



SERVICE BULLETIN No.1148

Addressees: ABC Customer Care and Parts Source

COACH MODEL	: C2045
BULLETIN TYPE	: Service Information
MANUAL & SECTION	: Operator's Guide Book: Section 2 – Operating instructions Spare Parts Manual: Sections 782109, 783001 and 783009
PARTS BOOK REVISION	: No
DATE	: June 21st, 2005
SUBJECT	: Introduction to multiplex systems
TERMS & CONDITIONS	: No claims will be accepted with reference to this Bulletin.

APPLICATION:

The service information subject of this Bulletin is applicable to following units:

Model	Engine	VIN
C2045	Cummins	45458 → 45500, 46001 →
	Detroit Diesel	46531 →
	Caterpillar	47001 →

DESCRIPTION:

Multiplex technology has been applied to the electric system of the above-mentioned commuter coaches because of the many advantages this technology offers over conventional electrical equipment. The purpose of this Bulletin is to acquaint C2045 operators with the new equipment and help them understand the particularities connected to multiplexing.

1. What is multiplex?

Multiplex is a collective term for the technology used to transmit multiple signals (data/commands) through a single conductor between two or more components in an electronic network (see Figures 1 and 2: multiplex vs. classic system).

Description continued on next page.

Service personnel: please read, initial and circulate.

Service Manager	Parts Manager	Warranty Administrator	Workshop Foreman	Service Technician

Continued from page 1.

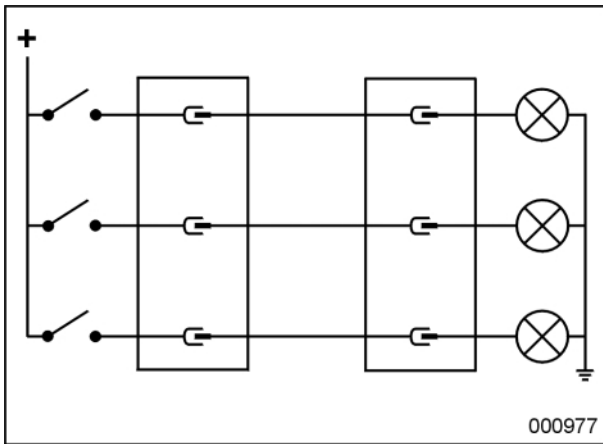


Figure 1: Classic electrical circuit with switches, conductors, plugs and load (lamps)

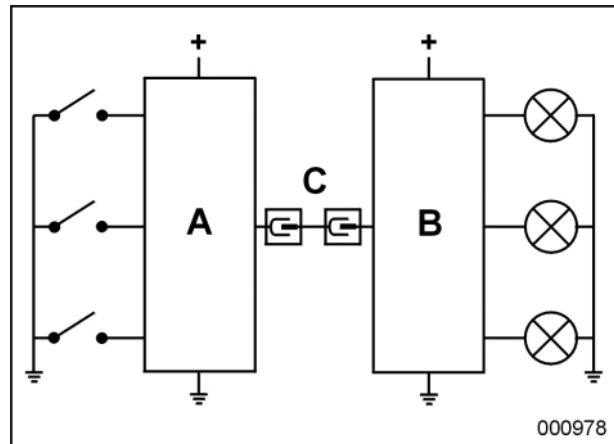


Figure 2: Multiplexed electrical circuit with switches, electronic boxes (A and B), plugs, signal line (C) and load (lamps)

2. Why multiplex?

The advantages of a multiplex system over conventional electrical equipment:

- A considerable reduction of the number of wires.
- Thinner cable looms in the vehicle.

The fact that all kinds of switching conditions can be built into a circuit means that the entire arrangement of electrical circuits can be simplified. This leads to:

- A reduction of the number of relays.
- Simplification of electrical junction boxes.
- A reduction of vehicle mass and hence reduced fuel consumption.

