

# Vehicle Improvement Products

## SmartWheel Multiplexed Steering Wheel Troubleshooting Guide

For use with:  
Steering Wheels PC209, PC210 and PC217  
Master Control SM209

10 April 2001  
Revised 15 August 2001

# Vehicle Improvement Products SmartWheel Troubleshooting Guide

**It is strongly recommended that this guide be read completely through prior to starting work. Doing so will speed diagnosing and repairing problems and help prevent damage to the SmartWheel and related systems.**

## PRODUCT DESCRIPTION

The SmartWheel Steering Wheel Control System offers control of the horn, headlamp and marker lamp flash, cruise control, and wiper functions from switches mounted in the steering wheel. The system consists of two components: the PC209, PC210 or PC217 Steering Wheel and the SM209 Master. Communication between the Steering Wheel and the Master is accomplished via two wires. The two wires carry a multiplexed communication signal and power for the Steering Wheel electronics. As each switch is closed, the Steering Wheel generates a unique signal that is transmitted to the Master. The Master decodes that signal to determine which switch is closed and operates the corresponding outputs for that function. Some systems include two additional wires to provide power to backlight the steering wheel switches.

## HOW IT WORKS

Functions on the Steering Wheel are either momentary or latching. The HORN, HEADLAMP FLASH, CRUISE CANCEL, CRUISE RESUME, CRUISE SET, MARKER LAMP FLASH, and WIPER WASH switches operate in the momentary mode and the corresponding outputs on the Master are only operated while the switch is pressed. The CRUISE ON/OFF, WIPER OFF, WIPER HI/LO, and WIPER VARIABLE switches operate in the latching mode and the corresponding outputs on the master remain actuated until the corresponding CRUISE OFF, or WIPER OFF switch is pressed or the Ignition input on the Master is turned off. The WIPER HI/LO switch has the additional feature that initially when the switch is pressed the wipers operate in the low speed mode and additional operations of the switch cause the wipers to alternate from the high to low speed modes.

An operational description of each function is as follows:

**HORN** - The horn switch function on the steering wheel is accomplished using a bar located below the center of the wheel. If the horn bar is actuated, the Steering Wheel will send the appropriate signal to the Master to cause the HORN output (J2.1) to be switched to ground while the switch is pressed. This output is rated at 0.5 Amps max. at 12Vdc.

**HEADLAMP FLASH** - Operation of this function relies on external switching for the headlamp function. If +12V is applied to the Headlamp SW input (J11.6), +12V power will be removed from the Headlamp Power output (J12.2) while this switch is pressed. If J11.6 is low, +12V power will be applied to the Headlamp Power output (J12.2) while this switch is pressed. The result is that if the headlamps are turned on, pressing the switch will cause them to go off. In like manner, if the headlamps are turned off, pressing the switch will cause them to go on. This relay output is rated at 25 Amps max. at 12Vdc. The connector is rated for 20 Amps with the appropriate wire.

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MARKER LAMP FLASH - Operation of this function relies on external switching for the marker lamp function. If +12V is applied to the Marker Lamp SW input (J11.12), +12V power will be removed from the Marker Lamp Power output (J12.3) while this switch is pressed. If J11.12 is low, +12V power will be applied to the Marker Lamp Power output (J12.3) while this switch is pressed. The result is that if the marker lamps are turned on, pressing the switch will cause them to go off. In like manner, if the marker lamps are turned off, pressing the switch will cause them to go on. This relay output is rated at 25 Amps max. at 12Vdc. The connector is rated for 20 Amps with the appropriate wire.

### CRUISE FUNCTIONS:

Because of the requirement that the cruise control functions be extremely flexible to accommodate the various brands of cruise control systems, the Smart Wheel System incorporates four individual relays with the normally-open and normally-closed contacts available to those systems. It also incorporates a programmable jumper field (JP1) that allows the common (armature) contact of the Cruise On/Off relay to be connected to one of three sources. If the jumper on JP1 is placed in position "A", the common contact on the Cruise On/Off relay will be connected to the Cruise Common input (J11.5). If the jumper on JP1 is placed in position "B", the common contact on the Cruise On/Off relay will be connected to the Ignition input (J2.4). If the jumper on JP1 is placed in position "C", the common contact on the Cruise On/Off relay will be connected to ground. In order to insure proper operation of the cruise control system the technician should consult with the chassis manufacturer to determine the proper jumper setting prior to installing or replacing a Master. In accordance with many of the cruise control system manufacturer's requirements, these relays are "dry-circuit" rated with gold plated contacts rated at 1 Amp max. at 12Vdc.

