

SECTION 4

TRANSMISSIONS

CHAPTER 2

RANGE COMMAND TRANSMISSION

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SECTION 4 – TRANSMISSIONS (Range Command Transmission)

Introduction

The transmission electronic management system has an inbuilt self diagnostic facility. This facility utilizes the digital display of the gear shift handle assembly to indicate, in coded format, any malfunction in the electrical and electronic circuitry and in the micro-processor. It should be noted that the self diagnostic capability is generally limited to diagnosis of the electrical and electronic circuitry and related components, however, there are some codes, which can be generated if pressure switch circuits are not closed because of an actual lack of hydraulic pressure. Any malfunction of the mechanical and hydraulic components must be diagnosed using conventional techniques, performance characteristics and tooling, such as pressure testing equipment. Full guidance for both electrical self diagnosis and conventional diagnosis is contained within this section.

Trouble-shooting and fault finding should always be carried out in a logical and planned sequence, many apparent faults associated with electronic components are often hastily diagnosed and result in the replacement of expensive components. An extra few minutes confirming the apparent fault will result in a more positive and cost effective repair.

With the use of micro-processors it is often that this item is blamed for any malfunction but the real truth is that this item is usually sound and that the fault is due to poor contacts in the associated connectors.

Each connector illustrated and identified in the wiring diagrams in Section 2 Chapter 9 and referred to in the following fault finding procedure, has the same identification reference. For example, the main transmission processor connectors are referred to as Connectors C100 and C101 in the illustration and also referred to as C100 and C101 in the fault finding procedure. Often in the fault finding flow chart the connector and pin are abbreviated and will read, for example, C100-21. The C100 refers to the connector and the 21 to the pin number. Alternatively, for connectors with fewer pins, the identification will read, C014-FM3100-B/G/S. This is broken down as follows:

C014	Connector number
FM3100	Front Main harness, circuit number 3100
B/G/S	Wire color

Refer to Section 2 Chapter 9 for complete wiring diagrams.

SECTION 4 – TRANSMISSIONS (Range Command Transmission)

Where the fault finding procedure requires checks for continuity a visual inspection of the wiring should be made prior to conducting tests to ensure that obvious 'mechanical' damage has not occurred to the harness or the connectors.

A good quality multimeter is an essential item to perform fault finding. It should be capable of measuring resistance of at least 20,000 ohms and measuring voltage and current. When using the multimeter it is good practice to select a high range and work downwards to avoid damaging the instrument.

IMPORTANT: *Care should be used when using the multimeter, only use the instrument as instructed to avoid damage to the internal elements of the micro-processor. When checking the continuity of wiring, sensors or switches it is necessary to isolate the electronic micro-processor and ensure the keystart is turned off to prevent possible further damage. The keystart should only be switched on and the processor connected where specifically instructed in the fault finding procedure.*

If it is found necessary to clean the connectors a contact spray should be used. **DO NOT USE ANY OTHER METHOD FOR CLEANING TERMINALS.** Do not use a cleaner that contains Trichloro-ethylene, this solvent will damage the plastic body of the connector. It is preferable to use a cleaner with a Freon T.F. base.

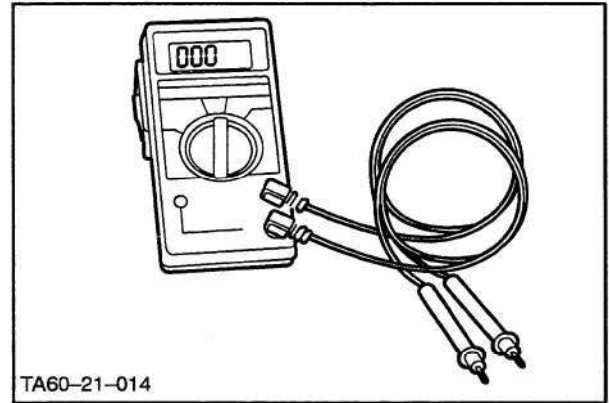


Figure 4-2-1

SECTION 4 – TRANSMISSIONS (Range Command Transmission)

LIMP HOME


WARNING


Care should be taken when operating the tractor with the limp home harness connected. Clutch engagement will be harsher than normal. Do not leave the limp home harness connected when the operation has been completed.

In the unlikely event of an electrical fault developing within the transmission that renders the tractor immobile, for example, failure of the supply voltage to the PWM valves, the emergency 'Limp Home Harness', Special Tool No. NH.21-100 for Semi-Powershift and Hi-Lo transmissions, is available to enable the tractor to be driven onto a transporter or hard standing, in order that the repair can be carried out in a suitable location. The Limp Home device **is not and must not** be used as a means to continue operating the tractor in its work environment.

To engage and operate the 'Limp Home Harness' proceed as follows:—

1. Apply the parking brake.
2. Stop the engine and turn keystart off.
3. Remove the electronic draft control panel.
4. Locate and disconnect the cab main harness access connector, Figure 4-2-3, enabling the connection of the limp home harness connector, Figure 4-2-2, marked with 'HARNESS', into the cab main harness of the tractor, Figure 4-2-5.
5. Connect the other connector of the Limp Home harness, Figure 4-2-2, marked 'DIAGNOSTIC', to the 'WHITE' diagnostic plug, Figure 4-2-5.
6. Start the vehicle.
7. Select forward or reverse by operating forward/reverse switch, (2) Figure 4-2-2, for 2 seconds on the Limp home harness control box. Return the switch to the center position.
8. Operate the momentary switch, (1) Figure 4-2-2, of the Limp Home Harness to move the vehicle. If necessary, depress the foot throttle to increase engine speed.
9. When the tractor has been delivered to the repair area, disconnect the Limp Home Harness and reconnect the limp home access connector of the cab main harness and proceed with diagnosing and repairing the fault.

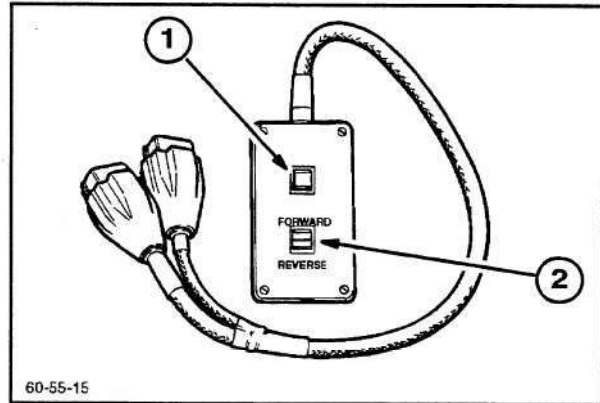


Figure 4-2-2

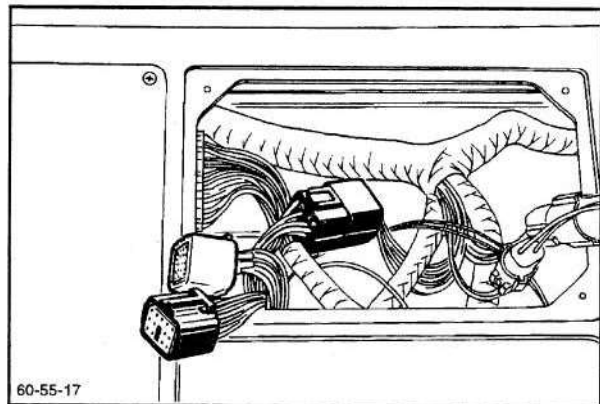


Figure 4-2-3

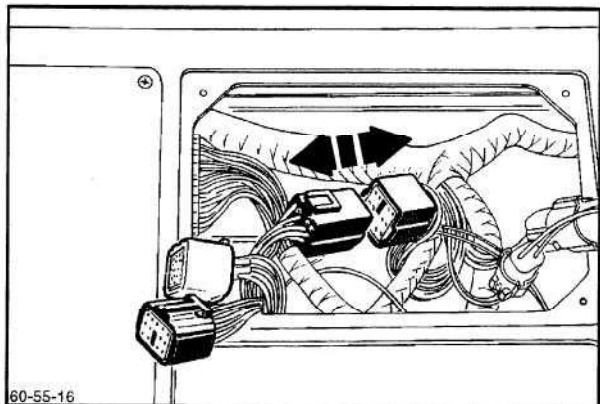


Figure 4-2-4

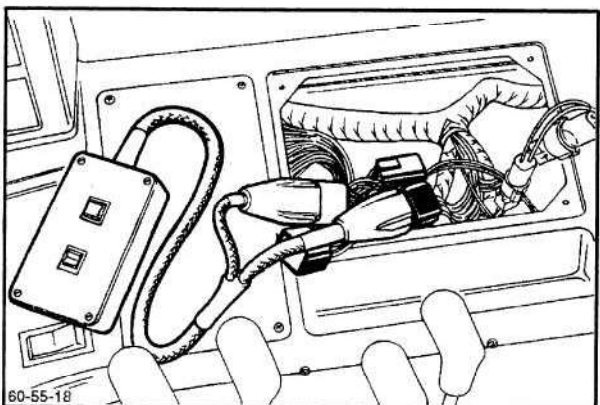
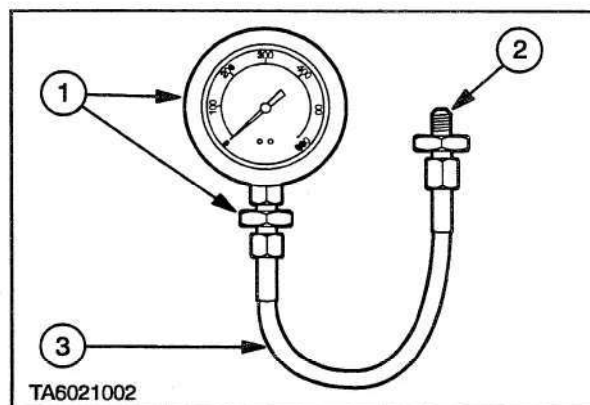
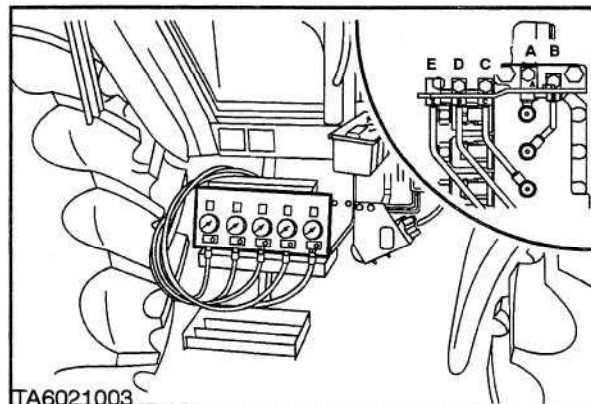
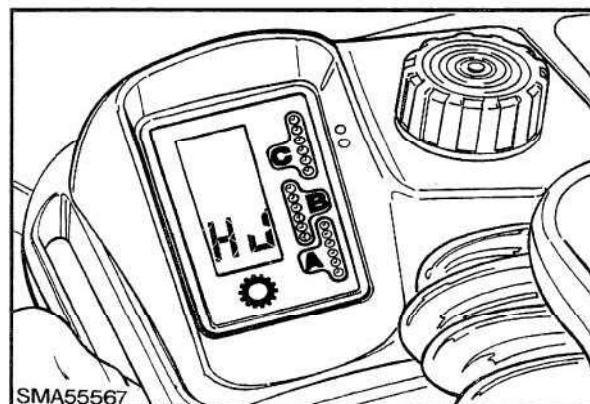
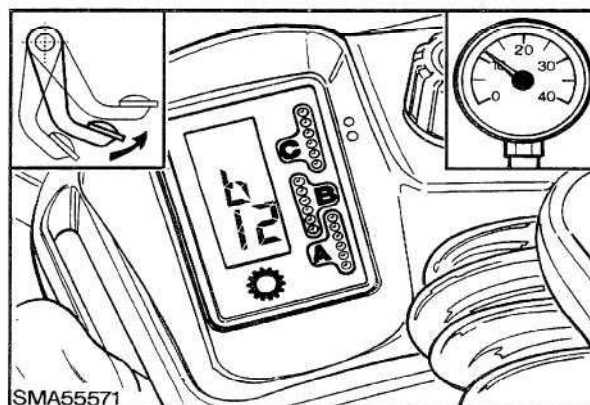