The multiplex system further reduces the number of separate electronic switches (for example: flasher unit, windscreen wiper interval, time switches...).

The multiplex system can also read messages that are available on the drive line CAN bus (*Control Area Network bus – see below*). This also leads to a reduction of the number of wires and components in the periphery of the drive line.

The fact that one or more diagnostic options have been applied makes it easier to test the vehicle or trace faults. These options can be used as an on-board diagnostic feature or can be connected to an external PC. The term on-board diagnosis means the possibilities provided without the use of special equipment.

3. What constitutes a multiplex system ?

The system is constructed with components called “hardware” (all equipment in the system). This hardware is controlled by “software” (a computer program which makes the hardware function as required).

The multiplex system used on Van Hool units consists of the following hardware components:

- A computer module (master) which contains the driver, in other words the programmable intelligence.
- A number of nodes (slaves) without programmable intelligence with input and output gates.
- A CAN-bus (connection between the elements of the system – see Figure 3).

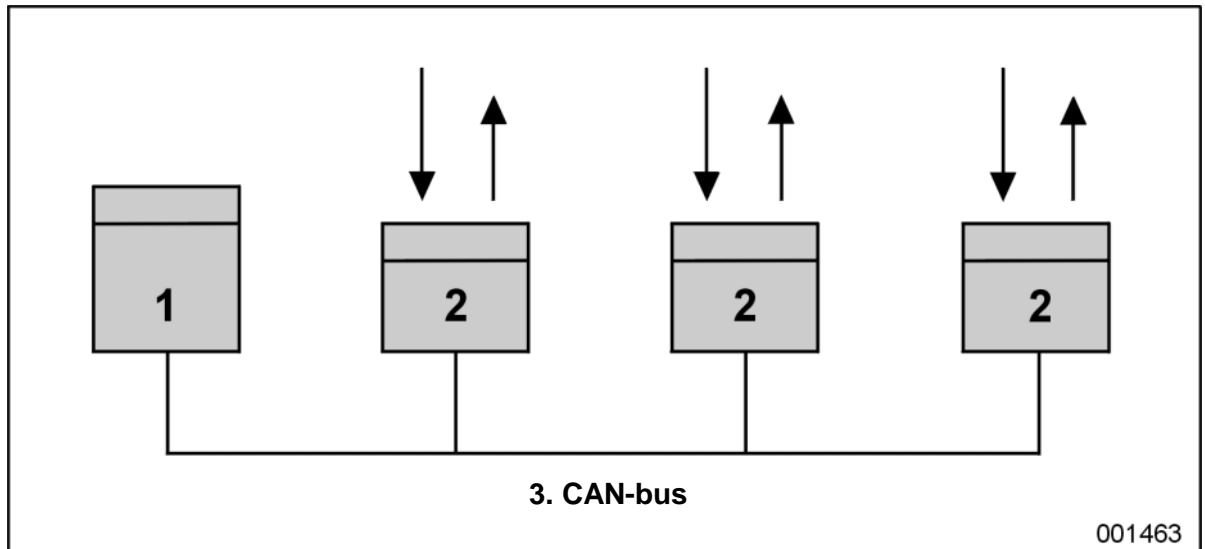


Figure 3: Basic multiplex system with: 1. Master (1x) 2. Nodes (3x) and 3. CAN-bus (1x)

Figure 4 shows a multiplex network in practice.