CRUISE ON - Operation of this switch latches the Cruise On/Off relay in the "on" state. This causes the source determined by the jumper position on JP1 to be disconnected from the Cruise On/Off normally-closed (N.C.) output (J11.7) and connected to the Cruise On/Off normally-open (N.O.) output (J11.8).

CRUISE OFF - Operation of this switch unlatches the Cruise On/Off relay. This causes the source determined by the jumper position on JP1 to be connected to the Cruise On/Off normally-closed (N.C.) output (J11.7) and disconnected from the Cruise On/Off normally-open (N.O.) output (J11.8). In essence, this function is inverse to the Cruise On function. This mode is also entered any time that +12Vdc power is removed from the Ignition input (J2.4) on the Master.

CRUISE SET - Operation of this switch operates the Cruise Set relay while the switch is pressed. This causes the Cruise Common input (J11.5) to be disconnected from the Cruise Set normally-closed (N.C.) output (J11.2) and be connected to the Cruise Set normally-open (N.O.) output (J11.2).

CRUISE RESUME - Operation of this switch operates the Cruise Resume relay while the switch is pressed. This causes the Cruise Common input (J11.5) to be disconnected from the Cruise Resume normally-closed (N.C.) output (J11.4) and be connected to the Cruise Resume normally-open (N.O.) output (J11.3).

CRUISE CANCEL - Operation of this switch operates the Cruise Cancel relay while the switch is pressed. This causes the Cruise Cancel Common input (J11.9) to be disconnected from the Cruise Cancel normally-closed (N.C.) output (J11.10) and be connected to the Cruise Cancel normally-open (N.O.) output (J11.11).

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## WIPER FUNCTIONS:

The wiper control functions are implemented via special control circuitry that is intended to control two wiper motors and maintain synchronization between these motors on each wipe cycle. For that reason the faster wiper will pause at the end of each cycle and wait for the slower wiper to complete its cycle before resuming. The control circuitry utilizes dynamic braking on the wiper motors to eliminate motor coasting. The connection to each of these motors is made via ten pin connectors J9 and J10. The output for the wash pump is J5. The +12Vdc power for all wiper functions is separate from the +12Vdc power for all other functions and is supplied via connector J6. The ground connection for the wiper motors should be made to the case of each wiper motor - not to the ground wire coming from the Master (J9.2 & J10.2). The output rating for all wiper relay functions is 25 Amps max. at 12Vdc. The wiper connector contacts are rated at 9 Amps. For applications requiring greater than 9 Amps, a second row of connector contacts is provided on connectors J9 and J10 for double-wiring. Note: If only one wiper motor is utilized a jumper needs to be placed between the PARK inputs (J9.3 & J10.3) and connected to the PARK contact for that motor.

**WIPER WASH** - Operation of this switch activates the wash pump relay while the switch is pressed, causing the Wash Pump output (J5) to be connected to +12Vdc Wiper Power (J6). In addition, if none of the latching wiper functions (Wiper Lo/Hi or Wiper Delay) had been previously selected, the Low Speed Wiper outputs (J9.4 & J10.4) will be connected to +12Vdc Wiper Power (J6) while the switch is pressed and remain connected for a period of approximately 3 wiper cycles after the switch is released. If any of the latching wiper functions (Wiper Lo/Hi or Wiper Delay) had been previously selected, the wipers will continue to run in the selected mode after the wash switch is released.

**WIPER LO/HI** - Operation of this switch initially causes the Low Speed Wiper outputs (J9.4 & J10.4) to be connected to +12Vdc Wiper Power (J6) continuously. If the switch is pressed again the High Speed Wiper outputs (J9.5 & J10.5) will be connected to +12Vdc Wiper Power (J6) continuously. Subsequent presses of this switch will cause alternate operation of the wipers in the low or high-speed mode.