Figure 4-2-5

SECTION 4 – TRANSMISSIONS (Range Command Transmission)

PRESSURE TESTING**Transmission Clutches, A,B,C,D and E**

1. Prepare the tractor for pressure testing:
 - (i) Ensure the handbrake is fully applied and wheels chocked.
 - (ii) Install diagnostic switch, Tool No. FNH00874 into the white diagnostic plug of the tractor harness.
 - (iii) Start and run the tractor to warm the transmission oil to a minimum operating temperature of 122°F (50°C).
2. Install suitable pressure gauges (0–600 lbf/in², 0–40 bar), five if available, into each of the clutch pressure test points, located in the raised horizontal manifold, under the right hand foot step. Figure 4-2-7. Reference Figure 4-2-6 for gauge, hose and adaptor details:
 1. Pressure gauge, FT8503A, with adaptor FT8503–8
 2. Adaptor, FNH00877-8 (10–1.00 mm x 7/16 JIC)
 3. Hose, (Finis Code 3936707)
3. Start the engine and enter HJ mode. Depress the clutch pedal and move the shuttle lever into forward. Release the clutch. The upper character on the display will show 'A', indicating that clutch 'A' solenoid will be energized. To energize the solenoid press and hold the downshift button and observe the pressure reading on the gauge which should be 246 ± 14.5 lbf/in² (17 ± 1 bar).
4. To select other clutches, B, C, D or E, repeatedly press the upshift button and then depress the downshift button to energize the solenoid.
5. The pressure can be controlled with the clutch pedal. When the pedal is depressed the lower two digits will change to a number 0–16 indicating the approximate pressure in bars, as long as the clutch pedal is correctly calibrated. With the pedal fully released 'FP' will be displayed indicating Full Pressure.

**Figure 4-2-6****Figure 4-2-7****Figure 4-2-8****Figure 4-2-9**

SECTION 4 – TRANSMISSIONS (Range Command Transmission)

Low, Medium, High and Reverse Synchronizer Pressure testing

Figure 4-2-10 – 1. Reverse synchronizer test point (R)
2. High synchronizer test point (F)

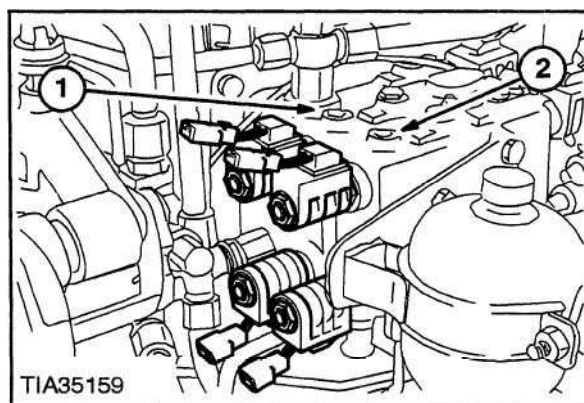


Figure 4-2-10

Figure 4-2-11 – 1. Low synchronizer test point (S)
2. Medium synchronizer test point (M)

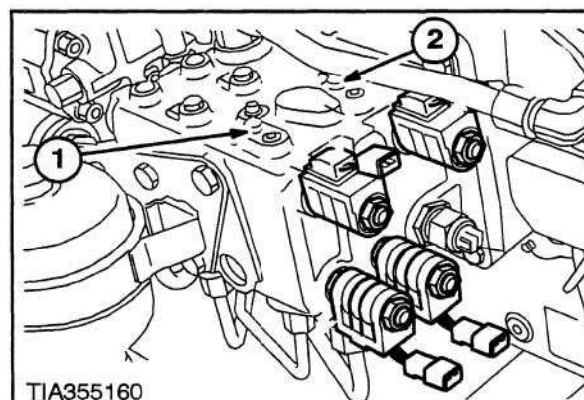


Figure 4-2-11

Due to the operating characteristics of the transmission it is not possible to pressure test the synchronizer circuits during normal tractor operation.

To check the pressure within the synchronizer circuits it is recommended that the clutch calibration procedure using, H1, mode 'N' is used.

1. Prepare the tractor for pressure testing:
 - (i) Ensure the handbrake is fully applied and wheels chocked.
 - (ii) Install diagnostic switch, Tool No. FNH00874 into the white diagnostic plug of the tractor harness.
 - (iii) Start and run the tractor to warm the transmission oil to a minimum temperature of 122°F (50°C).

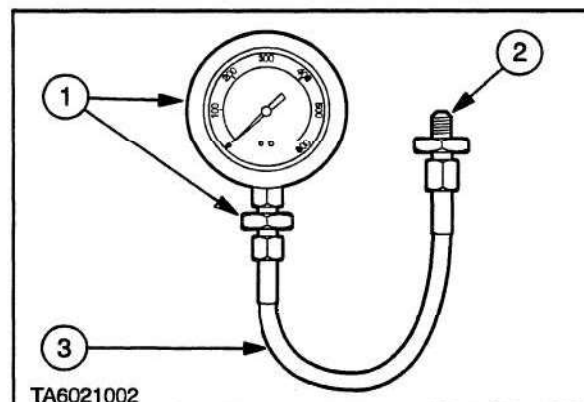


Figure 4-2-12

2. Install suitable pressure gauges, Figure 4-2-12,
 1. Pressure gauge, FT8503A, with adaptor FT8503-8
 2. Adaptor, NH.35-102 (10-1.25 mm x 7/16 JIC)
 3. Hose, (Finis Code 3936707), (0-600 lbf/in², 0-40 bar), four if available, into each of the synchronizer pressure test points, located in the transmission side cover, Figure 4-2-13.

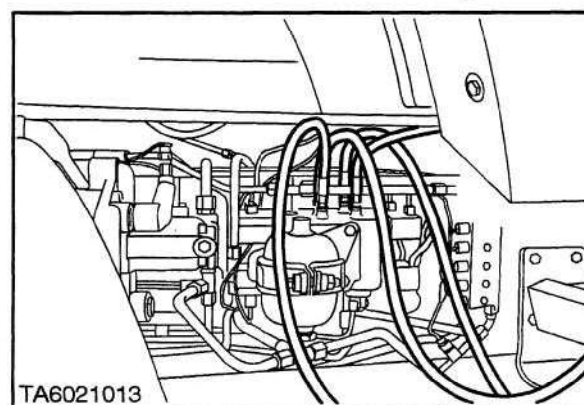


Figure 4-2-13

SECTION 4 – TRANSMISSIONS (Range Command Transmission)

3. Start the engine and enter mode H1.
4. Depress the clutch pedal and position the shuttle lever in forward.
5. Set engine speed to 1100 rev/min.

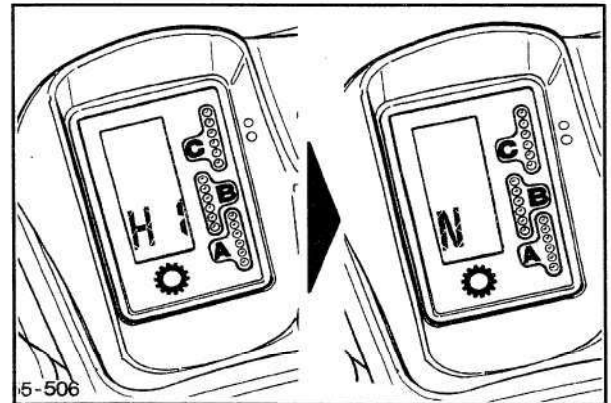


Figure 4-2-14

6. Cycle through H1 to 'N', using the upshift button.
7. Depress the downshift button to activate all of the synchronizer solenoids.

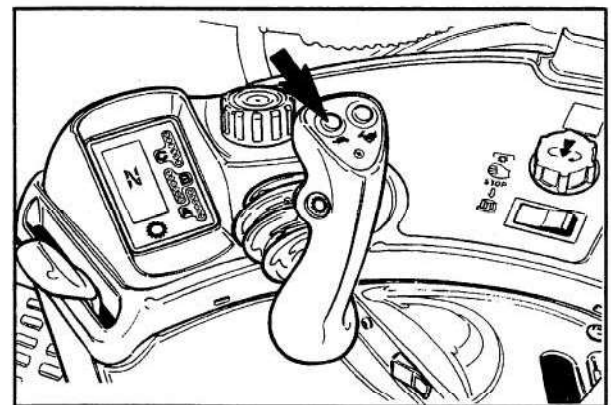


Figure 4-2-15

8. Each gauge should indicate 246 ± 14.5 lbf/in² (17 ± 1 bar) when the solenoids are activated and zero when deactivated, Figure 4-2-16.
9. If all gauges read low, suspect a fault in the low pressure hydraulic system, refer to section 8.
10. If one or more gauges read correct and the other gauges are low this indicates that the hydraulic system is okay and that the fault lies within the transmission assembly. Remove and inspect the solenoid valve assembly, if no fault is found remove the transmission side cover and inspect the operating piston and seals.

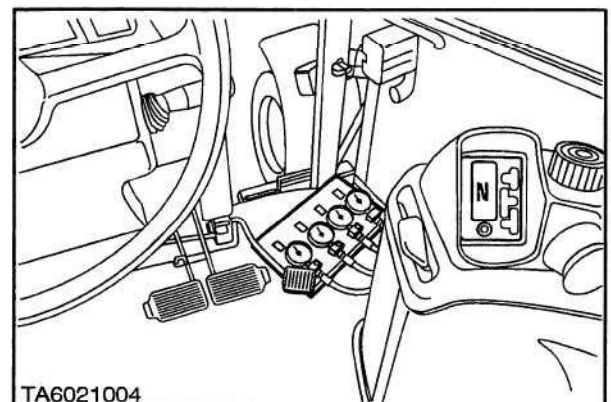


Figure 4-2-16

SECTION 4 – TRANSMISSIONS (Range Command Transmission)

CLUTCH AND SYNCHRONIZER CALIBRATION

The Semi-powershift transmission has 5 clutch packs and 2 synchronizers that require periodic calibration to compensate for wear. Calibration should be necessary only if a deterioration in gear shift quality is noted.

NOTE: During the calibration procedure the electronic management system detects precisely the point at which the clutches start to engage. The engagement is detected by a reduction in engine speed. During calibration it is essential that no action is taken to cause the engine speed to vary. Be sure that the air conditioner and all electrical equipment is switched off. Do not operate the PTO or any hydraulic lever or move the hand or foot throttle.

There are two methods to enter the calibration mode:
 (i) Through the white diagnostic connector, using special tool No. FNH00874 and menu mode H1, or,
 (ii) By depressing both up/down shift buttons together during start up.

