



Section M

Electronic Data Systems

Service Manual - 527-58

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Customer Support



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Section M - Electronic Network

Contents

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CANbus SYSTEM

Introduction

This topic contains information about a machine SYSTEM. The system has some devices that connect either mechanically, hydraulically or electrically. Make sure you are referring to the correct system. Refer to the applications table. [⇒ Related Topics \(📄 M1-2\)](#).

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This topic is intended to help you understand what the system does and how it works. Where applicable it also includes procedures such as removal and replacement and dismantle and assemble.

[⇒ Related Topics \(📄 M1-2\)](#)

[⇒ Operation Overview \(📄 M1-3\)](#)

[⇒ CANbus Communications System \(📄 M1-3\)](#)

[⇒ Electrical Operation and Schematics \(📄 M1-4\)](#)



Related Topics

Table 1. Related Topics in This Publication

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Sections	Topic Titles	Sub Titles
1	<i>Applications</i>	ALL
C	<i>Fuses and Relays</i>	ALL
C	<i>Electrical Harness SYSTEM</i>	ALL

Operation Overview

Modern machines use electronic control units (ECU's) to control machine systems such as hydraulics, transmission and engine.

In much the same way as office computers can be 'networked' to communicate with each other the machine ECU's can be 'networked'.

Some advantages of networking are:

- Improved more intelligent control systems
- More comprehensive and reliable in-cab instrumentation
- Service software tools can be used for fault finding and machine control set up.

The engine ECU can communicate with other machine ECU's using a CANbus network system.

CANbus Communications System

C Controller

A Area

N Network

An electronic communications system that connects all the machine ECU's to one pair of data wires called the CANbus. Coded data is sent to and from the ECU's on the CANbus.

By connecting Servicemaster diagnostic software to the CANbus, data is seen and decoded for use by a service engineer.

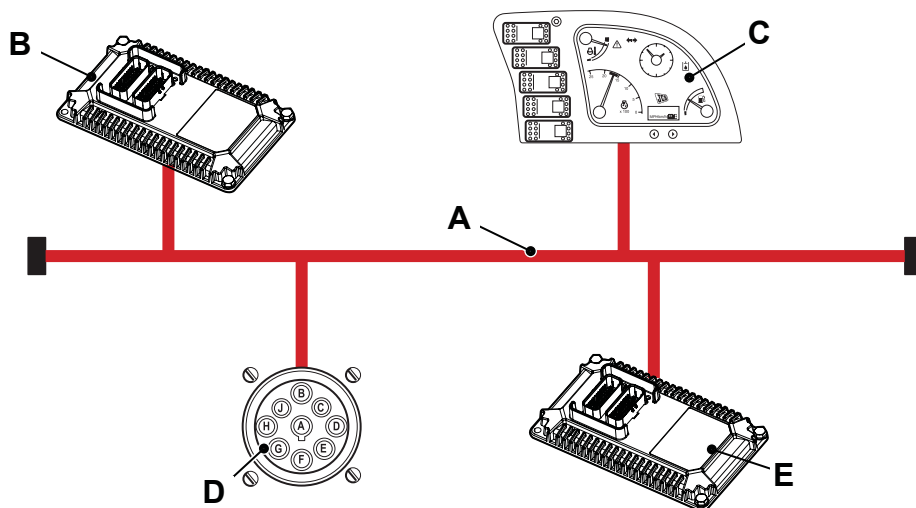


Fig 1.

C047150-C4

A	CANbus wires
B	Transmission Control ECU
C	Loadall Monitoring System (LMS) ECU
D	Diagnostics socket
E	Hydraulic Control ECU

Electrical Operation and Schematics

Key	⇒ Fig 2. (□ M1-5)
C001/ P01	Chassis Harness to Panel Harness Connector
C016	Joystick (Hydraulic Control Lever) Powerbase ECU
C046	Transmission ECU Connector J1
C048	Hydraulic ECU Connector J1
C051	CAN Terminator
P14	LMS ECU Connector J1
P25	Diagnostic Socket
P26	CAN Terminating Resistor
P28	LLMI CANbus Connector

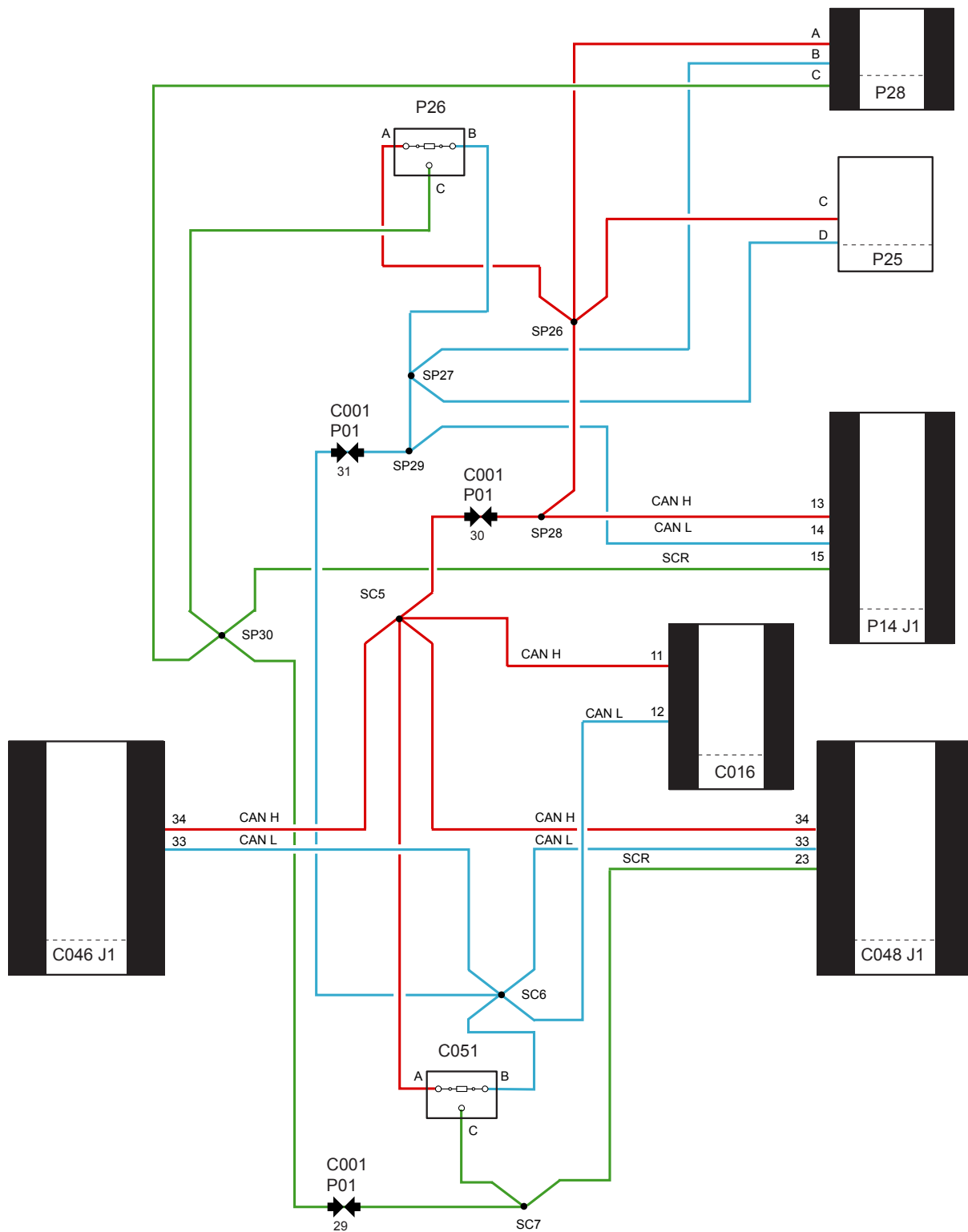


Fig 2.

C095050



Section M1 - Electronic Network CANbus SYSTEM

Electrical Operation and Schematics

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Loadall Monitoring SYSTEM

Introduction

This topic contains information about a machine SYSTEM. The system has some devices that connect either mechanically, hydraulically or electrically. Make sure you are referring to the correct system. Refer to the applications table. [⇒ Related Topics \(M2-2\)](#).

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[⇒ Related Topics \(M2-2\)](#)

[⇒ Operation Overview \(M2-3\)](#)

[⇒ Electrical Operation and Schematics \(M2-5\)](#)

[⇒ Service Hours Reset \(M2-9\)](#)

[⇒ Introduction \(M2-9\)](#)

[⇒ Using the Machine LCD Display \(M2-10\)](#)

[⇒ Using JCB Servicemaster 2 \(M2-11\)](#)

Related Topics

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Sections	Topic Titles	Sub Titles
1	Applications	ALL
2	ALL (Care and Safety) ⁽¹⁾	ALL
B	Fuel Tank	Fuel Sender Unit
C	Fuses and Relays	ALL
C	Electrical Harness SYSTEM	ALL
C	Battery Charging System	ALL
M	⇒ CANbus SYSTEM (□ M1-1)	ALL
M	⇒ Fault Code SYSTEM (□ M3-1)	⇒ Loadall Monitoring System ECU Fault Codes (□ M3-5)
M	⇒ Electronic Control Unit Theory (□ M6-1)	ALL

(1) You must obey all of the relevant care and safety procedures.

Operation Overview

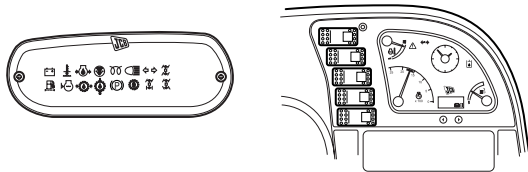
Machines fitted with digital display systems feature a Loadall Monitoring System (LMS) control unit (ECU). The ECU is part of the instrument cluster in the side console.

The ECU monitors data from electrical and electronic devices on the machine. Data is received via dedicated wires and from the machine CANbus, depending on the type of device.

The ECU processes the data and controls devices in the graphical user interface (GUI) such as the engine coolant temperature gauge, system status indicator lamps and engine tachometer.

The LMS ECU also monitors machine usage in the form of engine run hours and service events.

If the ECU receives electronic fault codes or electrical signals to be interpreted as faults the ECU activates visual and, when applicable, audible warnings. Fault codes are also logged by the ECU. → [Loadall Monitoring System ECU Fault Codes \(M3-5\)](#)



C048930

Fig 1.

Fault Code Display

If the ECU receives electronic fault codes or electrical signals to be interpreted as faults the ECU activates visual and, when applicable, audible warnings. Fault codes are also logged by the ECU. ➔ [Loadall Monitoring System ECU Fault Codes \(M3-5\)](#)

Electrical Operation and Schematics

The table shows how the monitoring system ECU responds to inputs from connected devices.

Note: Some of the warning and indicator light signals are sent through the CANBus system and do not have a dedicated input.

Important: The connector pin numbers are for the harness connectors, NOT the pins on the ECU's. The connectors are viewed from the front. DO NOT TOUCH the pins on the ECU's.

⇒ [Table 2. Monitoring System ECU - 4012 / 4013](#)
([M2-5](#))

Table 2. Monitoring System ECU - 4012 / 4013

Connector ⇒ Fig 2. (M2-8)	Pin	Device	Input/Output	Function	Display
J1	02	Not Used			
J1	02	Alternator Excitation	Input - alternator 'D' terminal	Alternator Excitation.	
J1	03	Alternator		Monitor alternator output and status. Activates Malfunction Indicator Lamp (MIL), alternator warning light and warning buzzer.	  
J1	04	Engine Temperature		Monitor engine temperature. Activates Malfunction Indicator Lamp (MIL), temperature warning light, temperature gauge and warning buzzer.	   

Connector ⇒ Fig 2. (M2-8)	Pin	Device	Input/Output	Function	Display
J1	05	Fuel level sender	Stepped resistance value depending on fuel level - steps 0 - 8	Calculate fuel level. Drive fuel gauge. Log faults. Transmit CAN messages (re-fuel event, fuel quantity in tank)	
J1	06	Not Used			
J1	07	Not Used			
J1	08	Air Filter vacuum switch	Digital Input Active Low	Monitor air filter switch status. Activates Malfunction Indicator Lamp (MIL), light and warning buzzer. Transmit CAN message. Log fault.	
J1	09	Not Used			
J1	10	Engine Oil Pressure Sender		Monitor oil pressure. Activates Malfunction Indicator Lamp (MIL), warning light and warning buzzer. Transmit CAN message. Log fault	
J1	11	Permanent power supply	+12V		
J1	12	Ground			
J1	13	CAN 1 H	Communication High Side Input/Output	Receive and transmit CANbus data	
J1	14	CAN 1 L	Communication Low Side Input/Output	Receive and transmit CANbus data	
J1	15	CAN 1 Shield		Provide an earth shield for CAN wires	
J1	16	Not Used			
J1	17	Not Used			
J1	18	Not Used			
J1	19	Ignition switch	+12V Digital input (wake up)	Illuminate all indicators for 1 second and supply ignition status data.	

Connector ⇒ Fig 2. (M2-8)	Pin	Device	Input/Output	Function	Display
J1	20	Side lights switch ON, Ignition switch OFF	+12V Digital input (wake up)	Turn on instrument back lighting. Display 'engine hours' on LCD	
J2	01	Fuel Agglomerator		Monitor agglomerator for water. Activates Malfunction Indicator Lamp (MIL), water in fuel warning light and warning buzzer. Transmit CAN message. Log fault	 
J2	02	Not Used			
J2	03	Not Used			
J2	04	Not Used			
J2	05	Not Used			
J2	06	Reverse fan switch	Digital Input Active High	Activate the fan control reverse function. Log faults and display warning lamp. Buzzer activated.	 
J2	07	Not Used			
J2	08	Not Used			
J2	09	Not Used			
J2	10	Not Used			
J2	11	Not Used			
J2	12	Not Used			
J2	13	Not Used			
J2	14	TBA			
J2	15	Reverse fan solenoid	Digital Output High Side	Operate solenoid to reverse fan oil flow direction and activate warning buzzer	
J2	16	Warning Buzzer		Operate warning buzzer.	
J2	17	Second auxiliary relay	Digital Input Active High	Operate indicator light showing second auxiliary circuit selected.	AUX II

Connector → Fig 2. (M2-8)	Pin	Device	Input/Output	Function	Display
J2	18	Info Button	Digital Input Active Low	Operate menu and acknowledgement of LCD display messages	
J2	19	Sensor Earth			
J2	20	Not Used			

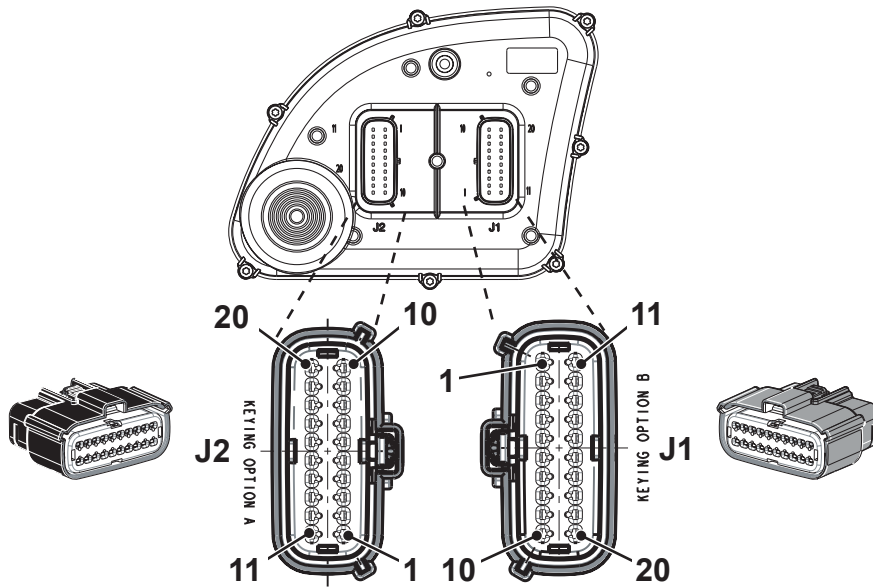


Fig 2.

C048910-C1

Service Hours Reset

Introduction

The Time Until Service display **3-1** is the difference between the next service interval and the current engine hours. In the example, the Time Until Service is 314.6 hours (1500 hours - 1185.4 hours).

Note: When the display is set to the Time Until Service screen, the Service symbol **3-1A** comes on.

This value can be reset using either:

- The machine LCD Display. [⇒ Using the Machine LCD Display \(□ M2-10\)](#)
- Servicemaster 2. [⇒ Using JCB Servicemaster 2 \(□ M2-11\)](#)

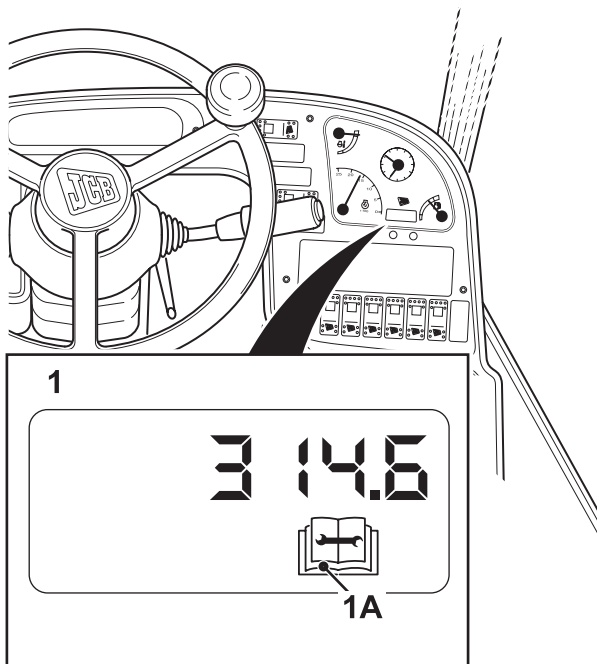


Fig 3.

432711-C1

Using the Machine LCD Display

You can use the instrument panel and related controls to reset the Service Hours. It is not necessary to connect a laptop computer to complete this task.

To reset the service hours, use the digital display **4-A** and the left or right arrow button. → [Using the Machine LCD Display \(M2-10\)](#)

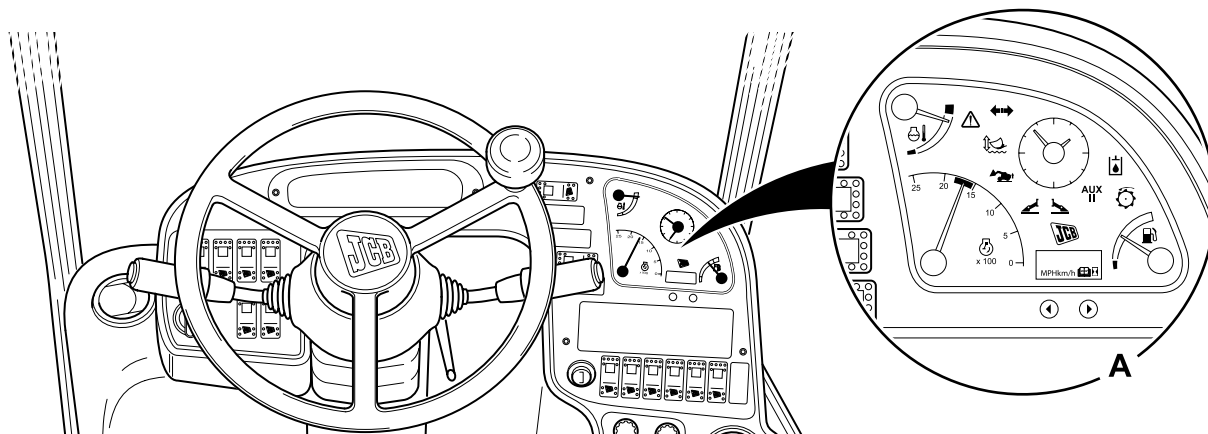


Fig 4.

432711-9-C1

- 1 Make the machine safe with the boom lowered.
- 2 Make sure that the park brake is engaged, then Switch ON the ignition.
- 3 Quickly push then release the Information button. Repeat as necessary until the Service Hours (the open book symbol **5-1**) is shown.
- 4 Push then hold the Information button for 20 seconds. Release the information button.
- 5 If necessary, use the left or right arrow button to change the screen from **FLT LST** to **SRV RST**.
- 6 Push then hold the Information button for one second to go into the **RESET** screen. Release the information button.
- 7 Push then hold the Information button for three seconds to reset the service hours (The word **RESET** flashes once). Release the information button.
- 8 Push then hold the Information button for one second to exit the **RESET** screen. Release the information button.
- 9 Use the left or right arrow buttons to move to **EXIT**.

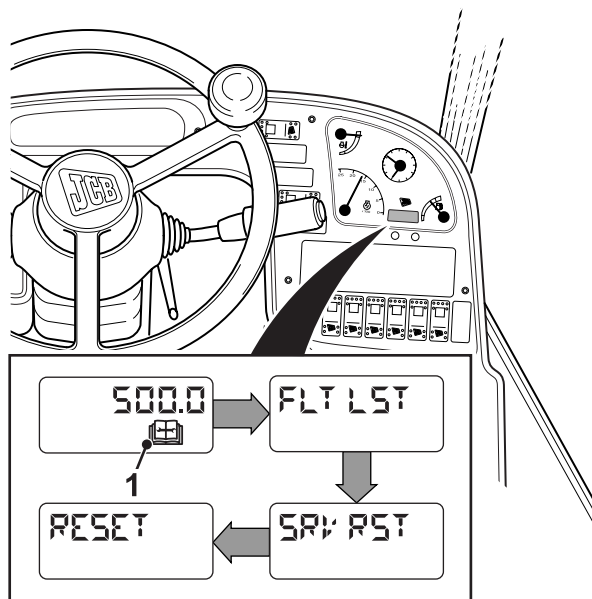


Fig 5.