**WIPER VARIABLE** - Operation of this switch initially causes the Low Speed Wiper outputs (J9.4 & J10.4) to be connected to +12Vdc Wiper Power (J6) for one wipe. If the switch is pressed again within approximately 30 seconds, the Low Speed Wiper function will be activated again and will repeat at an interval determined by the time between the last two operations of the switch. Additional switch operations will shorten the cycle. Activation of any other wiper mode cancels the variable mode. The effect for the driver is thus: In light rain or mist conditions the driver presses the switch once when the windshield first needs clearing. When the windshield again requires clearing the driver presses the button again - setting the time period between subsequent wipes to that required by current conditions.

**WIPER OFF** - Operation of this switch causes all operation of the wipers to be canceled. This mode is also entered any time that +12Vdc power is removed from the Ignition input (J2.4) on the Master.

**HEADLAMPS ON WITH WIPERS** - Activation of any wiper function generates a "Headlamps On" function in the Master that will only be reset by turning off the ignition or by activating then deactivating the dashboard headlamp switch.

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## SYSTEM INTERCONNECTIONS:

### STEERING WHEEL:

Prior to February 2001, most SmartWheels connected to the Master Control via a dual slip-ring assembly in the steering column. Steering Wheel item numbers PC209x utilize two wires for this purpose. The yellow wire is the multiplex Signal wire and the brown wire is the multiplex Ground wire. The controls on these wheels are not backlit.

Since February 2001 steering columns equipped with clock-springs have been widely used in motor homes. The clock-spring is a device in the steering column that allows continuous electrical connections through the rotation of the column without sliding contacts. The availability of the clock-spring has allowed the transmission of sufficient power through the column to backlight the steering wheel controls. Steering Wheel item numbers PC210x and PC217x utilize four wires for this purpose. These controls on these wheels are backlit.

Note: Clock-springs can be damaged if they are not handled and installed properly. Before performing any service involving removing the steering wheel from the column, consult a service manual for information on maintaining proper centering of the clock-spring. Do not rotate the parts of a clock-spring except as directed by the appropriate service manual. Failure to follow the proper procedure can result in the clock-spring being damaged although the damage may not be immediately apparent.

### MASTER:

The SM209 Master is supplied with eight connectors. Connector and pin-out information is included with the drawings that accompany this guide.

Note: The wiring diagram supplied with this guide is the recommended method of implementing the SmartWheel system. Individual chassis and coach manufacturers may choose to connect or implement part or all of the system differently than illustrated here.

## GENERAL TIPS:

General handling precautions: Electronics are sensitive to static electrical discharge. Handle them as little as possible. They are most safe from damage when they are in the package or when they are installed and connected in the vehicle.

The most common problem with any electrical device is usually related to interconnections: wires and connectors.

1. If the system does not function properly the first thing to check is that all connectors and wires are properly installed and fully seated making good contact.
2. If the system is partially functional, i.e., the horn, cruise and lights work but the wipers do not then the problem is likely not with the multiplex system but with the wiring between the Master and the wipers or the wiper system itself.
3. If the system is completely nonfunctional, start by checking the power, ground and wiring to the master and from the Master to the Steering Wheel.
4. If the system functions intermittently, the problem is almost certainly with the wiring in general or with connections in the steering column.

## EQUIPMENT REQUIRED:

- A Digital Volt/Ohm-meter with an audible continuity check.
- A low current (less than 0.5 Amp) 12 Volt test light.

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## INITIAL IN-VEHICLE TESTS:

Proceed with these in the order in which they are listed prior to attempting any other in-vehicle tests.

- The ignition key should be in the "OFF" position until directed otherwise.
- Disconnect connectors J5, J9, J10, J11, and J12 from the Master.
- Make sure that +12Vdc power is present at J2.5 and J2.6 and connector J6 on the Master. If not present, check the supply fuses or breakers and wiring.
- Measure the DC voltage at J1.1 (Multiplex SIG) on the Master. It should measure in the range of 7-10 Volts. If it doesn't, check the continuity between J1.2 and chassis ground. If continuity exists, replace the Master.
- Remove the center pad from the Steering Wheel and disconnect the Steering Wheel from the clock-spring. The center pad can be removed by loosening a 5 mm Allen head screw that is accessible through a hole on the bottom of the Steering Wheel below the horn bar. The Allen head screw does not have to be completely removed for the center pad to be released. It is not necessary to remove the Steering Wheel from the column for these tests.
- Measure the DC voltage between the wires in the column that were connected to the yellow and brown wires on the Steering Wheel. It should also measure in the range of 7-10 Volts. If it doesn't, check the wiring in the column and to the Master for continuity. If it does, reconnect the Steering Wheel to the column wiring.