Tractor Preparation

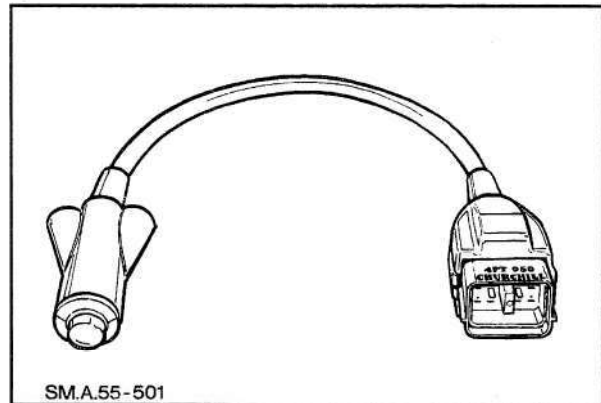
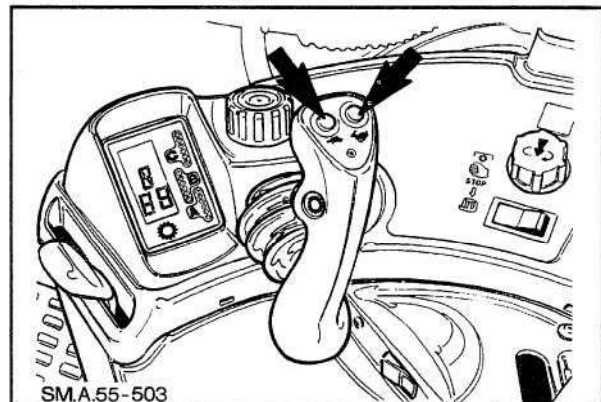
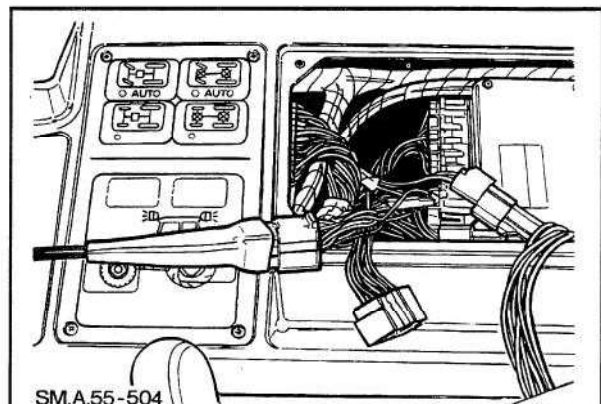
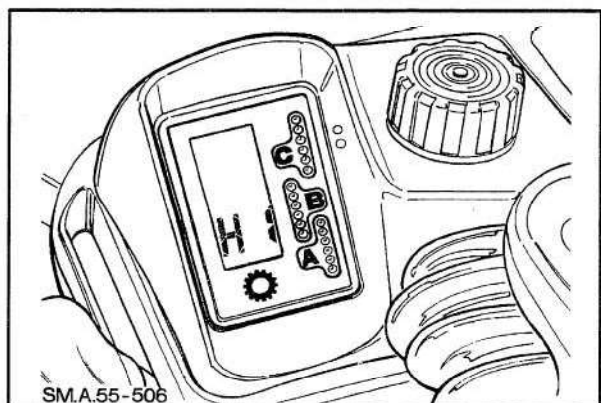
NOTE: The clutches can be adjusted when the transmission oil temperature is at 68°F (20°C) and 122°F (50°C) or over. The clutches should be adjusted when the transmission oil temperature is at 140°F (60°C) or over.

Park the tractor on level ground, away from obstacles (in case of unexpected tractor movement).

Apply handbrake, switch off all electrical equipment and air conditioning if fitted. Stop the engine and place remote levers in neutral and lower hydraulic equipment to the ground.

Place the shuttle in neutral. Block the wheels, front and rear.

Either, (i) Install tool FNH00874 into the diagnostic plug or (ii) press and hold both Up/down shift buttons and start the engine. Select H1 by depressing the diagnostic switch once.

**Figure 4-2-17****Figure 4-2-18****Figure 4-2-19****Figure 4-2-20**

SECTION 4 – TRANSMISSIONS (Range Command Transmission)

Release the buttons. The display will change to show transmission temperature. Press the up or downshift button to proceed.

If the temperature is less than 50°F (10°C) Error Code 'U19' will be displayed. If the temperature is between 50°F (10°C) and 68°F (20°C) "CL" will be displayed. If the temperature is above 122°F (50°C), "CH" will be displayed.

If 'U19' is displayed calibration will not be possible and the oil will have to be warmed before proceeding.

If 'CL' is displayed after 4 seconds the display will return to oil temperature and the tractor may be operated to obtain the correct transmission oil temperature. If it is not practical to wait for the oil temperature to change press either of the up or down shift buttons while 'CL' is being displayed. The display will then show an 'A' and calibration can proceed.

If 'CH' is displayed, press either the up or down shift buttons to display 'A' and proceed with the calibration.

Move the shuttle lever to forward and release the clutch pedal.

Set engine speed to 1200 ERPM \pm 100.

The transmission is now ready for calibration.

Press and hold the downshift button to calibrate clutch A.

If the start up procedure was incorrect a "U" error code will appear. See page 4-2-30 for a listing of error codes.

Hold the downshift button until the engine speed decreases by 50 RPM and the calibration number stops increasing.

Release the downshift button, the display will change to 'b', indicating that clutch B is ready for calibration. Hold the downshift button until the engine speed decreases by 50 RPM and the calibration number stops increasing.

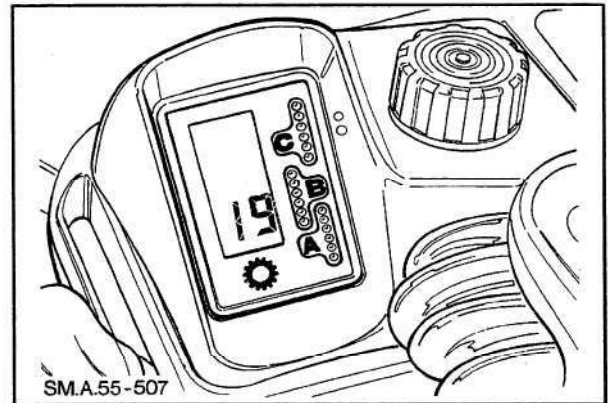


Figure 4-2-21

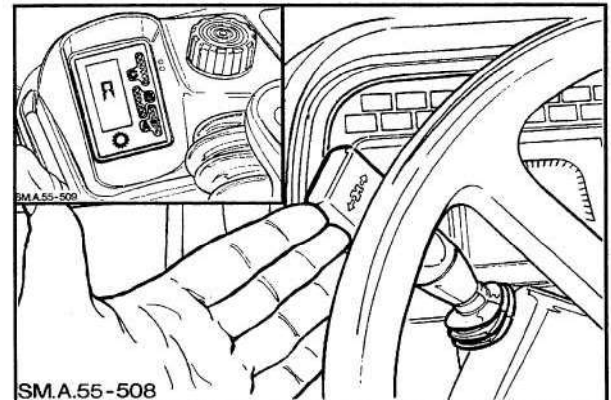


Figure 4-2-22

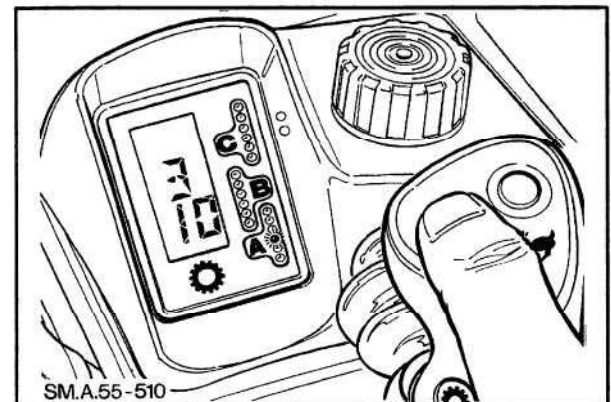


Figure 4-2-23

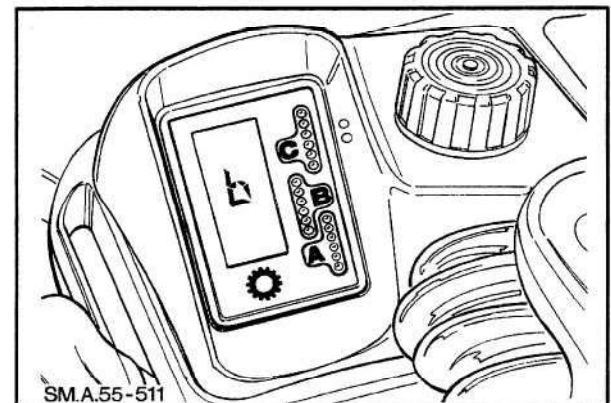


Figure 4-2-24

SECTION 4 – TRANSMISSIONS (Range Command Transmission)

Repeat the above steps for clutches C, D and E. After clutch E has been calibrated, release the downshift button and the display will change to F.

Press the downshift button again. The synchronizers will be shifted to neutral and synchronizer stroke relationship will be checked. If satisfactory the display will show 'CF'.

Pressing the downshift button again will select mode 'N'. This mode engages clutches A and C with the synchronizers in neutral. This can be used to 'free' transmission components that may be suspected of sticking, i.e., synchronizers. It should be noted that if a synchronizer is not actually in neutral, this mode can cause the tractor to move.

When the display alternates between 'N' and '750' this indicates that the mode has completed.

Turn the key start switch off for at least 2 seconds to store the calibration values.

NOTES: Transmission output speed and clutch pedal position are constantly monitored. Calibration cannot proceed unless the tractor is stationary and the clutch pedal released.

Repeatedly depressing the upshift button will cycle through each clutch mode, enabling a particular clutch to be calibrated several times if required.

During each clutch calibration the synchronizer positions are also calibrated:–

- During Clutch A – Mid range synchronizer calibrated
- During Clutch B – Reverse range synchronizer calibrated
- During Clutch C and D – High range synchronizer calibrated
- During Clutch E – Low range synchronizer calibrated

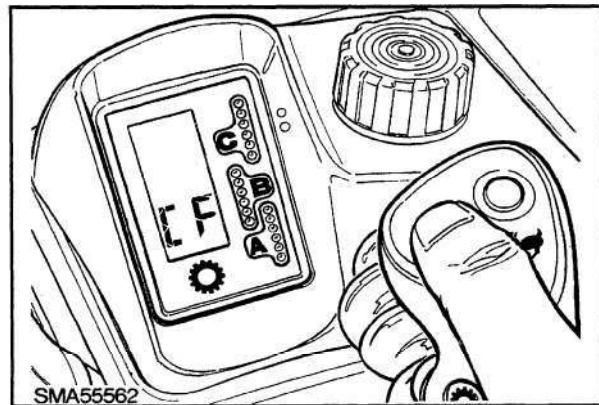


Figure 4-2-25

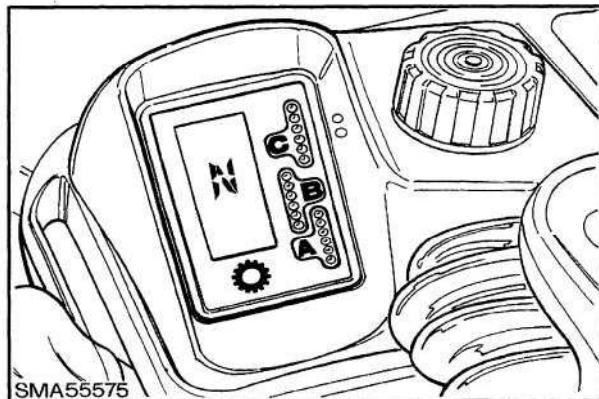


Figure 4-2-26

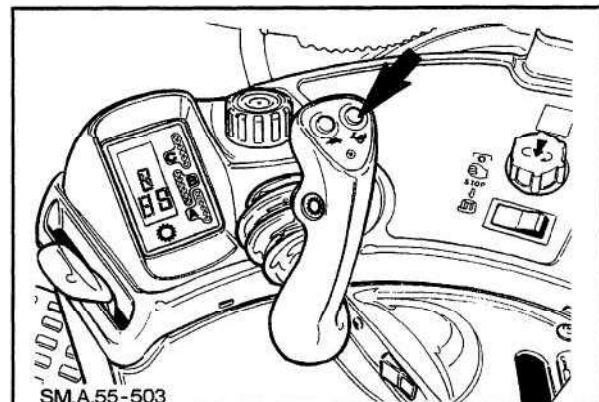


Figure 4-2-27

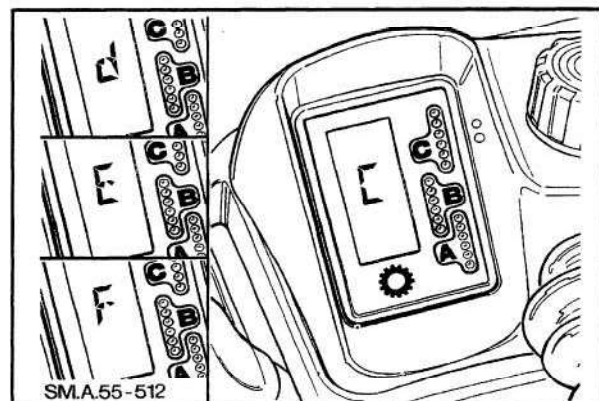


Figure 4-2-28

SECTION 4 – TRANSMISSIONS (Range Command Transmission)

TRANSMISSION DIAGNOSTIC ROUTINE

The Semi Powershift Tractors have a built in electronic diagnostic system.