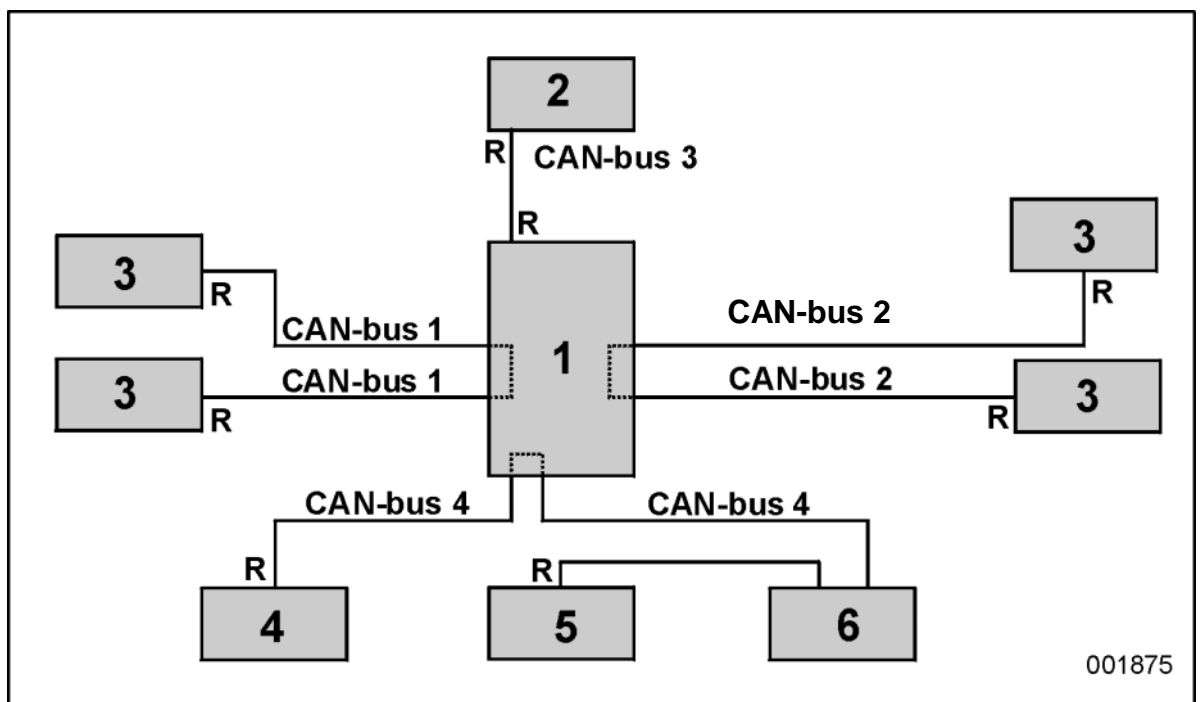


Figure 4: 1. Computer module. 2. Dashboard node (includes Multi Function Display - MFD). 3. Body nodes. 4. Vehicle engine control unit. 5. Transmission control unit. 6. ABS/ASR control unit. R: Terminal resistor

Figures 5 through 8 show some of the typical hardware that has been installed on the multiplexed C2045s.



Figure 5: Dashboard node DMUX – includes MFD

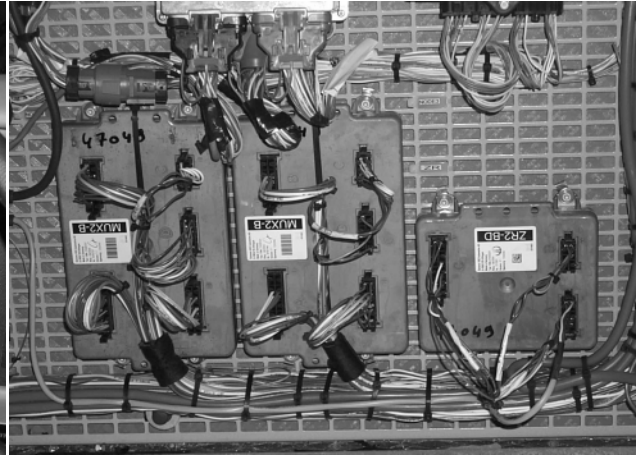


Figure 6: Computer module ZR2-BD and two nodes (located in the main junction box)



Figure 7: Typical node (this one is located behind the stepwell panel)



Figure 8: Diagnostic plug (located below right hand dash panel)

4. What's different on a C2045 equipped with a multiplex system?

1. **Dash.** From the driver's seat, operators who have experience with the classic C2045 will notice a different center dash panel (see Figure 9).