## IN-VEHICLE TESTS:

Perform the above Initial In-Vehicle Tests before attempting to perform these tests. Select these by function if problems are observed with a particular function. Make sure that connectors J5, J9, J10, J11, and J12 are disconnected from the Master.

**HORN TEST** - Connect the low current test light between a +12Vdc source and J2.1 (Horn output) on the Master. Press the HORN bar on the Steering Wheel and the test light should light. If it doesn't, the Horn output on the Master is damaged (replace the Master).

For the Lamp Flash tests below, the IGNITION Switch on the vehicle should be turned to the accessory or run position, causing +12Vdc to be present at J2.4 on the Master.

**HEADLAMP "OFF" TEST** - With no switches pressed on the Steering Wheel and the dash Headlamp switch off, check for continuity between J12.1 on the Master and J12.2. If continuity does exist, the headlamp "off" circuitry on the Master is damaged (replace the Master).

**HEADLAMP "ON" TEST** - While the HEADLAMP FLASH switch on the Steering Wheel is pressed and the dash Headlamp switch off, check for continuity between J12.1 on the Master and J12.2. If continuity does not exist, the headlamp "on" circuitry on the Master is damaged (replace the Master).

**MARKER LAMP "OFF" TEST** - With no switches pressed on the Steering Wheel and the dash Headlamp switch off, check for continuity between J12.3 on the Master and J12.4. If continuity does exist, the marker lamp "off" circuitry on the Master is damaged (replace the Master).

**MARKER LAMP "ON" TEST** - While the MARKER LAMP FLASH switch on the Steering Wheel is pressed and the dash Headlamp switch off, check for continuity between J12.3 on the Master and J12.4. If continuity does not exist, the marker lamp "on" circuitry on the Master is damaged (replace the Master).

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For the CRUISE and WIPER tests below, the IGNITION Switch on the vehicle should be turned to the accessory or run position, causing +12Vdc to be present at J2.4 on the Master. Note the position of the jumper on the configuration header JP1 so that unit can be returned to that configuration after the tests have been completed. After that position is noted, place the jumper in position "A" so that Cruise Common is the source.

**CRUISE "ON" TEST** - Momentarily press the CRUISE "ON" switch on the Steering Wheel. Because this is a latching function, the function should be active after the switch is released. Check for continuity between J11.5 on the Master and J11.8. If continuity does not exist, the cruise "on" circuitry on the Master is damaged (replace the Master).

**CRUISE "OFF" TEST** - Momentarily press the CRUISE "OFF" switch on the Steering Wheel. Because this is a latching function, the function should be active after the switch is released. Check for continuity between J11.5 on the Master and J11.7. If continuity does not exist, the cruise "off" circuitry on the Master is damaged (replace the Master).

**CRUISE "SET" TEST** - With the CRUISE "SET" switch on the Steering Wheel not pressed check for continuity between J11.5 on the Master and J11.2. If continuity does not exist, the cruise "set" circuitry on the Master is damaged (replace the Master). While the CRUISE "SET" switch on the Steering Wheel is pressed check for continuity between J11.5 on the Master and J11.1. If continuity does not exist, the cruise "set" circuitry on the Master is damaged (replace the Master).

**CRUISE "RESUME" TEST** - With the CRUISE "RESUME" switch on the Steering Wheel not pressed check for continuity between J11.5 on the Master and J11.4. If continuity does not exist, the cruise "resume" circuitry on the Master is damaged (replace the Master). While the CRUISE "RESUME" switch on the Steering Wheel is pressed check for continuity between J11.5 on the Master and J11.3. If continuity does not exist, the cruise "resume" circuitry on the Master is damaged (replace the Master).