To gain access to the diagnostic "H" routine it is necessary to use tool No. FNH00874.

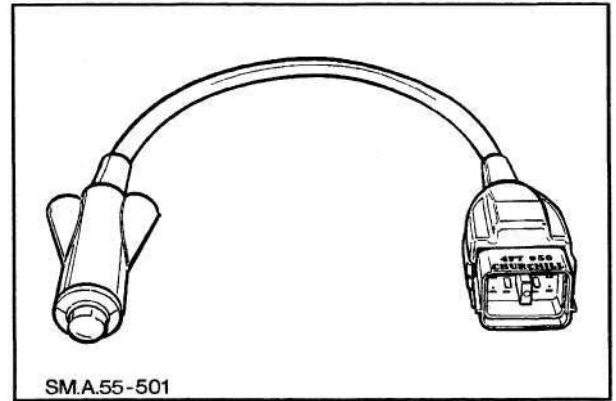


Figure 4-2-29

The tractor's diagnostic connectors are located under the right hand electronic draft control (EDC) panel.

White - Transmission
Black - Electronic Draft Control (EDC)

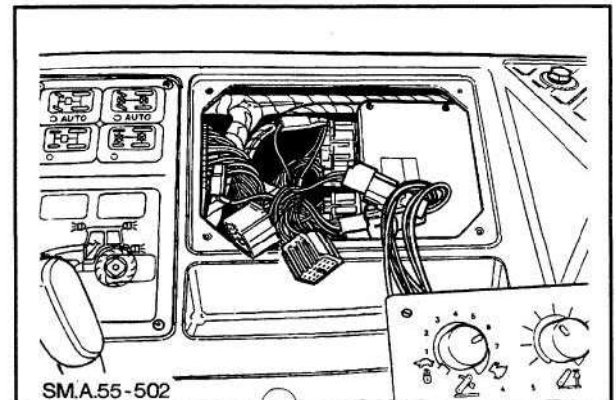


Figure 4-2-30

The transmission display unit is used to show transmission information and the instrument cluster for EDC information.

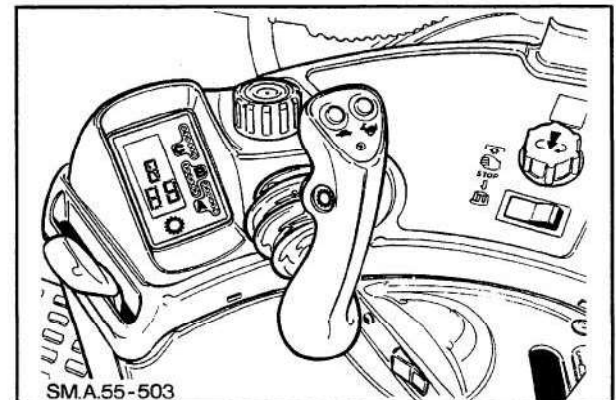


Figure 4-2-31

Connect Tool FNH00874 to the white connector and turn key on.

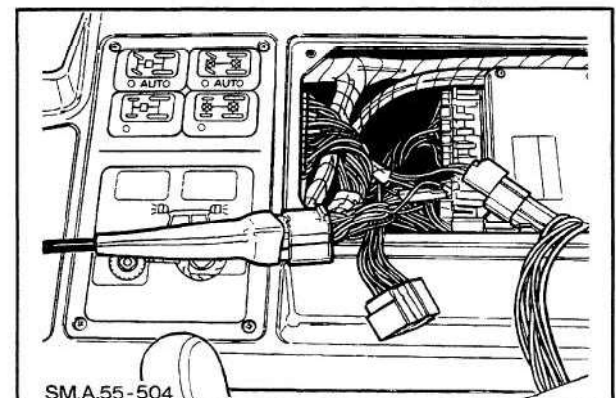


Figure 4-2-32

SECTION 4 – TRANSMISSIONS (Range Command Transmission)

The Transmission Display Unit (TDU) will display “HH” to indicate that the “H” menu has been activated.

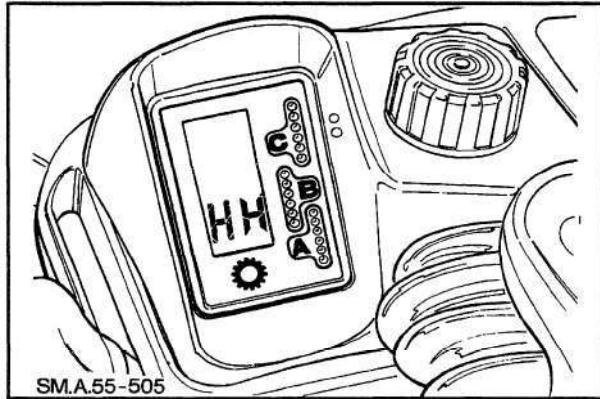


Figure 4-2-33

HH	Transmission Service Menu
H1	Clutch and synchronizer calibration
H2	View clutch calibration
H3	Clutch calibration temperature review
H4	Software revision level
H5	Switch test
H6	Synchronizer calibration view
H7	Not used
H8	Non volatile memory reset
H9	Voltmeter
HA	Clutch pedal position view (%)
HB	Transmission oil temperature compensation factor adjustment
HC	Transmission oil temperature display
HD	Synchronizer shift/view position mode
HE	Quickfill duration adjustment
HF	Manual clutch calibration adjustment
HJ	Clutch pressure test mode

SECTION 4 – TRANSMISSIONS (Range Command Transmission)

H1 CLUTCH AND SYNCHRONIZER CALIBRATION

Used to calibrate the 5 clutch packs and the position of 2 synchronizers.
See CALIBRATION section of this chapter for full details.

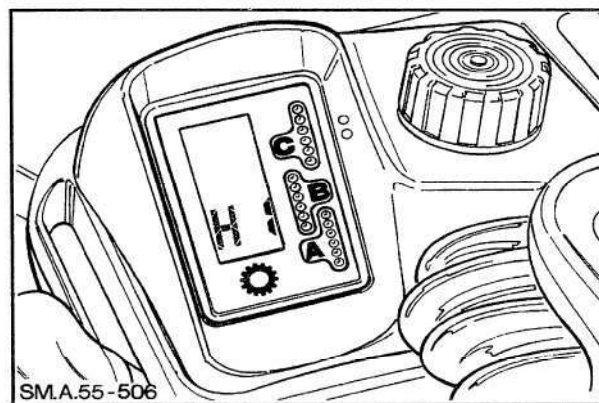


Figure 4-2-34

H2 VIEW CLUTCH CALIBRATIONS

Here each clutch calibration is displayed.

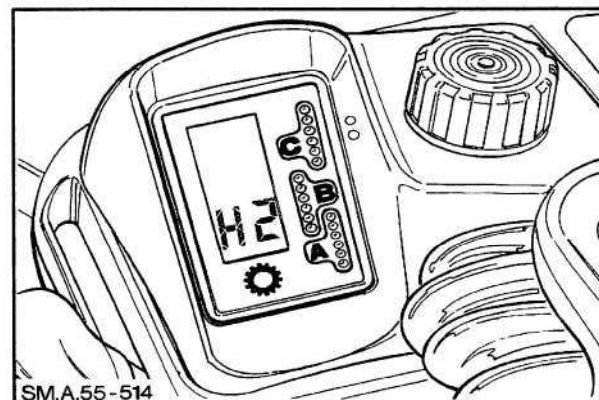


Figure 4-2-35

Clutch "A" and then its calibration number is displayed.

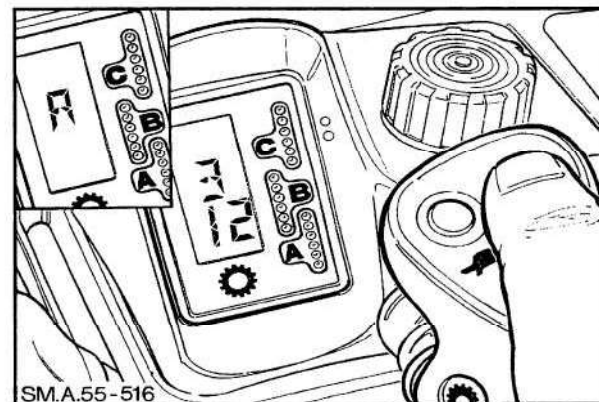


Figure 4-2-36

Progress through by pressing the upshift button.

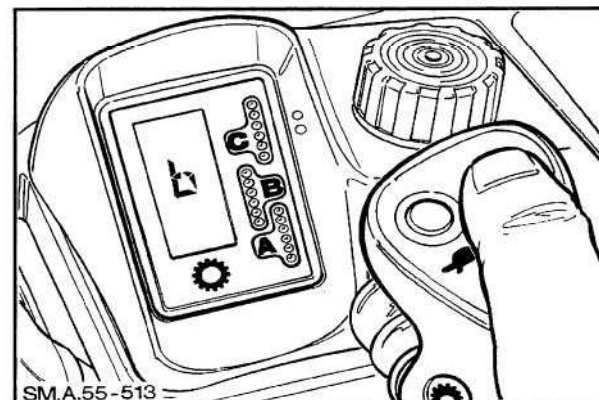


Figure 4-2-37

SECTION 4 – TRANSMISSIONS (Range Command Transmission)

H3 CLUTCH CALIBRATION TEMPERATURE VIEW

Shows the transmission temperature when each clutch was last calibrated.

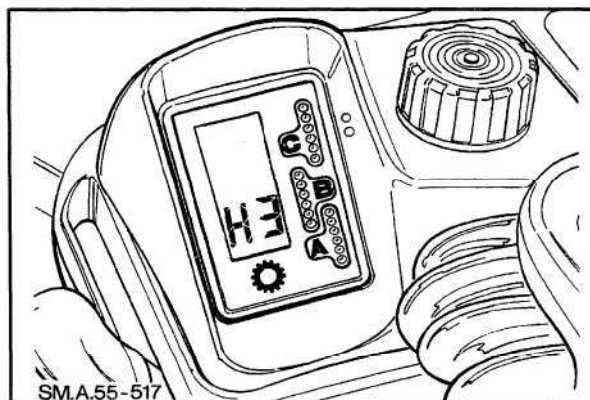


Figure 4-2-38

Displays "A" first with temperature.