NOTE: For the driver, the introduction of the Van Hool multiplex system on C2045 Commuter coaches concerns mainly changes made to the center instrument panel.

NOTE: Operation of all switches and controls remains as per non-multiplexed units, be they equipped with Detroit Diesel or Cummins engine.

NOTE: Display of the MFD wrench symbol indicates that the multiplex system has detected a malfunction and should be reported to the maintenance department as soon as possible.

Following changes have been made to the center section of the instrument panel:

- The speedometer and rev counter have switched places (9 and 14, Figure 9).

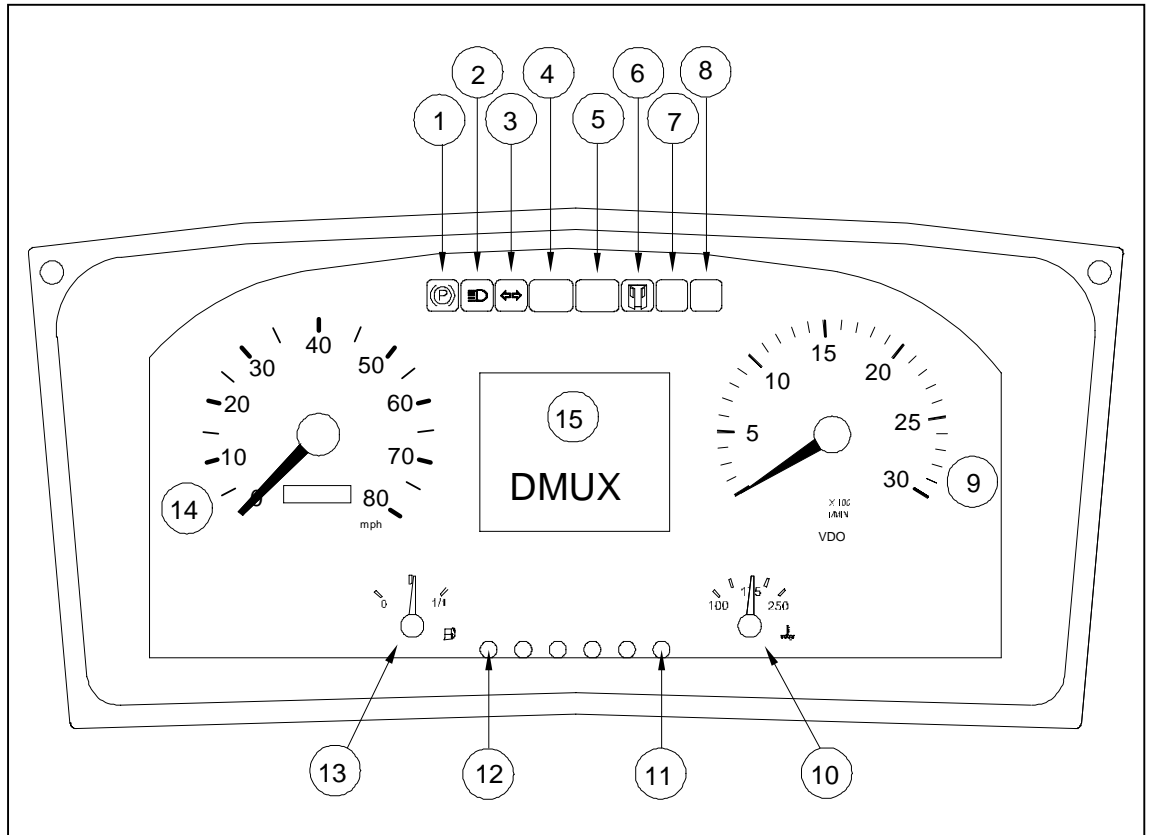


Figure 9, C2045 multiplexed center dash: 1. Parking brake ON 2. High beam indicator lamp 3. Turn signal indicator lamp 4. Red warning lamp 5. Amber warning lamp 6. Entrance door and lift door open 7. and 8. Blank 9. Rev counter 10. Coolant temperature gauge 11. Rheostat 12. MFD call-button 13. Fuel gauge 14. Speedometer 15. Multi Function Display