432711-14

- 10 Quickly push then release the Information button to go to the normal operation mode.

Using JCB Servicemaster 2

- 1 Turn ON the machine ignition and additionally start the engine if required (taking normal precautions).
- 2 Start **JCB Service Master 2** on the laptop computer.



Fig 6.

C075500

- 3 Make sure that the correct DLA is selected in the chooser. Click on 'Utilities', DLA Setup. The DLA Chooser window opens. Check the button to match to the Current Device. Click 'Apply'. [⇒ Fig 7. \(M2-11\)](#)

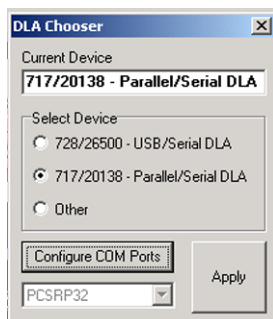


Fig 7.

C033110

- 4 Select 'Loadall 2007+' from the drop down list [⇒ Fig 6. \(M2-11\)](#) and then start the setup tool running by clicking on the **Service Hours Reset** icon. [⇒ Fig 8. \(M2-11\)](#)

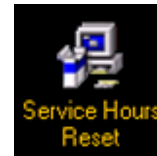


Fig 8.

C075650

- 5 The **Service Hours Reset** tool will then open up. [⇒ Fig 9. \(M2-11\)](#)

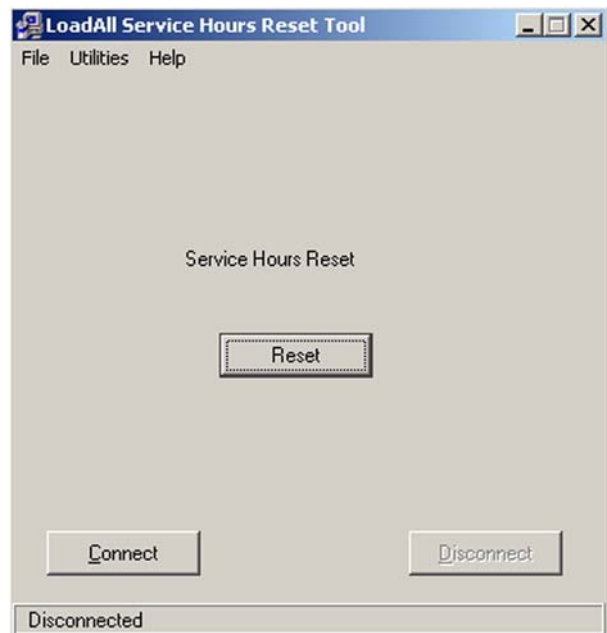


Fig 9.

C075670

- 6 Open the utilities menu and click on "Select Language". [⇒ Fig 10. \(M2-11\)](#)

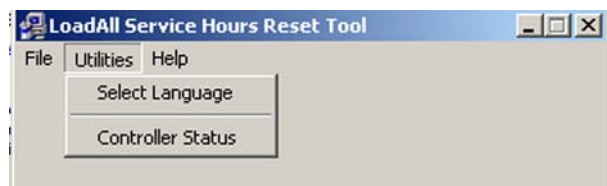


Fig 10.

C075680-C1

- 7 Select the language for the operation of the "Service Hours Reset" tool. [⇒ Fig 11. \(M2-12\)](#)



Fig 11.

C075680

- 8 Enable the connection between the PC/Laptop by pressing the "Connect" button → [Fig 12. \(M2-12\)](#) or select "Connect" from the "File" Menu. → [Fig 13. \(M2-12\)](#)



Fig 12.

C075510-C2

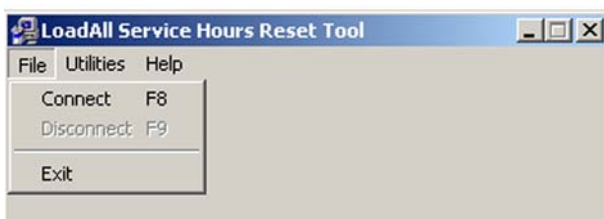


Fig 13.

C075660

- 9 Click the "Reset" Button. → [Fig 14. \(M2-12\)](#)



Fig 14.

C075680-C2

Fault Code SYSTEM

Introduction

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[⇒ Operation Overview \(□ M3-3\)](#)

[⇒ Loadall Monitoring System ECU Fault Codes \(□ M3-5\)](#)

[⇒ General "D" Codes \(□ M3-5\)](#)

[⇒ Transmission "T" Codes \(□ M3-9\)](#)

[⇒ Hydraulic Control ECU "L" Codes \(□ M3-27\)](#)

Related Topics

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Sections	Topic Titles	Sub Titles
1	Applications	ALL
2	ALL (Care and Safety) ⁽¹⁾	ALL

(1) You must obey all of the relevant care and safety procedures.

Operation Overview

Depending on the machine specification fault codes recorded by the engine ECU can be accessed and displayed in several ways:

CAN Enabled Display

The machine is equipped with a CAN enabled display. Such a display will be capable of displaying all recorded codes, for example **E127**. All logged codes will be displayed. The operator may also have a facility to erase the fault code log. See the applicable machine documentation for further information.

Malfunction Indicator Light (MIL)



Amber/Red light. The MIL light comes on to show that a system error has been detected.

- Red light. The light comes ON (and a continuous audible alarm sounds) to indicate faults that may result in serious damage to the machine or make the machine dangerous to operate. This is known as a 'STOP NOW' fault.
- Amber light. The light comes ON (and a audible alarm sounds for one second) to indicate faults that may result in reduced machine performance but are not dangerous. They are unlikely to damage the machine. This is known as a 'SERVICE' fault.

CANbus Connected Computer

Error codes logged can be accessed via a suitable laptop computer running the applicable diagnostics software, JCB 4.4 L Tier 3 Engine Diagnostics for example. The computer must be connected to the machine CANbus socket using a data link adapter (DLA). Once connected all recorded codes can be displayed, for example **E127**. The engineer also has a facility to erase the fault code log.

Fault Code Log

The monitoring system electronic control unit (ECU) incorporates a 'data logging' feature for recording fault codes.

The log enters the fault code together with the current time and date.

The fault code log can be read on the LCD. Alternatively use the JCB diagnostics tool.

Reading the Fault Code Log with JCB Servicemaster

Use JCB Servicemaster and a laptop computer connected to machine CANbus to see the codes. The diagnostics tool will also enable fault finding options. [⇒ Servicemaster SYSTEM \(M4-1\)](#) and [⇒ Servicemaster Tools \(M5-1\)](#)

Reading the Fault Code Log on the LCD

- 1 Operate the info button **1-4** with quick presses (less than 2 seconds) until the 'time until next service' is displayed.
- 2 Operate the info button **1-4** with a long press (20 seconds or more). The 'Service' menu is selected.
- 3 Press the UP **3** or Down **2** buttons adjacent to the applicable LCD until 'Fault List' is displayed.
- 4 Operate the info button with a quick press (less than 2 seconds) to display the fault list. Press the UP **3** or Down **2** buttons to scroll through the fault list on the applicable LCD.

The faults are listed in the order they were logged. The duration of the fault and time are logged too. The list contains a maximum of 30 fault logs.

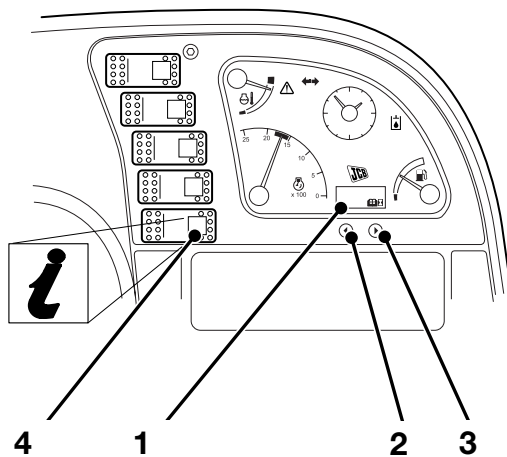


Fig 1. Monitoring System Display Panel

C049470

Loadall Monitoring System ECU Fault Codes

General “D” Codes

Fault Code	Description	Warning Displays	Severity
CAN	CANbus communication failure between LMS ECU and Engine ECU	MIL lamp activated. Message displayed on LCD.	TBA
D001	Air filter blocked	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second. Air filter blocked warning lamp activated.	<i>STOP NOW</i>
D002	Water in fuel detected	On start-up sequence - Message displayed on LCD.	<i>STOP NOW</i>
D003	Water in fuel detected	With engine running - MIL lamp activated (RED). Message displayed on LCD. Continuous buzzer activated.	<i>STOP NOW</i>

Fault Code	Description	Warning Displays	Severity
D004	Coolant over temperature	Continuous buzzer activated. MIL lamp activated (Red). Over temperature warning lamp activated. Message displayed on LCD ⁽¹⁾	<i>STOP NOW</i>
D006	Transmission oil over temperature	Continuous buzzer activated. MIL lamp activated (Red). Over temperature warning lamp activated. Message displayed on LCD	<i>STOP NOW</i>
D010	Coolant level low	Whilst engine running - MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	D010 - fault code logged
D011	Engine oil level low	On start-up sequence - Message displayed on LCD.	D011 - fault code logged
D012	Engine oil pressure low	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	<i>STOP NOW</i>

Fault Code	Description	Warning Displays	Severity
D014	Transmission oil pressure low	MIL lamp activated (RED). Message displayed on LCD. Continuous buzzer activated. Transmission oil pressure warning lamp activated.	D014    <i>STOP NOW</i>
D079	CANbus communication fault	MIL lamp activated (RED). Message displayed on LCD. Continuous buzzer activated.	D079   <i>STOP NOW</i>
D106	Alternator excitation open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	D106 - fault code logged
D107	Engine RPM open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	D107 - fault code logged
D108	Ground speed sensor open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	D108 - fault code logged
D115	Transmission oil pressure output open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	D115 - fault code logged
D117	Fuel level sensor open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second. Fuel level gauge falls to minimum reading.	D117 - fault code logged
D118	Coolant temperature sensor signal open circuit		D118   <i>SERVICE</i>

Fault Code	Description	Warning Displays	Severity
D119	Water in fuel sensor open circuit		D119  <i>SERVICE</i>
D128	Reversing fan output open circuit		D128 - fault code logged
D205	Alternator not charging	MIL lamp activated (Amber). Buzzer activated for 1 second. Charging system warning lamp activated. Message displayed on LCD.	D205 - fault code logged
D215	Transmission oil pressure output short circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	D215 - fault code logged
D217	Fuel level sensor short circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second. Fuel level gauge falls to minimum reading.	D217 - fault code logged
D218	Coolant temperature sensor signal short circuit	MIL lamp activated (amber). Message displayed on LCD. Buzzer activated for 1 second. Coolant temperature gauge falls to minimum reading.	D218 - fault code logged
D219	Water in fuel sensor short circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	D219 - fault code logged
D228	Reversing fan output short circuit		D228 - fault code logged
D300	CANbus communication fault	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	D300 - fault code logged
Z000	Error logs erased		Fault Logged
Z111	Error logs full		Fault Logged
Z200	Vehicle serviced		Fault Logged

(1) The engine coolant warning light in the cluster in front of the steering wheel is activated by a switch in the temperature sender unit. A buzzer is also activated. These warning devices are not controlled by the systems ECU.

Transmission "T" Codes

Fault Code	Description	Warning Displays		Severity
		MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	 	<i>STOP NOW</i>
T000	Column switch neutral out of range error	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	 	<i>SERVICE</i>
T001	Column switch forward out of range error	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	 	<i>SERVICE</i>
T002	Column switch reverse out of range error	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	 	<i>SERVICE</i>
T003	Column switch short circuit	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	 	<i>STOP NOW</i>

Fault Code	Description	Warning Displays		Severity
T004	Column switch open circuit	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	T004  	<i>STOP NOW</i>
T005	Joystick F/N/R switch short circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T005  	<i>SERVICE</i>
T006	Joystick F/N/R switch open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T006  	<i>SERVICE</i>
T007	Joystick CANbus fault	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T007  	<i>SERVICE</i>
T008	Joystick F/N/R neutral fault	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T008  	<i>SERVICE</i>

Fault Code	Description	Warning Displays		Severity
T009	Joystick F/N/R forward fault	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T009  	<i>SERVICE</i>
T010	Joystick F/N/R reverse fault	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T010  	<i>SERVICE</i>
T011	Pump forward solenoid (high side) - short circuit to battery	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	T011  	<i>STOP NOW</i>
T012	Pump forward solenoid (high side) - short circuit to ground	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	T012  	<i>STOP NOW</i>
T013	Pump forward solenoid (high side) - open circuit	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	T013  	<i>STOP NOW</i>

Fault Code	Description	Warning Displays		Severity
T014	Pump forward solenoid (low side) - short circuit to battery	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	T014  	<i>STOP NOW</i>
T015	Pump forward solenoid (low side) - short circuit to ground	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	T015  	<i>STOP NOW</i>
T016	Pump forward solenoid (low side) - open circuit	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	T016  	<i>STOP NOW</i>
T017	Pump reverse solenoid (high side) - short circuit to battery	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	T017  	<i>STOP NOW</i>
T018	Pump reverse solenoid (high side) - short circuit to ground	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	T018  	<i>STOP NOW</i>

Fault Code	Description	Warning Displays		Severity
T019	Pump reverse solenoid (high side) - open circuit	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	T019  	<i>STOP NOW</i>
T020	Pump reverse solenoid (low side) - short circuit to battery	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	T020  	<i>STOP NOW</i>
T021	Pump reverse solenoid (low side) - short circuit to ground	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	T021  	<i>STOP NOW</i>
T022	Pump reverse solenoid (low side) - open circuit	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	T022  	<i>STOP NOW</i>
T023	Motor control solenoid (high side) - short circuit to battery	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T023  	<i>SERVICE</i>

Fault Code	Description	Warning Displays		Severity
T024	Motor control solenoid (high side) - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T024 	<i>SERVICE</i>
T025	Motor control solenoid (high side) - open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T025 	<i>SERVICE</i>
T026	Motor control solenoid (low side) - short circuit to battery	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T026 	<i>SERVICE</i>
T027	Motor control solenoid (low side) - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T027 	<i>SERVICE</i>
T028	Motor control solenoid (low side) - open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T028 	<i>SERVICE</i>
T029	Low speed solenoid (high side) - short circuit to battery	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T029 	<i>SERVICE</i>

Fault Code	Description	Warning Displays		Severity
T030	Low speed solenoid (high side) - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T030 	<i>SERVICE</i>
T031	Low speed solenoid (high side) - open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T031 	<i>SERVICE</i>
T032	Low speed solenoid (low side) - short circuit to battery	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T032 	<i>SERVICE</i>
T033	Low speed solenoid (low side) - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T033 	<i>SERVICE</i>
T034	Low speed solenoid (low side) - open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T034 	<i>SERVICE</i>
T035	Vari-inch dial 1 - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T035 	<i>SERVICE</i>

Fault Code	Description	Warning Displays	Severity
T036	Vari-inch dial 1 - short circuit to battery	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	  <i>SERVICE</i>
T037	Vari-inch dial 2 - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	  <i>SERVICE</i>
T038	Vari-inch dial 2 - short circuit to battery	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	  <i>SERVICE</i>
T039	Vari-inch dial signal mismatch	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	  <i>SERVICE</i>
T040	Park brake switch - open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	  <i>SERVICE</i>
T041	Park brake switch - short circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	  <i>SERVICE</i>

Fault Code	Description	Warning Displays		Severity
T042	Transmission temperature sensor out of range error - low	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T042 	<i>SERVICE</i>
T746	Transmission temperature sensor out of range error - high	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T746 	<i>SERVICE</i>
T044	Steer valve A - short circuit to battery	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	T044 	<i>STOP NOW</i>
T045	Steer valve A - short circuit to ground	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	T045 	<i>STOP NOW</i>
T046	Steer valve A - open circuit	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	T046 	<i>STOP NOW</i>

Fault Code	Description	Warning Displays		Severity
T047	Steer valve B - short circuit to battery	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	T047  	<i>STOP NOW</i>
T048	Steer valve B - short circuit to ground	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	T048  	<i>STOP NOW</i>
T049	Steer valve B - open circuit	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	T049  	<i>STOP NOW</i>
T050	Steer valve C - short circuit to battery	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	T050  	<i>STOP NOW</i>
T051	Steer valve C - short circuit to ground	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	T051  	<i>STOP NOW</i>

Fault Code	Description	Warning Displays		Severity
T052	Steer valve C- open circuit	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	T052  	<i>STOP NOW</i>
T053	Steer valve D - short circuit to battery	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	T053  	<i>STOP NOW</i>
T054	Steer valve D - short circuit to ground	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	T054  	<i>STOP NOW</i>
T055	Steer valve D - open circuit	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	T055  	<i>STOP NOW</i>
T056	Steer mode switch - short circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T056  	<i>SERVICE</i>

Fault Code	Description	Warning Displays		Severity
T057	Steer mode switch - open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T057  	<i>SERVICE</i>
T058	Left turn output - short circuit to battery	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T058  	<i>SERVICE</i>
T059	Left turn output - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T059  	<i>SERVICE</i>
T060	Left turn output - open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T060  	<i>SERVICE</i>
T061	Right turn output - short circuit to battery	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T061  	<i>SERVICE</i>
T062	Right turn output - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T062  	<i>SERVICE</i>

Fault Code	Description	Warning Displays		Severity
T063	Right turn output - open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T063  	<i>SERVICE</i>
T064	Neutral start - short circuit to battery	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	T064  	<i>STOP NOW</i>
T065	Neutral start - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T066  	<i>SERVICE</i>
T066	Neutral start - open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T066  	<i>SERVICE</i>
T067	Brake lights - short circuit to battery	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T067  	<i>SERVICE</i>

Fault Code	Description	Warning Displays		Severity
T068	Brake lights - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T068  	<i>SERVICE</i>
T069	Brake lights - open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T069  	<i>SERVICE</i>
T070	Footbrake switch (Normally closed) out of range error	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T070  	<i>SERVICE</i>
T071	Footbrake switch (Normally open) out of range error	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T071  	<i>SERVICE</i>
T072	Footbrake switch - open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T072  	<i>SERVICE</i>
T073	Footbrake switch - short circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T07  	<i>SERVICE</i>

Fault Code	Description	Warning Displays		Severity
T074	Reverse alarm - short circuit to battery	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	T074  	<i>STOP NOW</i>
T075	Reverse alarm - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T075  	<i>SERVICE</i>
T076	Reverse alarm - open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T076  	<i>SERVICE</i>
T077	Ground speed sensor out of range error - low	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T077  	<i>SERVICE</i>
T078	Ground speed sensor out of range error - high	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T078  	<i>SERVICE</i>

Fault Code	Description	Warning Displays		Severity
T079	Ground speed invalid	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T079  	<i>SERVICE</i>
T080	Secondary ground speed lost	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T080  	<i>SERVICE</i>
T081	Ground speed signal disagreement	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T081  	<i>SERVICE</i>
T082	Secondary ground speed invalid	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T082  	<i>SERVICE</i>
T083	Vari-inch LED - short circuit to battery	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	T083  	<i>STOP NOW</i>
T084	Vari-inch LED - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T084  	<i>SERVICE</i>

Fault Code	Description	Warning Displays		Severity
T085	Vari-inch LED - open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T085  	<i>SERVICE</i>
T086	Switch supply - short circuit to battery	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	T086  	<i>STOP NOW</i>
T087	Switch supply - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T087  	<i>SERVICE</i>
T088	Switch supply - open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T088  	<i>SERVICE</i>
T089	Application checksum failure	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	T089  	<i>STOP NOW</i>

Fault Code	Description	Warning Displays		Severity
T091	Constant data checksum failure	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	T091 	<i>SERVICE</i>

Hydraulic Control ECU "L" Codes

Fault Code	Description	Warning Displays		Severity
L000	10° Proximity switch - open circuit	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	L000  	<i>STOP NOW</i>
L001	10° Proximity switch - short circuit	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	L001  	<i>STOP NOW</i>
L002	10° Proximity switch - supply open circuit	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	L002  	<i>STOP NOW</i>
L003	10° Proximity switch - supply short circuit to ground	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	L003  	<i>STOP NOW</i>
L004	10° Proximity switch - supply short circuit to battery	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	L004  	<i>STOP NOW</i>

Fault Code	Description	Warning Displays		Severity
L005	Boom retracted proximity switch - open circuit	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	L005  	<i>STOP NOW</i>
L006	Boom retracted proximity switch - short circuit	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	L006  	<i>STOP NOW</i>
L007	Boom retracted proximity switch - supply open circuit	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	L007  	<i>STOP NOW</i>
L008	Boom retracted proximity switch - supply short circuit to ground	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	L008  	<i>STOP NOW</i>
L009	Boom retracted proximity switch - supply short circuit to battery	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	L009  	<i>STOP NOW</i>

Fault Code	Description	Warning Displays		Severity
L010	45° Proximity switch - open circuit	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	L010  	<i>STOP NOW</i>
L011	45° Proximity switch - short circuit	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	L011  	<i>STOP NOW</i>
L012	45° Proximity switch - supply open circuit	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	L012  	<i>STOP NOW</i>
L013	45° Proximity switch - supply short circuit to ground	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	L013  	<i>STOP NOW</i>
L014	45° Proximity switch - supply short circuit to battery	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	L014  	<i>STOP NOW</i>

Fault Code	Description	Warning Displays		Severity
L015	Boom lower transducer - out of range error - low	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	L015  	STOP NOW
L016	Boom lower transducer - out of range error - high	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	L016  	STOP NOW
L017	Fork tilt switch - out of range error - low	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	L017  	STOP NOW
L018	Fork tilt switch - out of range error - high	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	L018  	STOP NOW
L019	Lower/tilt switch - supply open circuit	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	L019  	STOP NOW

