

DGX / MODAL ABS

Info Centre Diagnostic Display

OPERATOR'S GUIDE



000 700 279 / 08.02. / Redditch

Replacement For
Diagnostic Display Unit (DDU)
903 025 011
903 043 001
903 044 001
905 027 001
905 029 001

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Introduction

This handbook assists you in diagnosis of a range of Haldex ABS products, including DGX and DGX-I for Trucks, MODAL systems for Trailers, using a Info Centre.

The Info Centre

INFO CENTRE is a diagnostic unit, it can also readout odometer and other information as available in the ABS Electronic Control Unit (ECU).

The INFO CENTRE **can only be used whilst vehicle powered. While the ECU is powered from its normal sources (stoplight or permanent)** information is transferred to the Info Centre's memory, which can be recalled. Power is supplied from the vehicle system via the ECU diagnostics connector.

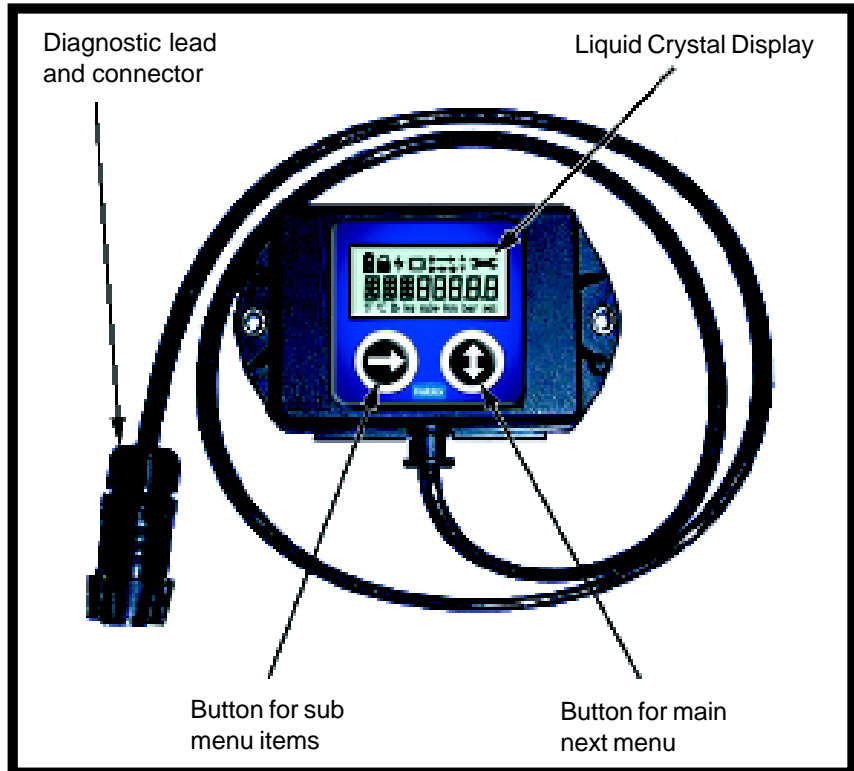


Fig.1 The Info Centre

INFO CENTRE comprises an LCD (Liquid Crystal Display) and two buttons marked up/down and right arrows. The up/down button accesses the next main menu item, the left button, marked right arrow, is used for sub menu items.

For adjustment of settings a watch style procedure is followed; the up/down button is held down for 2 seconds, then the first digit flashes and can then be increased by pressing the up/down button. The next digit is then selected using the right arrow button and so on.

INFO CENTRE is housed in a plastic enclosure provided with a cover boot for environmental protection.

The Info Centre is supplied as standard with 0.5 meter extension cable. A 1.0 meter interface cable (003 8637 09) is provided for DGX, DGX-I and MODAL systems

Diagnosing DGX ABS

WARNING:

It is essential to observe normal safety procedure during diagnostic work.

IMPORTANT

It should be noted that there are specific differences between DGX and DGX-I systems especially with reference to diagnostic codes.

Before attempting repair of either system the following action should be taken.

1. Determine the system fitted by reference to the electronic control unit identification label, which will refer to DGX or DGX-I.
2. When repairing/servicing DGX-I systems familiarise yourself with the information applicable contained in the DGX-I section.

Note: DGX and DGX-I use different code lists as shown in this guide.

Using the Info Centre

1. Plug the Info Centre connector, into the ECU diagnostic port (Fig.2). This may be done with ignition switched on or off, BUT codes registered in the ECU, disappear if the ignition is switched off, intermittent defects are best investigated by leaving the ignition on after detection (cab lamp lit), plug in the Info Centre to display the diagnostic code.
2. Switch ignition on if not already, and drive the vehicle above 6mph (10km/h).
3. Read the Info Centre display and consult the diagnostic code list for prescribed repair.

Diagnostic Code Interpretation

- ◆ With vehicle stationary, no fault present, switch on ignition, the Info Centre displays 'OK 07'
- ◆ Drive above 6mph (10km/h), the display changes to 'OK 00'
- ◆ Bars appear for sensors with output, above the necessary minimum.
- ◆ Stop the vehicle, the display reverts to 'OK 07'.

Sensor can be tested individually. By entering the wheel sensor check menu, with the vehicle jacked up and spinning a wheel will cause the wheel sensor bar to appear if output is above the necessary minimum (see page 6 - Sensor output/cabling check). If no sensor bar appears, the sensor is incorrectly adjusted, or has an intermittent defect. Reference Info Centre codes in the diagnostic code list for prescribed repair.

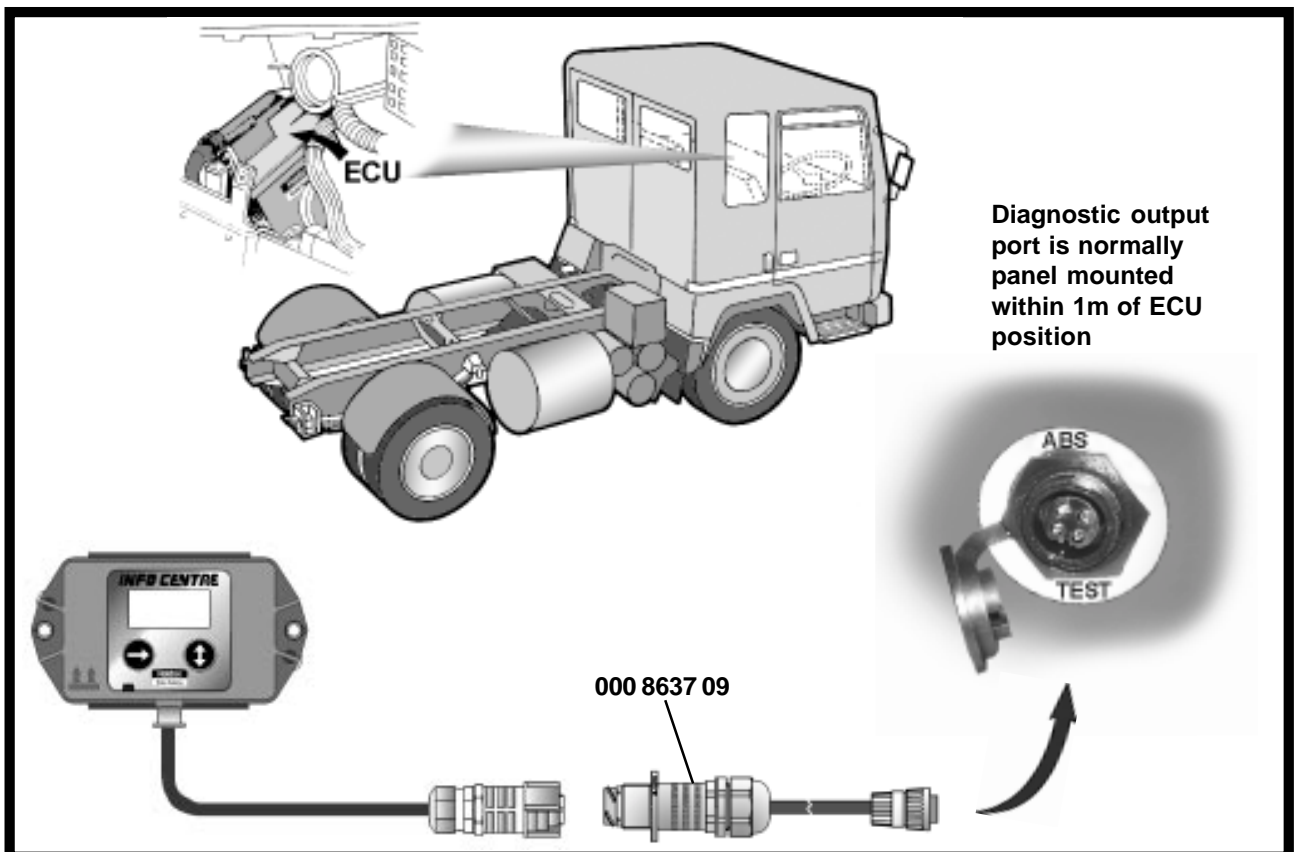


Fig. 2 DGX Diagnostic outlet socket location

Info Centre Function available for DGX/DGX-I ABS

Diagnostic:

Display Current fault code
Sensor / cabling check

Other Functions (Displayed but unavailable)

ECU Information:

Serial number (Display = "00000000")
Product type code (Display = "P 000000")
Configuration code (Display = "4S2C C2")
Info Centre Software version (Display "VER 0170")

Testing:

Reset-to-Ride
Tacho
Retarder

N.B. DO NOT opt to 'TEST' any of the offered items as the Info Centre will LOCK with the message "BUSY".

A power reset to the ABS ECU is required.

Meaning of relevant symbols



POWER: Vehicle power

- ON = Vehicle supply
- OFF = No vehicle supply
- FLASHING = Communications established between Info Centre and ABS ECU.



DIAGNOSTICS

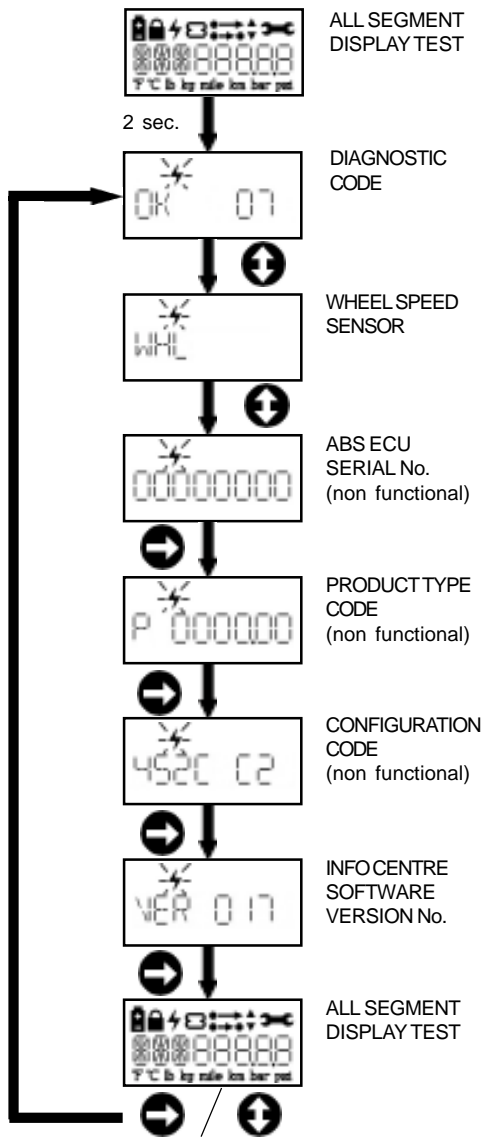
- FLASHING = Current ABS fault



Flashing symbol

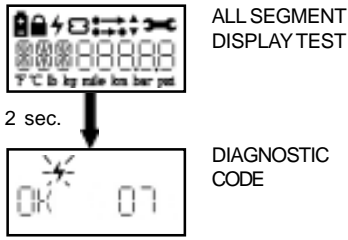
Functions:

Information Display

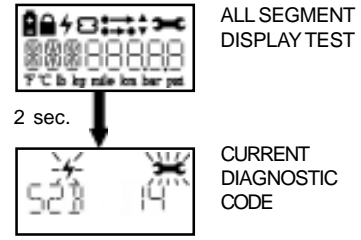


Diagnostic information

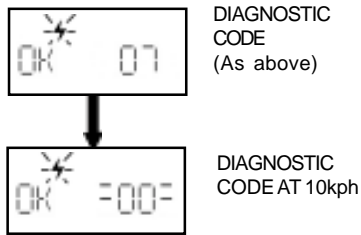
Display with no current fault (Vehicle stationary)



