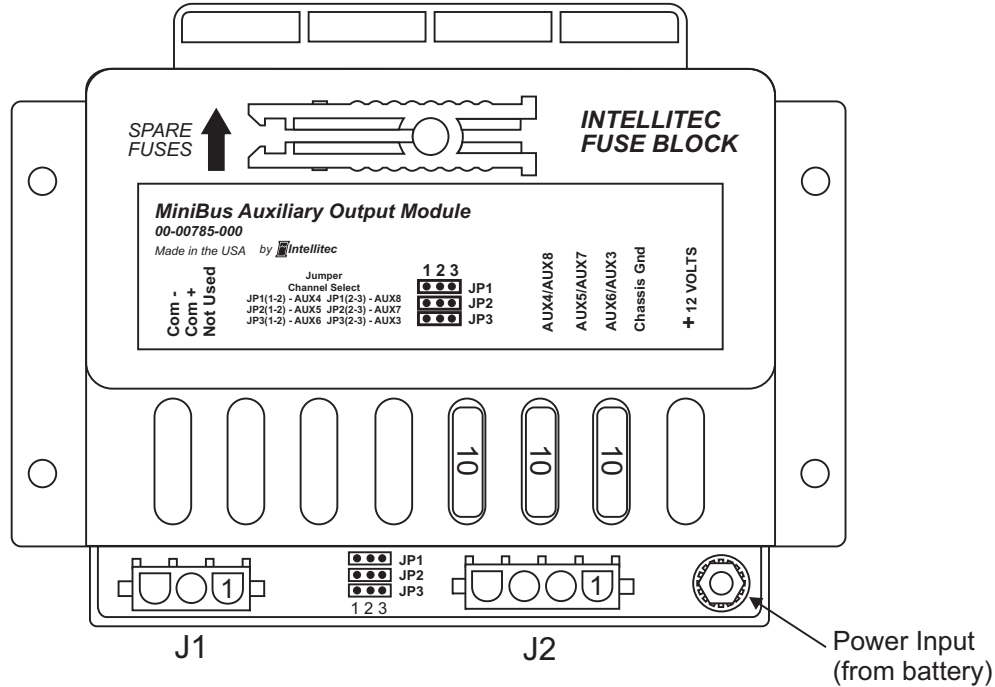
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# Mini-Bus Multiplex System

## Application Installation and Trouble Shooting Guide

### AUXILIARY OUTPUT MODULE



#### J1 Input

Mating Connector AMP 1-480700-0

- J1 - 1 No connection
- J1 - 2 IPX Signal
- J1 - 3 Signal Ground

#### J2 Outputs

Mating Connector AMP 1-480702-0

- J2 - 1 Power ground
- J2 - 2 Output 1 (Aux 6 or 3)
- J2 - 3 Output 2 (Aux 5 or 7)
- J2 - 4 Output 3 (Aux 4 or 8)

#### AMP Contacts

14-18 AWG	10-12 AWG
350919-3	640310.3

**JUMPER SETTINGS** - All Aux Module outputs operate from a switch adapter configured as "B".

Output	Switch #		Switch #		Switch #	
3	JP1 1-2	Select Channel 5	Aux 4	JP1 2-3	Select Channel 8	Aux 8
2	JP2 1-2	Select Channel 4	Aux 5	JP2 2-3	Select Channel 7	Aux 7
1	JP3 1-2	Select Channel 3	Aux 6	JP1 2-3	Select Channel 6	Aux 3

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# Mini-Bus Multiplex System

## Application Installation and Trouble Shooting Guide

### Trouble Shooting

The Intellitec MiniBus multiplex system does not require special equipment to trouble shoot. Most problems can be found with a common test light, voltmeter or ohmmeter. This guide will start out with some of the more simple causes for trouble in the multiplex system. In most cases, the cause is usually something simple rather than complex.