**CRUISE "CANCEL" TEST** - With the CRUISE "CANCEL" switch on the Steering Wheel not pressed check for continuity between J11.9 on the Master and J11.10. If continuity does not exist, the cruise "resume" circuitry on the Master is damaged (replace the Master). While the CRUISE "CANCEL" switch on the Steering Wheel is pressed check for continuity between J11.9 on the Master and J11.11. If continuity does not exist, the cruise "cancel" circuitry on the Master is damaged (replace the Master).

**WIPER "WASH" TEST** - While the WIPER "WASH" switch on the Steering Wheel is pressed, check for the presence of +12Vdc at J5. If +12Vdc is not present at J5, the wash pump output circuitry on the Master is damaged (replace the Master). In addition, check for the presence of +12Vdc at J9.4 and J10.4. If +12Vdc is not present, the low speed wiper wash circuitry on the Master is damaged (replace the Master).

**WIPER "LO/HI" TEST** - Momentarily press the WIPER "LO/HI" switch on the Steering Wheel. Because this is a latching function, the function should remain active after the switch is released. Check for the presence of +12Vdc at J9.4 and J10.4 on the Master. If +12Vdc is not present, the continuous low speed wiper circuitry on the Master is damaged (replace the Master). Momentarily press the WIPER "LO/HI" switch again and check for the presence of +12Vdc at J9.5 and J10.5 on the Master. If +12Vdc is not present, the continuous high-speed wiper circuitry on the Master is damaged (replace the Master). Subsequent presses of this switch will cause alternate presence of +12Vdc at the low speed (J9.4 and J10.4) or high-speed (J9.5 and J10.5) outputs on the Master.

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WIPER "OFF" TEST - Momentarily press the WIPER "OFF" switch on the Steering Wheel. Because this is a latching function, the function should be active after the switch is released. Check for no output at J9.4, J9.5, J10.4, and J10.5 on the Master. If +12Vdc power is present on any of these output pins, the wiper off circuitry on the Master is damaged (replace the Master). In order to check the dynamic braking circuitry after the WIPER "OFF" switch is pressed, check for continuity between J9.2 and J9.4 and also between J10.2 and J10.4. If continuity does not exist, the dynamic braking circuitry on the Master is damaged (replace the Master).

WIPER "VARIABLE" TEST – Thorough testing of the variable function is fairly complex and requires additional equipment. If all other functional wiper tests have been completed successfully, the only practical field test is to re-connect the wiper motor(s) and verify correct function operationally. Operation of this switch initially causes the Low Speed Wiper outputs (J9.4 & J10.4) to be connected to +12Vdc Wiper Power (J6) for one wipe. If the switch is pressed again within approximately 30 seconds, the Low Speed Wiper function will be activated again and will repeat at an interval determined by the time between the last two operations of the switch. Additional switch operations will shorten the cycle. Activation of any other wiper mode cancels the variable mode. The effect for the driver is thus: In light rain or mist conditions the driver presses the switch once when the windshield first needs clearing. When the windshield again requires clearing the driver presses the button again - setting the time period between subsequent wipes to that required by current conditions. If the driver does not press the switch again within approximately 30 seconds of the initial press, there will be only one wipe. If the function is not as described, the variable delay circuitry on the Master is damaged (replace the Master).

STEERING WHEEL – If as described above in the Initial In-Vehicle Tests 7 – 10 Volts is present on the yellow and brown wires on the Steering Wheel and the Master is not responding to any button presses in the above tests, replace the Steering Wheel.