- The information given by the three axle air pressure gauges is now provided by the multifunction display (15, Figure 9) on a need-to-know basis or by pressing the MFD call-button once (12, Figure 9). Status is shown as a bar graph (see Figure 10) which disappears automatically after 10 seconds. Pressures are in psi units.

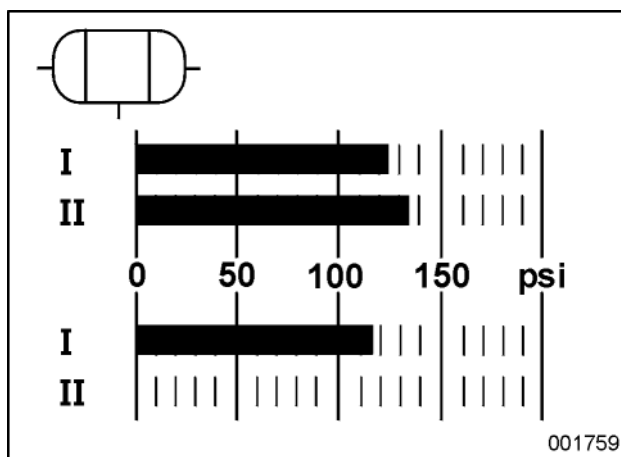


Figure 10: Bar graph showing 125 psi on the front axle (I), 135 psi on the drive axle (II) and 115 psi on the tag axle (I - beneath pressure numbers)

- The oil pressure gauge has been omitted. Oil pressure information is also provided by the MFD on a need-to-know basis (oil can shown in center of display, see Figure 11.1), or by pressing the MFD call-button (12, Figure 9) four times to obtain the actual operating pressure (Figure 11.2).

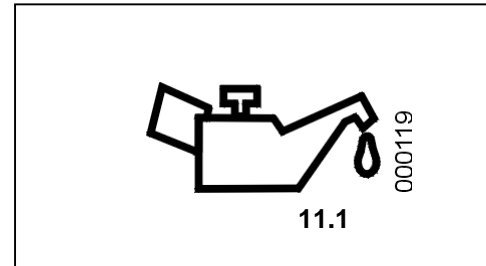
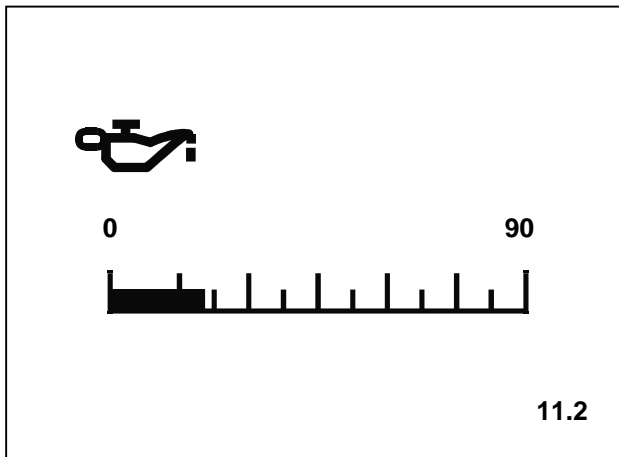


Figure 11.1: Oil pressure low – oilcan shown in center of MFD.

Figure 11.2: Actual oil pressure - oilcan and scale.