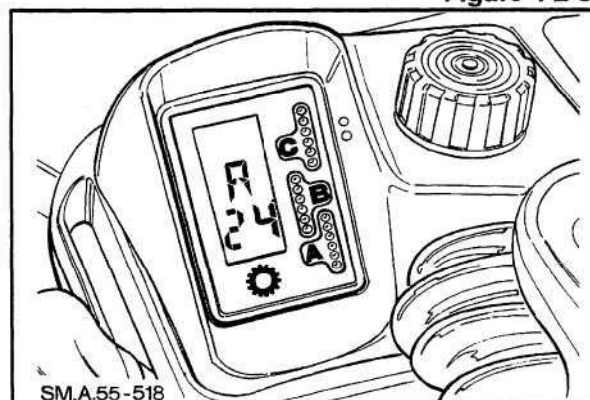


Figure 4-2-39

To progress through press the upshift button.

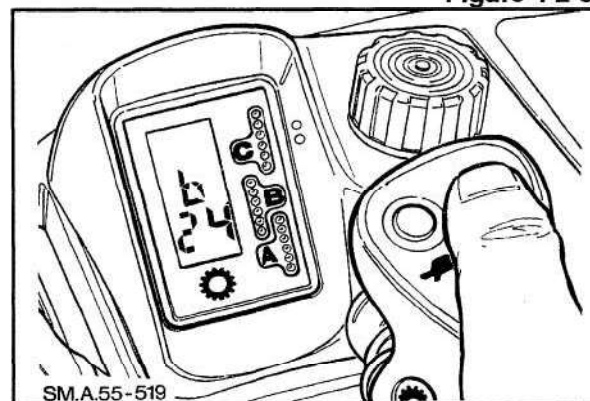


Figure 4-2-40

SECTION 4 – TRANSMISSIONS (Range Command Transmission)

H4 SOFTWARE REVISION LEVEL

Display the software installed into the processor.

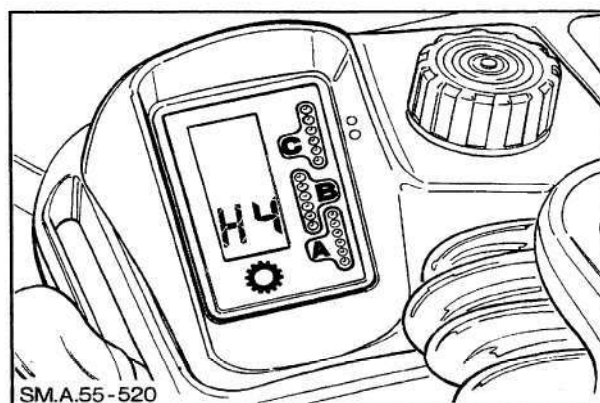


Figure 4-2-41

The display shows 4 figures consecutively.

- AD - Semi Powershift
- 01 - Production software level
- 00 -Prototype software level
- 30/40 -Transmission type, 19 or 25 mph (30 or 40 kph)

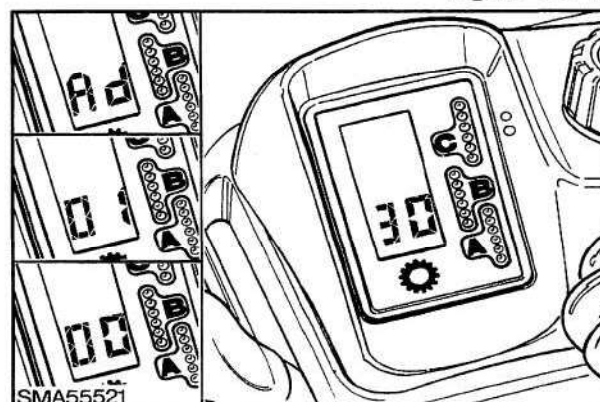


Figure 4-2-42

H5 SWITCH TEST

It is possible in "H5" to test the function of all switches used in the transmission electrical system.

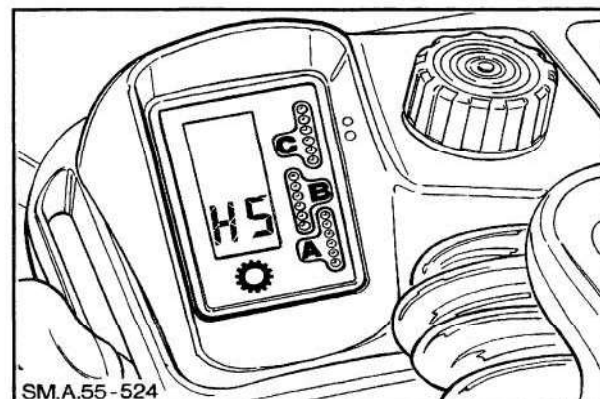


Figure 4-2-43

The display will show a code number.

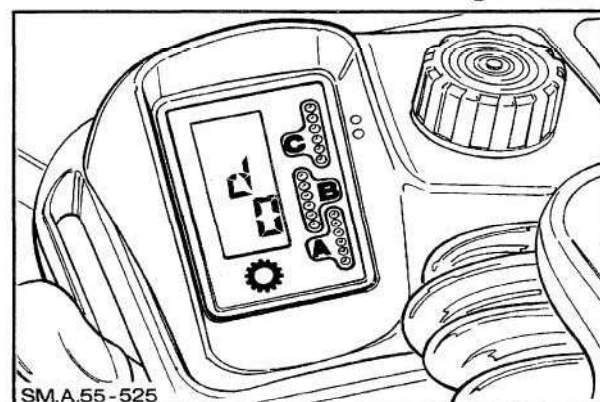


Figure 4-2-44

SECTION 4 – TRANSMISSIONS (Range Command Transmission)

When a switch is operated, its code will be displayed and an audible tone heard to indicate correct function.

If a switch's code is not displayed and the tone not heard, then the switch is not functioning correctly or the wiring to it is at fault.

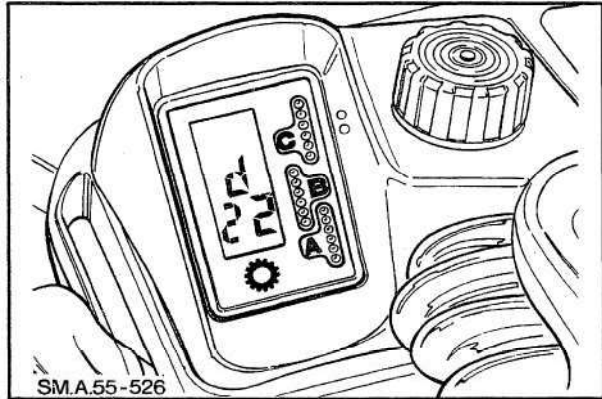


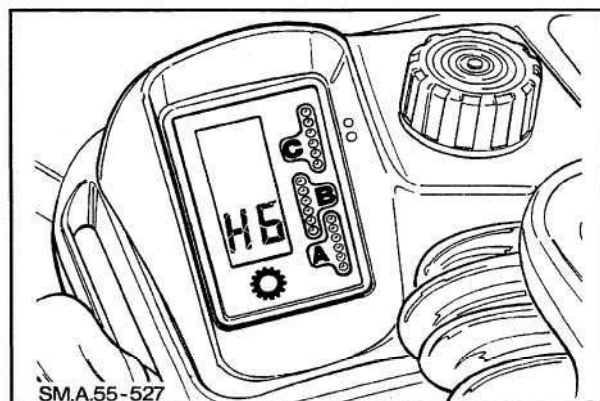
Figure 4-2-45

Identifier	Switch/Input	Special Requirements
d20	Clutch pedal potentiometer	Shuttle lever in forward Clutch pedal down Clutch pedal down
d21	Clutch pedal switch	
d22	Forward switch	
d23	Reverse switch	
d24	Downshift switch	
d25	Upshift switch	
d26	Range change button	
d27	Mid/Reverse synchro pot	
d28	Low/High synchro pot	
d29	Oil Temperature switch	
d30	Oil pressure switch	
d31	Creeper switch	

SECTION 4 – TRANSMISSIONS (Range Command Transmission)

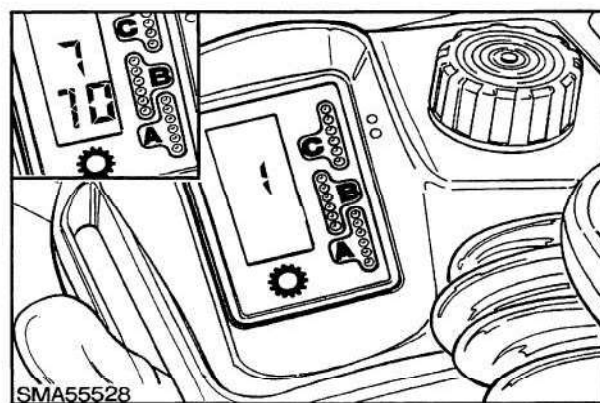
H6 SYNCHRONIZER CALIBRATION VIEW

Displays the values stored in the microprocessor

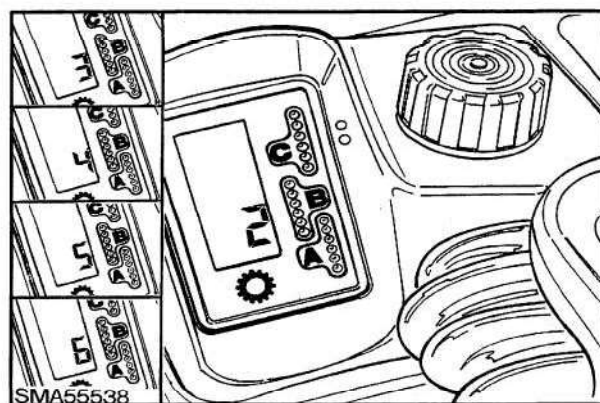

Figure 4-2-46

'1' is displayed first, followed by its calibration number.
There are 6 views:

1	Slow (low)	362-912
2	Medium (mid)	50-601
3	Fast (high)	50-601
4	Reverse	362-912
5	Slow/Fast (neutral)	242-722
6	Med/Reverse (neutral)	242-722


Figure 4-2-47

Progress through by pressing the upshift button.


Figure 4-2-48

SECTION 4 – TRANSMISSIONS (Range Command Transmission)

H7 NOT USED

H7 will be displayed when cycling through the H menu but does not have a function.

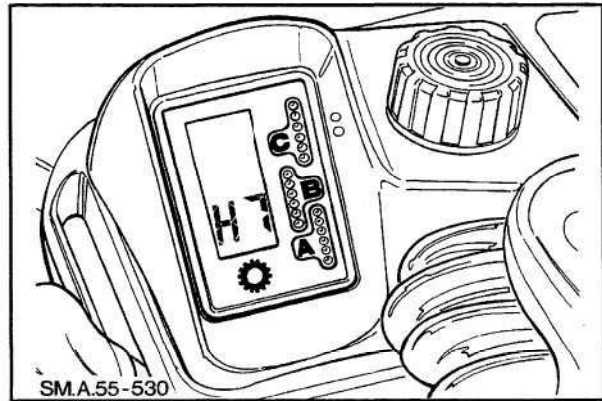


Figure 4-2-49

H8 NON VOLATILE MEMORY RESET

Used to reset (clear) all calibration figures in the processor.

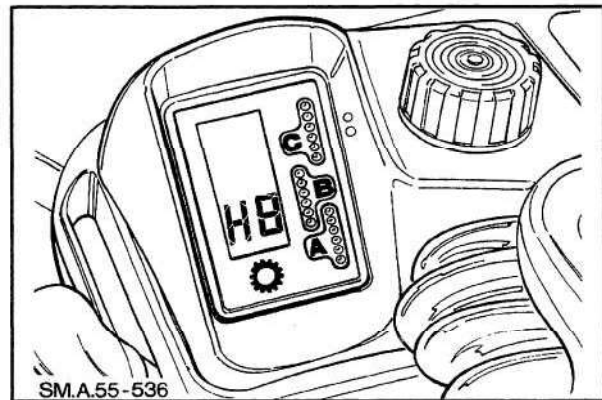


Figure 4-2-50

With H8 selected the procedure is automatic.