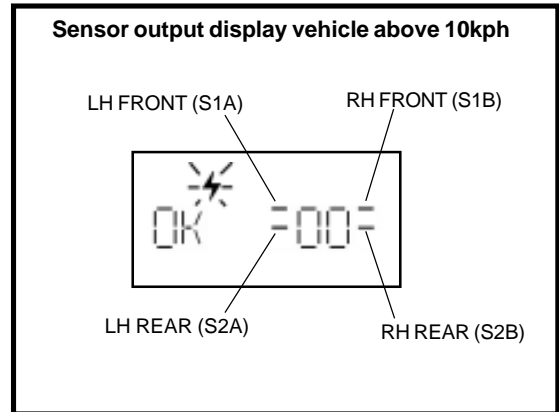
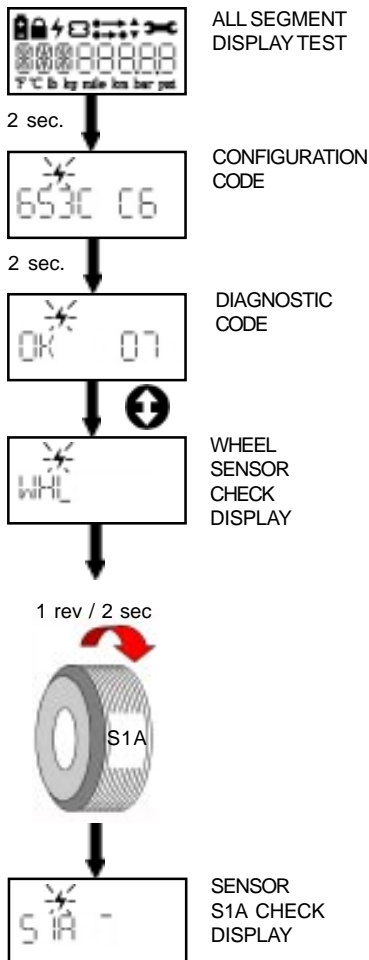
Display with current fault



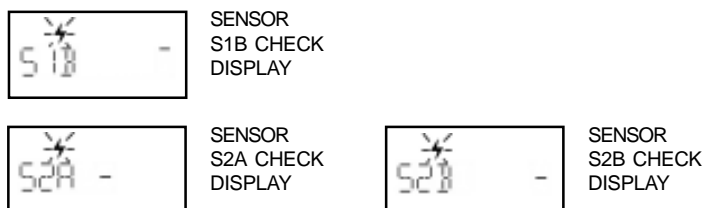
Vehicle above 10kph



Sensor output / cabling check



Alternative Displays on rotating appropriate wheel



DGX Diagnostic Code List

CODE DISPLAYED

BLANK DISPLAY No supply on ignition switched line.
High resistance in any SPS valve solenoid/wiring defect.
SPS valve, right dump solenoid or wiring open circuit defect - axle 2
SPS valve, right dump solenoid or wiring short circuit defect - axle 2
SPS valve, right dump solenoid or wiring short to B+ - axle 2
High resistance in any SPS valve solenoid/wiring defect.
Possible causes:
Fuse blown.
Info Centre or cable fault. Open circuit B -

SENSOR BAR Bar displayed = Sensor output O.K.
Bar not displayed = Sensor output too low

OK 00 System is O.K. vehicle is moving
OK 07 System is O.K. vehicle is stationary
RET 08 Retarder relay coil or wiring open circuit
RET 09 Retarder relay coil or wiring short circuit

LOW SENSOR OUTPUT GROUP

S1A 11 Left sensor system defect - axle 1
S1B 12 Right sensor system defect - axle 1
S2A 13 Left sensor system defect - axle 2
S2B 14 Right sensor system defect - axle 2

Possible causes:

Sensor worn, maladjusted sensor, coil or wiring open or short circuit.

INTERMITTENT LOW SENSOR OUTPUT GROUP

S1A 21 Left sensor system defect - axle 1
S1B 22 Right sensor system defect - axle 1
S2A 23 Left sensor system defect - axle 2
S2B 24 Right sensor system defect - axle 2

Possible causes:

Loose sensor, connection, bracket or exciter. Damaged exciter.
Maladjusted sensor or worn sensor cable insulation.

ONE WHEEL WITH SLOW RECOVERY GROUP

SLW 41 Left sensor wheel defect - axle 1
SLW 42 Right sensor wheel defect - axle 1
SLW 43 Left sensor wheel defect - axle 2
SLW 44 Right sensor wheel defect - axle 2

Possible causes:

Slow brake release, restricted piping, SPS valve defect.

DGX Diagnostic Code List

CODE DISPLAYED

OPEN CIRCUIT SPS VALVE SOLENOID OR SOLENOID WIRING GROUP

| | | |
|----------------|--------------------------------------|--------|
| RDDU 61 | Left dump solenoid circuit defect - | axle 1 |
| BUDU 62 | Right dump solenoid circuit defect - | axle 1 |
| YEDU 63 | Left dump solenoid circuit defect - | axle 2 |
| RDHD 67 | Latch solenoid circuit defect - | axle 1 |
| BUHD 68 | Latch solenoid circuit defect - | axle 2 |

SHORT CIRCUIT ACROSS SPS VALVE SOLENOID OR SOLENOID WIRING GROUP

| | | |
|----------------|--------------------------------------|--------|
| RDDU 71 | Left dump solenoid circuit defect - | axle 1 |
| BUDU 72 | Right dump solenoid circuit defect - | axle 1 |
| YEDU 73 | Left dump solenoid circuit defect - | axle 2 |

SPS VALVE SOLENOID WIRING OR SOLENOID SHORT TO B+ GROUP

| | | |
|----------------|---|--------|
| SOL 80 | Poor insulation in any SPS valve solenoid or wiring fault | |
| RDDU 81 | Left dump solenoid circuit defect - | axle 1 |
| BUDU 82 | Right dump solenoid circuit defect - | axle 1 |
| YEDU 83 | Left dump solenoid circuit defect - | axle 2 |
| RDHD 87 | Latch solenoid circuit defect - | axle 1 |
| BUHD 88 | Latch solenoid circuit defect - | axle 2 |

| | | |
|------------|--|--|
| ECU | Possible short circuit to B- on sensor S3 or S4. | |
|------------|--|--|

ANY OTHER DISPLAY - ECU or Info Centre defect

Note: If a Info Centre code is displayed and after following the recommended procedure no defect is found, the antilock control module (ECU) should be replaced