---

#### **VOLTAGE**

One of the most frequent problems found is low voltage. This is likely to occur if the vehicle systems have been operating without the engine running. Measure the voltage at the battery and at the power stud on the master (00-00778-000). **The system will not function properly below 10 volts.** Keep in mind that with a weak battery, voltages will fall during cranking.

**Some normal occurrences that you will notice as voltage begins to fall.**

1. If ignition is off and the interior light switches are on, the interior lights will automatically turn off when the voltage is low. This occurs to prevent further discharge of the battery, so that there is enough left to start the vehicle. Turning the switch off and back on again will allow several minutes of light and then the lights will shut off again. If the voltage is not low and the light switches are on, the interior lights will also turn off 20 minutes after ignition is turned off. Cycling the switch off and back on will allow another 20 minutes.
2. The step well light output located on the electric door module also has a low voltage detector that will turn the step well light off. If the voltage is low the step well light output on the door module will turn off whether the ignition is on or off. If the vehicle is fitted with a door module, the step well light can be used as an indicator of a low voltage condition.

The most common solution to this problem is to recharge the battery or to start the engine. A wiring problem could also be at fault. Check the connection from the battery stud on the master to + battery and the ground connection at J2-2 on the master.

---

#### **NORMAL FUNCTION THAT LOOKS LIKE TROUBLE**

Dip Switch and Jumper settings can be configured incorrectly. These are not likely to change once the vehicle has been in service but will need to be adjusted when replacing a module. Dip switches or jumpers are located on the switch adapters, input modules, aux output modules and door modules. If a switch adapter is set in the "B" position, it will not operate any of the outputs located on the master and will not operate a door module set in the "A" position. This of course would make it appear that the system was completely inoperative. The "B" setting is only used if a second switch adapter is used with auxiliary output modules and or a second door.

In addition to the A/B settings there are dip switch settings on the switch adapter which allow the system to be configured so that the Aux 1 and Aux 2 outputs, located on the master, turn off with ignition or with the 20 minute timer and low volt detector. The switch adapter also has a selection to allow a choice of whether the electric door will operate only with ignition on or whether it will operate regardless of whether ignition is on or off. (See the appropriate page for each module for the proper dip switch settings.)

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# Mini-Bus Multiplex System

## Application Installation and Trouble Shooting Guide

### Trouble Shooting

Another common occurrence is open Fuses. Except for auxiliary output modules, all of the fuses are located on the master module. If all or parts of the system appear not to function, a fuse may be at fault. Here are some common symptoms related to fuses. When checking fuses, it is a good idea to check their continuity. A fuse can visually appear to be ok, but still be open.

If the fuse for the switch adapters (F8) is open, the system will appear inoperative as the switches will not operate the outputs.

If the fuse for the Aux Heater (F7) is open, the Aux Heater Fan (Rear Heater) will not function. This fuse does not affect other parts of the system.

If the fuse for door 2 (F6) is open, no power will be supplied to the second door module and therefore the second door and stepwell light will not operate. Note some manufacturers may choose to use this fuse for alternate purposes when the vehicle does not have a second door.

If the fuse for door 1 (F5) is open, no power will be supplied to the door module and therefore the door and stepwell light will not operate.