- The turbo boost gauge too has been deleted. This information is again provided by the multifunction display (see Figure 12) and can be retrieved by pressing the MFD call-button (12, Figure 9) three times. End of scale equals 2 bar (29 psi).

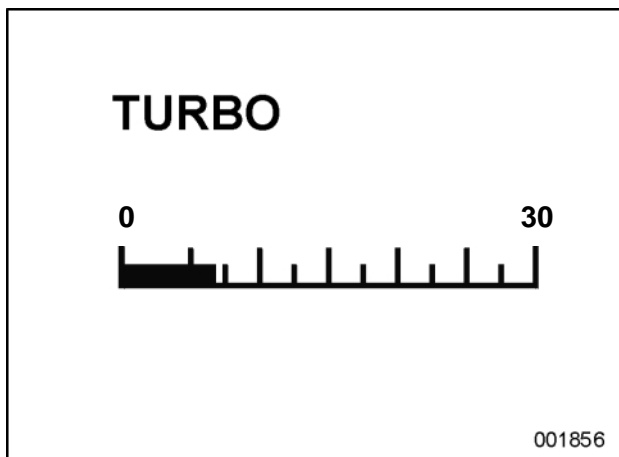


Figure 12: Turbo boost pressure shown on MFD

- New is the information on the temperature of the transmission fluid (see Figure 13). Press button 12, Figure 9 twice to have this information shown on the MFD.

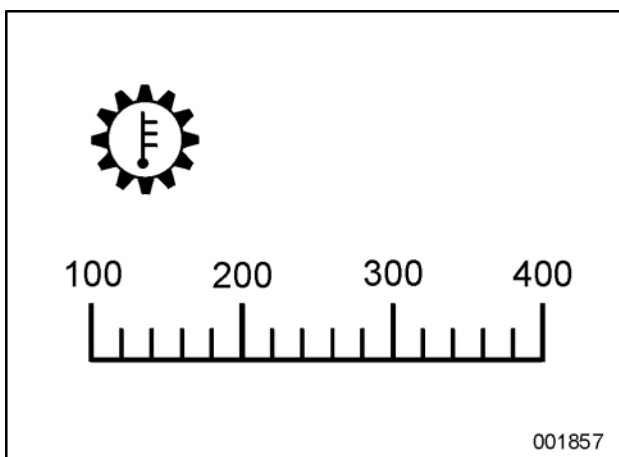


Figure 13: Transmission fluid temperature shown on MFD (no reading)





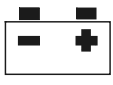
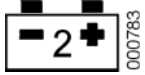
- The warning lamps in the center of the classic dash have been replaced by symbols and/or plain text on the multifunction display and by a single row of warning lamps (positions 1 through 8, Figure 9) which may or may not illuminate in conjunction with these symbols.

→ The function of lamps 1, 2, 3, 6, 7 and 8 is explained in the caption of Figure 9.




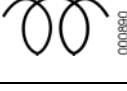




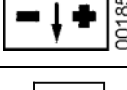


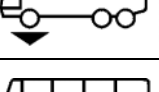
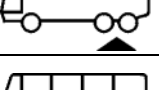
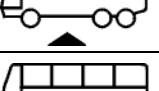



→ The function of the red warning lamp (4, Figure 9) and the amber warning lamp (5, Figure 9) is provided in the chart below.

Warning lamp		Symbol (on MFD)
Red	Amber	
	x	ABS/ASR
	x	Do not shift
	x	Raise/Lower/Kneel
	x	Fuel low
	x	Brake lining wear
	x	Engine maintenance
	x	Check engine/Engine warning
x		Transmission temperature
x		Stop engine
x		Alternators
x		Air system pressure, general
x		Parking brake
x		Air system pressure, axle 1/2/3
x		Engine compartment overheat
x		Auxiliary heater compartment overheat

- Key to symbols which may appear on the MFD (see 15, Figure 9):

MFD Symbol	Key	Warning lamp
	Transmission fluid temperature critical	Red
	NEW: Passenger emergency call	
	Air system pressure low	Red
	NEW: Brake lining wear	Amber
	Alternator 1 failure	Red
	Alternator 2 failure	Red

Symbols continued on next page.