The display changes from "H8" to "EE" to "HH", indicating the processor is now reset.

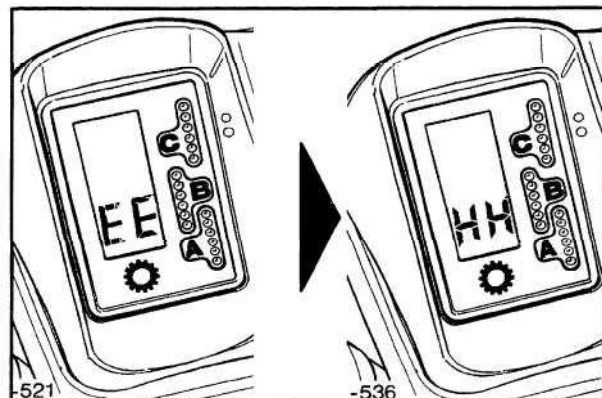


Figure 4-2-51

SECTION 4 – TRANSMISSIONS (Range Command Transmission)

H9 VOLT METER

Allows various voltage tests to be carried out on the inputs and outputs of the Transmission Control Module (TCM).

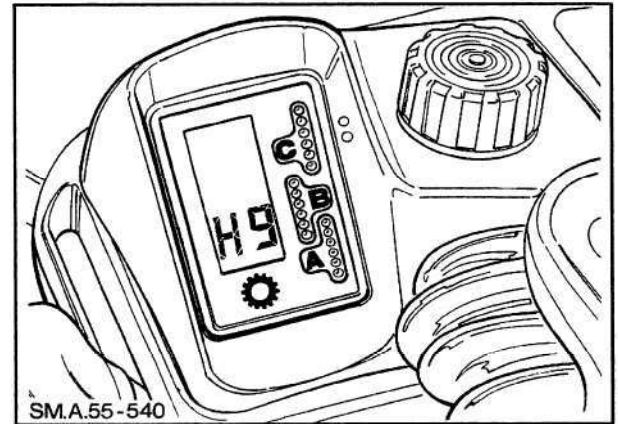


Figure 4-2-52

There are 26 channels which can be accessed.

Use the upshift button to select the required channel.

NOTE: Channels 21 through to 26, inclusive, are spare channels which have no function.

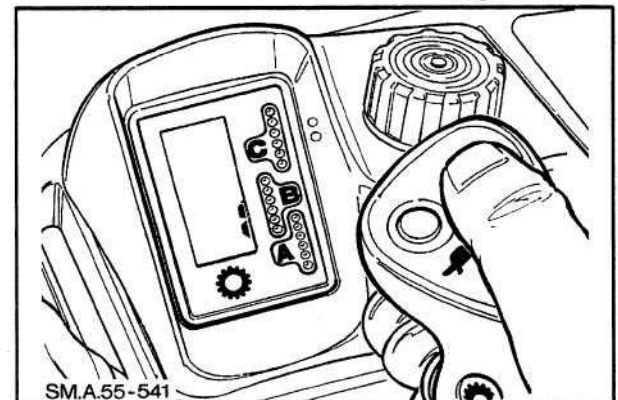


Figure 4-2-53

On entering the desired channel a value will be displayed. Compare the value displayed with the value shown in the table on the following page.

NOTE: The value is the output voltage from the processor displayed as a percentage. This cannot be directly translated into a voltage due to the internal processes of the module.

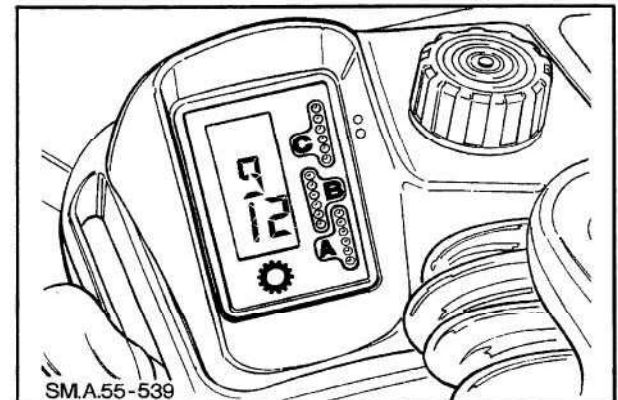


Figure 4-2-54

If the value displayed varies by more than 5% to that in the table a fault is indicated in either the component or the wiring relevant to that channel.

NOTE: It is worthwhile checking the connectors of the affected circuit, including the processor connectors, prior to replacing any components.

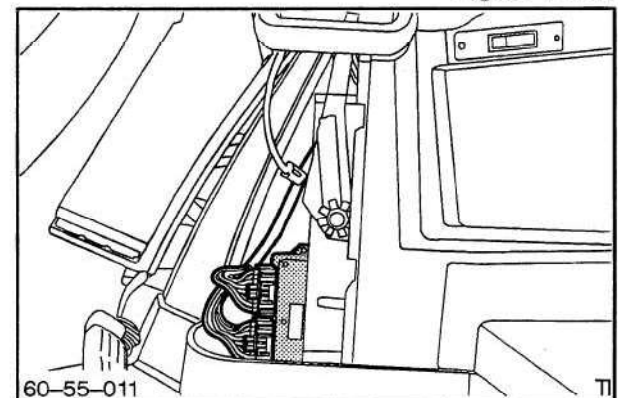


Figure 4-2-55

SECTION 4 – TRANSMISSIONS (Range Command Transmission)

Channel	Description	Typical Value
0	Clutch pedal position	91% released 26% depressed
1	Slow/Fast synchro	24% Fast range 45% Neutral 71% Slow range
2	Med/Rev synchro	24% Med range 45% Neutral 71% Slow range
3	Upshift switch	30% Released 67% Depressed
4	Downshift switch	30% Released 67% Depressed
5	Range shift switch	30% Released 67% Depressed
6	Forward switch	30% Released (Neutral) 67% Depressed (Forward)
7	Reverse switch	30% Released (Neutral) 67% Depressed (Reverse)
8	Temperature sender	71% @ 32°F (0°C) 46% @ 86°F (30°C) 26% @ 140°F (60°C) 14% @ 194°F (90°C)
9	+12v supply	43%
10	+12v supply	43%
11	Clutch pedal switch	43% Pedal up, forward 0% pedal down, neutral
12	5 volt sensor supply	50%
13	8 volts sensor supply	80%
14	Clutch A current	0% Clutch off 60% Clutch on
15	Clutch B current	0% Clutch off 60% Clutch on
16	Clutch C current	0% Clutch off 60% Clutch on
17	Clutch D current	0% Clutch off 60% Clutch on
18	Clutch E current	0% Clutch off 60% Clutch on
19	Rear speed diagnostic volts	49%
20	Mid speed diagnostic volts	49%

SECTION 4 – TRANSMISSIONS (Range Command Transmission)

HA CLUTCH PEDAL POSITION

Displays clutch pedal position as a percentage.

0 = fully down
99 = fully up

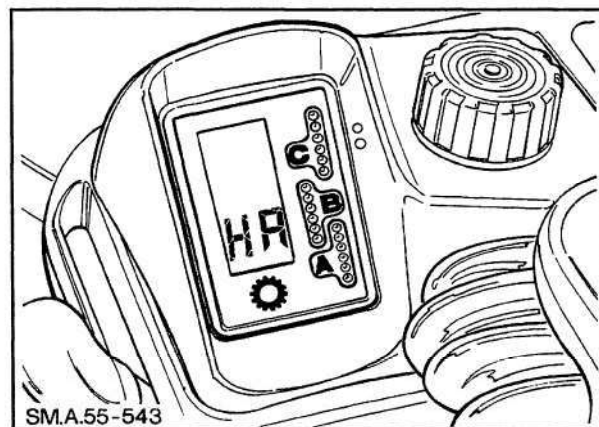


Figure 4-2-56

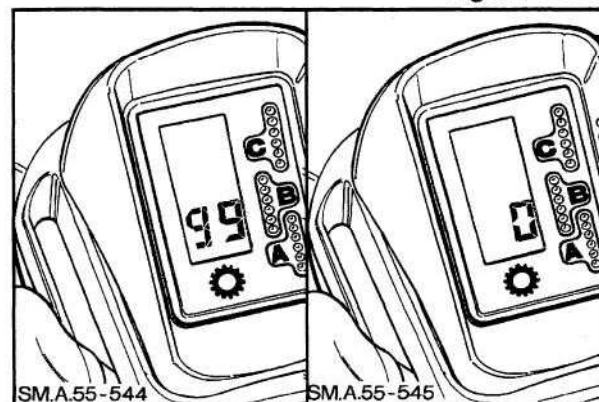


Figure 4-2-57

HB TEMPERATURE COMPENSATION FACTOR

Factory set at 16.

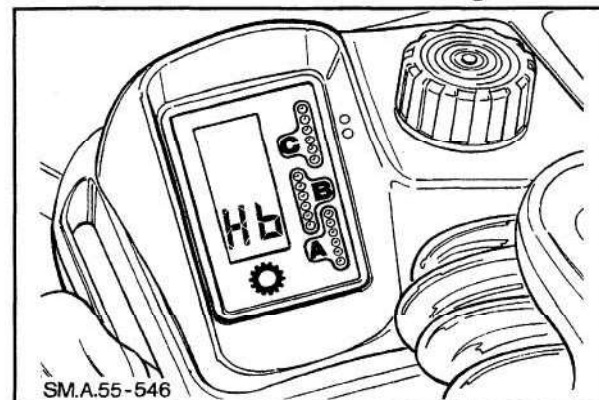


Figure 4-2-58

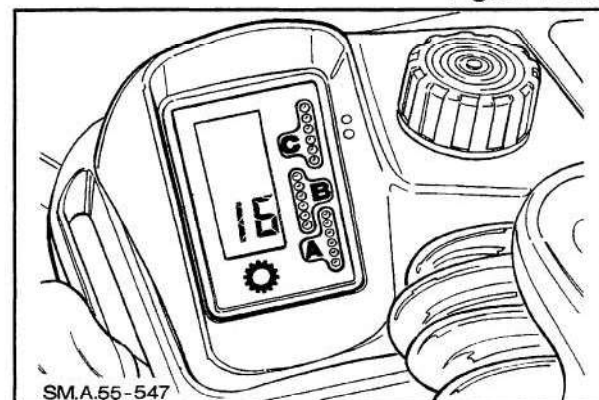


Figure 4-2-59

SECTION 4 – TRANSMISSIONS (Range Command Transmission)

HC TRANSMISSION OIL TEMPERATURE DISPLAY

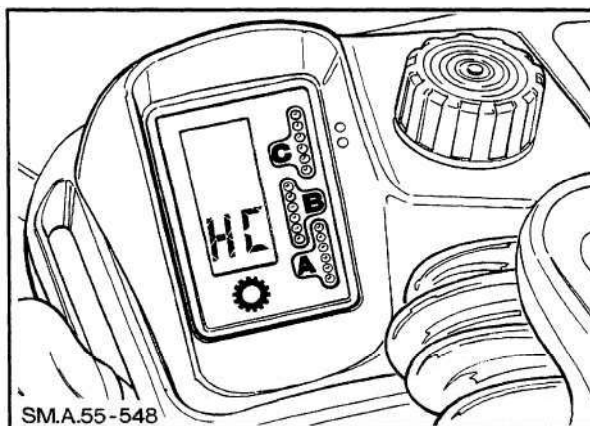


Figure 4-2-60

Displays transmission temperature in degrees Celsius.