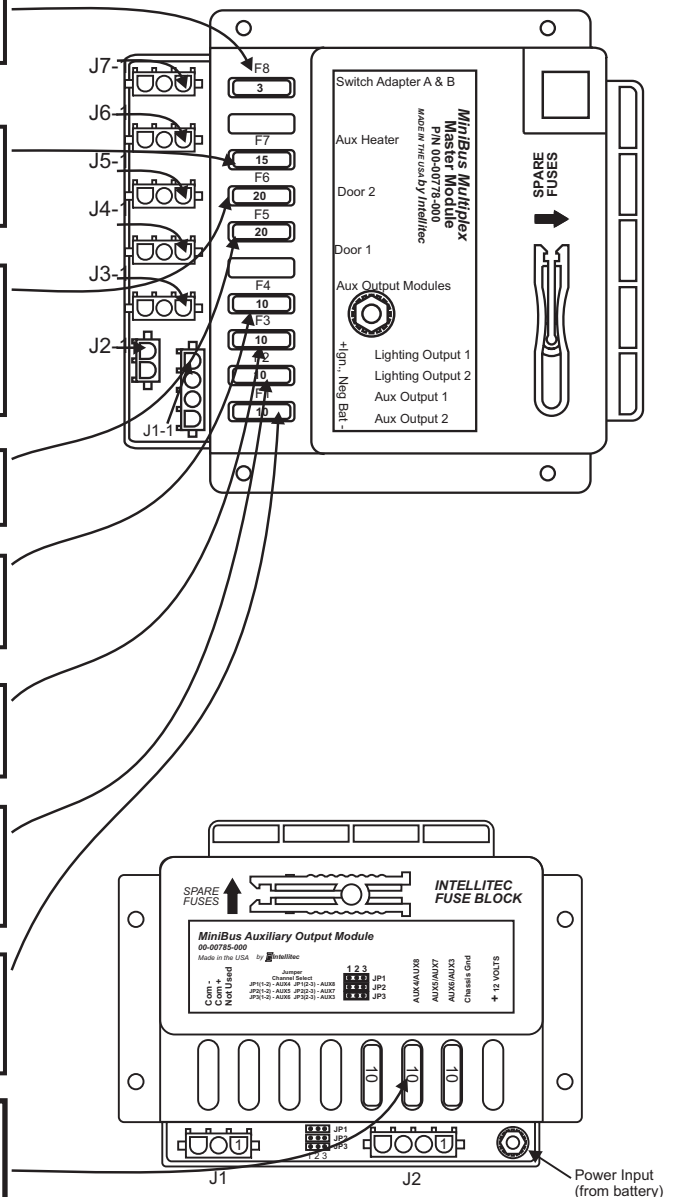
If the fuse for Lighting output 1 (F4) is open, no power will be supplied to the lighting one circuit and therefore the light will not operate from either the switch panel or when the door is open.

If the fuse for Lighting output 2 (F3) is open, no power will be supplied to the lighting two circuit and therefore the light will not operate from the switch panel.

If the fuse for the Aux 1 output (F2) is open, no power will be supplied to the Aux 1 circuit when the aux 1 switch is in the on position. This fuse only affects the aux 1 output located on the master.

If the fuse for the Aux 2 output (F1) is open, no power will be supplied to the Aux 2 circuit when the aux 2 switch is in the on position. This fuse only affects the aux 2 output located on the master.

Fusing for the auxiliary output modules is not located on the master module. Each auxiliary output module has 3 outputs and 3 associated fuses.



**WARNING: Replacing fuses with ratings higher than shown in this manual may be unsafe and will cause damage to the system.**

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# Mini-Bus Multiplex System

## Application Installation and Trouble Shooting Guide

### Trouble Shooting

#### SYMPTOM

**All of the outputs are off regardless of the switch positions..**

1. Check voltage between the power stud on the master and pin J2-2. It should be 10 volts or more.
2. Check fuse F8 on the master, this fuse provides power to the switch adapters.
3. Check multiplex communications to the modules.
  - A. Unplug J3, J4, J5, J6, and J7 at the Master Module
  - B. Using a voltmeter measure the voltage between pins 1 and 3 on J3 through J7. . You should read battery voltage. If not check the associated fuse and the voltage at the power stud on the master.
  - C. Using a voltmeter, check the voltage between pin 2 and 3.on any single connector. This is the systems multiplex communication signal, which is present at each of the connectors.. You should read between 6.5 and 9 volts (no more, no less). If the communications voltage is not in the correct range and there is 10 volts or more on the power stud, the master may be defective.
  - D. If the communication voltage is in the correct range, it is possible that another module or the wire harness is corrupting the communications. Begin isolating the cause of the problem by plugging J3 through J7 back in one at a time beginning with J7. When you plug J7 in, check to see if the outputs at the master turn on and off when you operate the switches, If they do you have eliminated the Master and switch adapter as a problem. If they do not operate it is likely that the wiring to the switch adapter or the switch adapter has a problem.