 000893	NEW: Fuel level low	Amber
 000126	Jake brake operating	
 000897	Auxiliary heater operating	
 000890	Auxiliary heater stand-by	
 000896	NEW: Lift system enabled	
 000113	Parking brake ON	Red
 000898	NEW: Active fault detected by multiplex. Report to maintenance personnel	
 001095	Tag axle unloading	
 001859	NEW: Battery low with engine running	
 000894	NEW: Communication failure/error	
 000894	NEW: Starter disabled in engine compartment	
 001862	NEW: Front axle kneeling	Amber
 001863	NEW: Rear suspension raising	Amber
 001864	Suspension raising	Amber
 001865	Suspension lowering	Amber
 000804	ABS active/error	Amber
 001880	ASR active/error	Amber

The battery master switch symbol is no longer used. The operator knows the battery master switch is on when the display lights up.

- Plain text which may appear on the MFD (see 15, Figure 9):

Text	Description
AXLE 3 RHS	Brake lining wear on tag axle, right hand side
AXLE 3 LHS	Brake lining wear on tag axle, left hand side
AXLE 2 RHS	Brake lining wear on drive axle, right hand side
AXLE 2 LHS	Brake lining wear on drive axle, left hand side
AXLE 1 RHS	Brake lining wear on front axle, right hand side
AXLE 1 LHS	Brake lining wear on front axle, left hand side
BATTERY UNBALANCE	Battery equalizer not operating properly
DO NOT SHIFT	Self explanatory
ENGINE MAINTENANCE	Corrective maintenance is required (Cummins)
ENGINE WARNING	A non-fatal system error has occurred which must be corrected as soon as possible
STOP ENGINE	A fatal system error has occurred. Engine protection shutdown is approaching (30sec - stop engine override is possible).

- A call-button has been provided to select different information screens of on the MDF (see 12, Figure 9).

Press	Shows
Once	Air pressure gauges
Twice	Transmission fluid temperature
Three times	Turbo boost pressure
Four times	Engine oil pressure
Five times	Air pressure gauges appear again

- A rheostat (11, Figure 9) allows the driver to change the light intensity of the dash.
 - With the introduction of the MFD as source of information, the warning lamp test switch has been omitted.
2. **Buzzer.** A buzzer has been installed, which can sound 4 different alarms (with engine running). These alarms may, or may not, sound in conjunction with the red or the amber warning lamp.

Buzzer signal	Key	Warning lamp
Continuous (1, Figure 14)	<ul style="list-style-type: none"> • Stop engine • Suspension rising/lowering/kneeling/rear raising • Passenger emergency call 	<ul style="list-style-type: none"> • Red • Amber
Spike pulse (2, Figure 14)	<ul style="list-style-type: none"> • Check engine/Engine warning • Fuel low • Do not shift 	<ul style="list-style-type: none"> • Amber • Amber • Amber
Single pulse (3, Figure 14)	<ul style="list-style-type: none"> • Transmission fluid temperature high • Fire alarm • Lift door unlocked 	<ul style="list-style-type: none"> • Red • Red
Twin pulse (4, Figure 14)	<ul style="list-style-type: none"> • Air system pressure low • Air pressure low at front/drive/tag axle 	<ul style="list-style-type: none"> • Red • Red