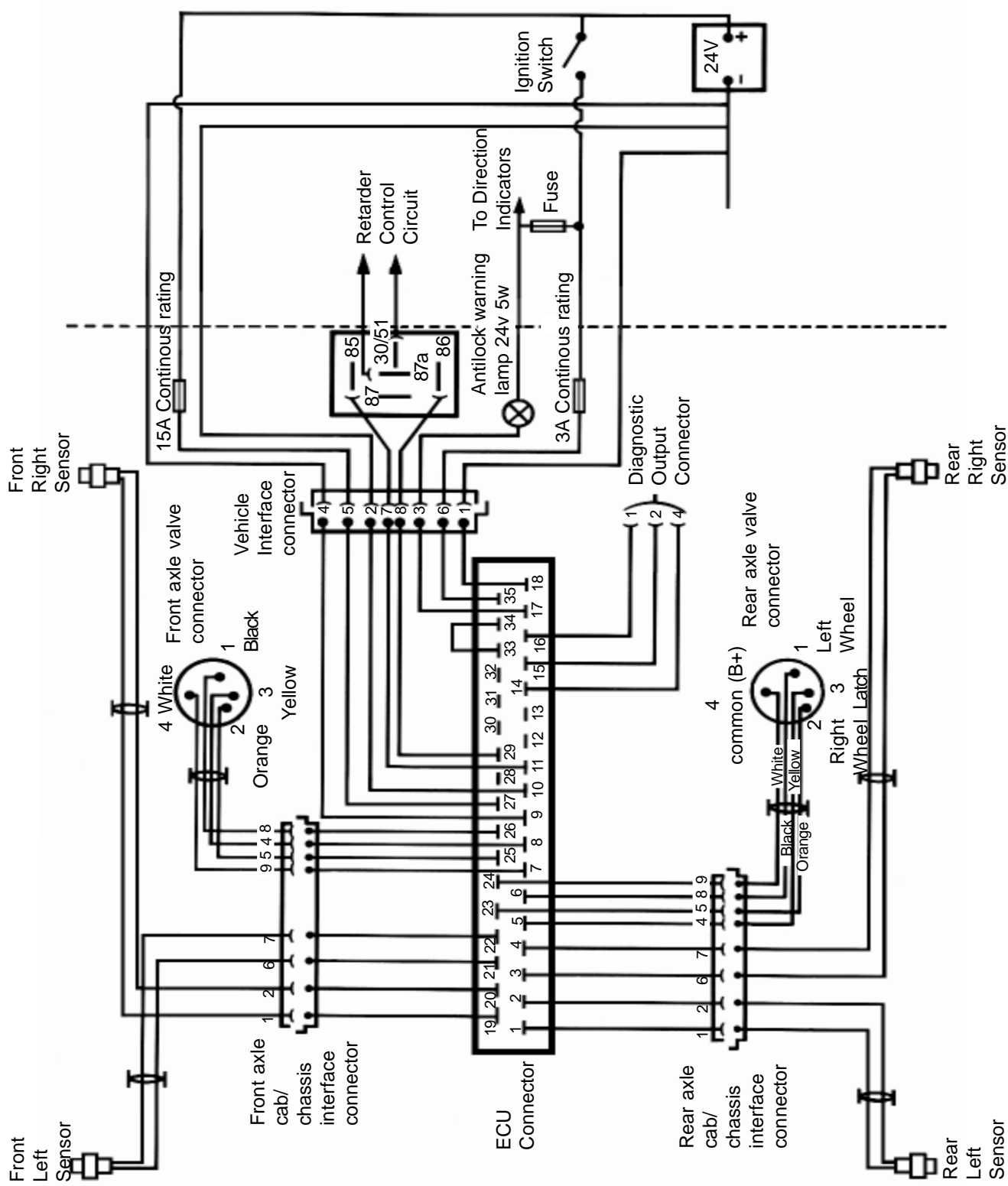


Fig. 3 DGX Wiring diagram - 60 Tooth Exciter Installation

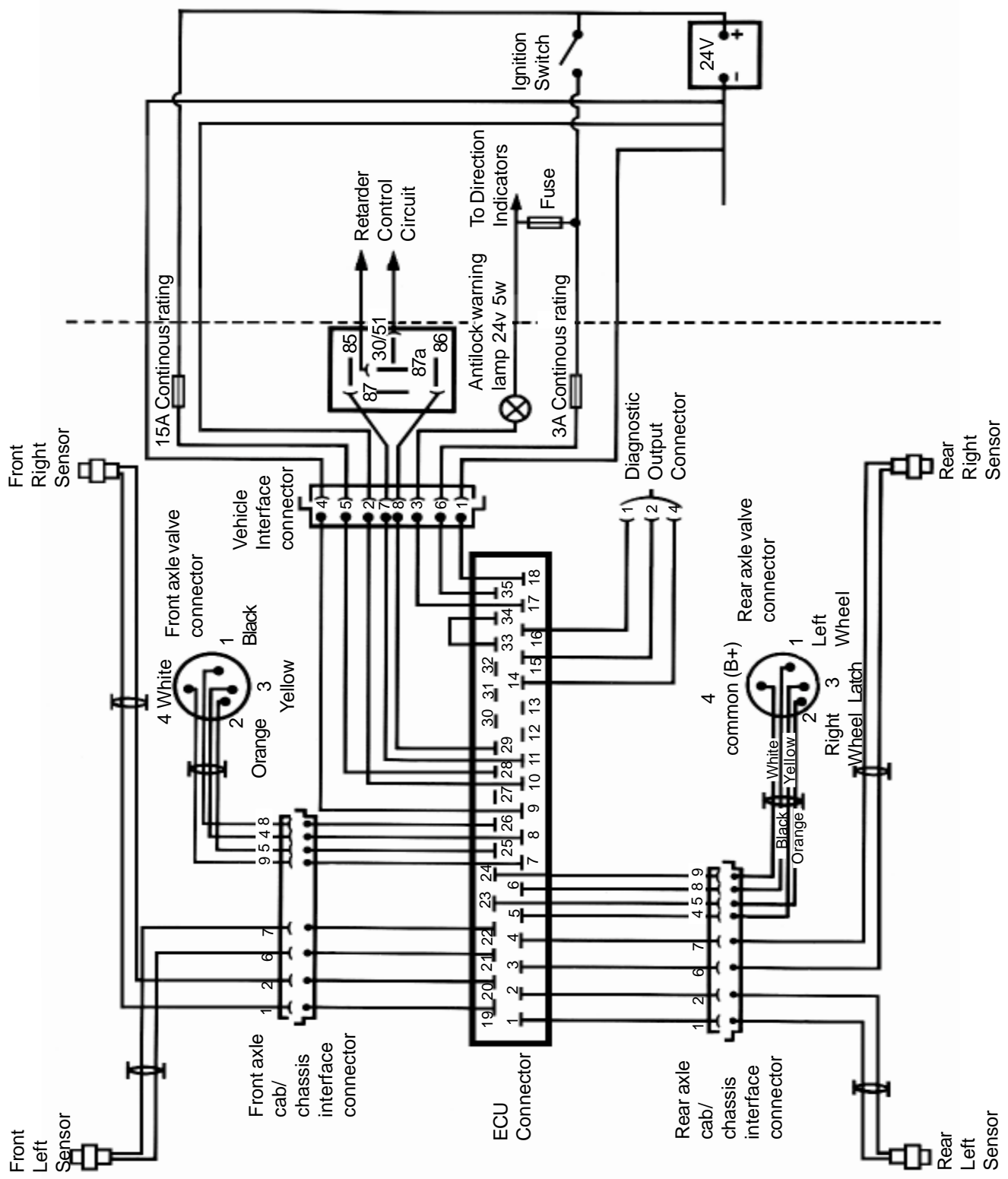


Fig. 4 DGX Wiring diagram - 100 Tooth Exciter Installation

DGX-I Diagnostic Code List

CODE DISPLAYED

BLANK DISPLAY No supply on ignition switched line.
B+ wiring shorted to valve solenoids.
High resistance in any SPS valve solenoid/wiring defect.
SPS valve, right dump solenoid or wiring open circuit defect - axle 2
SPS valve, right dump solenoid or wiring short circuit defect - axle 2
SPS valve, right dump solenoid or wiring short to B+ - axle 2
High resistance in any SPS valve solenoid/wiring defect.
Possible causes:
Fuse blown.
Info Centre or cable fault. Open circuit B -

SENSOR BAR Bar displayed = Sensor output O.K.
Bar not displayed = Sensor output too low

OK 00 System is O.K. vehicle is moving
OK 07 System is O.K. vehicle is stationary
RET 08 Retarder relay coil or wiring open circuit
RET 09 Retarder relay coil or wiring short circuit
LAMP OE Warning lamp relay coil/wiring open circuit

ECU Possible short circuit to B- on sensor S3 or S4.

LOW SENSOR OUTPUT GROUP

S1A 11 Left sensor system defect - axle 1
S1B 12 Right sensor system defect - axle 1
S2A 13 Left sensor system defect - axle 2
S2B 14 Right sensor system defect - axle 2
Possible causes:
Sensor worn, maladjusted sensor, coil or wiring open or short circuit.

INTERMITTENT LOW SENSOR OUTPUT GROUP

S1A 21 Left sensor system defect - axle 1
S1B 22 Right sensor system defect - axle 1
S2A 23 Left sensor system defect - axle 2
S2B 24 Right sensor system defect - axle 2
Possible causes:
Loose sensor, connection, bracket or exciter. Damaged exciter.
Maladjusted sensor or worn sensor cable insulation.

ONE WHEEL WITH SLOW RECOVERY GROUP

SLW 41 Left sensor wheel defect - axle 1
SLW 42 Right sensor wheel defect - axle 1
SLW 43 Left sensor wheel defect - axle 2
SLW 44 Right sensor wheel defect - axle 2
Possible causes:
Slow brake release, restricted piping, SPS valve defect.

DGX-I Diagnostic Code List

CODE DISPLAYED

OPEN CIRCUIT SPS VALVE SOLENOID OR SOLENOID WIRING GROUP

| | | |
|----------------|--------------------------------------|--------|
| RDDU 61 | Left dump solenoid circuit defect - | axle 1 |
| BUDU 62 | Right dump solenoid circuit defect - | axle 1 |
| YEDU 63 | Left dump solenoid circuit defect - | axle 2 |
| RDHD 67 | Latch solenoid circuit defect - | axle 1 |
| BUHD 68 | Latch solenoid circuit defect - | axle 2 |

SHORT CIRCUIT ACROSS SPS VALVE SOLENOID OR SOLENOID WIRING GROUP

| | | |
|----------------|--------------------------------------|--------|
| RDHD 71 | Left dump solenoid circuit defect - | axle 1 |
| BUHD 72 | Right dump solenoid circuit defect - | axle 1 |
| YEDU 73 | Left dump solenoid circuit defect - | axle 2 |
| RDHD 77 | Latch solenoid circuit defect - | axle 1 |
| BUHD 78 | Latch solenoid circuit defect - | axle 2 |

SPS VALVE SOLENOID WIRING OR SOLENOID SHORT TO B+ GROUP

| | | |
|----------------|---|--------|
| SOL 80 | Poor insulation in any SPS valve solenoid or wiring fault | |
| RDDU 81 | Left dump solenoid circuit defect - | axle 1 |
| BUDU 82 | Right dump solenoid circuit defect - | axle 1 |
| YEDU 83 | Left dump solenoid circuit defect - | axle 2 |
| RDHD 87 | Latch solenoid circuit defect - | axle 1 |
| BUHD 88 | Latch solenoid circuit defect - | axle 2 |

ANY OTHER DISPLAY - ECU or Info Centre defect

Note: If a Info Centre code is displayed and after following the recommended procedure no defect is found, the antilock control module (ECU) should be replaced

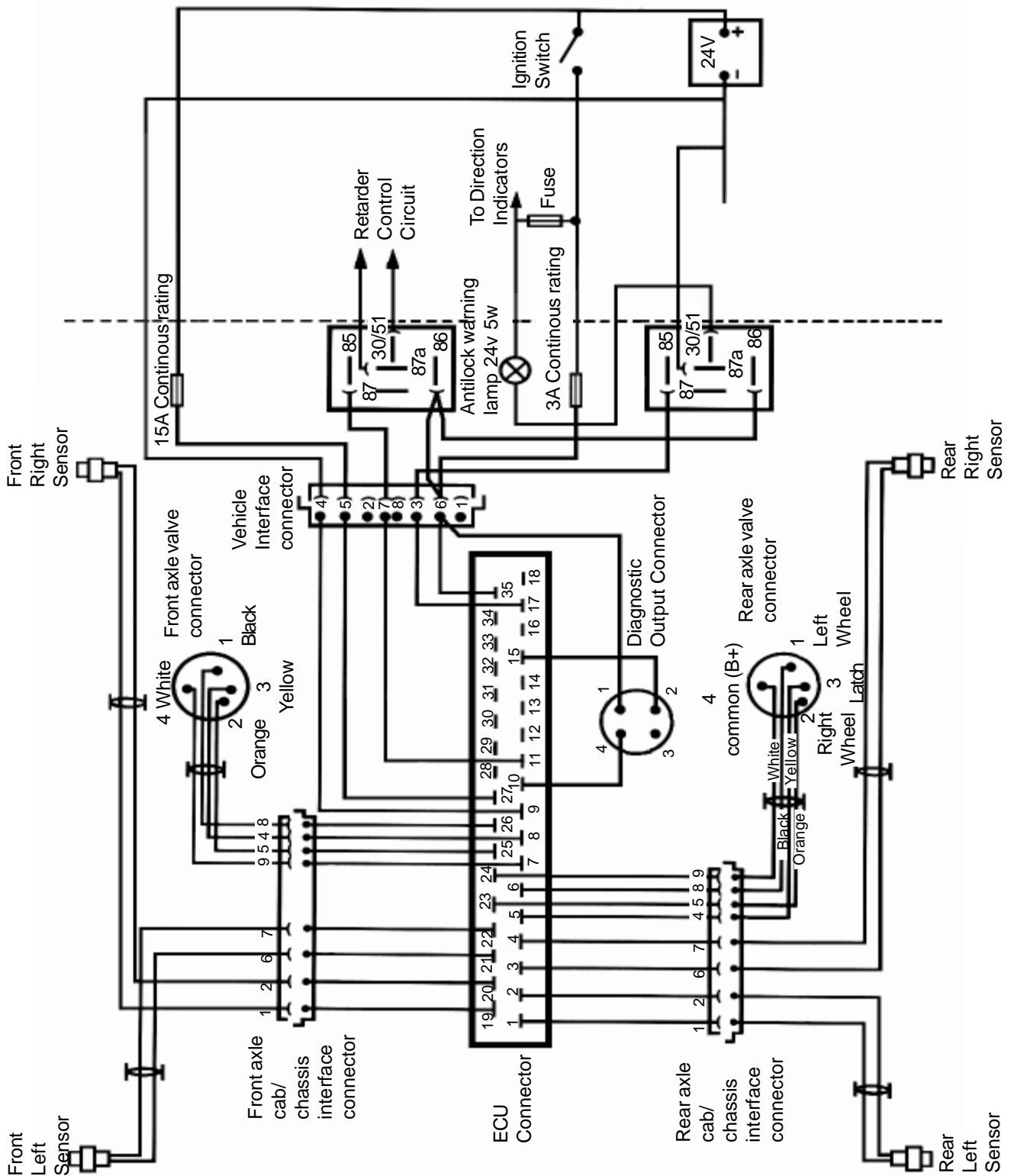


Fig. 5 DGX-I Wiring diagram - 60 Tooth Exciter Installation

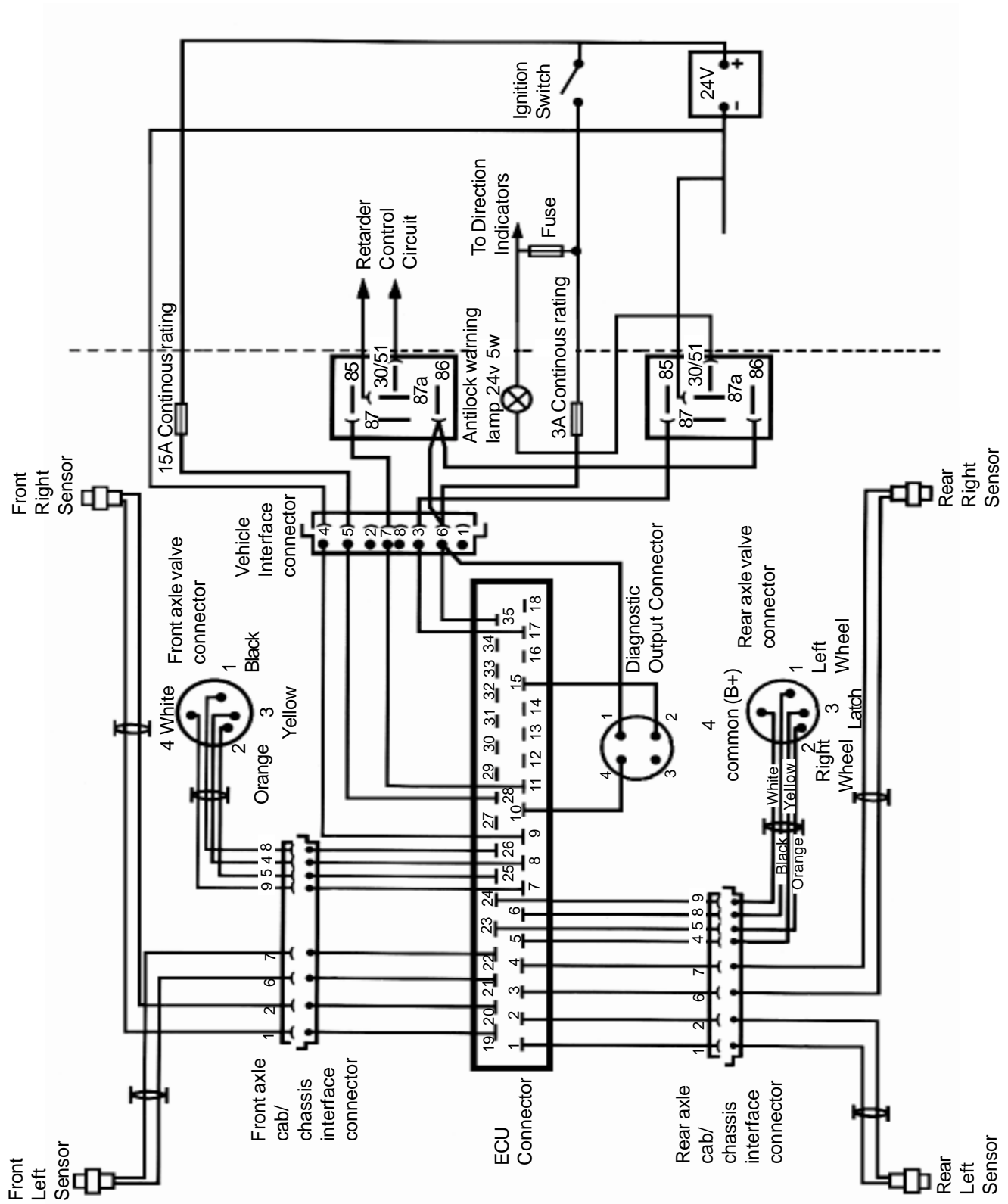


Fig. 6 DGX-I Wiring diagram - 100 Tooth Exciter Installation

Diagnosis of MODAL ABS

MODAL Diagnostic Memory

The ECU (Electronic Control Unit) contains an erasable, permanent memory which records diagnostic codes automatically and displays them on an LED, known as the TODD (Total Onboard Diagnostic Display) housed in the ECU. Information relating to the TODD is included in the full service manual, obtainable from Haldex Ltd. The codes may be recalled, displayed and erased using the Info Centre. The diagnosis of defects of an electrical electronic nature or those which cause poor anti-lock performance is achieved by reference to the diagnostic code displayed by the TODD or the Info Centre.