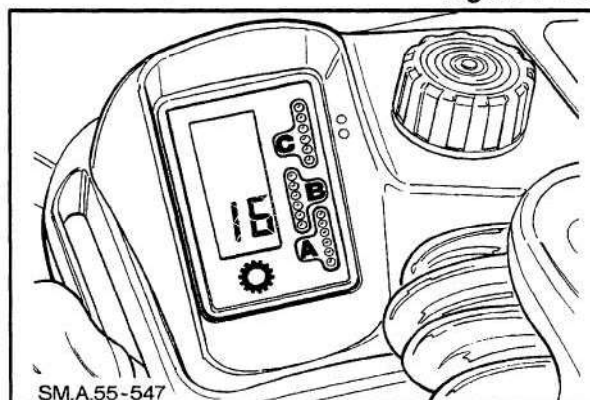


Figure 4-2-61

HD SYNCHRONIZER SHIFT/POSITION MODE

Checks operation of the 2 synchronizers.

The engine must be running with the transmission in neutral and clutch pedal released.

Transmission display, B1, indicates Med/Rev synchronizer operation.

Press and hold the downshift button to display the 'Mid' position as a % of potentiometer movement (approx 25%). (b)

Press the upshift button for Reverse (75%). (R)

Press both together for Neutral (50%). (N)

An LED will flash to indicate which gear is selected for each check. Return synchronizer to neutral prior to proceeding to next test.

If the clutch pedal is then depressed, a similar check can be carried out for the Low/High synchronizer.

High = approx 25% – downshift button (C)
Neutral = approx 50% – both buttons (N)
Low = approx 75% – upshift button (A)

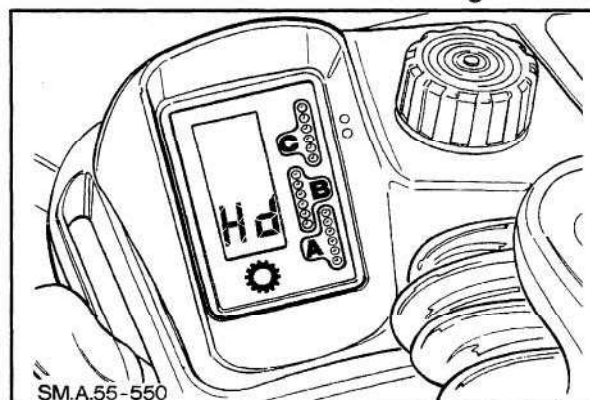


Figure 4-2-62

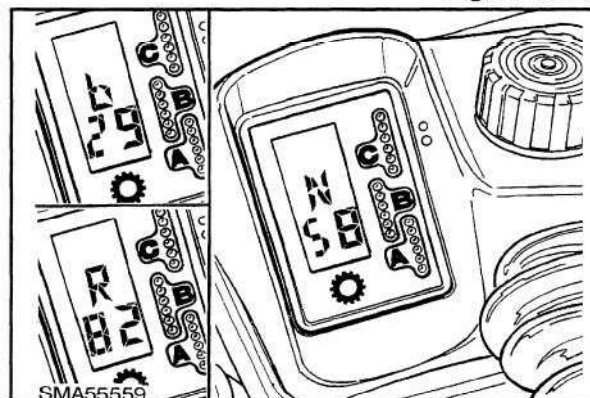


Figure 4-2-63

SECTION 4 – TRANSMISSIONS (Range Command Transmission)

HE QUICK FILL ADJUSTMENT.

Allows the amount of time to fill the clutch pack to be adjusted.

This can be carried out with the engine running.

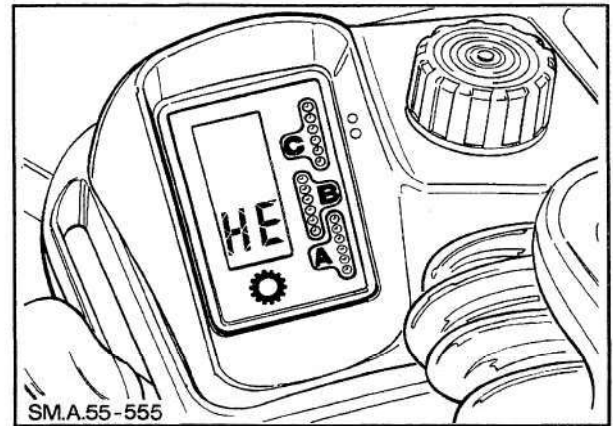


Figure 4-2-64

"A" appears in the display followed by the quick fill calibration figure.

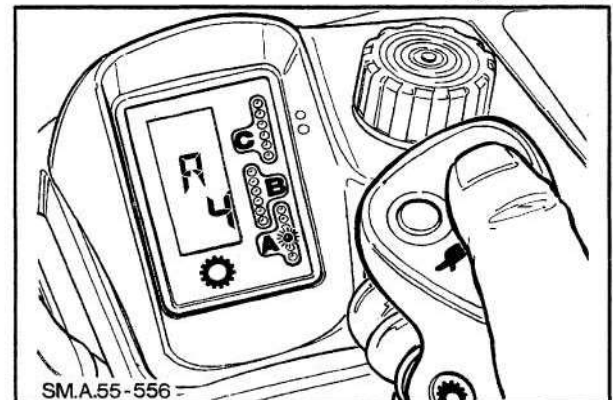


Figure 4-2-65

Adjust the quick fill time using the upshift/downshift buttons.

Change clutch by pressing the range button.

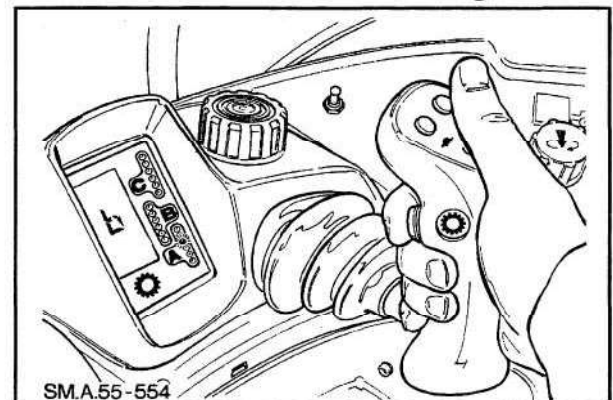


Figure 4-2-66

By selecting forward, the delay in engaging drive can be checked.

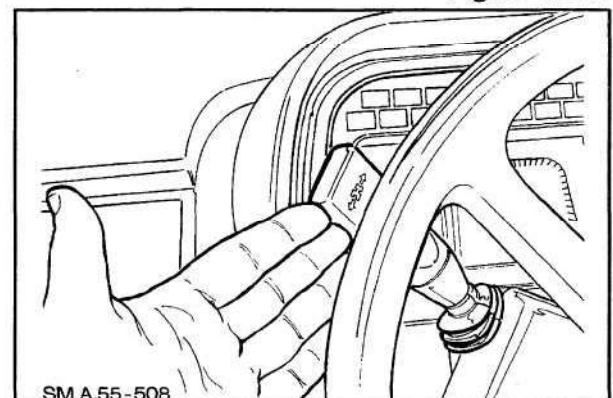


Figure 4-2-67

SECTION 4 – TRANSMISSIONS (Range Command Transmission)

HF MANUAL CLUTCH CALIBRATION ADJUSTMENT

Allows the clutch bite to be manually adjusted. This can be carried out with the engine running.

"A" appears followed by the clutch calibration figure "H1".

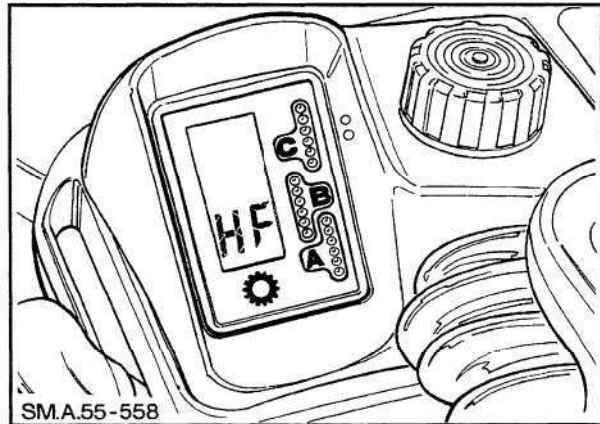


Figure 4-2-68

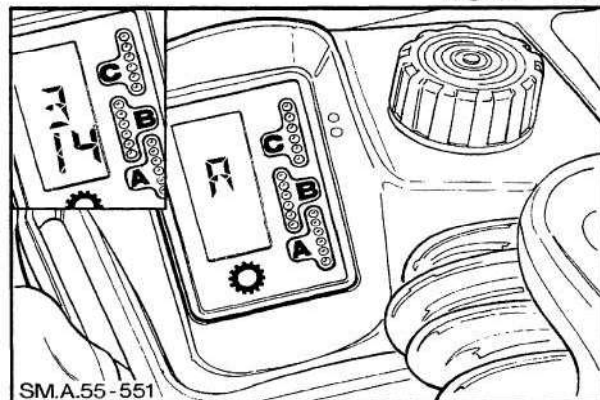


Figure 4-2-69

Adjust the calibration figure using the upshift or downshift buttons.

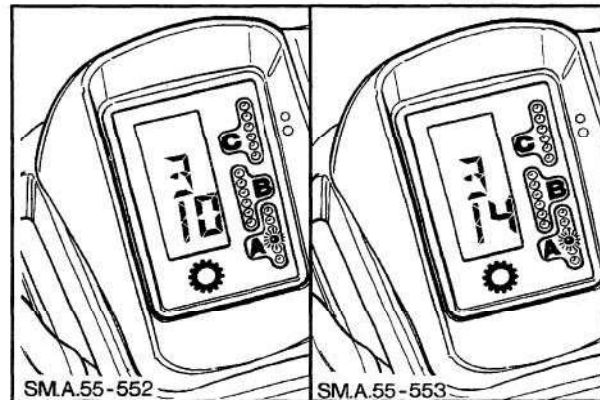


Figure 4-2-70

Change the clutch to be adjusted using the range button.

By selecting forward or releasing the clutch, the clutch engagement bite point can be checked.

The display will show % clutch pedal position.

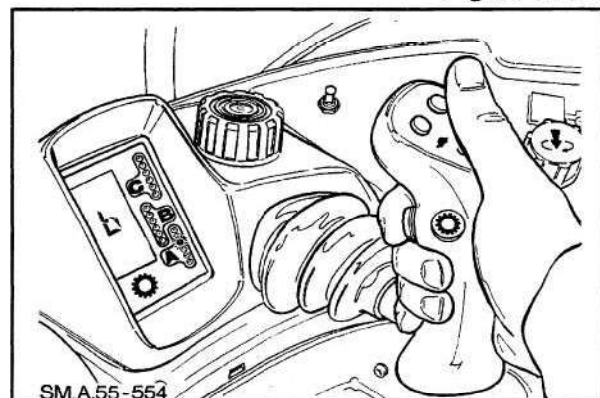


Figure 4-2-71

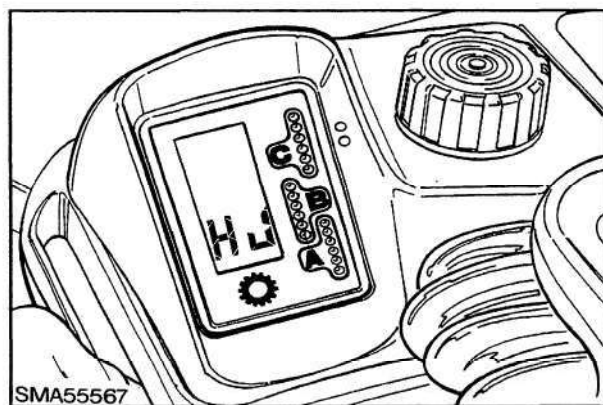
SECTION 4 – TRANSMISSIONS (Range Command Transmission)

HJ CLUTCH PRESSURE TEST MODE

This test mode is for use in pressure testing the transmission clutches, A, B, C, D and E.