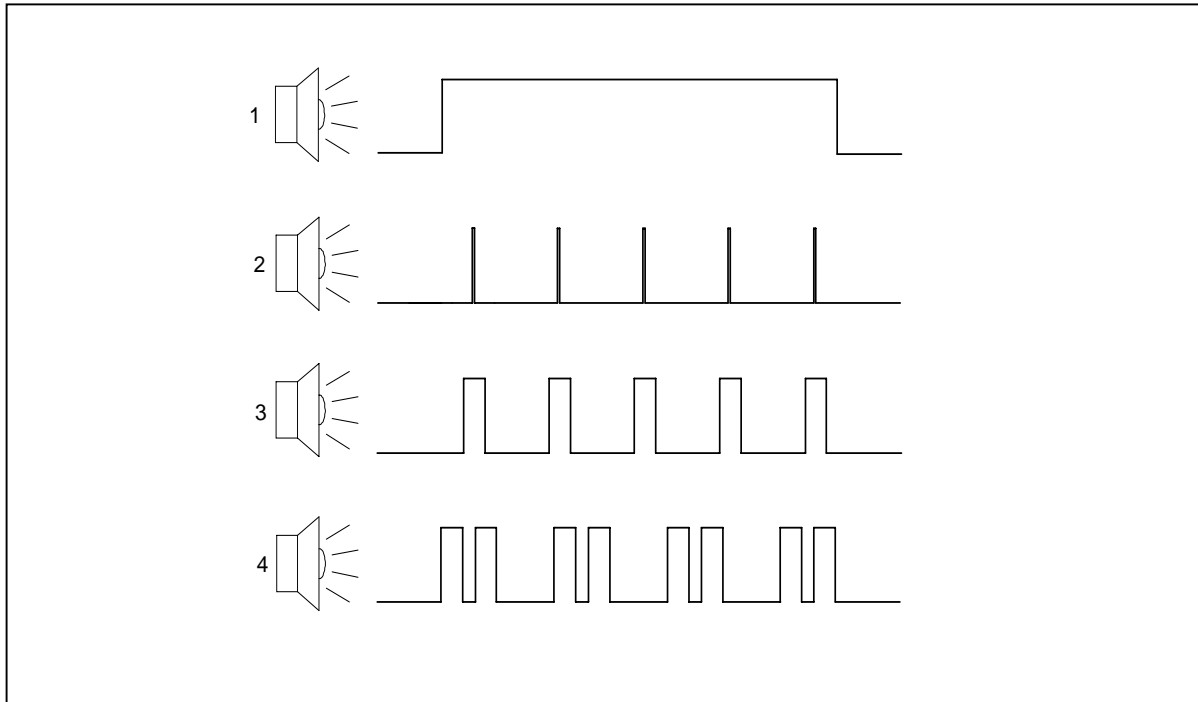


Figure 14: Multiplexed C2045 buzzer signals

1. Continuous
2. Spike
3. Single pulse
4. Twin pulse

3. Operation.

- Operation of all switches and controls remain as per non-multiplexed units.
- The back-up lights operate with the engine running only.
- The battery master switch cuts out with a delay:
 - After 2 seconds when the ignition has not been switched ON.
 - After 30 seconds when the ignition has been switched ON to allow all onboard computers to shut down after all data have been retrieved.
- Kneeling is possible only with vehicle stationary.
- It is possible to check cooling fan operation externally.
- Following electronic devices have been omitted:
 - Turn signal flasher
 - Watch-your-step flasher
 - NY DOT flasher (optional)
 - Wiper interval timer
 - Brake wear monitors

PARTS AND PRODUCTS:

- New parts have been included in the applicable Spare Parts Manual.
- New parts have been made available through regular channels.

- Always use genuine maintenance products and parts. Do not accept imitations.
- Parts and products disposition: discard according to applicable environmental regulations.

PROCEDURE:

- Except for minor details, the procedures to operate the coach as described in Van Hool C2045 Operator's Guide Book M458 remain unaltered.

Procedure complete.

SERVICE INFORMATION:

Service Bulletins are issued to supplement or supersede information in the Van Hool manuals. Note Service Bulletin number, date and subject on the register at the end of the relevant chapter(s). File Service Bulletin separately for future reference.

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