#### CHECKING THE SWITCH ADAPTER

After having checked the master and having reconnected J7, per the above procedure, check the switch adapter as follows.

- A. Check the dip switch settings on the switch adapter. (See the switch adapter settings on page 15) Only an adapter set for "A" will operate outputs at the master. An adapter set for "B" will operate auxiliary outputs located on the auxiliary output modules.
- B. At the switch adapter, remove the 3 pin plug. This harness should go back to J7 on the master. Measure the voltages on the harness. Pin 1-3 should measure battery voltage and pins 2-3 should measure the communication voltage of 6.5-9 volts. If this is the case you have eliminated the harness between the switch panel and master as a problem. If the dip switch settings are correct and the harness checks out and the switches still do not operate the outputs on the master, you may have a defective switch adapter. If it is only a single switch that does not work, check the fuse for the appropriate output at the master or auxiliary output module also check to see if the switch is defective.

If the adapter is ok, continue plugging the rest of connectors in one at a time. If the outputs turn off when you connect a plug, check that part of the harness as per above and the module connected to it by removing the 3 pin plug at the module. If the system returns to normal suspect the module if not, suspect the harness. Test the harness by measuring for voltages as per the switch adapter above.

**The interior lights can be turned on and off, but the auxiliary outputs do not operate.**

1. Check the fuses at the master and aux output modules.
2. The lighting circuits are designed to operate with or without ignition. Aux 1 and Aux 2 on the master can be set to go off with ignition or with the 20 minute timer. Check the dip switch settings on the switch adapter.
3. Pin J2-1 on the master should be connected to an ignition source. Check the voltage between J2-1 and J2-2 when the ignition is on. You should read battery voltage. When the ignition is off you will not read battery voltage. This is the sense lead to tell us whether the ignition is on or not. Auxiliary output modules will turn off when ignition is off.

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# Mini-Bus Multiplex System

## Application Installation and Trouble Shooting Guide

### Trouble Shooting

#### **SYMPTOM**

**All of the outputs are on regardless of switch position.**

This is a very specific symptom. The key word above is "All". When this happens it usually means that somewhere in the system, the communications wire, pin 2 on a 3 pin plug, is being shorted to ground. In the past we have found a screw driven through wires shorting it to ground as well as defective modules causing the problem. To isolate this, begin by disconnecting all of the 3 pin plugs from the master. If when you do this, all of the outputs turn off, begin connecting the 3 pin plugs one at a time until the lights come on again. When they do, you have identified the circuit responsible for the problem. Disconnect the 3 pin plug from the module on the other end of this circuit. If the system returns to normal, you have a bad module. If it does not, you may have a short to ground in your harness.

#### ***The electric door will not operate:***

1. Check the fuse located on the master module. Power to run the door comes from the master via this fuse.
2. Unplug the three pin plug from the door module 00-00787. This part of the harness should go back to J4 or J5 at the master. Check multiplex communications on the harness by measuring the voltage between pins 2 and 3. You should measure 6.5-9 volts. Check between pins 1 and 3. You should measure battery voltage. If these check out the harness is ok.
3. If there is an exterior key switch, check to make sure that it is not in the close position. When the door is closed via the exterior switch, the interior switch is disabled.
4. Check the jumper settings in the door module and the dip switch settings at the switch adapter. If the switch adapter is set for "A", the door module must also be set for "A" (See the module page to determine how to set the jumpers.).
5. Make sure that power ground is connected to pin 8 on the 8 pin connector of the door module
- 6 Try replacing the door module. Make certain that the module jumpers are configured properly.