Equipment Required

If the Truck is not available, a supply switch box (see Fig. 7) may be required for switching the various power supplies, when using the Info Centre.

Note: A Truck may be used as an alternative to a supply switch box, but you should ensure that the electrical supplies and connections are in satisfactory condition.

For 12V Installations referred to information in brackets

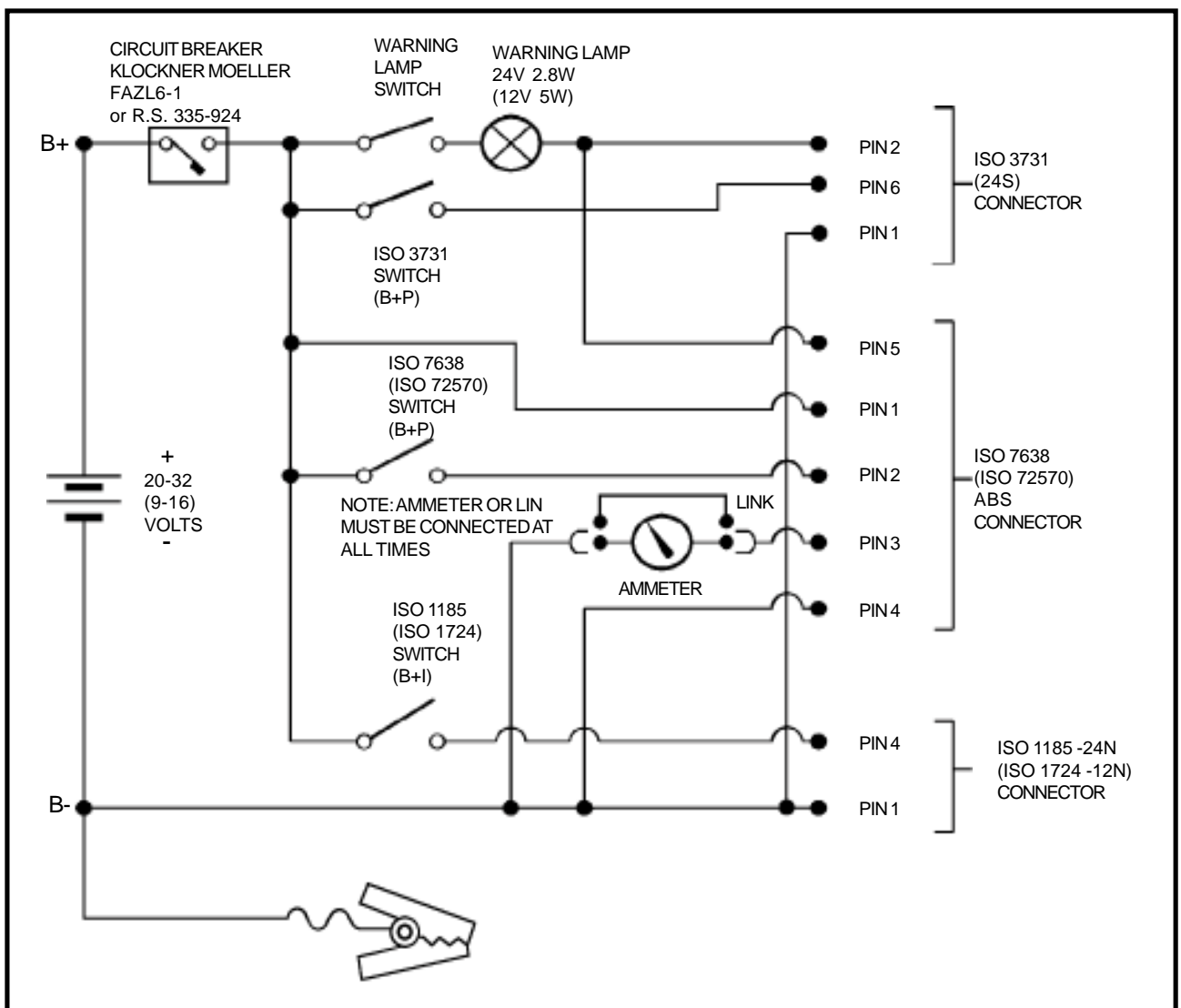


Fig. 7 Supply Switch Box Circuit

Initial diagnosis of ABS faults

Perform the following tests.

1. Apply electrical power to the trailer via the "24N" connector while observing the anti-lock warning lamp which should flash and then come on and stay on.
2. If the lamp fails to illuminate check the lamp bulb and electrical power supply.
3. If the lamp fails to flash but stays permanently illuminated check the diagnostic display codes including stored diagnostic codes using the procedure in described.
4. If (1) above is satisfactory drive the vehicle at above 6 m.p.h. (10 km/h). The anti-lock warning lamp should extinguish. If it does not there is a wheel speed sensing fault. Check the diagnostic display code.
5. To test for correct valve blow down, fully charge the air brake system, and turn off all electrical power to the trailer.

Do not apply the foot brake, set the ignition the ignition off in the Truck, if a switch box power supply is being used switch the B+I and B+P switches off.

6. When using a towing vehicle depress the foot brake then turn the ignition switch on.

Alternatively when using a test power supply switch B+I on. There should be as many brief pulses of air as there are ABS modulators (ABS valves).

7. If the number of air pulses is incorrect check the diagnostic display code.

Note that erroneous wiring of the modulator solenoid wiring will produce two air pulses on the affected modulator as the dump and hold solenoids are electrically identical but have different pneumatic functions.

8. When a wheel is rotated, and electrical power is applied, all modulator blowdowns are inhibited while the wheel is turning.

Using the Info Centre

Starting

1. Remove all electrical power from the trailer.
2. Connect the Info Centre cable to the trailer diagnostic output connector . See MODAL - Fig 8
3. Apply 24 volts to the anti-lock system and observe the Info Centre display.
4. Refer to functions (page 20-24)

Ending

5. Remove electrical power from the ABS system (the diagnostic display will be completely blank).
6. Disconnect the Info Centre cable from its connector and refit the connector cover.
7. Restore electrical power and carry out the driver's checks for correct lamp sequence as described in (1 and 4) of initial ABS diagnosis above.

Interpretation of Diagnostic Codes.

1. When the vehicle is stationary and no fault is present the diagnostic display will be "OK 07".
2. This display will change when the vehicle is driven at above 6 mph (10 km/h) to "OK 00" and bars will appear either side of the "OK 00" for left and right sensors representing a sensor output which is above the necessary minimum.
3. The number of bars which appear should be the same as the number of wheels which have speed sensors fitted.
4. The Info Centre displays "OK 00" as a code which indicates correct operation of the system, when vehicle speeds exceed 6mph (10km/h).
5. When the vehicle stops the code returns to "OK 07".
6. Flashing bars indicate that there are poorly adjusted sensors or loose sensor connections.
7. Spinning individual wheels with the trailer jacked up will cause the relevant bar to appear if the sensor output is above the minimum.
8. Codes other than those described above can be interpreted by using the diagnostic code table.

Sensors

Codes "S1A 01" to "S3B 06" indicate that a wheel speed sensor or its wiring is short or open circuit.

1. Disconnect the relevant sensor connector at the extension lead plug and measure the resistance between the 2 sockets in the connector housing.

2. The ohmmeter reading should be between **980 ohms and 2.35 kohms**.

3. The extension cable between the controller and wheel has an in line connector. If an open circuit is measured check that the connector is correctly assembled.

4. Disconnect the harness from the ECU and locate the appropriate pins for the cable to be tested, see the appropriate system wiring diagrams.

5. Using a 500 volt insulation tester measure the insulation resistance between each sensor wire and chassis. The insulation resistance must be more than **10 megohms**.

Codes "S1A 11" to "S3B 16" indicate that the output of a wheel speed sensor is insufficient. The most likely reason for this is that the sensor to exciter gap is too great. Adjust the sensor.

Codes "S1A 21" to "S3B 26" indicate that there is an intermittent loss of adequate sensor signal when moving. The most likely causes are loose connections, loose sensor bracket, broken sensor retaining clip, a distorted exciter or intermittent insulation failures of sensor cables (for which a cable insulation test will be required).

Modulator Solenoids

Codes "RDHD 61" to "YEDU 69" indicate that the solenoid or its cable is open circuit.

1. Disconnect the solenoid cable at its connector and measure the resistance.

2. The resistance should be between

24V systems - 12 ohms and 20 ohms.

12V systems - 3.75 ohms and 6.25 ohms.

Codes "RDHD 71" to "YEDU 79" indicate that a solenoid or its cable is short circuit.

Codes "RDHD 80" to "YEDU 89" indicate that a solenoid or its cable has a short circuit to battery positive.

1. Disconnect the harness connector from the solenoid. Measure the resistance of the solenoids with a multimeter at the modulator. Solenoid resistance should be

24v systems - 12 ohms and 20 ohms.

12v systems - 3.75 ohms and 6.25 ohms.

2. Disconnect the harness at the ECU and test at the solenoid connector between each wire and chassis with a 500 volt insulation tester. The insulation resistance must be greater than **10 megohms**.

Code "B+LO 90" indicates a voltage loss when a solenoid is energised and the voltage at the ECU falls below 18 or 9 Volts.

1. Ensure that the electrical supply is satisfactory under full electrical load conditions, i.e. there are no high resistance connections present.

2. Establish if the voltage drop occurs when using each of the power sources on their own, ISO7638, ISO3731 (24S), ISO1185 (24N).

3. Check for loose connections in the wiring from the source which produces the fault code.

NOTE: An inadequate power supply e.g. discharged test batteries will cause code "B+LO 90" to be displayed.

Code "ISOI 91" indicates that when using the ISO 7638 power source there is sufficient voltage coming from pin 2 of the ISO 7638 connector but the voltage coming from pin 1 is low or absent.

1. Check for broken wiring or blown fuses on both the trailer and the towing vehicle or with the workshop power supply if used. The voltage measured on the ECU connector which goes to ISO 7638 pin 1 should be between 18 Volts and 32 Volts when the voltmeter negative lead is on the ECU connector which goes to ISO 7638 pin 4.

Code "B+HI 92" indicates that the power supply to the ECU is above 32 volts and action must be taken to reduce this over voltage.

1. Check the towing vehicle voltage regulator and alternator system or the voltage output from the test power supply in use.