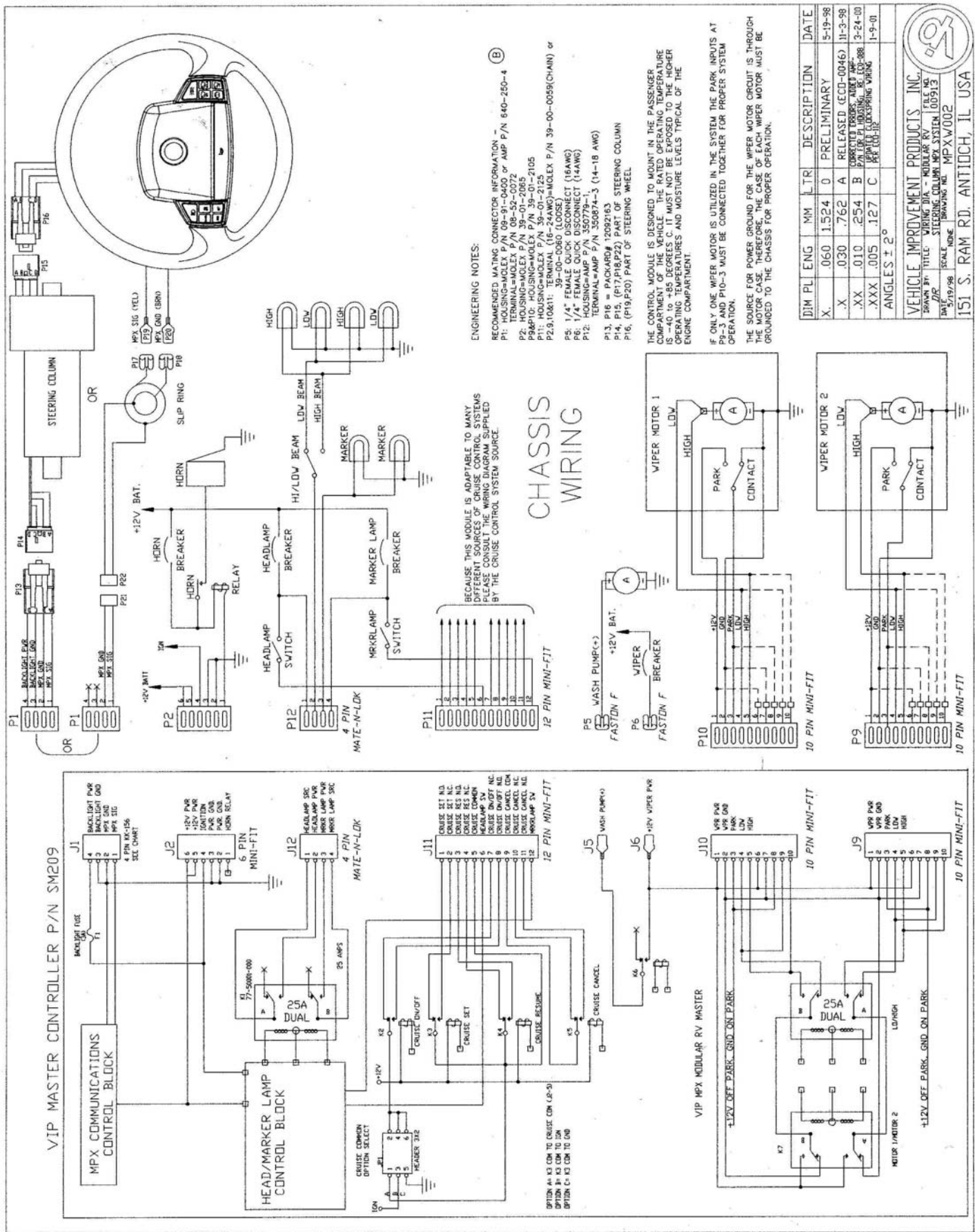
BACKLIT STEERING WHEEL – On Steering Wheels mounted on clockspring-equipped steering columns the Steering Wheel switch pads are backlit by LEDs. It may be necessary to look directly at the switch pads through cupped hands to see the backlighting in daylight. If the backlighting is not working, remove the center pad from the Steering Wheel as described above. Measure the DC voltage between the black and green wires on the Steering Wheel. There should be 12 Volts present when the IGNITION is on. If not check the 3 Amp fuse on the Master. If the fuse is good, check for 12 Volts on J1.4 on the Master. If there is 12 Volts present at J1.4 on the Master and not at the steering wheel then check the wiring between the master and the Steering Wheel. If there is 12 Volts present at the Steering Wheel and the backlighting is not working, replace the Steering Wheel.

### **AFTER TESTS ARE COMPLETED:**

If necessary, reconnect the Steering Wheel to the column connector(s) and re-attach the center pad with the Allen bolt.

If the cruise configuration jumper "JP1" on the Master was moved restore it to its original position. Re-connect all connectors that may have been removed from the Master. Note that the wiper connectors J9 and J10 can be interchanged without harm.