#### ***The electric door begins to move but stops or reverses direction.***

1. Check to see if there is an obstruction in the path of the door or a mechanical problem that impedes the movement of the door mechanism.
2. The sensitivity setting on the door module may be set too sensitive. See the door module page in this manual for proper setting.

#### ***The electric door closes all the way but then opens on it's own.***

In the path of the door mechanism there should be a switch that closes when the door is very close to being closed. This switch should be connected to the door closed inputs on the door module. The sole purpose of this switch is to defeat the sensitive edge when the door is nearly closed to allow the door to seal closed. This problem will occur if this switch is missing, defective or misadjusted.

#### ***The sensitive edge does not work or is not sensitive enough.***

Refer to the door module page 10 in this manual for sensitive edge settings

#### ***The step well light does not operate.***

1. The step well light output on the door module is on a voltage sensor. If the voltage is too low the light will turn off. Check the battery voltage. Check the bulb.

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# **Mini-Bus Multiplex System**

## **Application Installation and Trouble Shooting Guide**

### **Trouble Shooting**

#### ***The rear heater fan does not run.***

1. Check the fuse at the master module. If more than one heater module is used, there may be fuses located off of the master module.
2. Unplug the three pin plug from the heater module 00-00771. This part of the harness should go back to J6 at the master. Check multiplex communications on the harness by measuring the voltage between pins 2 and 3. You should measure 6.5-9 volts. Check between pins 1 and 3. You should measure battery voltage. If these check out the harness is ok.
3. Try replacing the heater module.

#### ***The hot water valve does not operate.***

The solenoid valve may be connected to the heater output on the switch adapter(tab terminal) or it may be connected to a heater module. Check the connections

---

#### ***Wheel Chair Lift Interlock II.***

Although the wheel chair lift interlock is a stand alone product, it is often used with the MiniBus Multiplex System. We are therefore including some trouble shooting tips with this manual. For data sheets and wiring information please see our web site at [www.intellitecsve.com](http://www.intellitecsve.com) .

The wheel chair lift interlock prevents operation of the lift unless the ignition is on, the transmission is in park, the parking brake is set and the lift door is open.

In addition to the interlock, the module provides a dome light output, warning output (lift not satisfied),3 Flashing warning light outputs.

#### ***Lift will not operate.***

1. Check the Lift power fuse.
2. The module has 4 LEDS that indicate if the appropriate inputs are present. A fifth LED indicates that the bypass switch has been activated. Pressing the bypass allows the lift to operate in the event an input is missing. Observe the LEDs and check to see that the appropriate inputs are present. It is possible that a door switch has become misadjusted.

#### ***Flashing Warning Lights, interlock alarm or dome lights do not operate.***

Check the fuses located on the module.

***See pin out and wiring diagrams for the Wheel Chair Lift Interlock on the following page.***

See page 28 for wiring and connections.

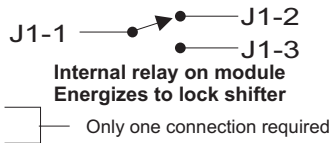
# Mini-Bus Multiplex System

## Application Installation and Trouble Shooting Guide

P/N 00-00847-000 12VDC Wheel Chair Lift Interlock

### CONNECTIONS

- J1-1 Shift lock output common
- J1-2 Shift lock output N/C
- J1-3 Shift lock output N/O
- J1-4 +12V input Lift door open
- J1-5 Ground input Lift door open
- J1-6 Ground input Park brake set



- J2-1 Ground input Transmission in Park  
(used when Ford Trans park harness is not used)
- J2-2 Connection for Ford Trans park harness
- J2-3 Connection for Ford Trans park harness

- J4-1 Lift door dome light output 10Amps
- J4-2 Low side lift power (Braun) remove lift power fuse.  
*No connection for (Ricon) high side*
- J4-3 To lift power relay
- J4-4 Input Ignition
- J4-5 Power Ground

- J5-1 5Amp flashing light output 1
- J5-2 5Amp flashing light output 2
- J5-3 5Amp flashing light output  
(compliment of 1 and 2)
- J5-4 5Amp Output Interlock not satisfied alarm