2. The correct power supply connections to the ECU supply pins as shown in the appropriate system wiring

MODAL Configuration Codes

Figures in brackets indicate sensing is disabled when the axle is lifted.

| Code | Function | Axle Lifted | Sensors Used | Modulators Used |
|----------------|----------|-------------|-----------------------------|---------------------|
| 2S1C C0 | 2S/1M | | S1A S1B | Red |
| 2S2C C1 | 2S/2M | | S2A S2B | Blue, Yellow |
| 4S2C C2 | 4S/2M | | S3A S2A S2B S3B | Blue, Yellow |
| 4S2C C3 | 4S/2M | 2 or 3 | (S3A) S2A S2B (S3B) | Blue, Yellow |
| 4S3C C4 | 4S/3M | | S2A S1A S1B S2B | Blue, Red, Yellow |
| 4S3C C5 | 4S/3M | 1 or 2 | S2A (S1A)(S1B) S2B | Blue, (Red), Yellow |
| 6S3C C6 | 6S/3M | | S3A S2A S1A S1B S2B S3B | Blue, Red, Yellow |
| 6S3C C7 | 6S/3M | 1 | S3A S2A(S1A)(S1B)S2B S3B | Blue, (Red), Yellow |
| 6S3C C8 | 6S/3M | 3 or 4 | (S3A) S2A S1A S1B S2B (S3B) | Blue, Red, Yellow |
| 6S3C C9 | 6S/3M | 1+3 or 4 | (S3A)S2A(S1A)(S1B)S2B(S3B) | Blue, (Red), Yellow |

Sensors used by various MODAL configurations

| System | Sensor Used | Modulator Valves Used |
|--------|---|-----------------------|
| 2S/1M | Red S1A,S1B | Red |
| 2S/2M | Blue S2A, Yellow S2B | Blue, Yellow |
| 4S/2M | Blue S2A,S3A Yellow S2B,S3B | Blue, Yellow |
| 4S/3M | Red S1A,S1B+Blue S2A, Yellow S2B | Red, Blue, Yellow |
| 6S/3M | Red S1A,S1B+Blue S2A,S3A Yellow S2B,S3B | Red, Blue, Yellow |

MODULAR Configuration Codes

Figures in brackets indicate sensing is disabled when the axle is lifted.

| Code | Function | Axle Lifted | Sensors Used | Modulators Used |
|----------------|----------|-------------|---------------------|-----------------|
| 2S1C C0 | 2S/1M | | S1A S1B | Red |
| 2S2C C1 | 2S/2M | | S2A S2B | Blue, Yellow |
| 4S2C C2 | 4S/2M | | S2A S2B S3A S3B | Blue, Yellow |
| 4S2C C3 | 4S/2M | 2 or 3 | S2A S2B (S3A) (S3B) | Blue, Yellow |

Note: Sensor faults in code groups "S1A 21" to "S3B 26" will electronically 'trip' the lamp drive such that, after repair of an associated sensor, on powering the ABS system, the lamp will come on and stay on. To effect reset of the lamp drive and restore normal lamp function, you must now drive the vehicle >6mph (10km/hr) or spin the wheel with the ABS powered up. This generates a signal, confirming sensor function, and allows the microprocessor controlled lamp drive to reset.

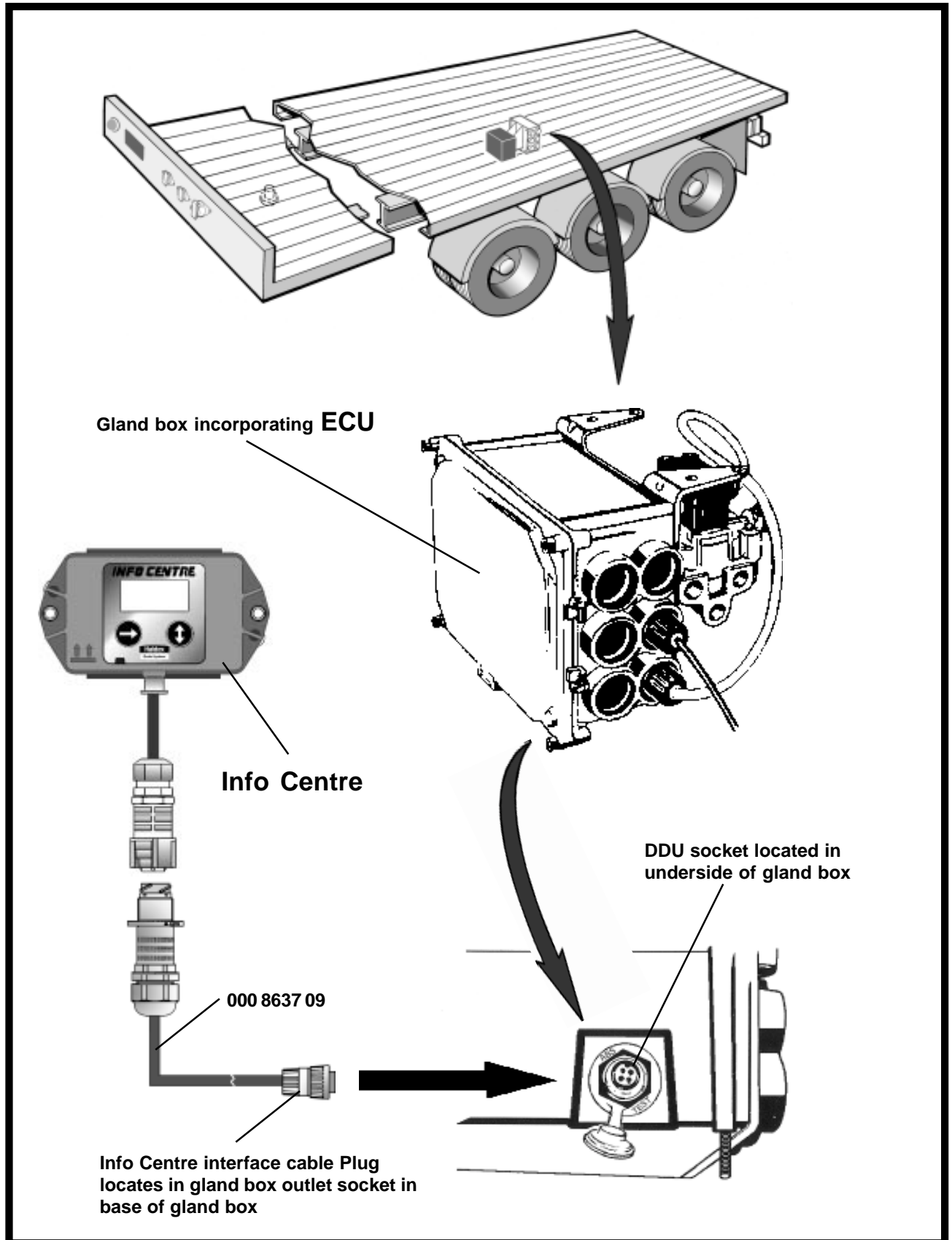


Fig. 8 MODAL Diagnostic outlet socket location

Info Centre Function available for MODAL ABS

ECU Information:

Serial number
Product type code
Configuration code

Diagnostic:

Display Current fault code
Display Stored fault codes
Sensor / cabling check

Testing:

Reset-to-Ride
Tacho
Retarder

Meaning of relevant symbols



POWER: Vehicle power

- ON = Vehicle supply
- OFF = No vehicle supply
- FLASHING = Communications established between Info Centre and ABS ECU.



DIAGNOSTICS

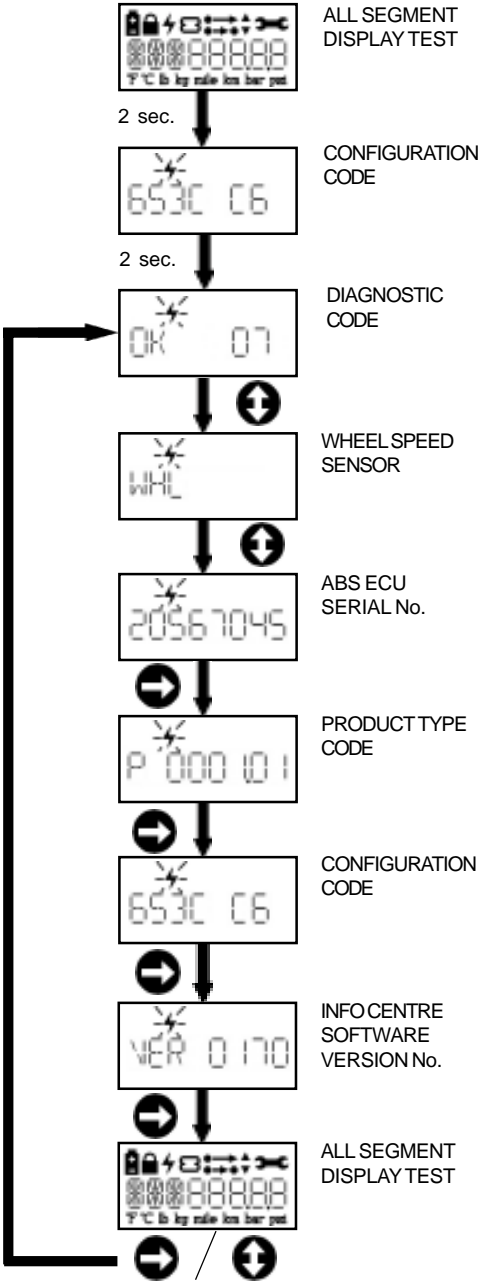
- FLASHING = Current ABS fault



Flashing symbol

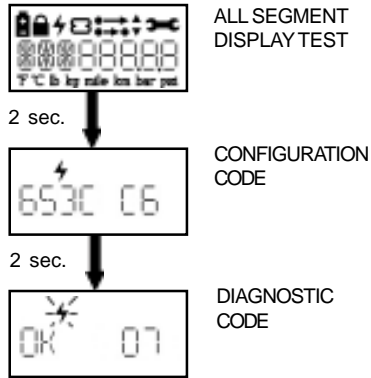
Functions:

ECU Information

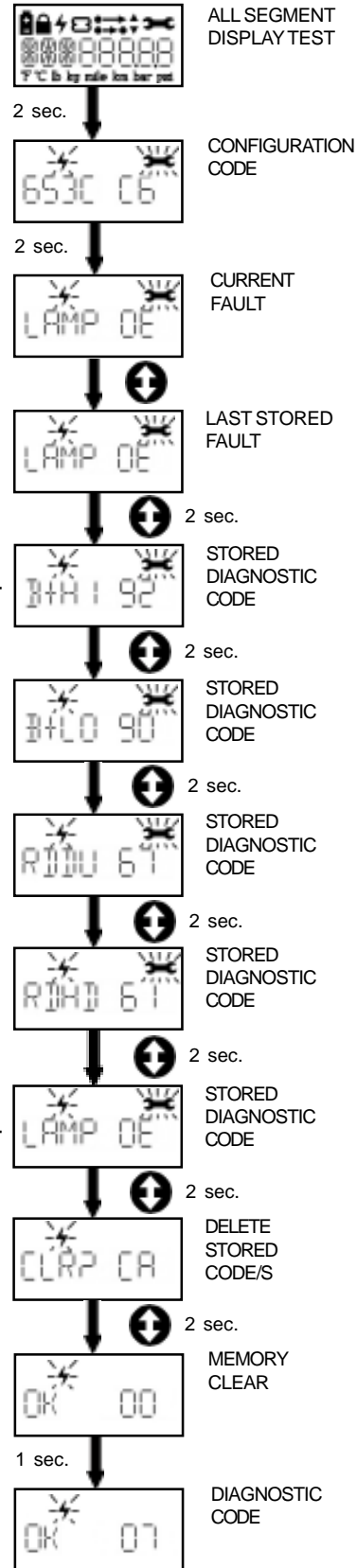


Diagnostic Information

Display 'OK' if no current faults

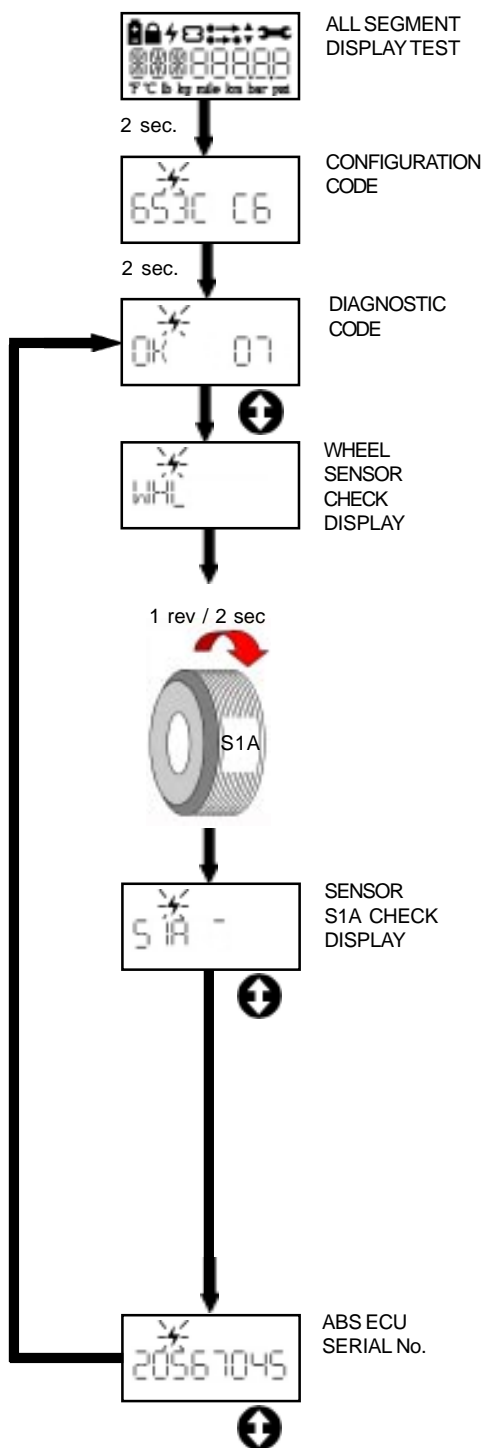


Stored Diagnostic codes

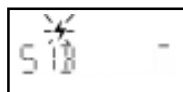


To display a further batch of five diagnostic codes, wait until CLR? CA is replaced with the next stored fault code and proceed as normal.