**ENGINEERING NOTES:**

- RECOMMENDED MATING CONNECTOR INFORMATION - (B)
- P1: HOUSING=MOLEX P/N 08-91-0400 or AMP P/N 640-260-4
  - P2: HOUSING=MOLEX P/N 39-01-2085
  - P3: HOUSING=MOLEX P/N 39-01-2105
  - P4: HOUSING=MOLEX P/N 39-01-2125
  - P5: 1/4" FEMALE QUICK DISCONNECT (14AWG)
  - P6: 1/4" FEMALE QUICK DISCONNECT (14AWG)
  - P7: HOUSING=AMP P/N 350779-1
  - P8: TERMINAL=AMP P/N 350874-3 (14-18 AWG)
  - P9: P10, P11, P12 = PACKARD# 12092163
  - P13, P14, P15, P16, P17, P18, P19, P20 = PART OF STEERING COLUMN
  - P21, P22 = PART OF STEERING WHEEL

BECAUSE THIS MODULE IS ADAPTABLE TO MANY DIFFERENT SOURCES OF CRUISE CONTROL SYSTEMS PLEASE CONSULT THE WIRING DIAGRAM SUPPLIED BY THE CRUISE CONTROL SYSTEM SOURCE.

**CHASSIS WIRING**

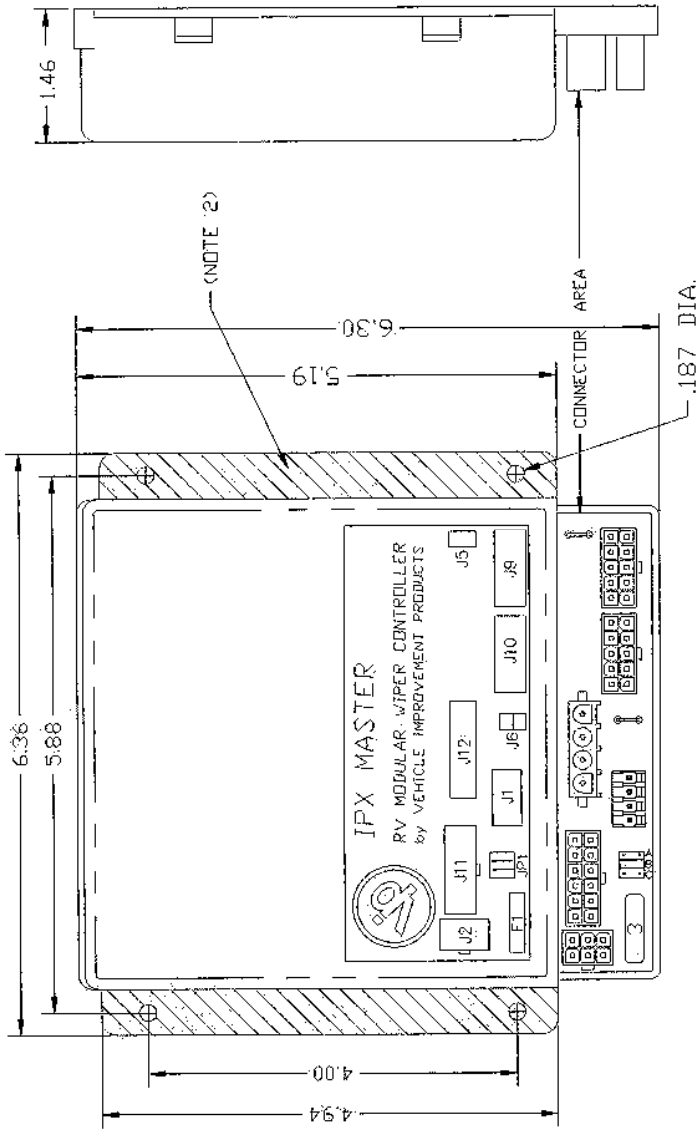
THE CONTROL MODULE IS DESIGNED TO MOUNT IN THE PASSENGER COMPARTMENT OF THE VEHICLE. THE RATED OPERATING TEMPERATURE IS 40 TO 185 DEGREES C. IT MUST NOT BE EXPOSED TO THE HIGHER TEMPERATURES OF THE ENGINE COMPARTMENT.

IF ONLY ONE WIPER MOTOR IS UTILIZED IN THE SYSTEM THE PARK INPUTS AT P10 AND P11 MUST BE CONNECTED TOGETHER FOR PROPER SYSTEM OPERATION.