Fault Code	Description	Warning Displays	Severity
L020	Lower/tilt switch - supply short circuit to ground	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	STOP NOW
L021	Lower/tilt switch - supply short circuit to battery	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	STOP NOW
L022	Load Moment Indicator (LMI) fault	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	STOP NOW
L023	SRS switch - short circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	SERVICE
L024	80% Solenoid - open circuit	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	STOP NOW

Fault Code	Description	Warning Displays	Severity
L025	80% Solenoid - short circuit to ground	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	<i>STOP NOW</i>
L026	80% Solenoid - short circuit to battery	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	<i>STOP NOW</i>
L027	100% Solenoid - open circuit	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	<i>STOP NOW</i>
L028	100% Solenoid - short circuit to ground	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	<i>STOP NOW</i>
L029	100% Solenoid - short circuit to battery	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	<i>STOP NOW</i>

Fault Code	Description	Warning Displays		Severity
L030	Accumulator solenoid - open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L030  	<i>SERVICE</i>
L031	Accumulator solenoid - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L031  	<i>SERVICE</i>
L032	Accumulator solenoid - short circuit to battery	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L032  	<i>SERVICE</i>
L033	Drain solenoid - open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L033  	<i>SERVICE</i>
L034	Drain solenoid - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L034  	<i>SERVICE</i>
L035	Drain solenoid - short circuit to battery	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L035  	<i>SERVICE</i>

Fault Code	Description	Warning Displays		Severity
L036	Boom extend solenoid - open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L036  	<i>SERVICE</i>
L037	Boom extend solenoid - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L037  	<i>SERVICE</i>
L038	Boom extend solenoid - short circuit to battery	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L038  	<i>SERVICE</i>
L039	Boom retract solenoid - open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L039  	<i>SERVICE</i>
L040	Boom retract solenoid - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L040  	<i>SERVICE</i>
L041	Boom retract solenoid - short circuit to battery	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L041  	<i>SERVICE</i>

Fault Code	Description	Warning Displays	Severity
L042	Boom extend/retract solenoid return - open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L043	Boom extend/retract solenoid return - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L044	Boom extend/retract solenoid return - short circuit to battery	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L045	Auxiliary 'A' solenoid - open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L046	Auxiliary 'A' solenoid - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L047	Auxiliary 'A' solenoid - short circuit to battery	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>

Fault Code	Description	Warning Displays	Severity
L048	Auxiliary 'B' solenoid - open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L049	Auxiliary 'B' solenoid - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L050	Auxiliary 'B' solenoid - short circuit to battery	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L051	Auxiliary 'A'/'B' solenoid return - open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L052	Auxiliary 'A'/'B' solenoid return - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L053	Auxiliary 'A'/'B' solenoid return - short circuit to battery	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>

Fault Code	Description	Warning Displays	Severity
L054	Auxiliary changeover solenoid - open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L055	Auxiliary changeover solenoid - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L056	Auxiliary changeover solenoid - short circuit to battery	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L057	Boom extend/retract thumbwheel out of range error - low	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L058	Boom extend/retract thumbwheel out of range error - high	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L059	Column F/N/R switch - 'Neutral' position open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>

Fault Code	Description	Warning Displays	Severity
L060	Column F/N/R switch - 'Neutral' position short circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L061	Auxiliary thumbwheel out of range error - low	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L062	Auxiliary thumbwheel out of range error - high	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L063	Joystick hydraulic lock (isolation) switch - open circuit	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	<i>STOP NOW</i>
L064	Joystick hydraulic lock (isolation) switch - short circuit	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	<i>STOP NOW</i>

Fault Code	Description	Warning Displays		Severity
L065	Neutral start relay - open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L065  	<i>SERVICE</i>
L066	Neutral start relay - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L066  	<i>SERVICE</i>
L067	Neutral start relay - short circuit to battery	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L067  	<i>SERVICE</i>
L068	Joystick/control lever F/N/R switch supply - open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L068  	<i>SERVICE</i>
L069	Joystick/control lever F/N/R switch supply - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L069  	<i>SERVICE</i>
L070	Joystick/control lever F/N/R switch supply - short circuit to battery	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L070  	<i>SERVICE</i>

Fault Code	Description	Warning Displays	Severity
L071	CANbus fault	MIL lamp activated (Red). Message displayed on LCD. Continuous buzzer activated	STOP NOW
L072	EEPROM fault	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	SERVICE
L073	Lower transducer disagreement	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	SERVICE
L074	Tilt transducer disagreement	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	SERVICE
L075	Boom angle sensor disagreement	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	SERVICE

Fault Code	Description	Warning Displays	Severity
L076	Boom angle sensor 1 out of range error - low	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L077	Boom angle sensor 1 out of range error - high	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L078	Boom angle sensor 2 out of range error - low	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L079	Boom angle sensor 2 out of range error - high	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L080	Lift pressure transducer out of range error - low	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L081	Lift pressure transducer out of range error - high	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>

Fault Code	Description	Warning Displays	Severity
L082	Boom raise solenoid- open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L083	Boom raise solenoid - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L084	Boom raise solenoid - short circuit to battery	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L085	Boom lower solenoid- open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L086	Boom lower solenoid - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L087	Boom lower solenoid - short circuit to battery	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>

Fault Code	Description	Warning Displays		Severity
L088	Boom crowd solenoid- open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L088  	<i>SERVICE</i>
L089	Boom crowd solenoid - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L089  	<i>SERVICE</i>
L090	Boom crowd solenoid - short circuit to battery	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L090  	<i>SERVICE</i>
L091	Boom dump solenoid- open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L091  	<i>SERVICE</i>
L092	Boom dump solenoid - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L092  	<i>SERVICE</i>
L093	Boom dump solenoid - short circuit to battery	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L093  	<i>SERVICE</i>

Fault Code	Description	Warning Displays	Severity
L094	Hand throttle extend - open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L095	Hand throttle extend - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L096	Hand throttle extend - short circuit to battery	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L097	Hand throttle retract - open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L098	Hand throttle retract - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L099	Hand throttle retract - short circuit to battery	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>

Fault Code	Description	Warning Displays	Severity
L100	Hand throttle relay - open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L101	Hand throttle relay - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L102	Hand throttle relay - short circuit to battery	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L103	Hydraulic isolation solenoid - open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L104	Hydraulic isolation solenoid - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L105	Hydraulic isolation solenoid - short circuit to battery	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>

Fault Code	Description	Warning Displays	Severity
L106	Raise/lower solenoid return - open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L107	Raise/lower solenoid return - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L108	Raise/lower solenoid return - short circuit to battery	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L109	Crowd/dump solenoid return - open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L110	Crowd/dump solenoid return - short circuit to ground	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>
L111	Crowd/dump solenoid return - short circuit to battery	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	<i>SERVICE</i>

Fault Code	Description	Warning Displays		Severity
L112	Tilt lock switch - open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L112  	<i>SERVICE</i>
L113	Tilt lock switch - short circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L113  	<i>SERVICE</i>
L114	Hand throttle position feedback out of range error - low	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L114  	<i>SERVICE</i>
L115	Hand throttle position feedback out of range error - high	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L115  	<i>SERVICE</i>
L116	SRS pressure switch out of range error - low	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L116  	<i>SERVICE</i>
L117	SRS pressure switch out of range error - high	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L117  	<i>SERVICE</i>

Fault Code	Description	Warning Displays		Severity
L118	SRS pressure switch disagreement	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L118  	<i>SERVICE</i>
L119	Vari-inch dial sensor 1 out of range error - low	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L119  	<i>SERVICE</i>
L120	Vari-inch dial sensor 1 out of range error - high	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L120  	<i>SERVICE</i>
L121	Vari-inch dial sensor 2 out of range error - low	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L121  	<i>SERVICE</i>
L122	Vari-inch dial sensor 2 out of range error - high	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L122  	<i>SERVICE</i>
L123	Vari-inch dial sensor disagreement	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L123  	<i>SERVICE</i>

Fault Code	Description	Warning Displays		Severity
L124	Boom movement when joystick is in neutral (stuck spool)	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L124 	SERVICE
L125	Boom movement when LMI is greater than 115%	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L125 	SERVICE
L126	Hand throttle not able to achieve position	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L126 	SERVICE
L127	Emergency stop switch - short circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L127 	SERVICE
L128	Emergency stop switch - open circuit	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L128 	SERVICE
L129	Speed sensor out of range error - high	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L129 	SERVICE

Fault Code	Description	Warning Displays		Severity
L130	Speed sensor out of range error - low	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L130  	<i>SERVICE</i>
L131	Speed sensor disagreement	MIL lamp activated (Amber). Message displayed on LCD. Buzzer activated for 1 second.	L131  	<i>SERVICE</i>

Servicemaster SYSTEM

Introduction

This topic contains information about a machine SYSTEM. The system has some devices that connect either mechanically, hydraulically or electrically. Make sure you are referring to the correct system. Refer to the applications table. [⇒ Related Topics \(□ M4-2\)](#).

Descriptions and procedures relate to the system and not the individual devices. For information about the devices refer to the relevant topics. [⇒ Related Topics \(□ M4-2\)](#)

This topic is intended to help you understand what the system does and how it works. Where applicable it also includes procedures such as removal and replacement and dismantle and assemble.

[⇒ Related Topics \(□ M4-2\)](#)

[⇒ Why Use Servicemaster? \(□ M4-3\)](#)

[⇒ Introduction \(□ M4-3\)](#)

[⇒ Fault Finding \(□ M4-3\)](#)

[⇒ Identify Poor Maintenance \(□ M4-3\)](#)

[⇒ Access Machine Set Up Data \(□ M4-3\)](#)

[⇒ Re-Programming ECU's \(□ M4-3\)](#)

[⇒ Summary \(□ M4-3\)](#)

[⇒ What is Servicemaster? \(□ M4-4\)](#)

[⇒ Introduction \(□ M4-4\)](#)

[⇒ CANbus Communications System \(□ M4-4\)](#)

[⇒ Servicemaster Structure \(□ M4-4\)](#)

[⇒ How to Set Up Servicemaster \(□ M4-5\)](#)

[⇒ Install Servicemaster \(□ M4-6\)](#)

[⇒ Start Servicemaster \(□ M4-7\)](#)

[⇒ Load the DLA Laptop Driver Software \(□ M4-8\)](#)

[⇒ Configure the DLA Type and Communications Port \(□ M4-9\)](#)

[⇒ Check the DLA Firmware File \(□ M4-10\)](#)

[⇒ Connect Servicemaster to the Machine CANbus \(□ M4-12\)](#)

Related Topics

Table 1. Related Topics in This Publication

The table lists other topics in the manual that contain information related to this topic. Refer to the applicable topics to complete your procedures. Where applicable the text in this section contains cross references to this page to help you find the correct information. Some machines have different systems and devices. Make sure you refer to the correct topic, refer to **Section 1 - Applications**.

Sections	Topic Titles	Sub Titles
1	Applications	ALL
1	Service Tools	ALL
2	ALL (Care and Safety) ⁽¹⁾	ALL
M	⇒ CANbus SYSTEM (□ M1-1)	ALL
M	⇒ Loadall Monitoring SYSTEM (□ M2-1)	ALL
M	⇒ Fault Code SYSTEM (□ M3-1)	ALL

(1) You must obey all of the relevant care and safety procedures.

Table 2. Service Tools

The table lists the service tools you will need to do some of the procedures in this topic. Make sure you have the correct service tools BEFORE you start the procedures

Tool Part Number	Description
892/01174 ⁽¹⁾	Data Link Adaptor Kit
718/20235 ⁽¹⁾	USB PC Cable
718/20236 ⁽¹⁾	Serial PC Cable
728/26500 ⁽¹⁾	USB DLA
718/20237 ⁽¹⁾	Machine Cable

(1) Tool available from JCB Service, refer to Section 1 - Service Tools

Why Use Servicemaster?

Introduction

JCB machines now use the latest developments in electronic management of machine systems. This means that machine systems such as service hydraulics, engine, transmission and steering are controlled using electronic control units (ECU's).

The ECU's process inputs from electrical sensors and then output signals to electrical actuators on the applicable devices. The ECU's are also connected to the machine CANbus electronic communication system.

Fault Finding

Faults with ECU controlled systems can be difficult or impossible to trace using traditional methods.

In addition to the primary function of machine control the ECU's are also able to detect possible faults with sensors and actuators. The faults are 'logged' using a code system.

Use **Servicemaster** to see and understand these codes.

In addition **Servicemaster** has direct links to relevant on-screen help information about relevant devices. This information is designed to help you identify, test, and if applicable, remove and replace devices.

Identify Poor Maintenance

System faults that are present, or have happened in the past can be seen. This is not only useful when fault finding but can also identify poor standards of maintenance. For example a log showing a history of water in fuel detected.

Use **Servicemaster** to see and understand these codes.

Access Machine Set Up Data

Machine parameters such as tyre sizes, gear shift points and engine injector calibration codes are all stored and used by the relevant control ECU's. During the life of the machine it will be necessary to change some of these parameters. Without the correct data the machine will not operate correctly.

This can only be done with **Servicemaster**.

Re-Programming ECU's

The ECU's use pre-loaded data to compute responses to inputs from sensors. If an ECU is replaced the correct data files must be programmed (' flashed') into the ECU memory.

New data files may also be issued by JCB Service to improve machine operation. This will also require the ECU to be re-programmed.

This can only be done with **Servicemaster**.

Summary

With the latest **Servicemaster** software loaded on your laptop and you can:

- **Fault find**
- For fast, effective fault finding.
- **Check maintenance standards**
- See if the machine has been abused.
- **View and change machine set up data**
- This can only be done with Servicemaster.
- **Flash ECU's with the correct data files**
- This can only be done with Servicemaster.



C047000

What is Servicemaster?

Introduction

JCB Servicemaster is software for use with Microsoft Windows and a laptop personal computer.

The laptop computer is connected to the machine 'diagnostic socket' using special cables and an adapter. Use Servicemaster software to:

- Display data from machine ECU's
- Change data stored in ECU's

CANbus Communications System

C Controller **A** Area **N** Network

Servicemaster software communicates with the machine ECU's using the CAN.

CAN is an electronic communications system that connects compatible machine ECU's to one pair of data wires called the CANbus. Coded data is sent to and from the ECU's on the CANbus. By connecting Servicemaster software to the CANbus this data is seen and decoded for use by an engineer. [⇒ CANbus SYSTEM \(M1-1\)](#)

Servicemaster Structure

Servicemaster software is supplied as part of the JCB Service data DVD **1-A** issued to JCB dealers.

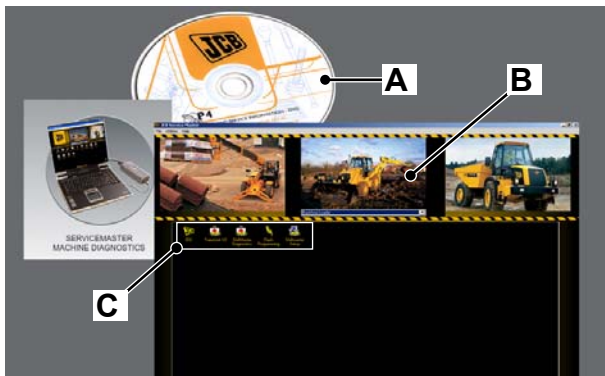


Fig 1.

C047160

The DVD includes all the software tools for all applicable JCB machines. A selector window **1-B** is used to choose the correct software tool set **1-C** for each machine range.

Tool Sets

Tool sets **1-C** are different for each machine range. A typical tool set includes:

 C046750	 C46230
Vehicle Setup tool	Diagnostics tool
 C046760	 C046230-C2
Flash Programmer tool	Data Logger tool
 C046230-C1	 C075490
Service History	Loadall Electronic Instrument Cluster Setup

Each tool is specific to the chosen machine range. The tool icons are 'shortcuts' to the tool software files. Detailed information about how to use the tools is given in the applicable machine documentation.

How to Set Up Servicemaster

Note: The procedures that follow describe how to set up Servicemaster for USB compatible equipment. There are other procedures and options. These are described in detail in the Servicemaster help files contained on the JCB Service Information DVD.

Before you set up Servicemaster make sure you have:

- A Microsoft Windows compatible laptop computer with a DVD drive and a USB port (**2-A**)

Note: Servicemaster is compatible with Windows 98, 2000, ME and XP.

- The latest Servicemaster software (JCB Service Information DVD) (**2-B**)
- A JCB compatible data link adapter (DLA) (**2-C**)
- The correct connection cables (**2-D**)

Important: DO NOT connect any cables at the laptop, DLA or machine now.

- 4 Configure the DLA type and communications port
- 5 Make sure that the DLA flash memory contains the latest firmware file
- 6 Connect Servicemaster to the machine CANbus

[⇒ Install Servicemaster \(\[M4-6\] \)](#)

[⇒ Start Servicemaster \(\[M4-7\] \)](#)

[⇒ Load the DLA Laptop Driver Software \(\[M4-8\] \)](#)

[⇒ Configure the DLA Type and Communications Port \(\[M4-9\] \)](#)

[⇒ Check the DLA Firmware File \(\[M4-10\] \)](#)

[⇒ Connect Servicemaster to the Machine CANbus \(\[M4-12\] \)](#)



Fig 2.

C047170

To set up Servicemaster for the first time:

- 1 **Install Servicemaster**
- 2 **Start Servicemaster**
- 3 **Load the DLA laptop driver software**

Install Servicemaster

- 1 Exit all open programs on your laptop computer.
- 2 Insert the 'JCB Service Information Pack DVD' into the DVD drive. The chooser screen will open. Click on the 'S4' icon. [⇒ Fig 3. \(M4-6\)](#)



Fig 3.

C047180

- 3 The S4 chooser screen will open. Click on the Servicemaster icon. [⇒ Fig 4. \(M4-6\)](#)



Fig 4.

C047190

- 4 The Servicemaster set up screen will open. Click on the 'Install' button. [⇒ Fig 5. \(M4-6\)](#). The installation process now starts:



Fig 5.

C047200-C1

- a At the 'installer' screen click 'Next'.
[⇒ Fig 6. \(M4-6\)](#)



Fig 6.

C047200-C2

- b At the 'destination location' screen click 'Next'.
- c At the 'installation type' screen click 'Next'. (A full installation is recommended.)
- d At the 'installation complete' screen, click 'Finish'.

Start Servicemaster

- 1 Double click on the Servicemaster icon.
⇒ [Fig 7. \(M4-7\)](#) (The icon is found on the desktop or in the 'Start' menu - 'Programs' - 'JCB'.)

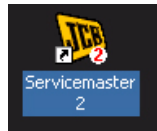


Fig 7.

C047200

- 2 The Servicemaster chooser window will open.
⇒ [Fig 8. \(M4-7\)](#)



Fig 8.

C047200-C3

- 3 Open the drop down menu to see the machines and components supported by Servicemaster tools.
⇒ [Fig 9. \(M4-7\)](#)

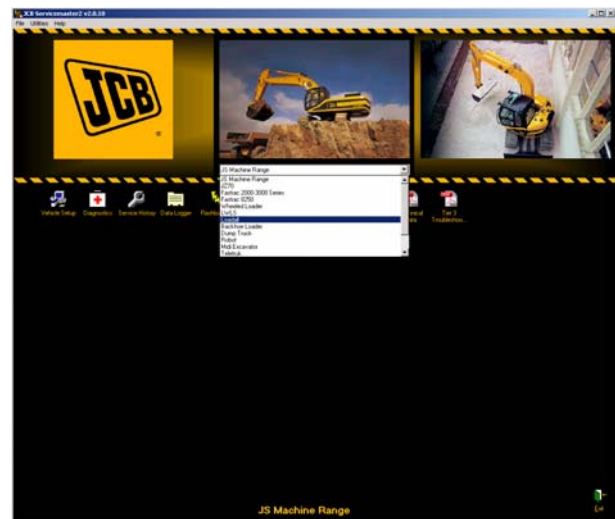


Fig 9.

C047200-C4

Load the DLA Laptop Driver Software

To use Servicemaster for the first time you must load the DLA driver software. You will not have to do the procedure again.

Important: DO NOT connect the DLA or cables at the laptop or machine now.

- 1 Start the Servicemaster software on your laptop computer. → [Start Servicemaster](#) (□ M4-7)
- 2 Select 'DLA' from the drop down menu. → [Fig 10.](#) (□ M4-8)

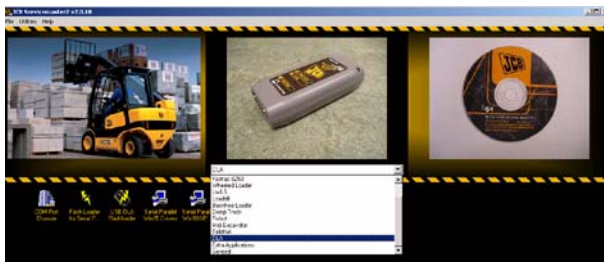


Fig 10.

C047210-C2

- 3 Double click on the USB driver icon. → [Fig 11.](#) (□ M4-8)



Fig 11.

C047210-C

Note: Drivers are also available for computers with serial ports (no USB) and other versions of Microsoft Windows. If your laptop does not have a USB port, double click on the correct driver icon.

- 4 The driver installer window will open. → [Fig 12.](#) (□ M4-8) Follow the on-screen installation instructions to complete the installation.

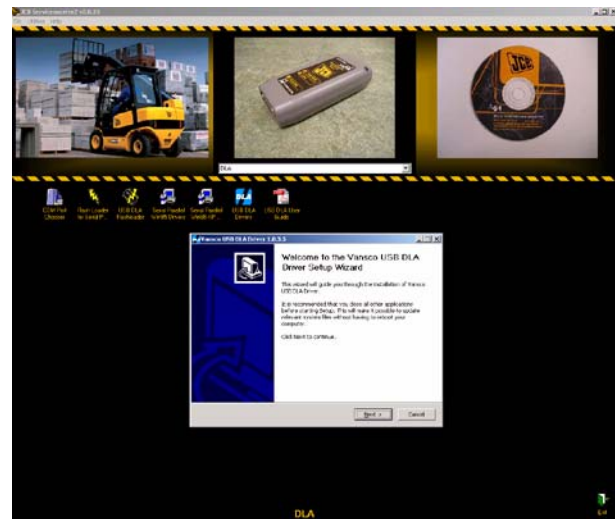


Fig 12.