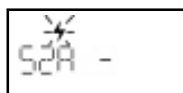
Sensor output / cabling check



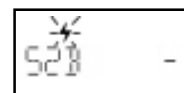
Alternative Displays on rotating appropriate wheel



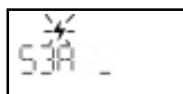
SENSOR S1B CHECK DISPLAY



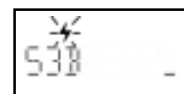
SENSOR S2A CHECK DISPLAY



SENSOR S2B CHECK DISPLAY

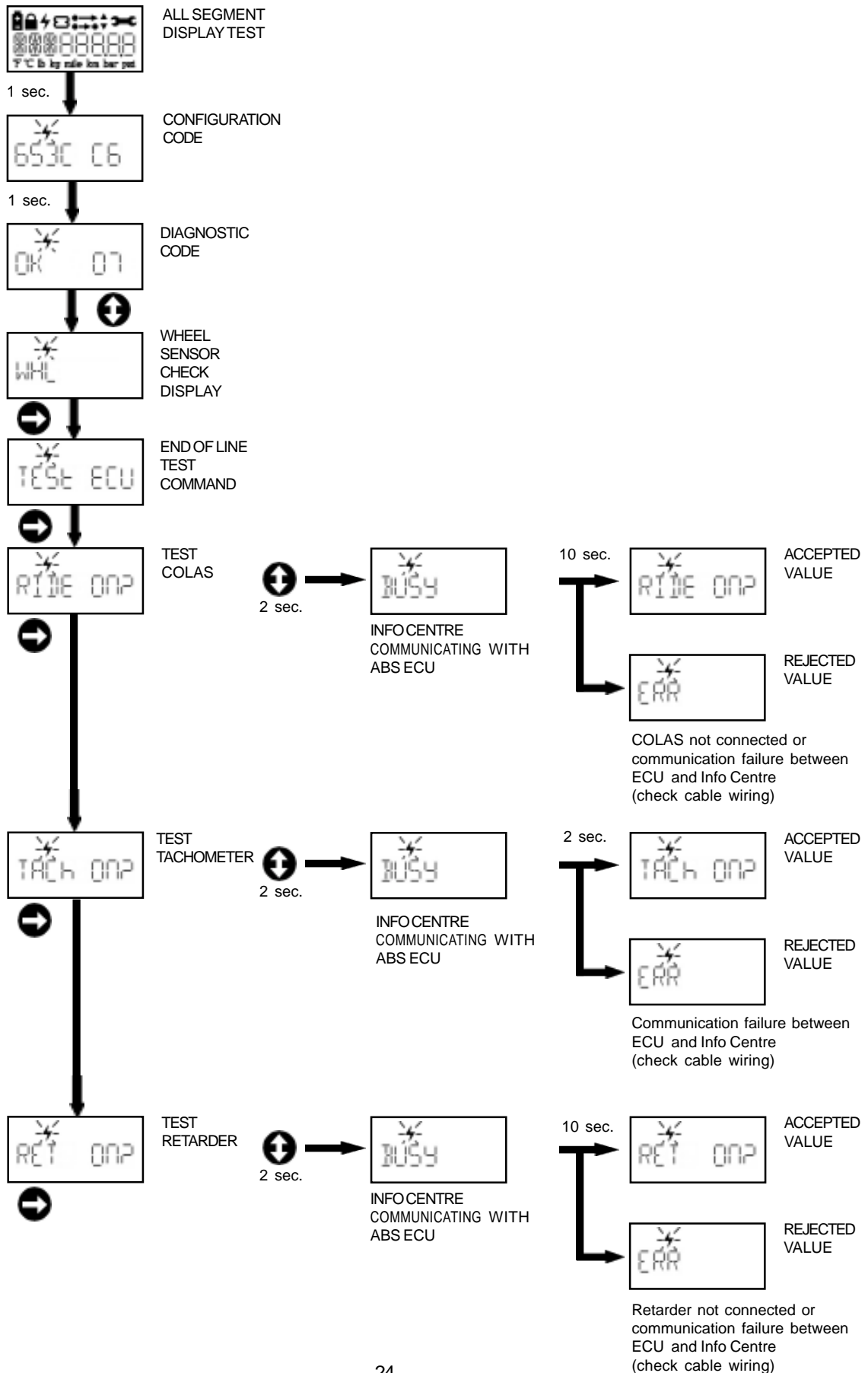


SENSOR S3A CHECK DISPLAY



SENSOR S3B CHECK DISPLAY

Test Mode



MODAL Diagnostic Code List

Note: If an unlisted diagnostic code is displayed, clear the ECU memory and repeat the test procedure. should the code persist, consult HALDEX Technical Service on Tel: +44 1325 310 110
Refer to this section for diagnostic test procedures. A and B define left and right hand side of the vehicle. A comprehensive fault code list is shown in this section.

CODE DISPLAYED

POSSIBLE CAUSE

| | |
|--------|--|
| OK 00 | Normal running i.e. no fault found |
| S1A 01 | Sensor 1A or wiring open or short circuit |
| S1B 02 | Sensor 1B or wiring open or short circuit |
| S2A 03 | Sensor 2A or wiring open or short circuit |
| S2B 04 | Sensor 2B or wiring open or short circuit |
| S3A 05 | Sensor 3A or wiring open or short circuit |
| S3B 06 | Sensor 3B or wiring open or short circuit |
| | Possible causes: Sensor connector loose, cable damaged, sensor faulty. |
| OK 07 | System is OK but all sensors have no output. Drive above 6 mph (10 km/h), sensor bars will appear if sensors are OK. |
| RET 08 | Retarder relay or wiring open circuit. |
| RET 09 | Retarder relay or wiring short circuit. |

LOW SENSOR OUTPUT GROUP

| | |
|--------|--|
| S1A 11 | Sensor 1A, low output |
| S1B 12 | Sensor 1B, low output |
| S2A 13 | Sensor 2A, low output |
| S2B 14 | Sensor 2B, low output |
| S3A 15 | Sensor 3A, low output |
| S3B 16 | Sensor 3B, low output |
| | Possible causes: Sensor worn, sensor connector loose, maladjusted sensor, wiring open or short circuit, short across conductors in cable. |

EXCITER GROUP

| | |
|--------|--|
| EXC 20 | Incorrect exciter type fitted. i.e. 80 tooth instead of 100 tooth or vice versa. |
|--------|--|

INTERMITTENT LOW SENSOR OUTPUT GROUP

| | |
|--------|--|
| S1A 21 | Sensor 1A, intermittent low output |
| S1B 22 | Sensor 1B, intermittent low output |
| S2A 23 | Sensor 2A, intermittent low output |
| S2B 24 | Sensor 2B, intermittent low output |
| S3A 25 | Sensor 3A, intermittent low output |
| S3B 26 | Sensor 3B, intermittent low output |
| | Possible causes: Loose or maladjusted sensor, sensor connector loose, bracket or exciter loose damaged exciter, worn sensor cable insulation. |

| | |
|--------|-----------------------------------|
| EXT 37 | Lamp signalled by external device |
|--------|-----------------------------------|

SENSED WHEEL SLOW RECOVERY GROUP

| | |
|---------|---|
| XSEN 40 | Sensor wiring crossed across an axle |
| SLW 41 | Slow recovery of sensed wheel(s) of red channel. |
| SLW 42 | Slow recovery of sensed wheel(s) of blue channel. |
| SLW 43 | Slow recovery of sensed wheel(s) of yellow channel. |
| | Possible causes: Slow brake release, check foundation brake for mechanical faults, dry bearings, broken springs, restricted piping, check for kinks and blockages etc. Check for incorrectly wired sensors and modulator solenoids, incorrect piping or modulator fault. |

OPEN CIRCUIT SOLENOID OR WIRING

| | |
|---------|---|
| RDHD 61 | Red channel, hold solenoid or wiring |
| BUHD 62 | Blue channel, hold solenoid or wiring |
| YEHD 63 | Yellow channel, hold solenoid or wiring |
| RDDU 67 | Red channel, dump solenoid or wiring |
| BUDU 68 | Blue channel, dump solenoid or wiring |
| YEDU 69 | Yellow channel, dump solenoid or wiring |

CODE DISPLAYED**POSSIBLE CAUSE**

| CODE DISPLAYED | POSSIBLE CAUSE |
|-------------------------------------|---|
| | SHORT CIRCUIT MODULATOR SOLENOID OR WIRING |
| RDHD 71 | Red channel, hold solenoid or wiring |
| BUHD 72 | Blue channel, hold solenoid or wiring |
| YEHD 73 | Yellow channel, hold solenoid or wiring |
| RDDU 77 | Red channel, dump solenoid or wiring |
| BUDU 78 | Blue channel, dump solenoid or wiring |
| YEDU 79 | Yellow channel, dump solenoid or wiring |
| | SOLENOID WIRING SHORT TO B+ OR LOW SOL. RESISTANCE |
| SOL 80 | Poor insulation in solenoid or wiring |
| RDHD 81 | Hold solenoid, red channel |
| BUHD 82 | Hold solenoid, blue channel |
| YEHD 83 | Hold solenoid, yellow channel |
| RDDU 87 | Dump solenoid red channel |
| BUDU 88 | Dump solenoid blue channel |
| YEDU 89 | Dump solenoid yellow channel |
| | SUPPLY VOLTAGE GROUP |
| B+LO 90 | ECU supply voltage <18V (<9v on 12V system) when solenoid energised. |
| ISOI 91 | Faulty supply from ISO 7638 Pin 1 or fuse blown |
| B+HI 92 | ECU supply voltage >32V. (<16v on 12V system) |
| ECU 93 | Internal ECU fault |
| ECU 99 | Internal ECU fault |
| | ALPHA/NUMERIC DIAGNOSTIC CODES |
| CLR CA | When reading codes this appears as an invitation to Clear All. |
| CLR CC | When revising configuration this appears as an invitation to Clear Configuration. |
| CF | Unacceptable combination of sensors and solenoids. |
| RIDE OA | COLAS® solenoid wiring open circuit. |
| RIDE OC | COLAS® solenoid wiring short circuit. |
| LAMP OE | Warning lamp circuit fault. Open or short circuit. Bulb may be faulty. |
| | AUXILIARY CODES |
| AUX A1 | Automatic Reset-to-ride (COLAS®) and wiring fitted ABS function available. |
| AUX A2 | Retarder relay and wiring fitted ABS function available. |
| AUX A3 | Steerable axle locking device signal available. |
| Blank Display | No supply on ignition switched line, fuse blown, Info Centre or cable fault, open circuit B-. |
| S1A[™] (Sensor Bar) | Bar displayed = Sensor OK. Bar not displayed = Sensor output too low. |
| Unlisted Display. | ECU or Info Centre fault. Replace faulty component as necessary. |

Note: If a code is displayed and after following the recommended procedure fault is found, the ECU should be replaced.

| LEGEND | |
|--------|--|
| N1 | SENSORS 3A AND 3B ARE OMITTED IN 4S INSTALLATIONS. |
| N2 | SOME MODULATORS HAVE THE CARL F AS A LYLING LEAD IS NO CONNECTION IS FITTED |
| N3 | ALL WIRFS ARE 1.5mm (1/16) IN DIA. UNLESS OTHERWISE SPECIFIED. |
| N4 | DIAGNOSTIC WIRING INSTALLED (HALD) OMITTED FOR CLARITY. |
| N5 | SENSOR PAIRS 1A, 1B AND / OR 2A, 2B MAY BE INSTALLED ON LEFT AXLES. |
| N6 | AXLE 1 IS AT THE REAR OF THE VEHICLE. |
| N7 | SENSOR CABLES TO GO TO THE LEFT AND RIGHT HAND WHEELS OF THE SENSORS AXLE 1 LEFT AND RIGHT HAND IS ALL SITTING IN THE DRIVE'S SLAT FACING FORWARD. |
| N8 | THE MAXIMUM CABLE LENGTH BETWEEN THE ISO1185 / ISO3731 CONNECTORS AND THE FRONT JUNCTION BOX IS 1m. |
| N9 | ALL CABLES EXCEPT MODULATOR AND SENSOR CABLES ARE TO BE ENCLOSED IN CONDUIT. |
| N10 | SENSOR CONNECTOR. |