THE SOURCE FOR POWER GROUND FOR THE WIPER MOTOR CIRCUIT IS THROUGH THE MOTOR CASE. THEREFORE, THE CASE OF EACH WIPER MOTOR MUST BE GROUND TO THE CHASSIS FOR PROPER OPERATION.

DJM	PL	ENG	MM	LTR	DESCRIPTION	DATE
X.	.060	1.524	0		PRELIMINARY	9-19-98
X.	.030	.762	A		RELEASED (ECO-0046)	11-3-98
.XX	.010	.254	B		CORRECTED ERRORS: WIPER AMP	3-24-00
.XXX	.005	.127	C		REWORK: WIPER MOTOR WIRING	1-9-01
ANGLES ± 0°						

**VEHICLE IMPROVEMENT PRODUCTS, INC.**  
 TITLE: WIPER DIA. - MODULAR RV  
 DRAWING NO.: STEERING COLUMN MPX SYSTEM 100913  
 DATE: 5/19/98  
 SCALE: NONE  
 DRAWING NO.: MPXW002  
 151 S. RAM RD. ANTIPOCH, IL USA



- J2**
1. HORN RELAY
  2. PWR GROUND
  3. PWR GROUND
  4. IGNITION
  5. +12 VOLT PWR
  6. +12 VOLT PWR

- J11**
1. CRUISE SET N.O.
  2. CRUISE SET N.C.
  3. CRUISE RES N.O.
  4. CRUISE RES N.C.
  5. CRUISE COMMON
  6. HEADLAMP SW
  7. CRUISE ON/OFF N.C.
  8. CRUISE ON/OFF N.O.
  9. CRUISE CANCEL COM.
  10. CRUISE CANCEL N.C.
  11. CRUISE CANCEL N.O.
  12. MRKRLAMP SW

- J12**
1. HEADLAMP SRC
  2. HEADLAMP PWR
  3. MRKRLAMP PWR
  4. MRKRLAMP SRC
- J1**
1. MPX SIGNAL
  2. MPX GROUND
  3. BACKLIGHT GND
  4. BACKLIGHT PWR
- J6**
- +12V WIPER PWR

- J10**
1. WPR PWR
  2. WPR GND
  3. PARK
  4. LOW
  5. HIGH
  - 6.
  - 7.
  - 8.
  - 9.
  - 10.

- J5**
- WASH PUMP
- J9**
1. WPR PWR
  2. WPR GND
  3. PARK
  4. LOW
  5. HIGH
  - 6.
  - 7.
  - 8.
  - 9.
  - 10.

THE CONTROL MODULE IS DESIGNED TO MOUNT IN THE PASSENGER COMPARTMENT OF THE VEHICLE. THE RATED OPERATING TEMPERATURE IS -40 to +85 DEGREES C. IT MUST NOT BE EXPOSED TO THE HIGHER OPERATING TEMPERATURES AND MOISTURE LEVELS TYPICAL OF THE ENGINE COMPARTMENT.

IF ONLY ONE WIPER MOTOR IS UTILIZED IN THE SYSTEM THE PARK INPUTS AT J9-3 AND J10-3 MUST BE CONNECTED TOGETHER FOR PROPER SYSTEM OPERATION.

THE SOURCE FOR POWER GROUND FOR THE WIPER MOTOR CIRCUIT IS THROUGH THE MOTOR CASE. THEREFORE, THE CASE OF EACH WIPER MOTOR MUST BE GROUNDED TO THE CHASSIS FOR PROPER OPERATION.

DRM PL	ENG	MM	LTR	DESCRIPTION	DATE
X.	.060	1.524	0	PRELIMINARY	6-10-98
X.	.030	.762	A	RELEASED	6-18-98
.XX	.010	.254			
.XXX	.005	.127			
ANGLES ± 2°					

**VEHICLE IMPROVEMENT PRODUCTS, INC.**

TRADE BY TITLE MULTIPLEX MASTER, I FILE NO. 6-10-98  
 DRAWN BY: J. MASIER, I. SUDSER  
 DATE: 6-8-98  
 FILE: 8-38  
 151 S. RAM RD. ANTIPOCH, IL USA