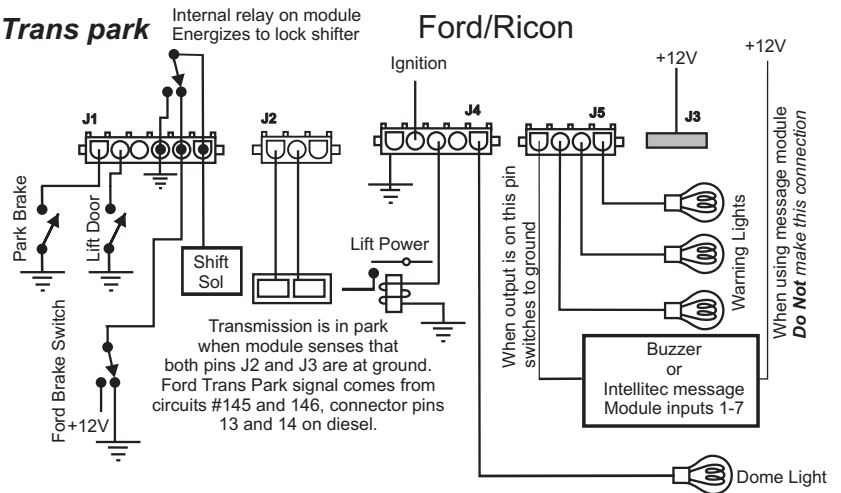
### Harness for connection to Ford chassis for Trans park signal is available

Gas 11-00847-100  
Diesel 11-00847-200

- J3 +12 Volt input (Size wire to carry all loads supplied by this module)

### MATING CONNECTIONS

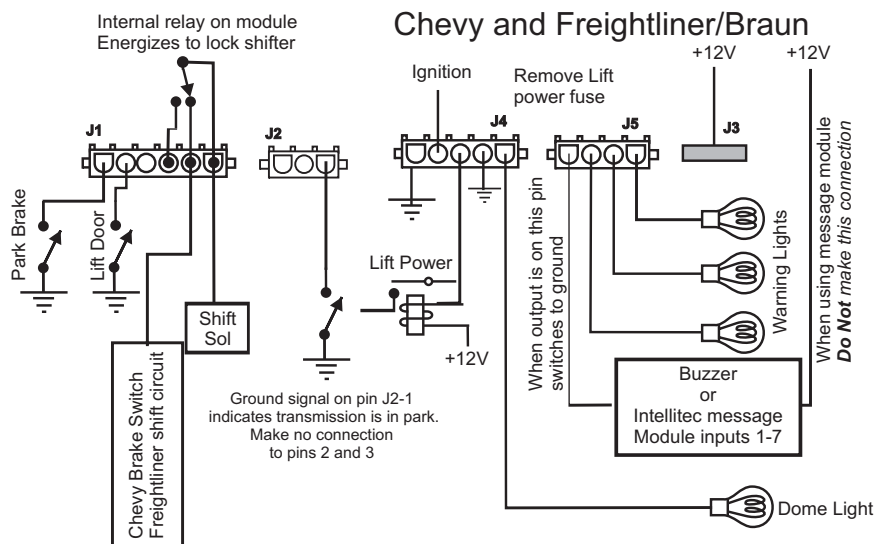
- Amp Mate-N-Lok:
- J2 3 Pin 1-480700-0
  - J5 4 Pin 640586-1
  - J4 5 Pin 1-480763-0
  - J1 6 Pin 640585-1
  - J3 .250 female tab terminal



### CONTACTS

- For 14-18 AWG 350919-3
- For 10-12 AWG 640310-3

For additional information, see [www.intellitescvs.com](http://www.intellitescvs.com) or Contact General Dynamics Intellitec Products.



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# ***Mini-Bus Multiplex System***

## ***Application Installation and Trouble Shooting Guide***

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