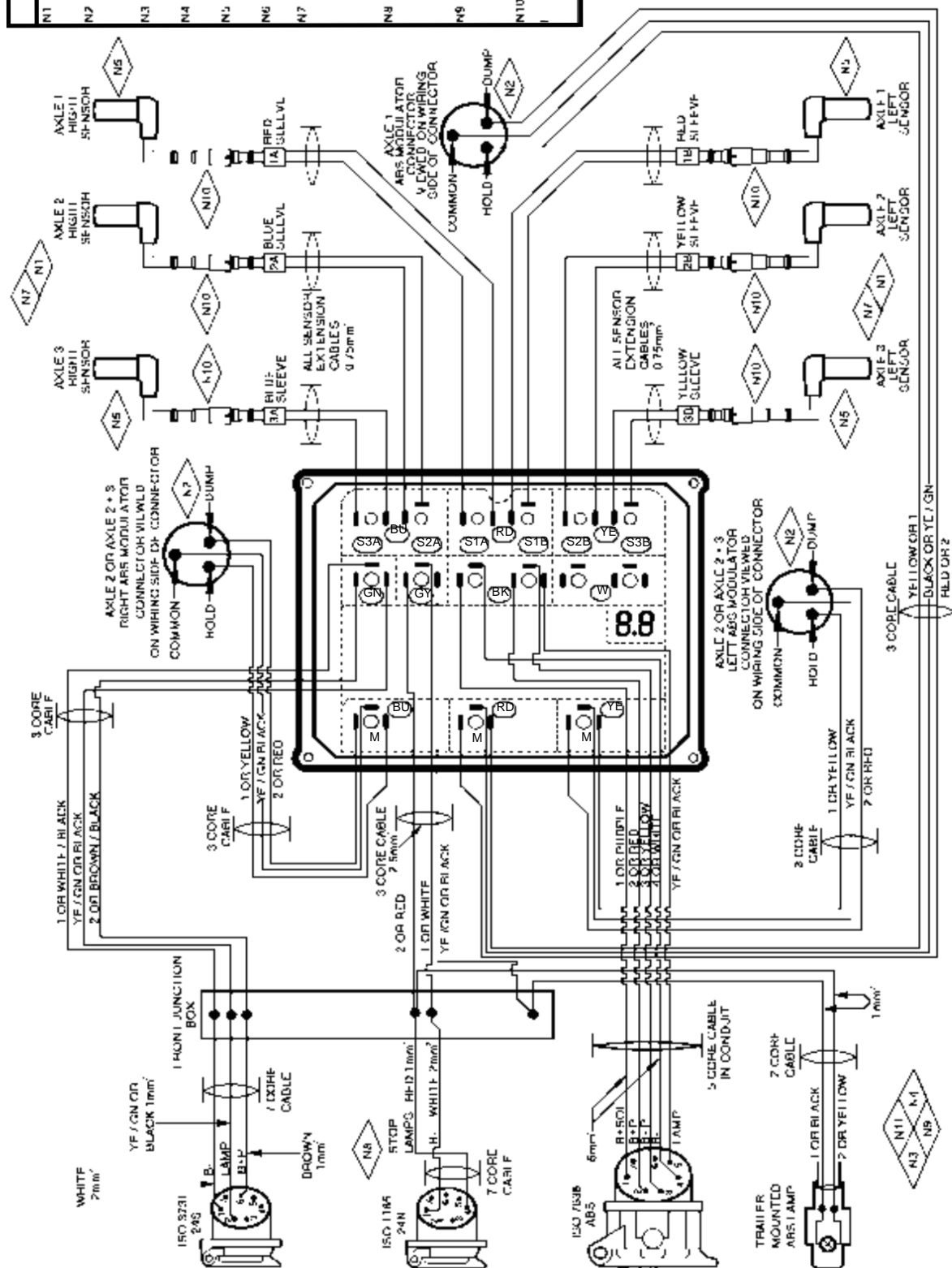


Fig. 9 MODAL Wiring diagram - 6S/3M

LEGEND

| | |
|----|---|
| N1 | SENSORS 3A AND 3B ARE OMITTED IN 4S INSTALLATIONS. |
| N2 | SOME MODULATORS HAVE THE CABLE AS A FLYING LEAD i.e. NO CONNECTOR IS FITTED. |
| N3 | ALL WIRES ARE 1.5mm ² UNLESS SPECIFIED. |
| N4 | DIAGNOSTIC WIRING INSTALLED BY HALDEX OMITTED FOR CLARITY. |
| N5 | SENSOR PAIRS 1A, 1B AND / OR 3A, 3B MAY BE INSTALLED ON LEFT AXLES. |
| N6 | AXLE 1 IS AT THE REAR OF THE VEHICLE. |
| N7 | SENSOR CABLES TO GO TO THE LEFT AND RIGHT HAND WHEELS OF THE SENSIZED AXLE. LEFT AND RIGHT HAND IS AS IF SITTING IN THE DRIVER'S SEAT FACING FORWARD. |
| N8 | THE MAXIMUM CABLE LENGTH BETWEEN THE ISO1185 CONNECTOR AND THE FRONT JUNCTION BOX IS 1m. |
| N9 | SENSOR CONNECTOR |

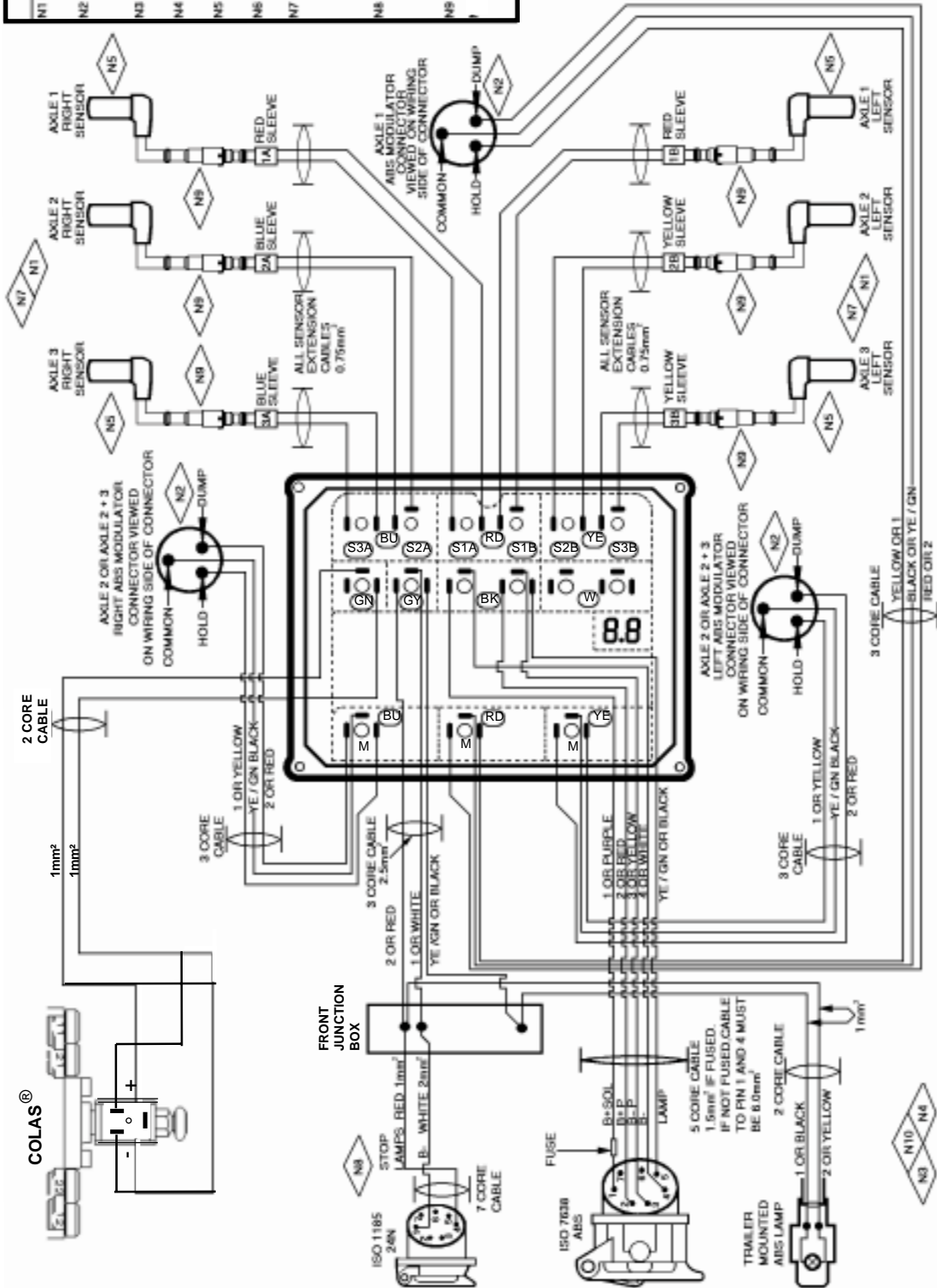


Fig. 10 MODAL Wiring diagram - 6S/3M with Automatic Reset-to-ride (COLAS®)

| LEGEND | |
|--------|--|
| N1 | CONNECTS BETWEEN 30/51 AND 37a OPEN CIRCUIT - RING ABS OPERATIONAL - THE RELAY IS MOUNTED IN THE CABLE GLAND BOX |
| N2 | SOME MODULATORS HAVE THE CABLE AS A FIXTURE - YEL / FAD / W / B CAN NOT BE REMOVED - THE MODULATORS ARE TIED |
| N3 | ALL WIRES ARE 1.5mm UNLESS SPECIFIED |
| N4 | DIAGNOSTIC WIRING INSTALLED BY HALDEX ON TIED FOR CLARITY |
| N5 | SEALER PAINS ARE AVAILABLE - THEY MAY BE INSTALLED ON LIFT AXLES |
| N6 | SOME SYSTEMS DO NOT HAVE A FUSE BUT USE 5mm ² WIRE TAPS AND REFER TO THE RELEVANT WIRING DIAGRAM |
| N7 | THE MAXIMUM CABLE LENGTH BETWEEN ISO 1185 CONNECTOR AND THE RING JUNCTION BOX IS 1V |
| N8 | SUPPLIED BY HALDEX WITH THE RELAY CONNECTOR FITTED |