C047210

Configure the DLA Type and Communications Port

To use Servicemaster for the first time you must make sure that the correct DLA and laptop port is selected to communicate with the DLA. You will not have to do the procedure again.

Note: Older DLAs and laptop computers may not be compatible with USB ports. Choose the 'Parallel/Serial DLA' device in the DLA chooser.

- 1 Start the Servicemaster software on your laptop computer. → [Start Servicemaster \(□ M4-7\)](#)
- 2 Select 'DLA' from the Servicemaster drop down menu. → [Fig 10. \(□ M4-8\)](#)
- 3 Double click the COM Port Chooser icon. → [Fig 13. \(□ M4-9\)](#)



Fig 13.

C047220

- 4 The DLA Chooser window will open. Select the 'USB/Serial DLA' device and then click 'Apply'. → [Fig 14. \(□ M4-9\)](#)

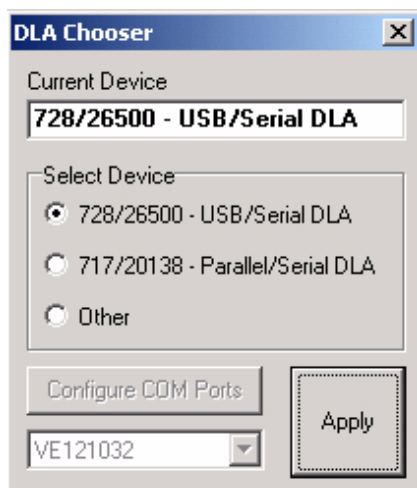


Fig 14.

C047220-C1

Check the DLA Firmware File

Important: Do not connect the DLA to the machine until this procedure has been completed.

The DLA has software embedded in its own flash memory. This file must be replaced with a new one when new firmware is released. You will only have to Check the DLA firmware file version if you receive a new Servicemaster version or use a different DLA.

- 1 Make sure that the DLA is connected to the laptop computer. [⇒ Connect the 'USB PC Cable' 19-A to the DLA and a free port on your laptop computer. \(□ M4-12\)](#)
- 2 Start the Servicemaster software on your laptop computer. [⇒ Start Servicemaster \(□ M4-7\)](#)
- 3 Select 'DLA' from the drop down menu. [⇒ Fig 10. \(□ M4-8\)](#)
- 4 Double click on the USB DLA Flash Loader icon. [⇒ Fig 15. \(□ M4-10\)](#)



Fig 15.

C048070-C4

Note: Older DLAs and laptop computers may not be compatible with USB ports. Double click the 'Flash loader for Serial/Parallel DLA' icon.

- 5 The device flash update tool window opens. The details of the firmware in the DLA are displayed including the application version, for example 1.04.

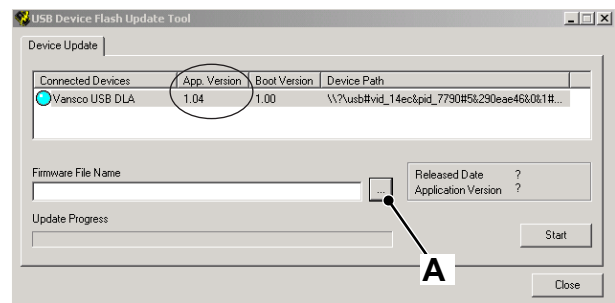


Fig 16.

C048070

- 6 **Check for a new firmware file:** Click on the browse button **16-A** and locate the file stored within the JCB_Servicemaster directory on your laptop hard drive.
 - a Click the 'Open' button. The selected file appears in the 'Firmware File Name' field together with its release date and application version, for example 2.01. [⇒ Fig 18. \(□ M4-11\)](#)

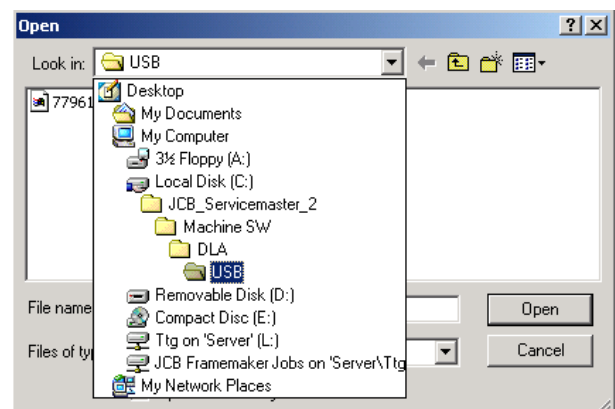
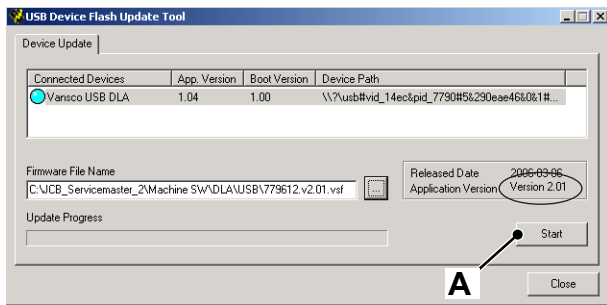


Fig 17.

C048070-C1



C048070-C3

Fig 18.

- 7 Load a new firmware file:** If the firmware in the DLA is not up to date, load the new file. Click the 'Start' button **18-A** and follow the on-screen instructions.
- 8** When the update is complete disconnect the DLA and close the servicemaster application.

Important: *The computer must be restarted before the updated software can be used.*

Connect Servicemaster to the Machine CANbus

To use Servicemaster connect your laptop computer to the machine CANbus. Connection is made using Data Link Adapter (DLA) **19-C** and the applicable cables.

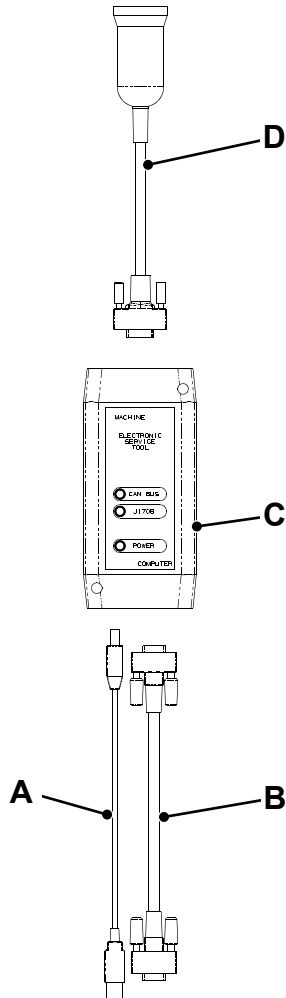


Fig 19.

C032140

Table 3. Component Key

A	USB PC Cable	718/20235
B	Serial PC Cable	718/20236
C	USB DLA	728/26500
D	Machine Cable	718/20237
Kit 892/01174 (includes items A,B,C and D)		

- 1 Make sure the machine ignition system is OFF.
- 2 Connect the 'USB PC Cable' **19-A** to the DLA and a free port on your laptop computer.

Note: Connect the USB cable directly to the laptop computer. DO NOT connect the cable via a USB hub.

Note: Older DLAs and laptop computers may not be compatible with USB ports. Use the serial PC cable **19-B** to connect the DLA to the laptop serial port.

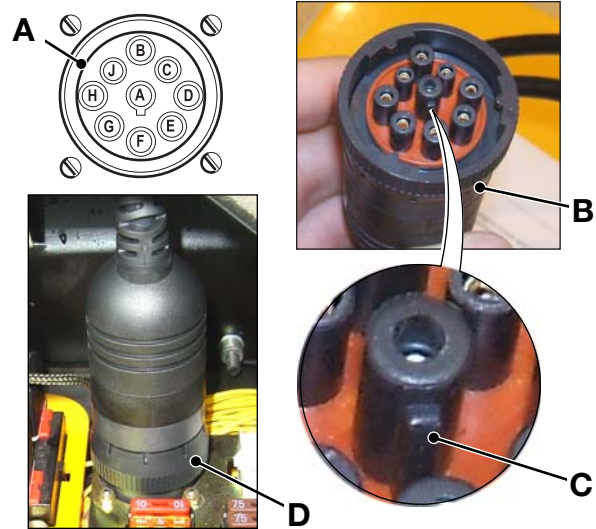


Fig 20.

A405350-C2

- 3 Connect the 'Machine Cable' **19-D** to the DLA. The 'Machine Cable' has a 15-way D-type connector on one end and a 9-way CAN connector on the other. Plug the 15-way connector into the DLA and tighten the thumb-screws.
- 4 Connect the 9-way CAN connector into the machines' Diagnostics Connector **20-A** as follows:
 - a Position the CAN connector **20-B** to align the centre pin location tab **20-C** with the diagnostics connector. **20-A**.
 - b Couple the connectors. Turn the locking ring **20-D** clockwise to secure the connectors.

Servicemaster Tools

Introduction

This topic contains information about a machine DEVICE. Make sure you are referring to the correct device. Refer to the applications table.

Descriptions and procedures relate to the device and not related systems. For information about the systems refer to the relevant topics.

This topic is intended to help you understand what the device does and how it works. Where applicable it also includes procedures such as removal and replacement and dismantle and assemble.

[⇒ *Related Topics* \(!\[\]\(12e34e9e4252b30a852242f38c907701_img.jpg\) M5-2\)](#)

[⇒ *Summary* \(!\[\]\(2f7b7716d9e9a4c6bd653c73a2b75b79_img.jpg\) M5-3\)](#)

[⇒ *Loadall LMS Setup - User Guide* \(!\[\]\(4c8a200be85d8be7ce33b7f7e1327e22_img.jpg\) M5-4\)](#)

[⇒ *Loadall Machine Diagnostics - User Guide* \(!\[\]\(b204018f07f35ae64259225ce55111a1_img.jpg\) M5-18\)](#)

Related Topics

Table 1. Related Topics in This Publication

The table lists other topics in the manual that contain information related to this topic. Refer to the applicable topics to complete your procedures. Where applicable the text in this section contains cross references to this page to help you find the correct information. Some machines have different systems and devices. Make sure you refer to the correct topic, refer to **Section 1 - Applications**.

Sections	Topic Titles	Sub Titles
1	Applications	ALL
1	Service Tools	ALL
2	ALL (Care and Safety) ⁽¹⁾	ALL
M	⇒ Servicemaster SYSTEM (□ M4-1)	ALL

(1) You must obey all of the relevant care and safety procedures.

Table 2. Service Tools

The table lists the service tools you will need to do some of the procedures in this topic. Make sure you have the correct service tools BEFORE you start the procedures

Tool Part Number	Description
892/01174 ⁽¹⁾	Data Link Adaptor Kit
718/20235 ⁽¹⁾	USB PC Cable
718/20236 ⁽¹⁾	Serial PC Cable
728/26500 ⁽¹⁾	USB DLA
718/20237 ⁽¹⁾	Machine Cable

(1) Tool available from JCB Service, refer to Section 1 - Service Tools

Summary

Tool	Icon	Description	User Guide
JCB Loadall LMS Setup	 C075490	Configure the LMS display ECU to match machine parameters.	⇒ Loadall LMS Setup - User Guide (□ M5-4)
JCB Loadall Machine Diagnostics	 C087940	Comprehensive information about machine related sensors, actuators and ECU fault codes.	⇒ Loadall Machine Diagnostics - User Guide (□ M5-18)

Loadall LMS Setup - User Guide



C032980

Introduction

The **Loadall LMS Setup** software tool is part of the **JCB Service Master** software suite. The software is designed to allow software updates and to configure the Electronic Instrument cluster to match machine parameters.

Note: This software guide is universal and some functions may not be available on particular machine variants.

This software is intended for use on IBM Compatible Personal Computers (**PCs**) running **Windows 9x**, **Windows2000** and **WindowsXP** operating systems but is not compatible with either earlier versions of **Windows 3.x**. Ideally the computer should be a laptop type.

Care and Safety

WARNING

Be sure to read and follow any on screen instructions. Failure to follow correct procedure could result in death or injury.

2-4-5-5



Installing

The **Loadall LMS Setup** tool is fully integrated within JCB Service Master 2 Version 7.1. To use the setup program you must install **JCB Service Master 2 Version 7.1** onto a suitable laptop computer.

For full instructions on how to install **JCB Service Master** software see **Servicemaster SYSTEM**. ➔ [Servicemaster SYSTEM \(□ M4-1\)](#)

Connection

To use the setup program your laptop computer must be connected to the machine CANbus. See **Servicemaster SYSTEM** for servicemaster connection details.

⇒ [Servicemaster SYSTEM](#) ([M4-1](#))

Starting Loadall LMS Setup

- 1 Turn ON the machine ignition and additionally start the engine if required (taking normal precautions).
- 2 Start **JCB Service Master** on the laptop computer.



Fig 1.

C075500

- 3 Make sure that the correct DLA is selected in the chooser. Click on 'Utilities', DLA Setup. The DLA Chooser window opens. Check the button to match to the Current Device. Click 'Apply'. [⇒ Fig 2. \(□ M5-7\)](#)

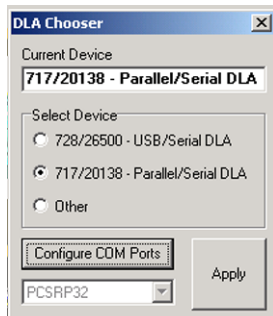


Fig 2.

C033110

- 4 Select 'Loadall 2007+' from the drop down list [⇒ Fig 1. \(□ M5-7\)](#) and then start the setup tool running by clicking on the **Loadall Cluster Setup** icon. [⇒ Fig 3. \(□ M5-7\)](#)



Fig 3.

C075490

- 5 The **Loadall LMS Setup** tool will then open up displaying the build option window. [⇒ Fig 4. \(□ M5-7\)](#).

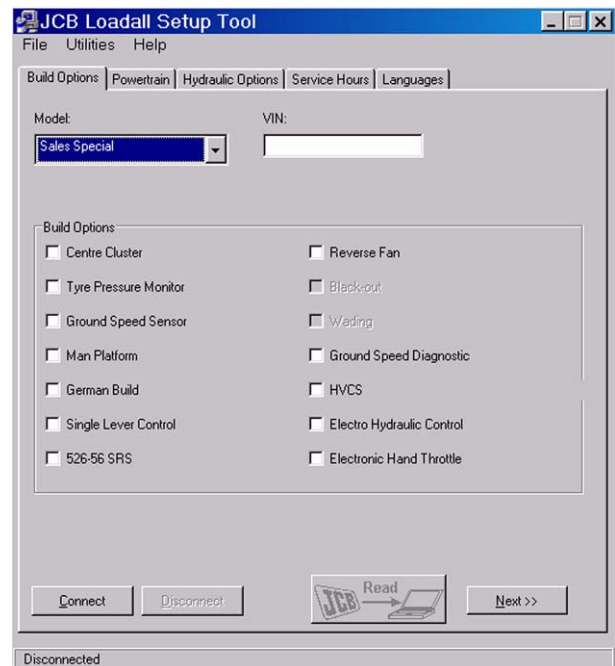


Fig 4.

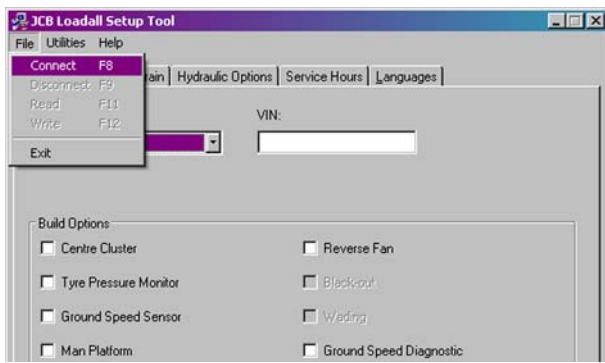
C075510-C6

- 6 Enable the connection between the PC/Laptop by pressing the "Connect" button [⇒ Fig 5. \(□ M5-7\)](#) or select "Connect" from the "File" Menu. [⇒ Fig 6. \(□ M5-8\)](#)



Fig 5.

C075510-C2



C075530-C1

Fig 6.

Navigating within Loadall LMS Setup

Navigation is designed to be via a mouse. On Laptop PCs this may take the form of a small joystick or touch sensitive pad and some buttons, usually located near to the keyboard.

As with most Windows based programs, it is possible to navigate the cluster setup software using the keyboard by pressing certain combinations of keys.

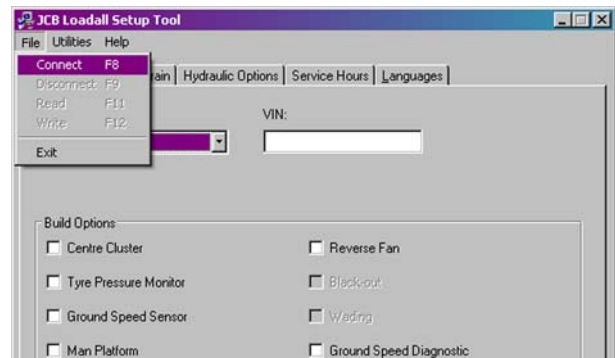
Note: This can be particularly useful for certain Laptop computers where the mouse/joystick can be over-sensitive. Try out the following, it may come in useful one day.

There are two main methods of navigation described below;

- Pressing the **ALT** key will cause the File option on the Menu Bar to be highlighted. You can then use the arrow keys to navigate the menus.
- Notice that all the menu items on the Menu Bar have a letter that is underlined (e.g. the 'F' in **File**). Holding down the ALT key and pressing the required letter key will activate that option (i.e. either open the menu or execute a function). For example, if you wish to open the Preferences Dialogue this can be done by pressing **ALT + O** (to open the **Options** menu) then **ALT + P** (to execute the **Preferences** option).

Menu Bar - File Menu

⇒ [Fig 7. \(M5-9\)](#)

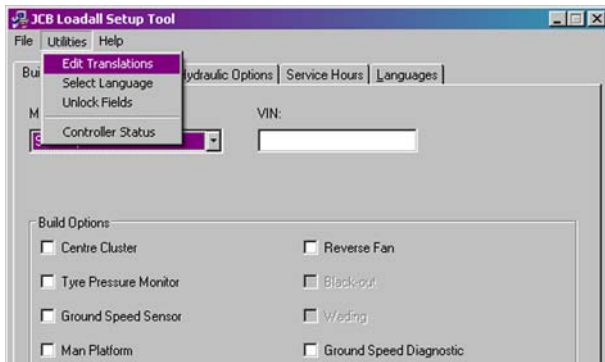


C075530-C1

Fig 7.

- **Connect:** to connect the PC/laptop to the instrument cluster to enable communication.
- **Disconnect:** to disconnect the PC/laptop and the instrument cluster and cease communication.
- **Read:** to read the existing configuration of the instrument cluster.
- **Write:** used to update the instrument cluster configuration.
- **Exit:** to close down the program. On exiting the program communications with both ECU and DLA are shut down.

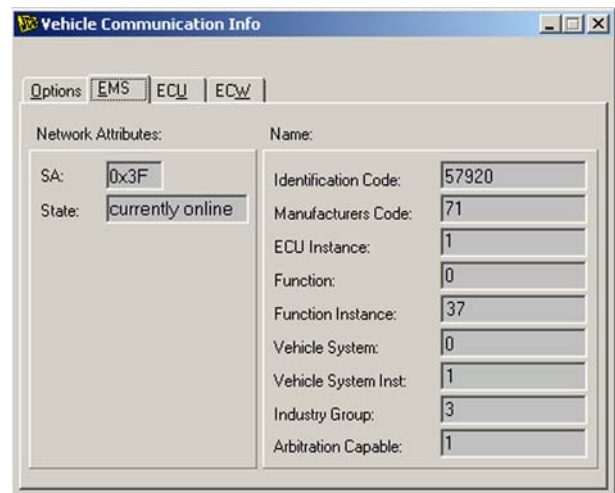
Menu Bar - Utilities Menu



C075540-C1

Fig 8.

- **Select Language:** - to select the language of the setup program. → [Fig 9.](#) ([M5-10](#))
- **Controller Status:** to show that the ECU is online. When the ECU is online the machine codes are displayed. This diagram shows the actual settings read from a test machine. → [Fig 10.](#) ([M5-10](#))



C075570

Fig 10.

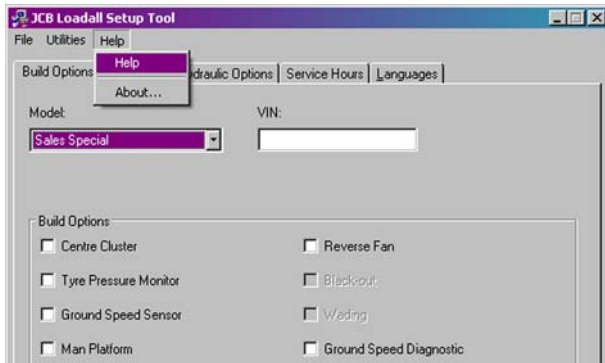


C075550

Fig 9.

Menu Bar - Help Menu

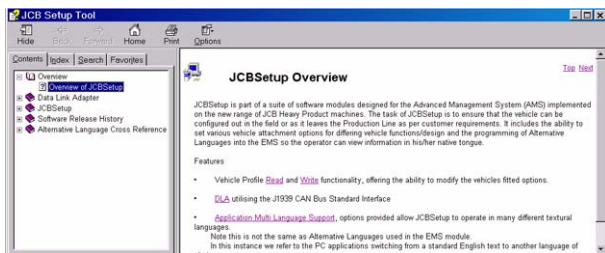
⇒ [Fig 11. \(M5-11\)](#)



C075580-C1

Fig 11.