It enables each clutch to be energized independently and allows operation of the clutch pedal to control the pressure.

Refer to the pressure testing section of this Chapter for details of full operating instructions.

**Figure 4-2-72**

SECTION 4 – TRANSMISSIONS (Range Command Transmission)

ERROR CODES

Semi-Powershift Error Display Logic

1. Errors are displayed on the liquid crystal display portion of the gear shift and display assembly. A semi-powershift transmission error code is prefixed with an 'F'.

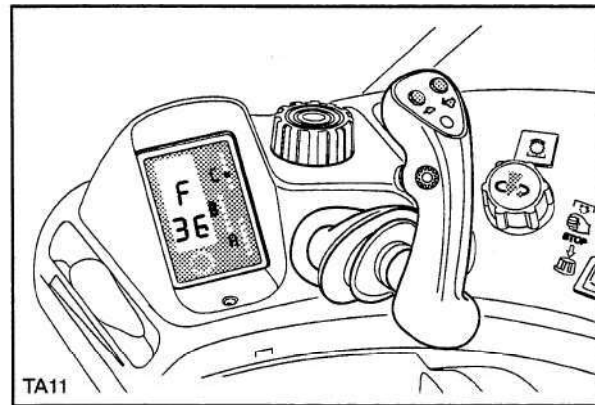


Figure 4-2-73

NOTE: Some very early tractors may have an 'E' prefix displayed instead of an 'F'.

2. Error codes always flash.
3. Generally, error codes accompanied by a pulse alarm signal require action by the operator, and the alarm will continue until the operator takes action.

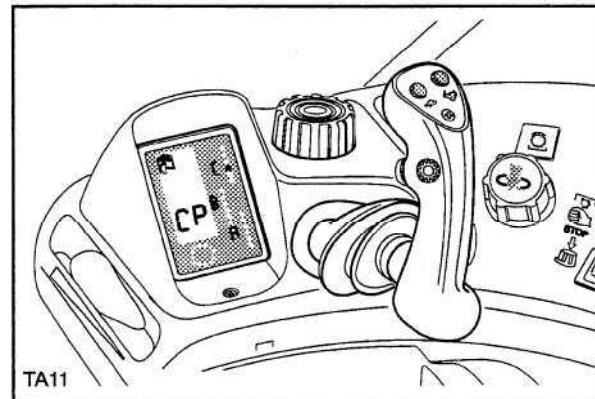


Figure 4-2-74

- a) "CP" can be cleared by cycling the clutch pedal. In most cases the shuttle lever can also be used to clear "CP".
- b) Most other errors, accompanied by a pulse alarm, can be cleared by cycling the shuttle lever. Under certain conditions, the pulse alarm will continue for 4 seconds while the lever is in neutral.

4. Other error codes, those not accompanied by a pulse alarm are accompanied by a steady 5 second alarm which then stops. If the error clears during the 5 second period the alarm will stop when the error clears.

5. After the 5 second period the alarm will alternate with normal gear information on the gear display if the transmission is still operable. If the transmission is disabled, only the error code will be displayed.

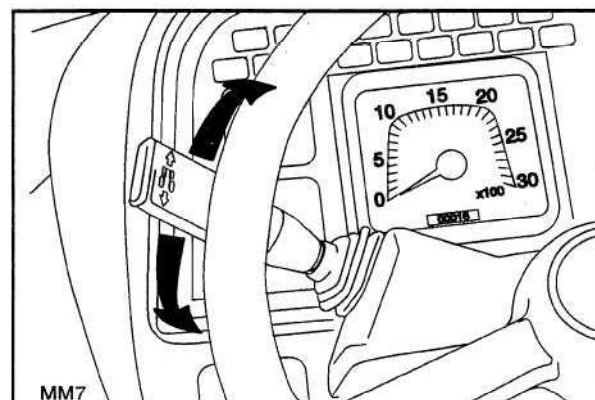


Figure 4-2-75

SECTION 4 – TRANSMISSIONS (Range Command Transmission)

6. Errors have priority. Errors accompanied by the pulse alarm will not allow lower priority errors to be displayed, but pulse alarm errors are usually temporary in nature. For errors without pulse alarm:
 - a) If a lower priority error occurs when a higher priority error is being displayed, the lower priority error will be displayed for 5 seconds AFTER the higher priority has been displayed for at least 5 seconds. Then the display will return to the higher priority error.
 - b) If a higher priority error occurs when a lower priority error is being displayed, the higher priority error will interrupt the display of the lower priority error. If the lower priority error has not been displayed for 5 seconds yet it will return for 5 seconds after the higher priority error has been displayed. For example, if there are several errors at start up, due to a major harness wiring fault, the errors will all be displayed once, for 5 seconds each, in priority order, before the display returns to displaying only the highest priority error.

SECTION 4 – TRANSMISSIONS (Range Command Transmission)

Error Code Listing

ERROR CODE	ERROR DESCRIPTION	PRIORITY	TRANS. STATUS	ALARM MODE
F02	Fast/Slow Synchro – bad calibration value in NVM or not calibrated	42	Enabled	
F03	M/R Synchro – bad calibration value in NVM or not calibrated	41	Enabled	
F11	Inching pedal potentiometer undervoltage	14 & 71	Disabled Enabled	Pulse
F12	Inching pedal potentiometer overvoltage	13 & 70	Disabled Enabled	Pulse
F13	Upshift and downshift switches both closed	78	Enabled	
F20	Synchronizer did not engage – range shift	23	Enabled	
F21	Coils disconnected – Limp home or harness error	1	Disabled	
F22	Synchronizer did not disengage – range shift	24	Enabled	
F23	Creeper engaged, speed or gear too high	35	Enabled	
F24	All clutches/synchronizers need calibration	11	Disabled	
F27	ERPM too low – circuit open or short	60	Enabled	
F31	Synchronizer did not engage – shuttle shift	19	Disabled	Pulse
F32	Synchronizer did not engage after power up	20	Disabled	Pulse
F33	Synchronizer did not disengage – shuttle or neutral	21	Disabled	Pulse
F34	Synchronizer did not disengage after power up	22	Disabled	Pulse
F35	Failed to engage previous range after error codes F20 & F22	18	Disabled	Pulse
F36	Synchronizer not engaged (possibly jumped out)	17	Disabled	Pulse
F37	Solenoid power switch circuit open	31	Disabled	
F38	Disabled range selected by operator	25 & 16 & 15	Enabled Disabled Disabled	Pulse Pulse
F40	Medium/reverse synchronizer potentiometer overvoltage	43	Enabled	
F41	Medium/reverse synchronizer potentiometer undervoltage	44	Enabled	
F42	Fast/slow synchronizer potentiometer overvoltage	45	Enabled	
F43	Fast/slow synchronizer potentiometer undervoltage	46	Enabled	
F44	Medium/reverse synchronizer potentiometer out of calibrated range	76	Enabled	
F45	Fast/slow synchronizer potentiometer out of calibrated range	77	Enabled	
F47	Solenoid power switch misadjusted (clutch pedal)	69	Enabled	
F48	Solenoid power switch circuit short to 12 volts	68	Enabled	
F49	Wheel speed sensor circuit open	47	Enabled	
F50	Wheel speed sensor circuit short	48	Enabled	

SECTION 4 – TRANSMISSIONS (Range Command Transmission)

ERROR CODE	ERROR DESCRIPTION	PRIORITY	TRANS. STATUS	ALARM MODE
F51	Temperature sensor circuit open	66	Enabled	Pulse
F52	Temperature sensor circuit short to ground	67	Enabled	
F53	Regulated 5/7 volts too high	7	Disabled	
F54	Regulated 5/7 volts too low	8	Disabled	
F55	Regulated 8 volts too high	9	Disabled	
F56	Regulated 8 volts too low	10	Disabled	
F59	Forward/reverse/neutral switch disagreement	12	Disabled	
F60	Upshift input undervoltage	50	Enabled	
F61	Upshift input overvoltage	51	Enabled	
F62	Downshift input undervoltage	52	Enabled	
F63	Downshift input overvoltage	53	Enabled	
F64	Range shift input undervoltage	54	Enabled	
F65	Range shift input overvoltage	55	Enabled	
F66	Forward input undervoltage	56	Enabled	
F67	Forward input overvoltage	57	Enabled	
F68	Reverse input undervoltage	58	Enabled	
F69	Reverse input overvoltage	59	Enabled	
F73	Mid speed sensor circuit open	79	Enabled	
F74	Mid speed sensor circuit short to ground or 12V	80	Enabled	
F75	Swapped mid and rear speed sensors	82	Enabled	
F77	No signal from wheel speed sensor	49	Enabled	Pulse
F78	No signal from mid speed sensor	81	Enabled	
F79	Engine RPM >3000	34	Enabled	
F80	Wheel speed too high for gear selected	33	Enabled	
F81	Proper ratio not detected	30	Disabled	
F1A	Clutch A open or short to ground	36	Disabled	Pulse
F1b	Clutch B open or short to ground	37	Disabled	
F1C	Clutch C open or short to ground	38	Disabled	
F1d	Clutch D open or short to ground	39	Disabled	
F1E	Clutch E open or short to ground	40	Disabled	
F2A	Clutch A short to 12V	2	Disabled	
F2b	Clutch B short to 12V	3	Disabled	
F2C	Clutch C short to 12V	4	Disabled	
F2d	Clutch D short to 12V	5	Disabled	
F2E	Clutch E short to 12V	6	Disabled	

SECTION 4 – TRANSMISSIONS (Range Command Transmission)

ERROR CODE	ERROR DESCRIPTION	PRIORITY	TRANS. STATUS	ALARM MODE
F1P	Reverse solenoid open or shorted to ground	27 & 73	Disabled Disabled	Pulse Steady
F1L	Slow range solenoid open or shorted to ground	28 & 74	Disabled Disabled	Pulse Steady
F1U	Mid range solenoid open or shorted to ground	26 & 72	Disabled Disabled	Pulse Steady
F1h	Fast range solenoid open or short to ground	29 & 75	Disabled Disabled	Pulse Steady
FCA	Clutch A not calibrated	61	Enabled	
FCB	Clutch B not calibrated	62	Enabled	
FCC	Clutch C not calibrated	63	Enabled	
FCD	Clutch D not calibrated	64	Enabled	
FCE	Clutch E not calibrated	65	Enabled	
CP	Depress clutch pedal or select neutral to re-enable	32	Disabled	Pulse
	CALIBRATION ERRORS			
U19	Oil temperature below 68°F (20°C)			
U21	Engine RPM too low			
U22	Engine RPM too high			
U23	Shuttle lever is in neutral			
U26	Clutch pedal is not released			
U31	Output speed sensed – tractor is moving			
U36	Maximum allowed clutch calibration value exceeded			
U37	ERPM dropped too soon during clutch cal			
U81	No mid–reverse synchro movement sensed			
U82	No low–high synchro movement sensed			
U83	Synchro potentiometer connectors swapped			
U84	Reverse and high synchro solenoid connectors swapped			
U85	Mid and low synchro solenoid connectors swapped			
U86	Mid–reverse synchro neutral error			
U87	Low–high synchro neutral error			
U88	Mid–rev synchronizer calibration values out of tolerance			
U89	Low–high synchronizer calibration values out of tolerance			
	CALIBRATION MESSAGES			
CF	Calibration procedure completed successfully			
CH	Oil temperature above 122°F (50°C)– Press upshift to proceed			
CL	Oil temperature between 50 and 68°F (10 and 20°C) – press upshift to proceed			