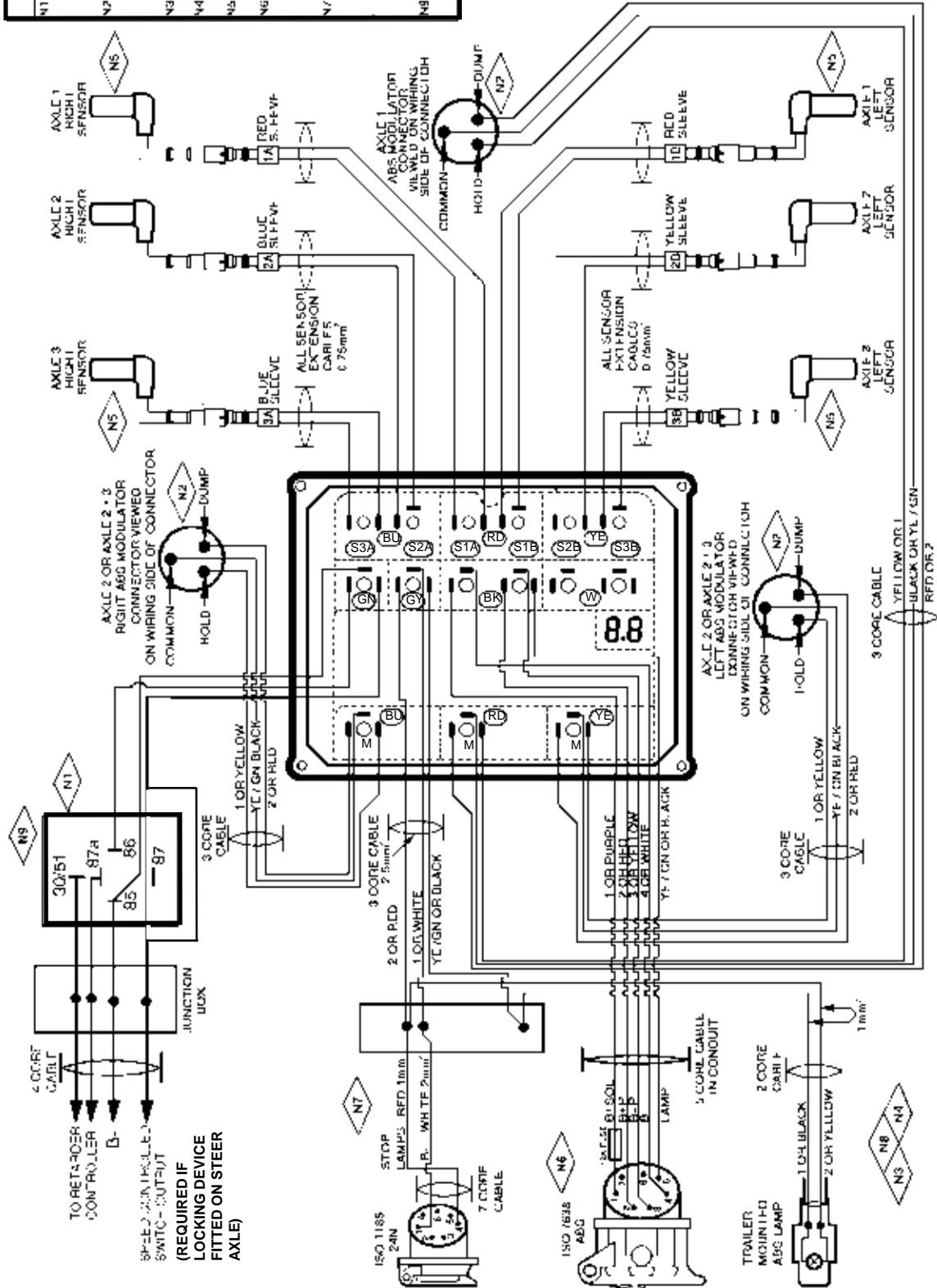


Fig. 11 MODAL Wiring diagram - 6S/3M with Retarder

| LEGEND | |
|--------|--|
| M1 | 5F SQUARE 3A AND 3B AND 5F OMITTED IN INSTALLATIONS |
| M2 | 5AMP MINIMUM CURRENT RATING CABLE AS A FLYING LEAD TO NO CONNECTOR |
| M3 | ALL WIRING SHALL BE 1.5mm ² UNLESS SPECIFIED |
| M4 | CONDUCTIVE WIRING SHALL BE BY HALDEX IS OMITTED FOR CLARITY |
| M5 | SIGNALS PAIR 3A, 3B MAY BE INSTALLED ON A LIFT AXLE |
| M6 | AXLE 1 IS AT THE FRONT OF THE VEHICLE |
| M7 | SIGNALS CABLES TO GO TO THE LEFT AND RIGHT AND WHEELS OF THE SIGNAL AXLE, LEFT AND RIGHT, MUST BE SETTING IN THE DRIVERS SEAT AS FAR AS POSSIBLE |
| M8 | THE MAXIMUM CABLE LENGTH BETWEEN THE ISO3731 CONNECTOR AND THE FRONT AND REAR WHEEL SENSOR CONNECTOR |
| M9 | FOR LIFT TRAILER CONNECTION OFF SECTION 2.C |
| M10 | ON HAZARDOUS LOAD CARRIERS ALL SIGNAL CABLES SHALL BE ENCLOSED IN CONDUIT |

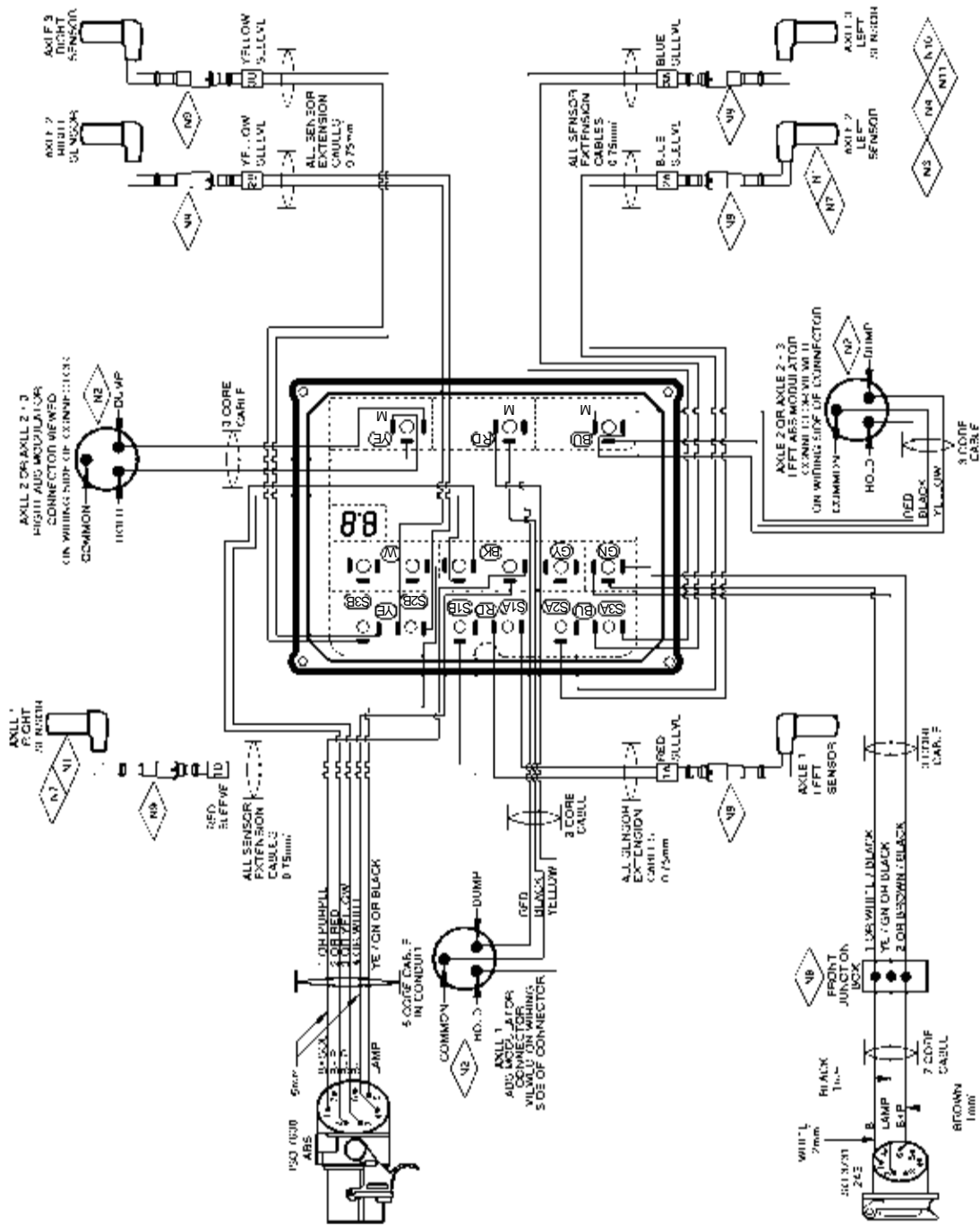


Fig. 12 MODAL Wiring diagram - Full-Trailers (4S-6S/3M)

| LEGEND | |
|--------|--|
| N1 | THE WHEEL SPEED SENSORS WILL BE FITTED TO ONE AXLE ONLY |
| N2 | SOME MODULATORS HAVE THE CABLE AS A FLYING LEAD. THE FLYING LEAD IS NOT IN THE CONNECTOR. THE FLYING LEAD IS 1.5m UNLESS SPECIFIED OTHERWISE FOR CLARITY |
| N3 | DIAGNOSTIC WIRING INSTRUMENT INDEX |
| N4 | SENSOR CABLES TO BE TO THE LEFT AND RIGHT HAND WHEELS OF THE SENSING AXLE. LEFT AND RIGHT HAND IS AS IF SEAT IN THE DRIVERS SEAT FACING FORWARD |
| N5 | THE MAXIMUM CABLE LENGTH IS 1.5m (5.0ft) FROM THE CONNECTOR TO THE FRONT JUNCTION BOX 5.1m (16.7ft) |
| N6 | ALL CABLES EXCEPT MODULATOR AND SENSOR CABLES ARE TO BE INCLUDED IN CONDUIT |
| N7 | SENSOR CONNECTOR |
| N8 | SENSOR CONNECTOR |

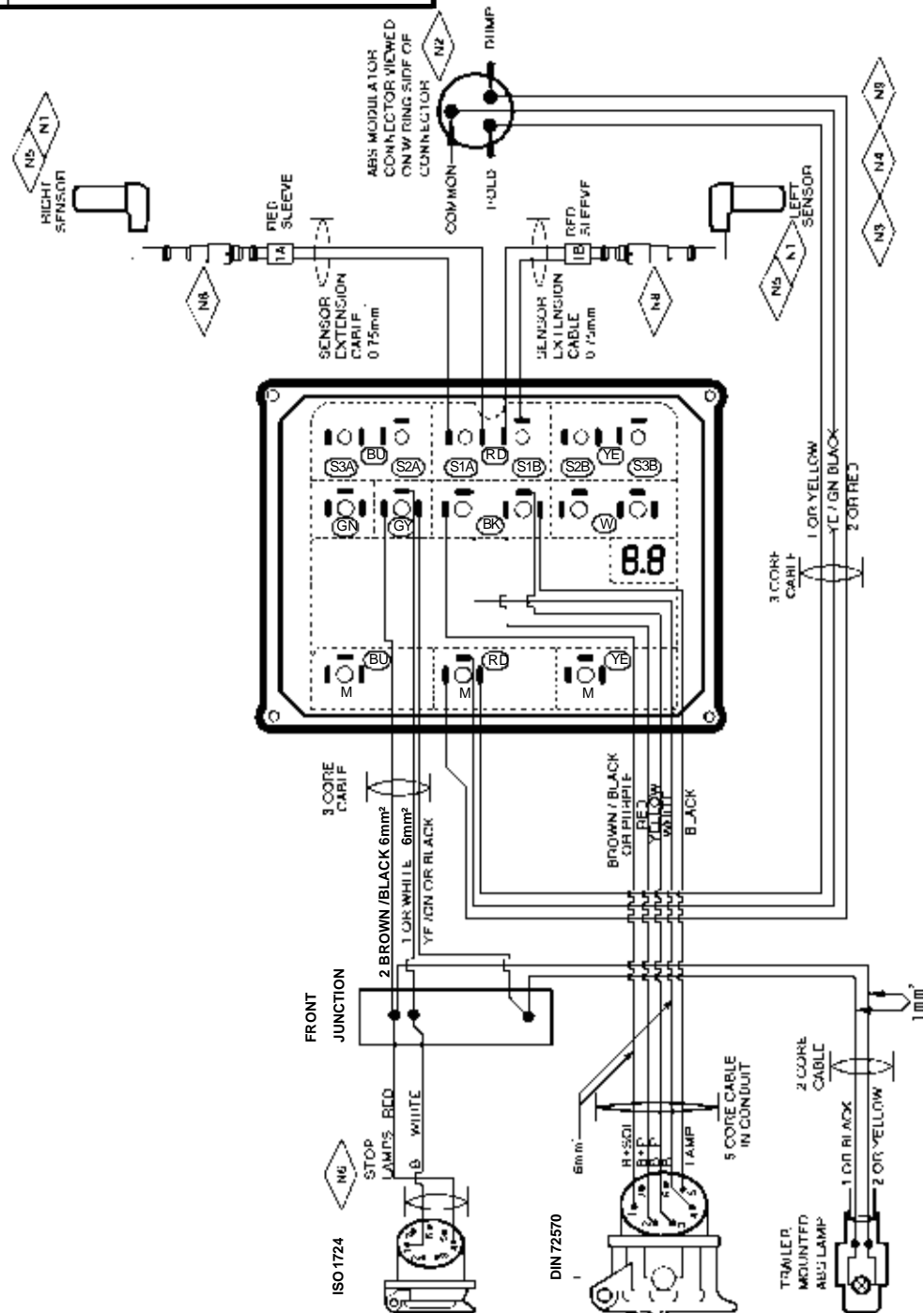


Fig. 13 MODAL Wiring diagram - 2S/1M (12V System)

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The Haldex Group is listed on the Stockholm Stock Exchange.

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We use our demonstrated competence to provide innovative components, systems and service for trucks, trailers and buses, that lower life cycle costs and improve vehicle safety. Haldex wants to become the first choice business partner of commercial vehicle manufacturers world wide in the areas of braking and suspension control systems with special emphasis on heavy commercial vehicles.

Total Support

A uniquely wide range of services is available from Haldex. These include expert consultancy for braking and suspension development, brake calculations, type approvals and application engineering.

The aim is accurate specification for manufacturers and low cost of ownership for the operator.

Full aftermarket support includes a Worldwide parts distribution and service network, on-line technical advice, field visits and installation/maintenance training held on-site or at Haldex facilities.

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Continual, heavy investment in Research and Development is carried out in response to ever increasing commercial, legislative, environmental, performance and technological demands.

Quality and Production Standards

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Innovative Vehicle Technology