- **Help:** opens the help program. ⇒ [Fig 12. \(M5-11\)](#)
- **About:** Opens a window showing the version number of the installed copy of the software. ⇒ [Fig 13. \(M5-11\)](#)



C095060

Fig 12.



C087950-C13

Fig 13.

Build Options

⇒ Fig 14. (M5-12)

This screen is used to configure the instrument cluster ECU machine build options. The options available will vary depending on machine model selected.

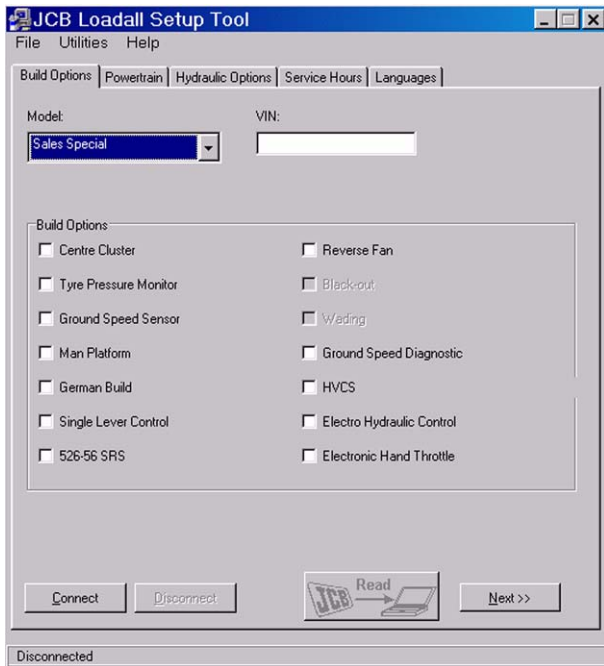


Fig 14.

C075510-C6

Transmission Options

⇒ Fig 16. (M5-13)

This screen is used to configure the instrument cluster ECU transmission options. The options available will vary depending on machine model selected.

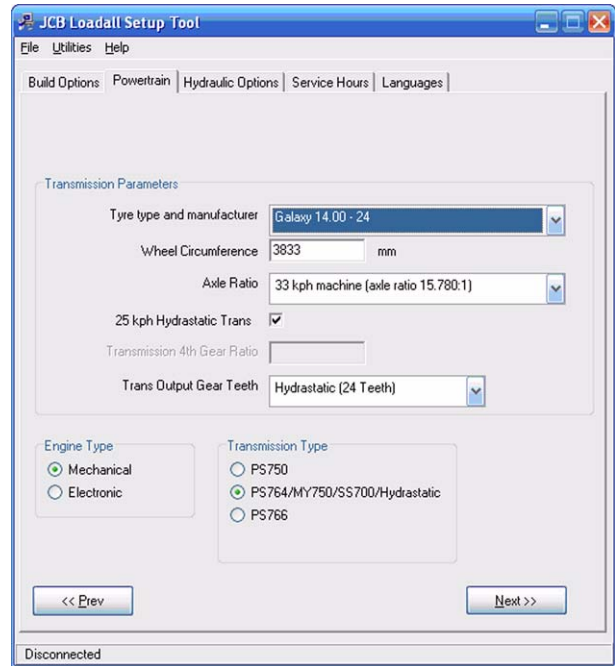


Fig 15.

C0107270

Configure Electronic Instrument Cluster Build Options

- 1 Click "Connect" to begin communication with the ECU.
- 2 Using the "Model" Drop down menu select the machine model.
- 3 Enter the machine VIN number into the VIN box.
- 4 The available build options will be represented with white check boxes next to the text.
- 5 Click on the relevant check boxes to inform the ECU that the machine has that option fitted.
- 6 Click "Next" to be taken to the Powertrain Screen.

Configure Electronic Instrument Cluster Transmission Options

- 1 The available transmission build options will be represented with white check boxes next to the text.
- 2 Click on the relevant check boxes to inform the ECU that the machine has that option fitted.
- 3 Click "Next" to be taken to the Hydraulic Options Screen.

Hydraulic Options

⇒ Fig 16. (M5-13)

This screen is used to configure the instrument cluster ECU hydraulic options. The options available will vary depending on machine model selected.

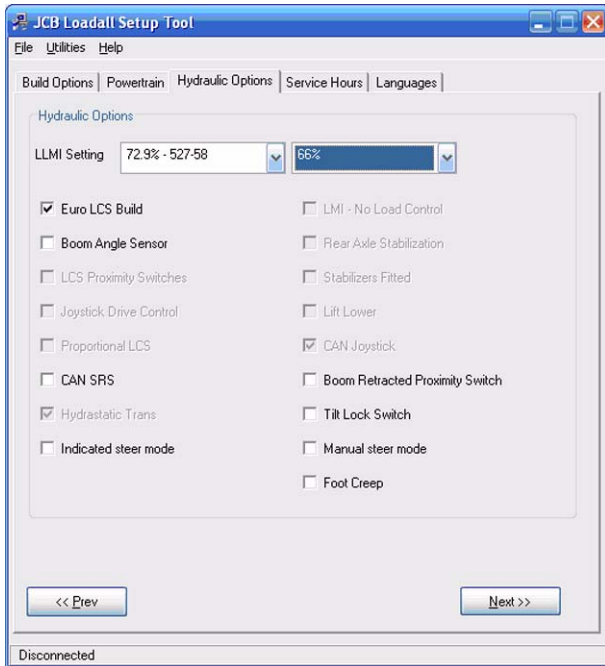


Fig 16.

C107260

Service Options

⇒ Fig 17. (M5-13)

This screen is used to configure the instrument cluster ECU service interval options. The options available will vary depending on machine model selected.

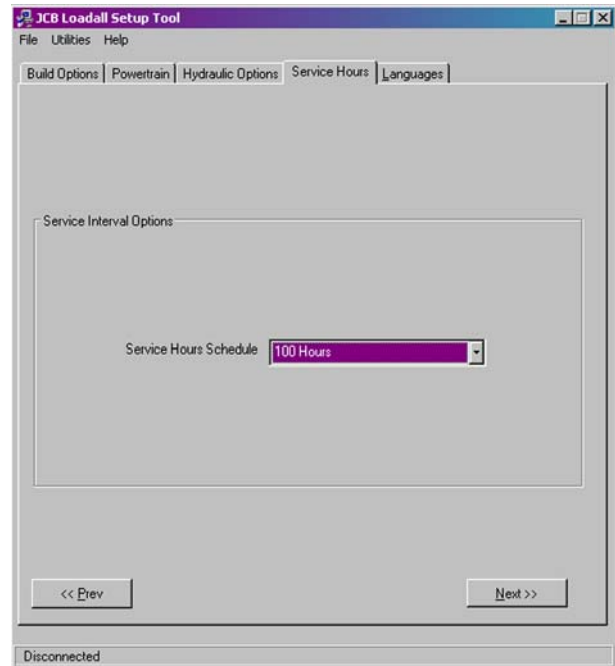


Fig 17.

C087940-C2

Configure Electronic Instrument Cluster Hydraulic Options

- 1 The available hydraulic build options will be represented with white check boxes next to the text.
- 2 Click on the relevant check boxes to inform the ECU that the machine has that option fitted.
- 3 Click "Next" to be taken to the Service Hours Screen.

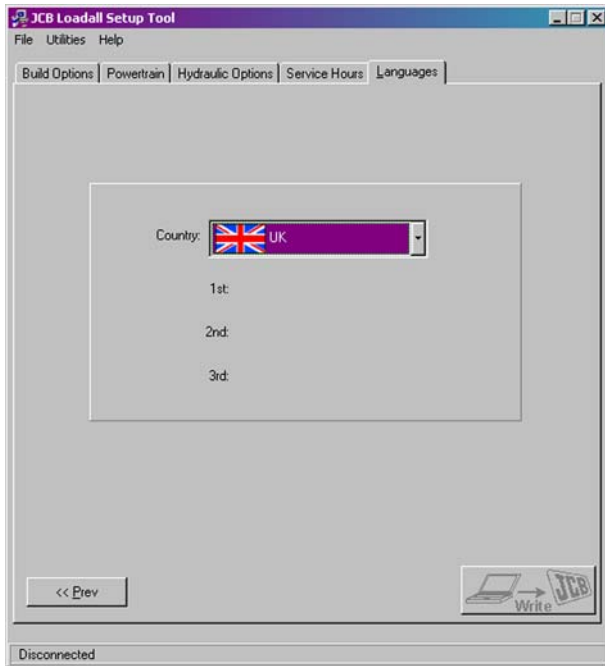
Configure Electronic Instrument Cluster Service Options

- 1 Using the "Service Hours Schedule" drop down menu select the applicable service interval for the machine.
- 2 Click "Next" to be taken to the Languages Screen.

Language Options

⇒ [Fig 18.](#) ([M5-14](#))

This screen is used to configure the instrument cluster ECU language options. The options available will vary depending on machine model selected.



C087940-C3

Fig 18.

Configure Electronic Instrument Cluster Language Options

- 1 Using the "Country" drop down menu select the applicable language for the machine.
- 2 The settings can now be written the machine electronic instrument cluster ECU.

⇒ [Write](#) ([M5-15](#))

Write

The User can program the machine Electronic Instrument Cluster connected using the write function.

Several programming checks are made to ensure all required values are made (Model Type, Languages etc.) to ensure the data written will not make any invalid conditions in the vehicle system.

Press the "Write" button [⇒ Fig 19. \(□ M5-15\)](#) or select "Write" from the "File" menu [⇒ Fig 20. \(□ M5-15\)](#).



Fig 19.

C075520-C1

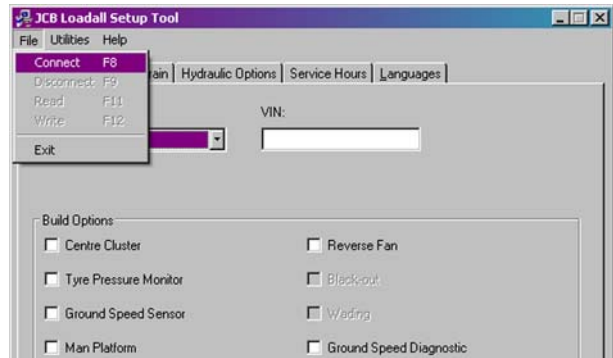


Fig 22.

C075530-C1

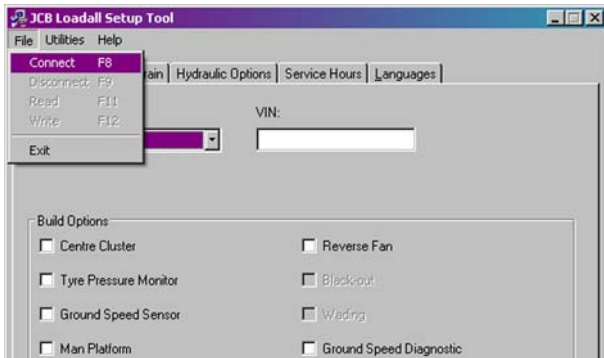


Fig 20.

C075530-C1

If the "Write" function is disabled make sure the communication connection is enabled by pressing the "Connect" button [⇒ Fig 21. \(□ M5-15\)](#) or select "Connect" from the "File" Menu. [⇒ Fig 22. \(□ M5-15\)](#)



Fig 21.

C075510-C2

Read

On occasion it may be necessary for the software and setup information to be read back from the ECU to check settings or preload current settings ready for updating because of new options being fitted to the vehicle.

Press the “Read” button → [Fig 23.](#) ([M5-16](#)) or select “Read” from the “File” menu. → [Fig 24.](#) ([M5-16](#))



Fig 23.

C075510-C1

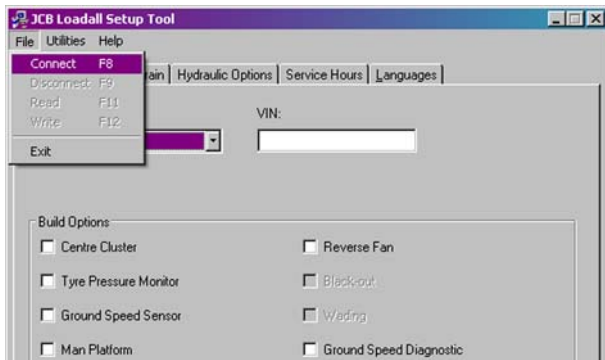


Fig 24.

C075530-C1

The progress of the read operation is shown in the status window. When the data has been read from the ECU the data is stored back into the data entry boxes on the options screen. → [Fig 25.](#) ([M5-16](#))

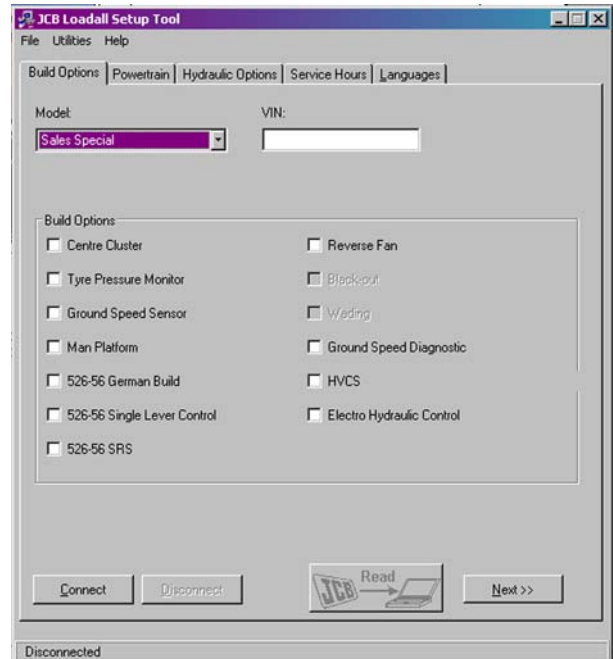


Fig 25.

C075510-C4

Connection Problems

In general, whenever there are problems communicating with the DLA there will be an error message displayed. The following section although not exhaustive attempts to identify the more common ECU communication problems.

The setup program must use the authorised Data Link Adaptor (DLA) contained in the Electronic Service Tool Kit. The latest versions of both the hardware and software can be obtained through authorised suppliers. Servicemaster software has been designed to run on the Windows 9.X, Windows 2000 and Windows XP operating systems.

A number of reasons can generate software problems and assistance from an Information Technology engineer is advised. In particular, laptop PCs can suffer serial communications conflicts where the PC hardware does not allow the software access to the communication ports. In the majority of cases conflicts are caused by either software already running on the PC, or by certain 'driver' files not releasing the COM port(s).

An error is generated [⇒ Fig 26. \(M5-17\)](#) when no communications can be established with the DLA and the ECU usually through a hardware problem. Another source could be related to resistance of the two data communication wires making up the machine's harness for the ECU's CAN connection to the Deutsch 9 way round diagnostic connector.



Fig 26.

C075620

Note: The ECU must be powered for communications to work, i.e. the machine ignition must be ON (but the engine need not be running).

If a problem is experienced it can take one of three forms, a constant failure to establish communications, drop out during communications or intermittent communication connection. Contributory factors to communication errors could be related to the following items:

- **DLA Drivers.** The DLA and PC are programmed with software 'drivers' which handle communications. Ensure the latest drivers are installed on the PC and DLA (contained in the latest version of Service Master).
- **PC Power Management.** Previous experiences have shown that some laptops' Power Management software can disrupt the COM ports. Turning off the power management software may resolve the problem.
- **IR Drivers.** If the PC has an InfraRed (IR) communications port then disabling the driver may help.
- **Modem Drivers.** Modem drivers could cause communication conflicts and temporary disabling to establish if the software is conflicting with the port may establish this source.

If the aforementioned information fails to resolve the situation then the following contacts may be able to provide further assistance;

- Information Technology (IT) engineer.
- Authorised machine dealer or agent.
- Machine OEM. The Original Equipment Manufacturer (OEM) will make the relevant enquires.

Loadall Machine Diagnostics - User Guide



C032980

Introduction

The **Loadall Machine Diagnostics** software tool is part of the **JCB Servicemaster** software suite. The software is designed to view the operation of machine sensors and actuators.

This software is intended for use on IBM Compatible Personal Computers (PCs) running **Windows 9x**, **Windows2000** and **WindowsXP** operating systems but is not compatible with either earlier versions of **Windows 3.x**. Ideally the computer should be a laptop type.

Care and Safety

WARNING

Be sure to read and follow any on screen instructions. Failure to follow correct procedure could result in death or injury.

2-4-5-5



Installing

The **Loadall Machine Diagnostics** tool is fully integrated within JCB Service Master 2 Version 7.1. To use the program you must install **JCB Service Master 2 Version 7.1** onto a suitable laptop computer.

For full instructions on how to install **JCB Service Master** software see **Servicemaster SYSTEM**. ➔ [Servicemaster SYSTEM \(M4-1\)](#)

Connection

To use the program your laptop computer must be connected to the machine CANbus. See **Servicemaster SYSTEM** for servicemaster connection details.

⇒ [Servicemaster SYSTEM \(M4-1\)](#)

Starting Loadall Machine Diagnostics

- 1 Turn ON the machine ignition and additionally start the engine if required (taking normal precautions).
- 2 Start **JCB Service Master** on the laptop computer.



Fig 27.

C075500

- 3 Make sure that the correct DLA is selected in the chooser. Click on 'Utilities', DLA Setup. The DLA Chooser window opens. Check the button to match to the Current Device. Click 'Apply'.
⇒ Fig 28. (□ M5-21)

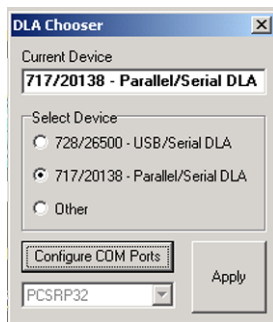


Fig 28.

C033110

- 4 Select 'Loadall 2007+' from the drop down list
⇒ Fig 27. (□ M5-21) and then start the diagnostic tool running by clicking on the **Loadall Machine Diagnostics** icon. ⇒ Fig 29. (□ M5-21)



Fig 29.

C087940

- 5 The **Loadall Machine Diagnostic** tool will then open up displaying the main window.
⇒ Fig 30. (□ M5-21).

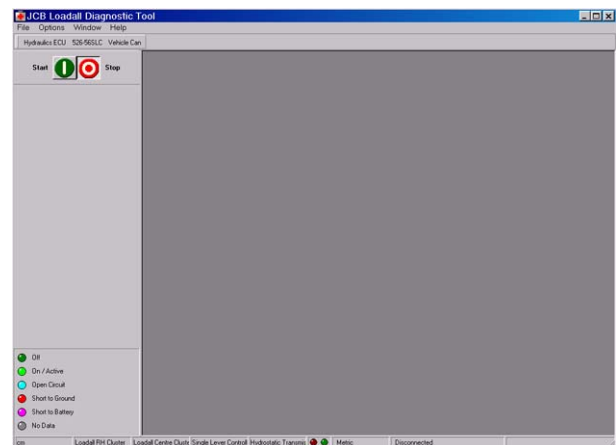


Fig 30.

C087950-C7

- 6 Enable the connection between the PC/Laptop by pressing the "Start Diagnostics" button
⇒ Fig 31. (□ M5-21) or select "Start Diagnostics" from the "File" Menu. ⇒ Fig 32. (□ M5-22)



Fig 31.

C087950-C8

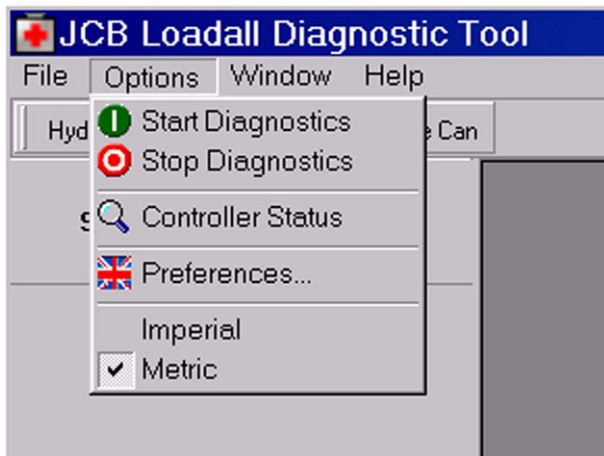


Fig 32.

C087950-C10

Navigating within Loadall Machine Diagnostics

Navigation is designed to be via a mouse. On Laptop PCs this may take the form of a small joystick or touch sensitive pad and some buttons, usually located near to the keyboard.

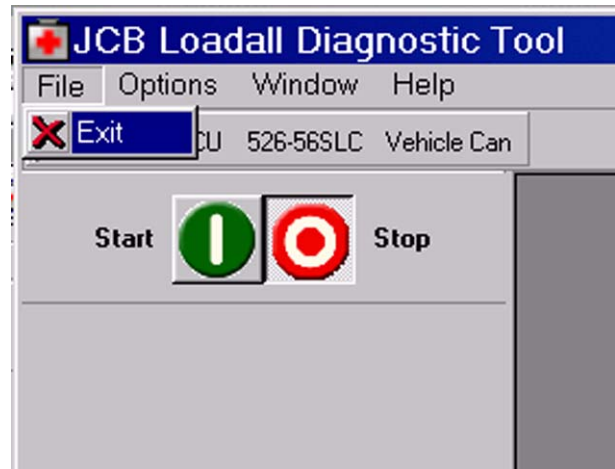
As with most Windows based programs, it is possible to navigate the cluster setup software using the keyboard by pressing certain combinations of keys.

Note: This can be particularly useful for certain Laptop computers where the mouse/joystick can be over-sensitive. Try out the following, it may come in useful one day.

There are two main methods of navigation described below;

- Pressing the **ALT** key will cause the File option on the Menu Bar to be highlighted. You can then use the arrow keys to navigate the menus.
- Notice that all the menu items on the Menu Bar have a letter that is underlined (e.g. the 'F' in **File**). Holding down the ALT key and pressing the required letter key will activate that option (i.e. either open the menu or execute a function). For example, if you wish to open the Preferences Dialogue this can be done by pressing **ALT + O** (to open the **Options** menu) then **ALT + P** (to execute the **Preferences** option).

Menu Bar - File Menu



C087950-C9

Fig 33.

- **Exit:** to close down the program. On exiting the program communications with both ECU and DLA are shut down.

Menu Bar - Options Menu

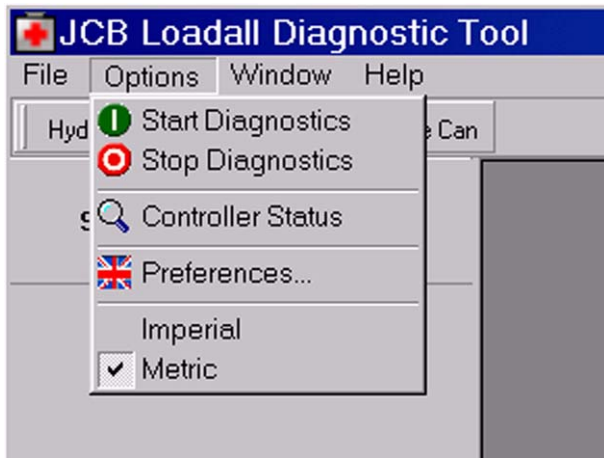


Fig 34.

C087950-C10

- **Start Diagnostics:** to connect the PC/laptop to the ECU to enable communication and the tracking of machine sensors and actuators.
- **Stop Diagnostics:** to disconnect the PC/laptop and the ECU and cease communication.
- **Controller Status:** to show that the ECU is online. When the ECU is online the machine codes are displayed. This diagram shows the actual settings read from a test machine. → [Fig 36.](#) ([M5-24](#))
- **Preferences:** - to select the language of the machine diagnostic program. → [Fig 35.](#) ([M5-24](#))
- **Imperial/Metric:** - to select the units used in the machine diagnostic program.

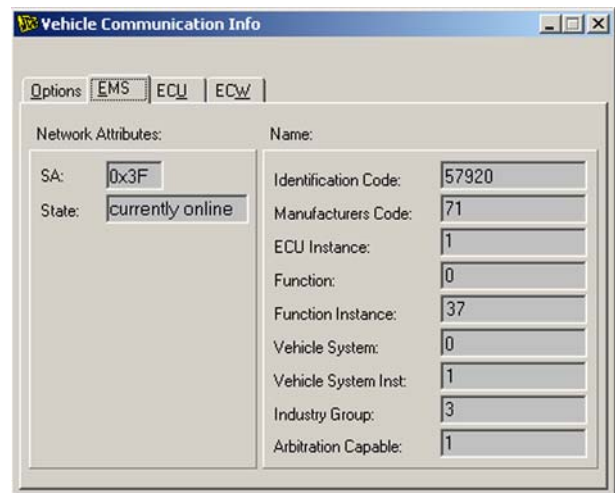


Fig 36.

C075570



Fig 35.

C075550

Menu Bar - Window Menu

⇒ [Fig 37. \(M5-25\)](#)

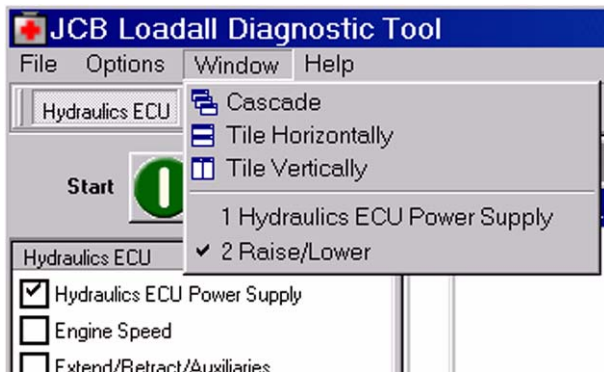


Fig 37.

C087950-C11

Like most other Windows based programs where there are multiple sub-windows or Pages used, there are usually options to organise how they are laid-out. JCB Machine Diagnostics software is no different and offers the following options;

- **Cascade**
- **Tile Horizontally**
- **Tile Vertically**

Menu Bar - Help Menu

⇒ [Fig 38. \(M5-25\)](#)

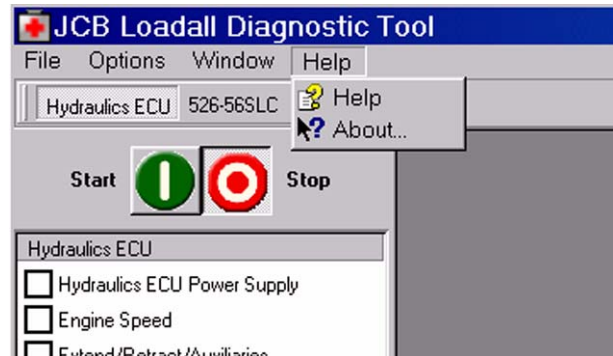


Fig 38.

C087950-C12

- **Help:** opens the help program.
- **About:** Opens a window showing the version number of the installed copy of the software.

⇒ [Fig 39. \(M5-25\)](#)



Fig 39.

C087950-C13

Machine System Tabs and Page List

The diagnostics software contains more than one diagnostics tool. The different tools are selected by clicking on the applicable tab, **A**, **B**, **C**, or **D**.

When a diagnostics tool is selected a list of pages (**E**) which can be displayed appears in the top left corner of the main window.

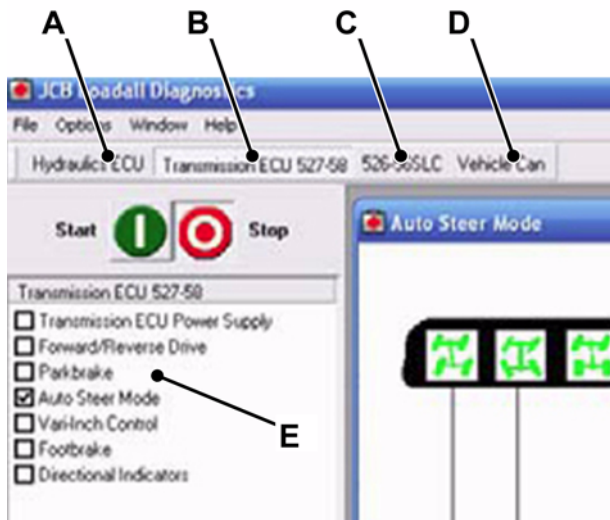


Fig 40.

C106040

Clicking in the box next to the required page will make that page appear in the main window display area. (A tick will also appear in the box to show it is being displayed.) At any time the user may swap between displayed pages simply by clicking in the check box of the required page in the page list. The function keys, F2, F3 etc. can also be used to select pages as required.

Status bar

There are 3 items of interest displayed on the **Status Bar**, which is located along the bottom of the Diagnostics main window.

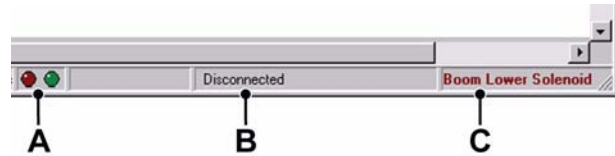


Fig 41.

C095200

CAN Communications: Two small LEDs A indicate data being transmitted (red) and received (green) over the CAN communications link.

These LEDs can be seen to be flashing rapidly as data is transported. This can be another useful aid to determining the state of any established communications.

Connection Status: Indicates if the diagnostics software is connected, connecting or not connected to the ECU. Shown at B in the status bar.

Data Identification: When the mouse pointer is put on a data field or 'LED' in the diagnostics page its description is shown in the status bar at C.

LED Status Key

Displays a key for the colour status of the LEDs shown on the diagnostics pages. The LED's change colour dependant on the electrical signal.

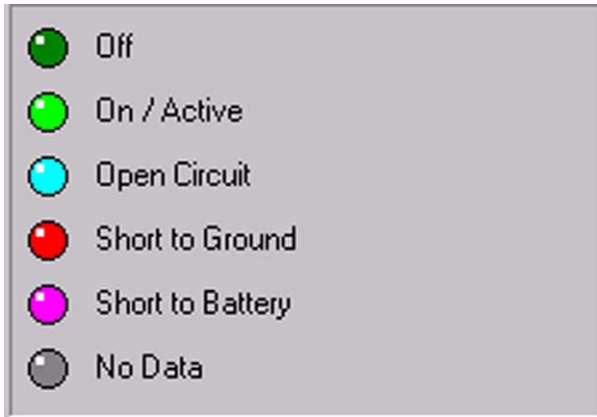


Fig 42.

C095210

LED Colour	Electrical signal status
Dark Green	Input/Output OFF
Light Green	Input/Output ON
Blue	Open circuit
Red	Short to ground
Magenta	Short to battery
Grey	No data

Hydraulics ECU Diagnostic Pages

Information on the diagnostic pages is constantly updated in real-time. The status of the ECU electrical inputs and outputs is displayed using simulated LED's. The LED's change colour depending on the status of the inputs and outputs. A key in the bottom left corner of the main window explains the colours.

The following is a brief explanation of each feature.

Switches

The status of each of the switch inputs to the ECU is shown. Where there are two switch inputs "NO" (Normally Open) and "NC" (Normally closed) both inputs are shown. The status is displayed using the simulated LED's.

Variable Inputs

The voltage of the variable inputs is shown on this page. The voltages can be observed during operation and their values compared to expected readings.

Digital Outputs

The status of the digital outputs from ECU are displayed using the simulated LED's.

Valve Outputs

The status of the digital outputs from the ECU to the hydraulic solenoid valves is displayed using the simulated LED's.

The current value of the solenoid outputs can be monitored to make sure they both meet specifications.

Diagnostic Procedure

Important: Use of the diagnostics pages requires operation of the relevant machine system at the same time. If necessary get the help of an assistant.

In the event of a system fault the applicable diagnostic page can be used to check the operation of all the relevant electronic and electrical devices. Operate the system and view the diagnostics page to see if the system devices respond as expected. For example; there is no voltage change shown when the servo control lever is operated in the relevant axis. This may indicate a fault with the servo lever or its wire interconnection.

Pages

⇒ [Hydraulics ECU Power Supply \(M5-29\)](#)

⇒ [Engine Speed \(M5-29\)](#)

⇒ [Extend/Retract/Auxiliaries \(M5-30\)](#)

⇒ [Raise/Lower \(M5-30\)](#)

⇒ [Crowd/Dump \(M5-31\)](#)

⇒ [Smooth Ride System \(M5-31\)](#)

⇒ [Second Auxiliary \(M5-32\)](#)

⇒ [Constant Auxiliary \(M5-32\)](#)

⇒ [Hydraulic Isolation \(M5-33\)](#)

⇒ [Tilt Isolation \(M5-33\)](#)

⇒ [Load Control \(M5-34\)](#)

For details of the electrical operation refer the relevant system topic.

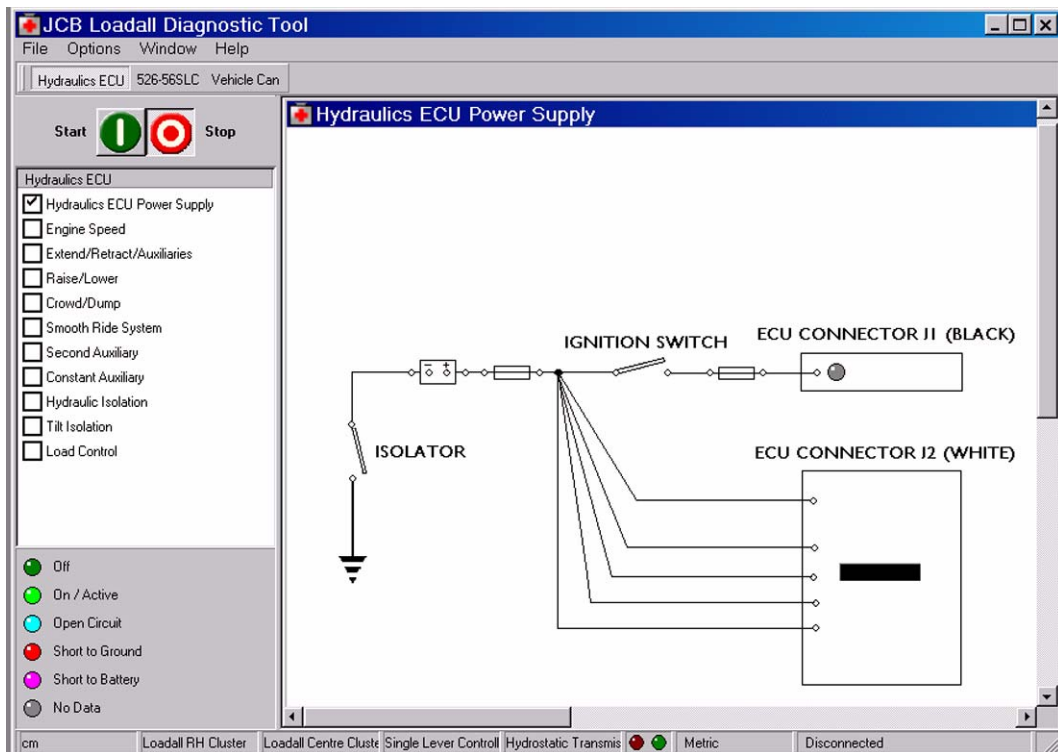


Fig 43. Hydraulics ECU Power Supply

C095080

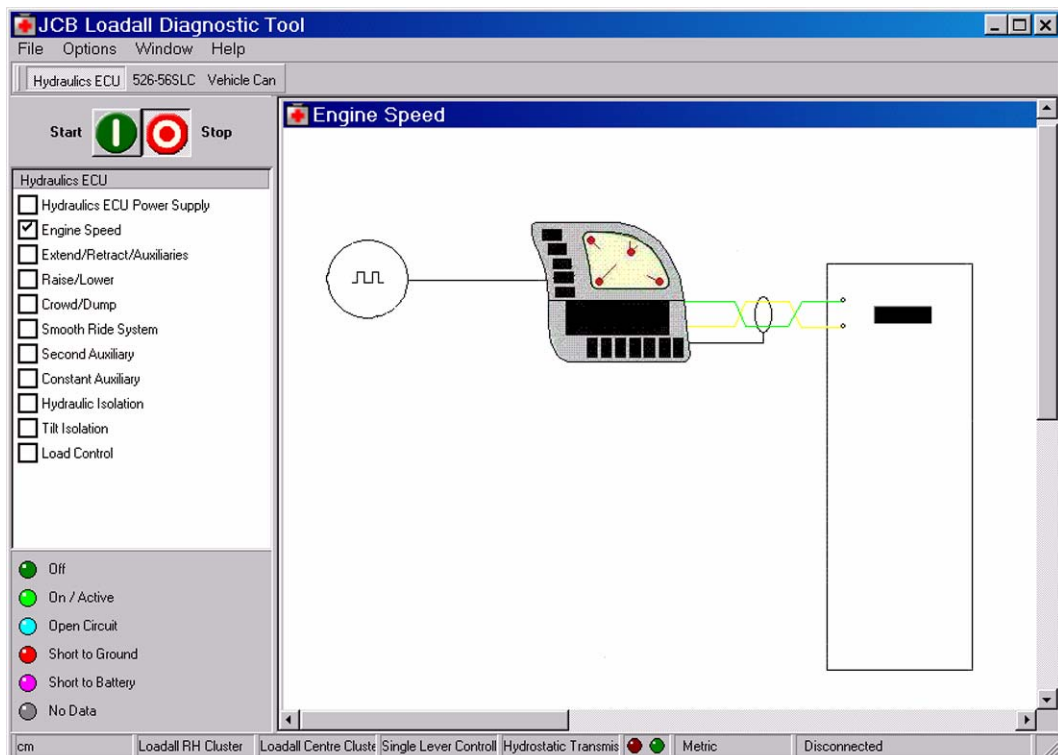


Fig 44. Engine Speed

C095090

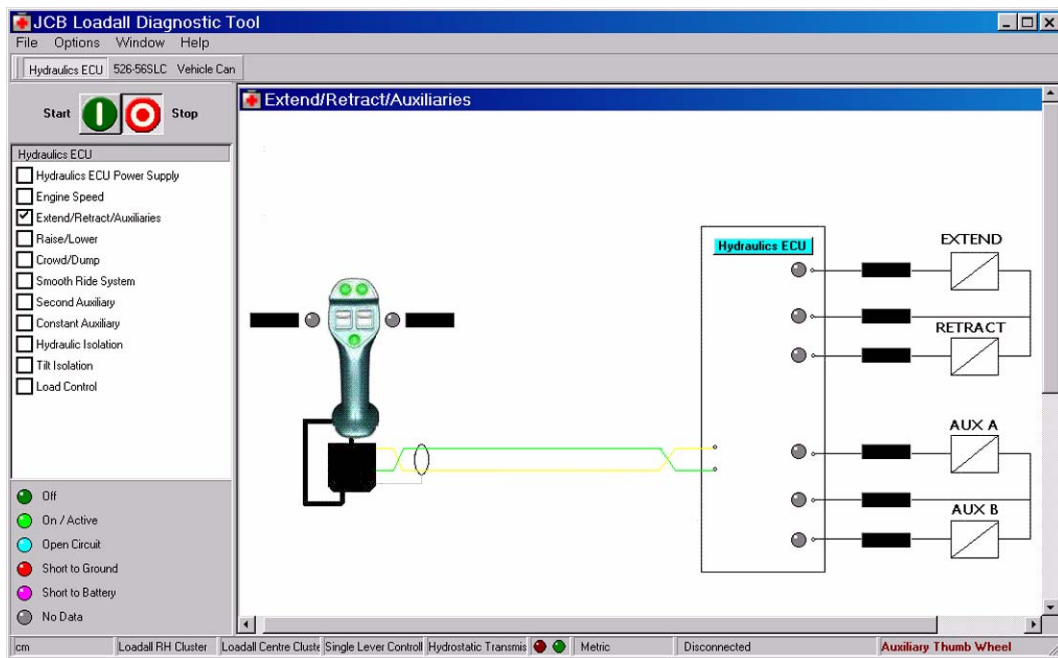


Fig 45. Extend/Retract/Auxiliaries

C095100

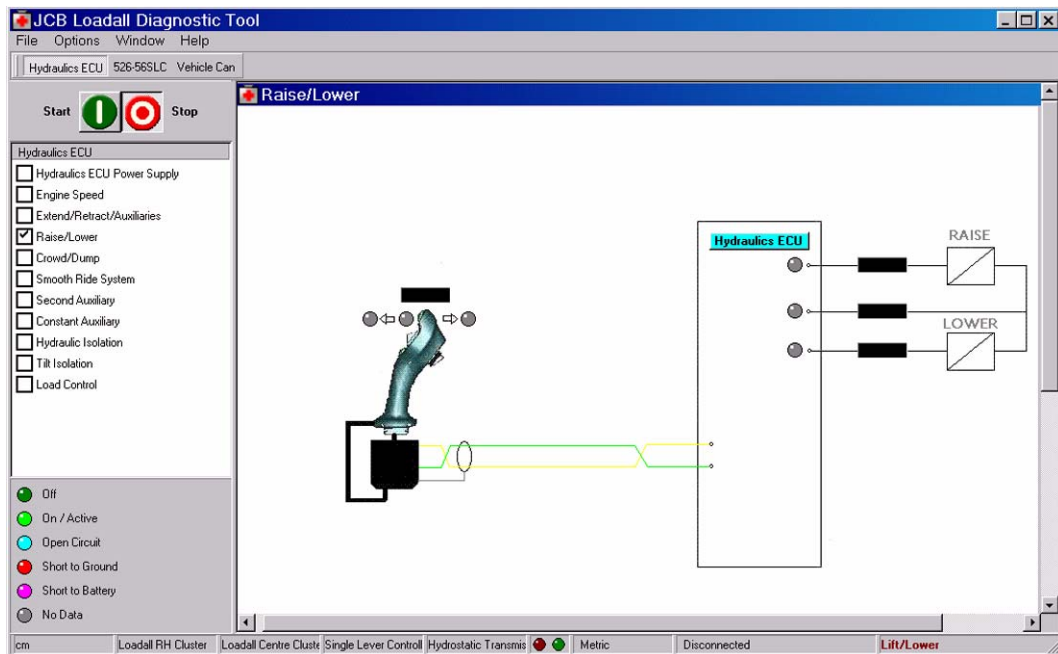


Fig 46. Raise/Lower

C095110

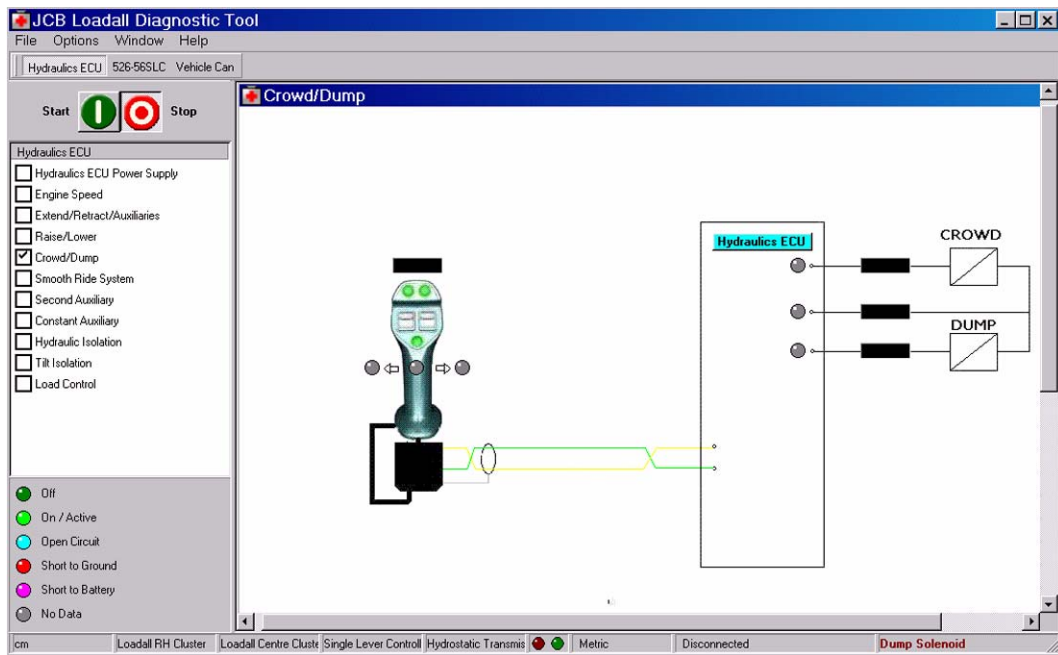


Fig 47. Crowd/Dump

C095120

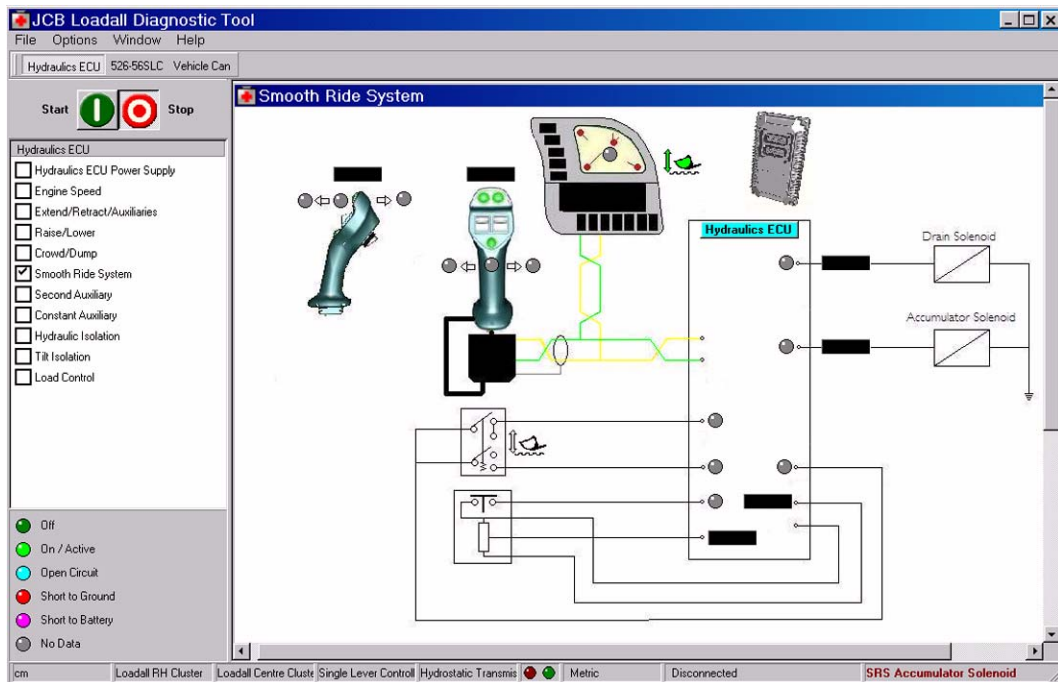


Fig 48. Smooth Ride System

C095130

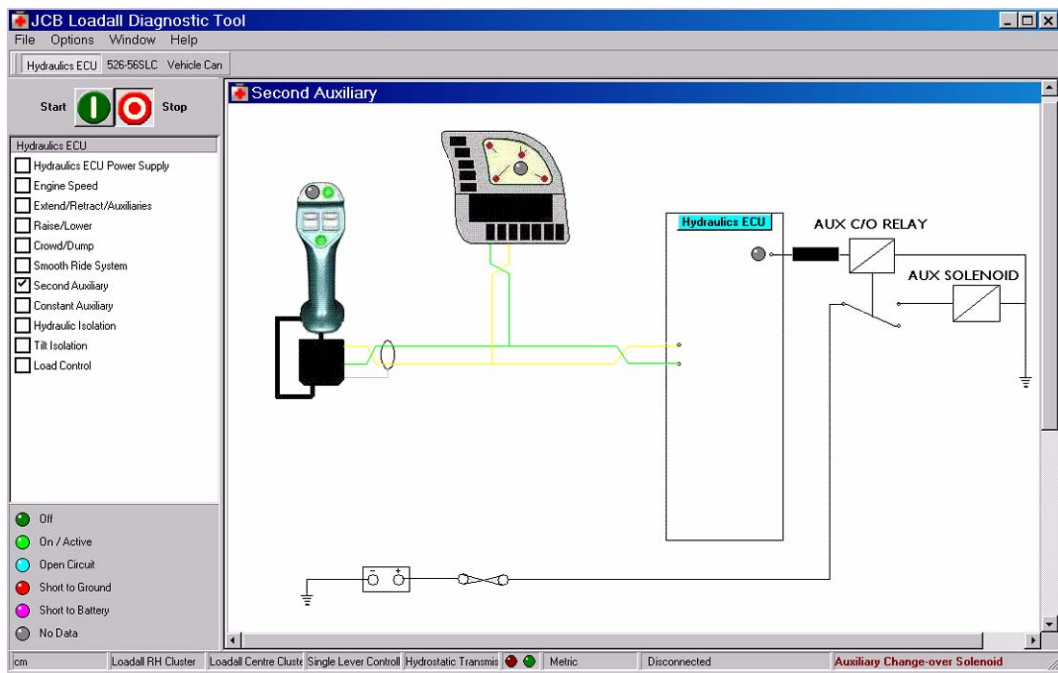


Fig 49. Second Auxiliary

C095140

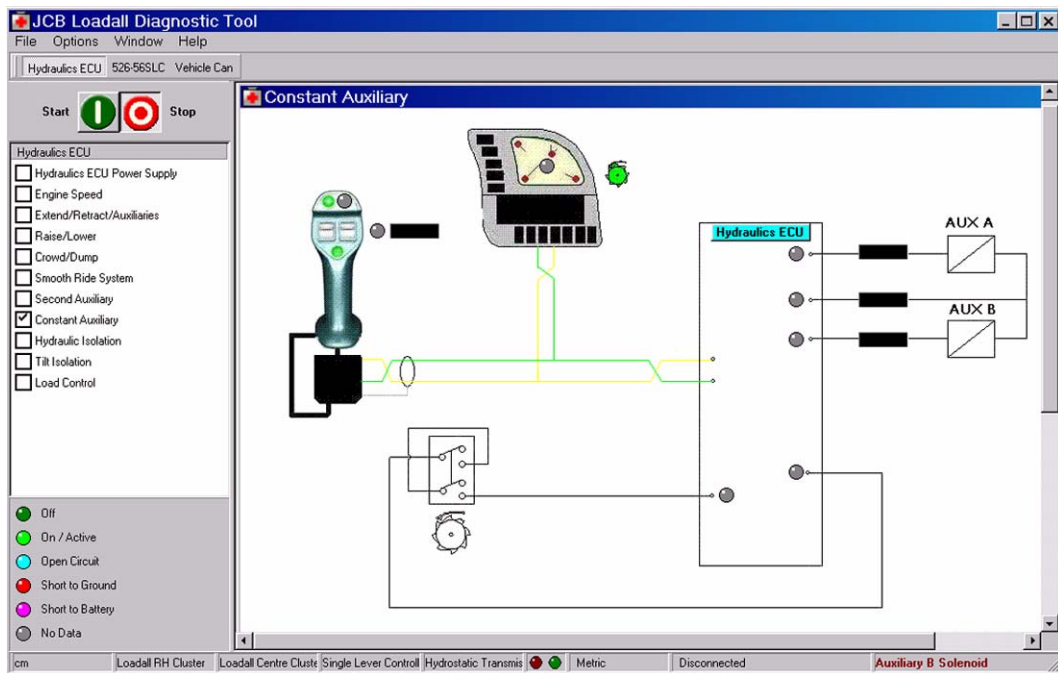


Fig 50. Constant Auxiliary

C095150

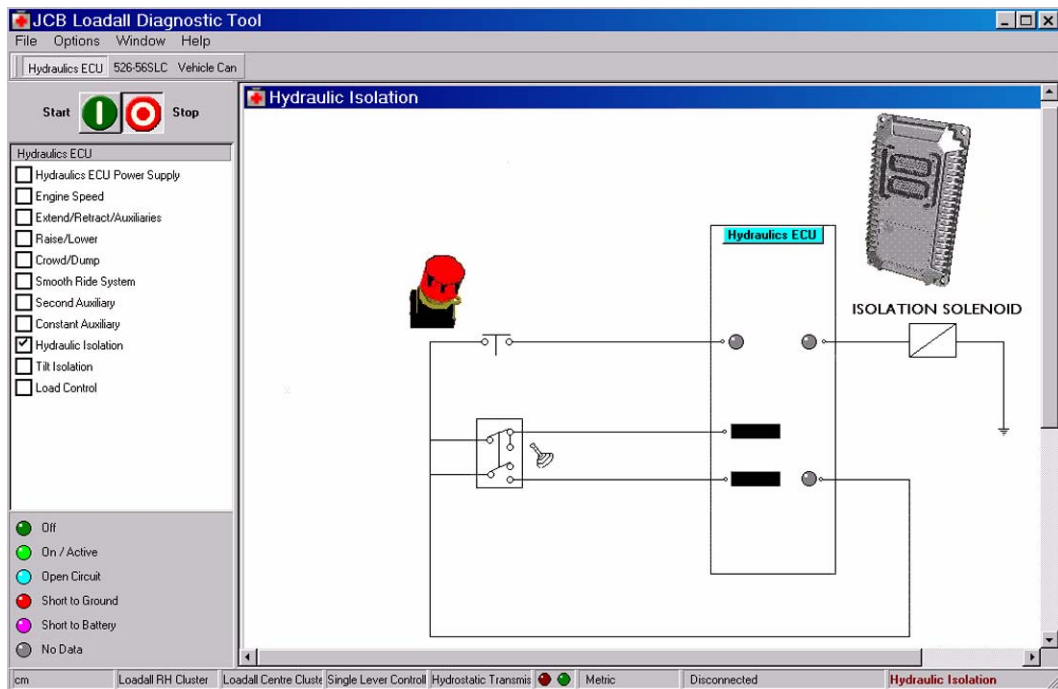


Fig 51. Hydraulic Isolation

C095160

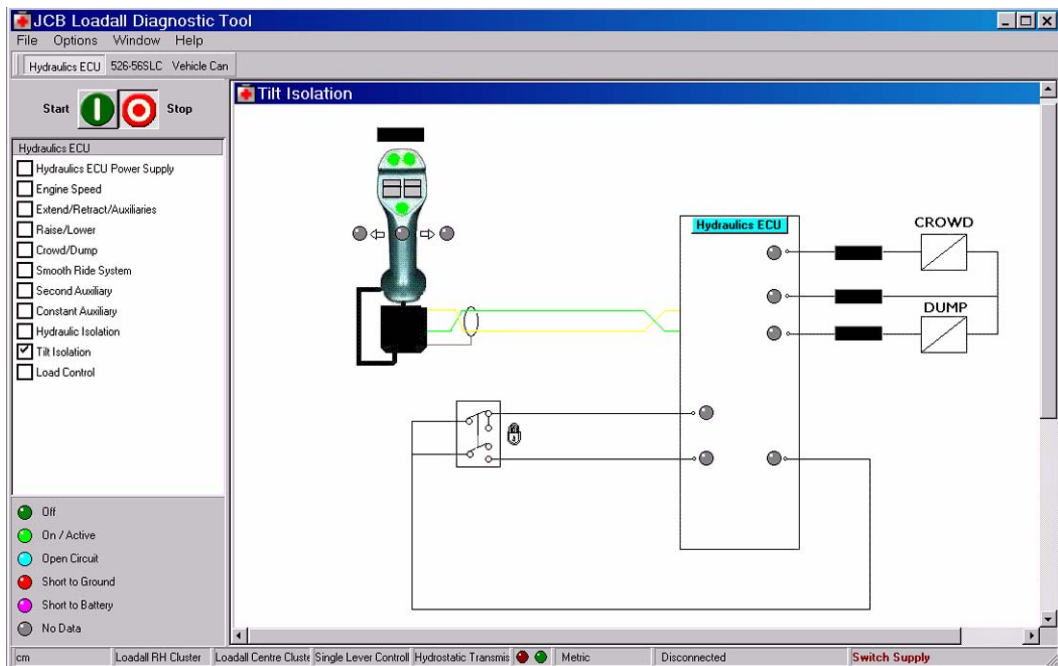


Fig 52. Tilt Isolation

C095170

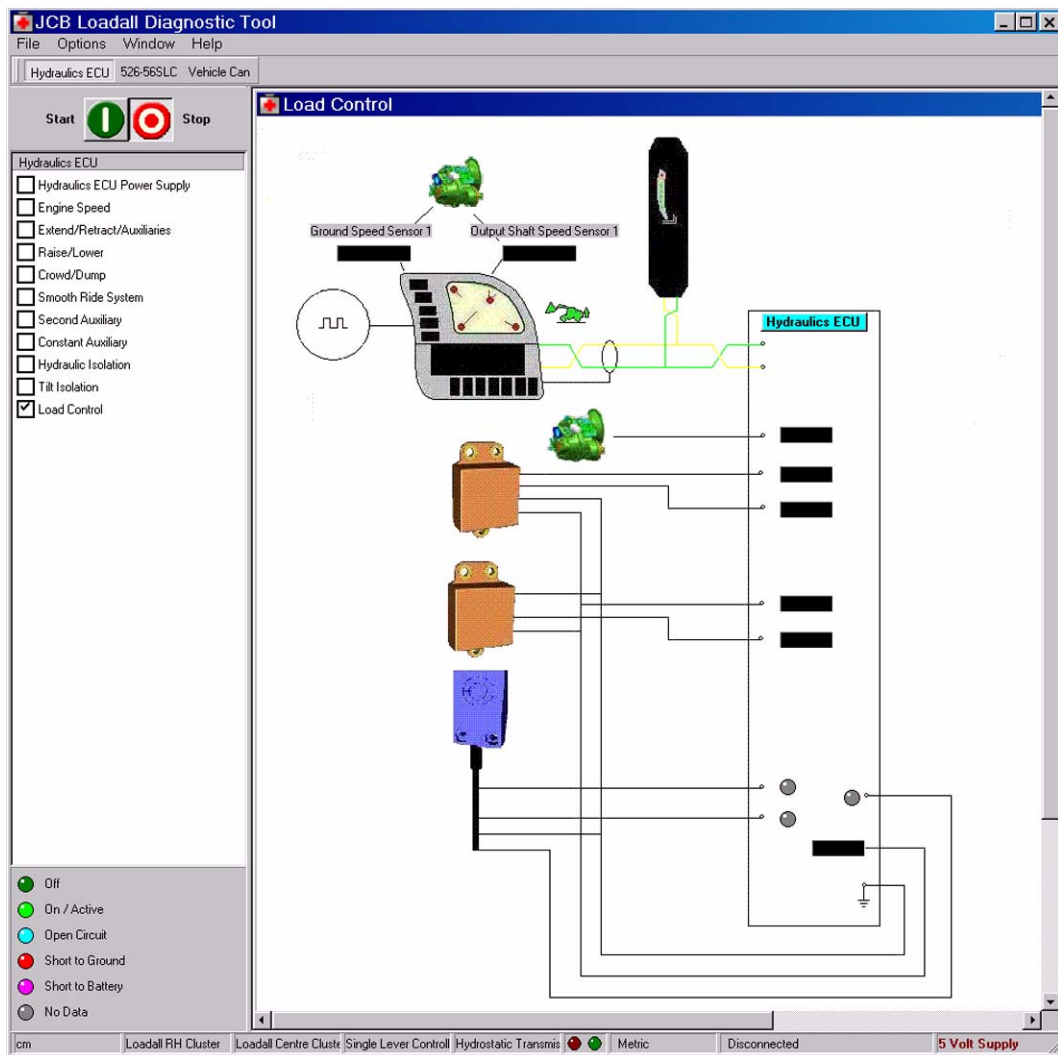


Fig 53. Load Control

C095180

Transmission ECU Diagnostic Pages

Information on the diagnostic pages is constantly updated in real-time. The status of the ECU electrical inputs and outputs is displayed using simulated LED's. The LED's change colour depending on the status of the inputs and outputs. A key in the bottom left corner of the main window explains the colours.

The following is a brief explanation of each feature.

Switches

The status of each of the switch inputs to the ECU is shown. Where there are two switch inputs "**NO**" (Normally Open) and "**NC**" (Normally closed) both inputs are shown. The status is displayed using the simulated LED's.

Variable Inputs

The voltage of the variable inputs is shown on this page. The voltages can be observed during operation and their values compared to expected readings.

Digital Outputs

The status of the digital outputs from ECU are displayed using the simulated LED's.

Valve Outputs

The status of the digital outputs from the ECU to the hydraulic solenoid valves is displayed using the simulated LED's.

The current value of the solenoid outputs can be monitored to make sure they meet specifications.

Diagnostic Procedure

Important: Use of the diagnostics pages requires operation of the relevant machine system at the same time. If necessary get the help of an assistant.

In the event of a system fault the applicable diagnostic page can be used to check the operation of all the relevant electronic and electrical devices. Operate the system and view the diagnostics page to see if the system devices respond as expected.

Pages

⇒ [Transmission Diagnostics \(M5-36\)](#)

⇒ [Vari Speed Diagnostics \(M5-36\)](#)

⇒ [Steer Mode Diagnostics \(M5-37\)](#)

For details of the electrical operation refer the relevant system topic.

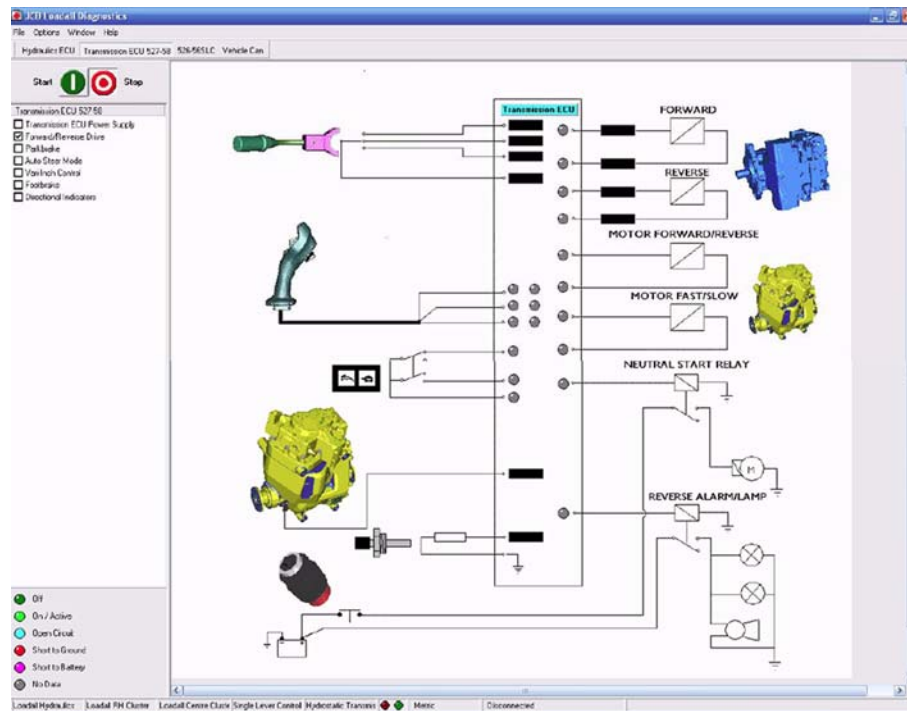


Fig 54. Transmission Diagnostics

P002780-C2

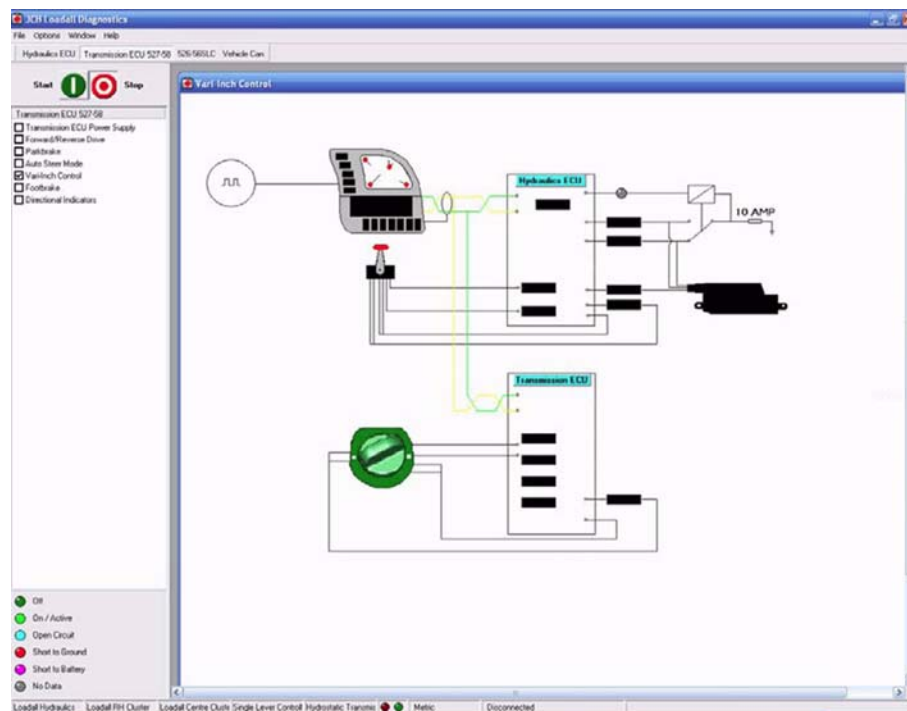


Fig 55. Vari Speed Diagnostics

P002770-C2

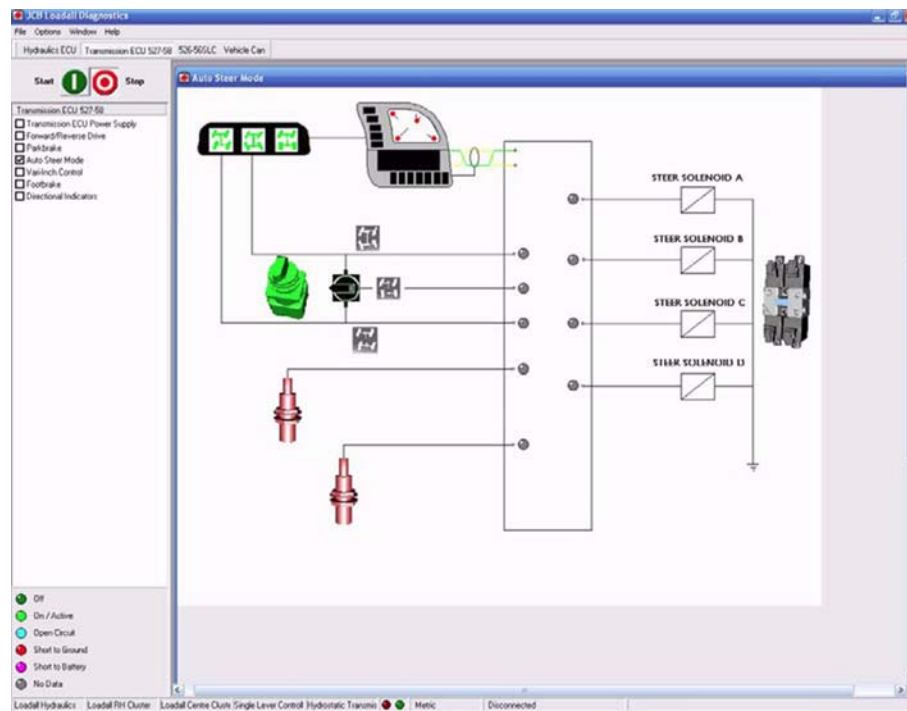


Fig 56. Steer Mode Diagnostics

P002760-C2

Vehicle Can - Diagnostic Pages

Information on the diagnostic page is constantly updated in real-time. Each ECU connected to the CANbus is shown.

Data is displayed in the fields on the page when CAN messages are transmitted.

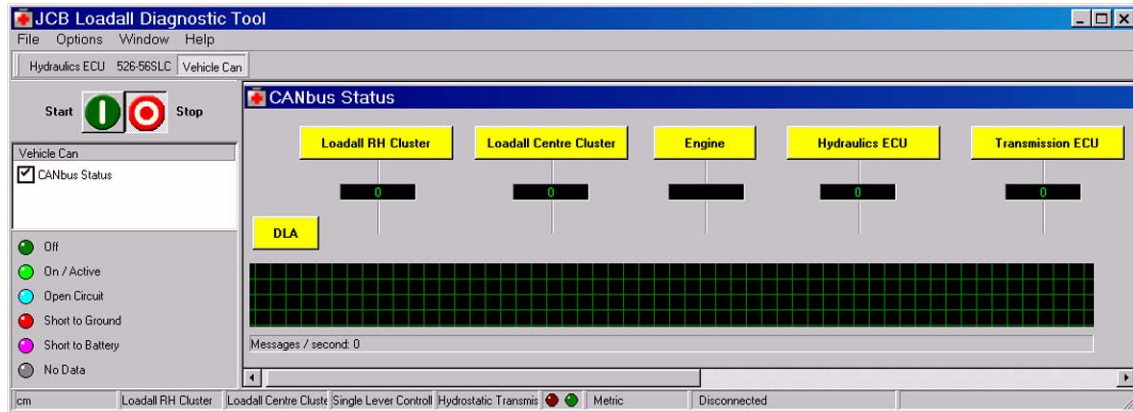


Fig 57. Vehicle Can

C095070

Connection Problems

In general, whenever there are problems communicating with the DLA there will be an error message displayed. The following section although not exhaustive attempts to identify the more common ECU communication problems.

The setup program must use the authorised Data Link Adaptor (DLA) contained in the Electronic Service Tool Kit. The latest versions of both the hardware and software can be obtained through authorised suppliers. Servicemaster software has been designed to run on the Windows 9.X, Windows 2000 and Windows XP operating systems.

A number of reasons can generate software problems and assistance from an Information Technology engineer is advised. In particular, laptop PCs can suffer serial communications conflicts where the PC hardware does not allow the software access to the communication ports. In the majority of cases conflicts are caused by either software already running on the PC, or by certain 'driver' files not releasing the COM port(s).

An error is generated → [Fig 58. \(M5-39\)](#) when no communications can be established with the DLA and the ECU usually through a hardware problem. Another source could be related to resistance of the two data communication wires making up the machine's harness for the ECU's CAN connection to the Deutsch 9 way round diagnostic connector.



C075620

Fig 58.

Note: The ECU must be powered for communications to work, i.e. the machine ignition must be ON (but the engine need not be running).

If a problem is experienced it can take one of three forms, a constant failure to establish communications, drop out during communications or intermittent communication connection. Contributory factors to communication errors could be related to the following items:

- **DLA Drivers.** The DLA and PC are programmed with software 'drivers' which handle communications. Ensure the latest drivers are installed on the PC and DLA (contained in the latest version of Service Master).
- **PC Power Management.** Previous experiences have shown that some laptops' Power Management software can disrupt the COM ports. Turning off the power management software may resolve the problem.
- **IR Drivers.** If the PC has an InfraRed (IR) communications port then disabling the driver may help.
- **Modem Drivers.** Modem drivers could cause communication conflicts and temporary disabling to establish if the software is conflicting with the port may establish this source.

If the aforementioned information fails to resolve the situation then the following contacts may be able to provide further assistance;

- Information Technology (IT) engineer.
- Authorised machine dealer or agent.
- Machine OEM. The Original Equipment Manufacturer (OEM) will make the relevant enquires.



Section M5 - Electronic Network Servicemaster Tools

Loadall Machine Diagnostics - User Guide

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Electronic Control Unit Theory

Introduction

This topic contains information about a machine DEVICE. Make sure you are referring to the correct device. Refer to the applications table.

Descriptions and procedures relate to the device and not related systems. For information about the systems refer to the relevant topics.

This topic is intended to help you understand what the device does and how it works. Where applicable it also includes procedures such as removal and replacement and dismantle and assemble.

[⇒ Related Topics \(!\[\]\(33332bf34dc25a73ebb6ba745ab9f138_img.jpg\) M6-2\)](#)

[⇒ Operation Overview \(!\[\]\(20f3bde2c6fa895b054d24c428d46310_img.jpg\) M6-3\)](#)

Related Topics

Table 1. Related Topics in This Publication

The table lists other topics in the manual that contain information related to this topic. Refer to the applicable topics to complete your procedures. Where applicable the text in this section contains cross references to this page to help you find the correct information. Some machines have different systems and devices. Make sure you refer to the correct topic, refer to Section 1 - Applications .		
Sections	Topic Titles	Sub Titles
1	Applications	ALL
2	ALL (Care and Safety) ⁽¹⁾	ALL
H	Auto Steer Mode SYSTEM	ALL
K	Stop and Start SYSTEM (Electronic F.I. Engines)	ALL
M	⇒ Pulse Width Modulation Theory (M7-1)	ALL
M	Loadall Monitoring SYSTEM	ALL
M	Servicemaster SYSTEM	ALL

(1) You must obey all of the relevant care and safety procedures.

Operation Overview

The machines use an electronic control unit (ECU) to control machine operations. The ECU uses analog and digital signals from machine sensors, switches etc. and uses this data to supply a feed or a ground connection for other machine devices. The machines can have one or more ECU's depending on the model variant. For information on each ECU refer to the correct topic.

Key	⇒ Fig 1. (□ M6-4)
A	LMS ECU
B	Joystick (Hydraulic Control Lever) Powerbase ECU
C	Hydraulic Control ECU
D	Transmission Control ECU
E	Cold Start ECU

The machine ECU's can be connected to JCB Servicemaster diagnostic software to check ECU version and operation. [⇒ Related Topics \(□ M6-2\)](#)

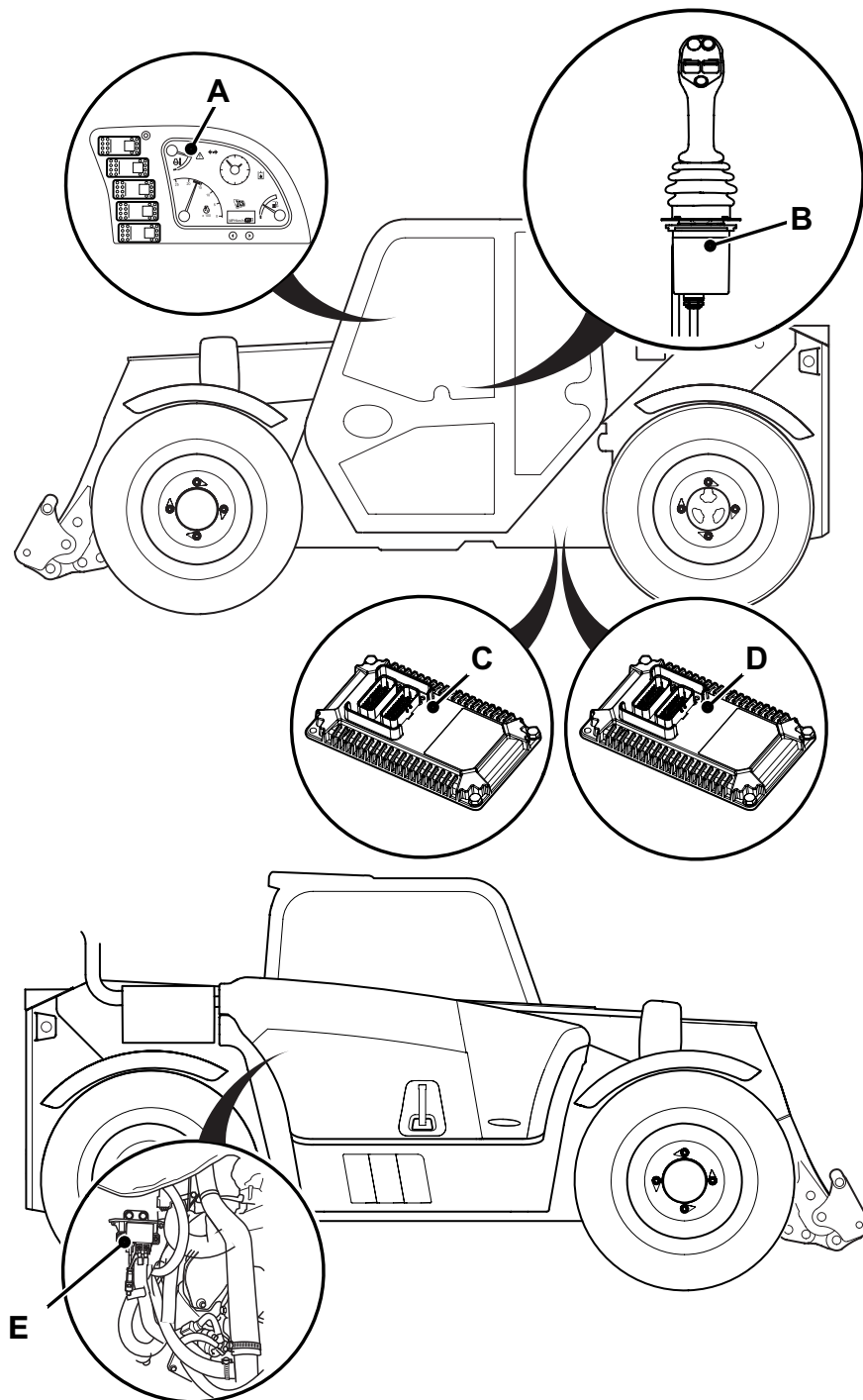


Fig 1.

C094020-C2

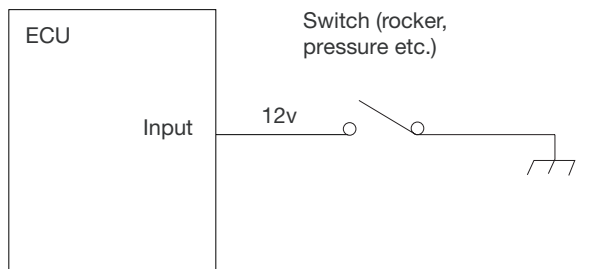
ECU Inputs

There are two main types of input, Digital and Analogue.

- Digital inputs (i.e. On-Off switch type inputs):** Digital type inputs are on-off type inputs (i.e. switches) and can be Low side inputs or High side inputs. Low side inputs are inputs that provide a ground to the

ECU. High side inputs are inputs that provide a positive feed to the ECU.

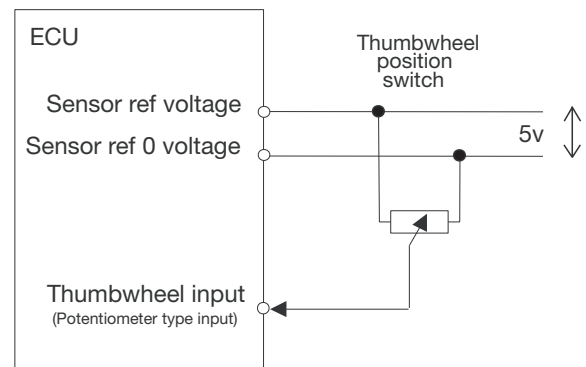
Low side input: The low side input is the most frequently used input on an electrical system. The low side input can be in the form of rocker switches or pressure switches.



C007170GB-C1

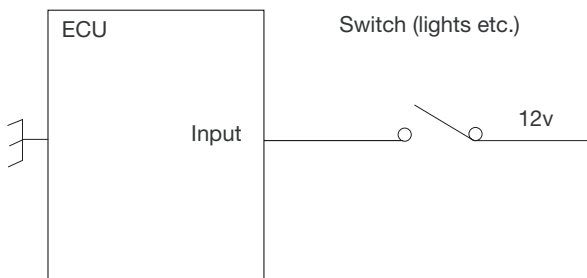
Fig 2.

High side input: The high side input is used on circuits that require a positive feed when the ignition is switched off, e.g. sidelights or hazard lights.



C007190GB-C1

Fig 4.



C007180GB-C1

Fig 3.

- 2 **Analogue inputs (i.e. sensor type inputs):** Analogue inputs are sensor type inputs that provide a varying type input to the ECU, this input could be a voltage, resistance or frequency type input.

ECU Outputs

There are three main types of outputs. Low side output, High side output and Modulated output.

- 1 Low side output:** In the Low side output circuit the solenoid or relay which is being driven already has a positive feed available, the ECU then provides the ground side of the circuit.

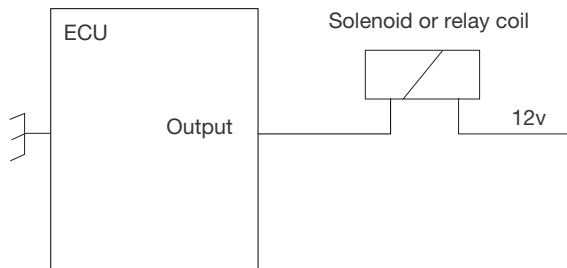


Fig 5.

C007220GB-C1

- 2 High side output:** In the High side output circuit the solenoid or relay which is being driven already has a ground available, the ECU provides the positive side of the circuit.

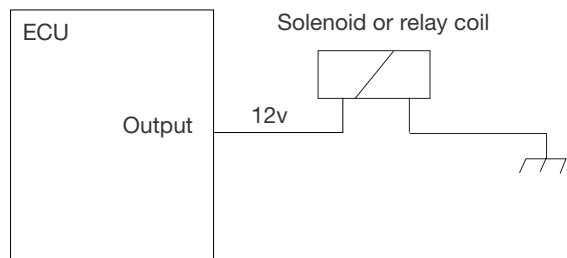


Fig 6.

C007230GB-C1

- 3 Modulated outputs:** In the Modulated Output circuit the ECU provides a PWM (Pulse Width Modulation) signal to a proportional valve. As the ECU varies the duty cycle of the signal the proportional valve will select more or less depending on the change in duty cycle. ⇒ Pulse Width Modulation Theory (□ M7-1).

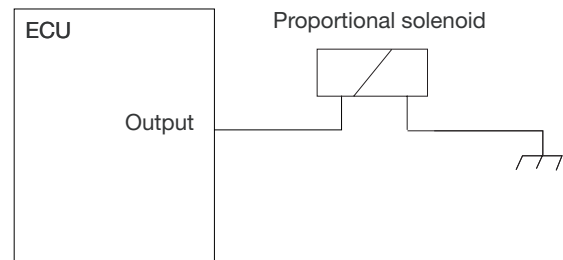


Fig 7.

C007240GB-C1

Pulse Width Modulation Theory

Introduction

This topic contains information about a machine DEVICE. Make sure you are referring to the correct device. Refer to the applications table.

Descriptions and procedures relate to the device and not related systems. For information about the systems refer to the relevant topics.

This topic is intended to help you understand what the device does and how it works. Where applicable it also includes procedures such as removal and replacement and dismantle and assemble.

[⇒ Related Topics \(!\[\]\(2e3b4d8f57734338894f9c0e205034ba_img.jpg\) M7-2\)](#)

[⇒ Operation Overview \(!\[\]\(7f678e2e7e6eaedcd4656c413625a05a_img.jpg\) M7-3\)](#)

Related Topics

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Sections	Topic Titles	Sub Titles
1	Applications	ALL
1	Service Tools	ALL
2	ALL (Care and Safety) ⁽¹⁾	ALL
C	⇒ Electronic Control Unit Theory (□ M6-1)	ALL

(1) You must obey all of the relevant care and safety procedures.

Operation Overview

The machines use an electronic control unit (ECU) to provide a current signal output to operate proportional solenoid valves for some machine operations. Note that the ECU is a non serviceable part and is NOT programmable. For information on the ECU operation please refer to the relevant topic. → [Electronic Control Unit Theory \(□ M6-1\)](#)

Ohms law states that, the amount of current flow in a circuit is determined by the voltage, and the resistance. A 12v circuit with a resistance of 6 ohms, would draw a current of 2 amps. This would be the case for a standard solenoid, which is either on or off.

Once the voltage is applied to the circuit, it is present 100% of the time. This would be known as a 100% duty cycle. Therefore the circuit will draw 2 amps constantly.

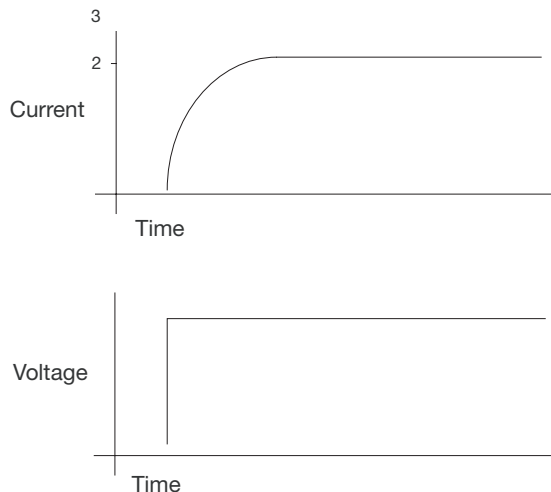


Fig 1.

A proportional solenoid requires differing amounts of current, depending on its condition. As the coil has a fixed resistance, changing the current rating can be done in either of two ways,

- 1 Having lots of different resistors switched in and out of the circuit at different times to change the current flowing.
- 2 To change the duty cycle of the solenoid.

It is easier, more economical, and more reliable to change the duty cycle of the circuit, especially using today's computer - controller technology.

The duty cycle is the amount of time a component is switched on compared to the time it is switched off. If a solenoid is on for three seconds, then off for one second, on for three, off for one etc. this would be a 75% duty cycle.

The graph **A** although unstable would give a current rating of 1.5 amps. To stabilise the current in the circuit, the frequency would need to be increased. If the time scale on the graph **A** was one second, the frequency would be 4Hz (Hertz (cycles per second)). The graph **B** shows the same duty cycle, but at a higher frequency of 32 Hz. Note that the proportional solenoids can operate at a frequency of 250 Hz.

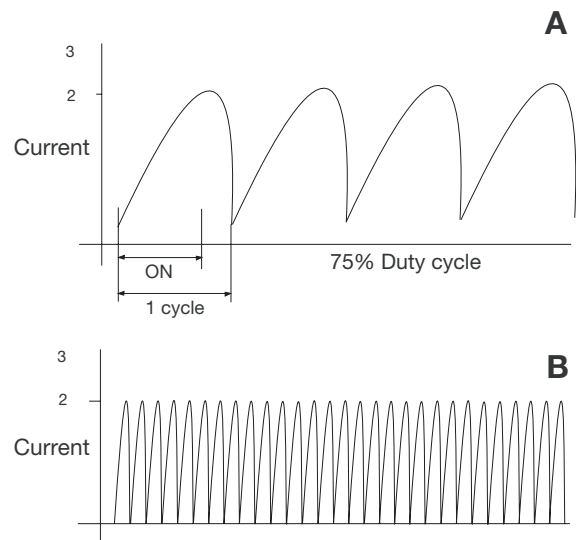


Fig 2.



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