

ZDR INTERFACE WITH CUSTOMER-SPECIFIC CONTROL MODULE (STEP 1) FOR EXTERNAL ENGINE SPEED CONTROL AND FLEET MANAGEMENT INTERFACE ON TG

| | | |
|------|---|----|
| 1. | Areas of application | 2 |
| 2. | Terms and abbreviations | 2 |
| 3. | Guidelines and standards also applicable | 3 |
| 4. | Adresses and responsibilities | 3 |
| 5. | General observations on the ZDR interface with KSM | 4 |
| 6. | Notes on setting up the parameters for the KSM | 5 |
| 6.1. | Fundamental functions regulating intermediate engine speed settings | 5 |
| 6.2. | Possibilities for setting parameters om the KSM | 5 |
| | Engine speed and torque limiting | 5 |
| | Parameter selection matrix for switching outputs | 6 |
| | Function parameters and signal descriptions | 7 |
| | Fault recognition for switch signal outputs | 10 |
| | “Fail safe” operation of signal outputs | 12 |
| | Engine speed | 14 |
| | Evaluation of the request for digital inputs/A-CAN | 14 |
| | NA-ZDR connention | 14 |
| | A-can interface | 15 |
| 7. | A-CAN Interface with FMS Interface | 16 |
| 7.1. | General points | 16 |
| 7.2. | Setting parameters for the A-CAN | 16 |
| 7.3. | Information on vehicle operating status on the A-CAN | 17 |
| 7.4. | Possible request to the KSM via the A-CAN | 18 |
| 7.5. | A-CAN output messages | 19 |
| 7.6. | A-CAN input messages | 38 |
| 7.7. | Information processing in KSM/VCM as specified by KSM1_A-message | 41 |
| 8. | Pin description and circuit diagrams | 43 |
| 9. | Interface Design and Installation Point | 56 |
| 10. | Sample circuits | 58 |
| 11. | Quick Reference for Interface Assignments | 68 |

1. Areas of Application

This description of an interface will be useful to all vehicle body constructors who need an “external engine speed control system” on a MAN-commercial vehicle. The interface described here supplements and extends the standard “ZDR-Interface with FFR” and provides a much wider range of functions. Via the CAN interface of the KSM (A-CAN) it is possible to set up the Fleet Management System Interface (FMS-Interface). The interface implementation described here refers to the “Trucknology Generation” (TG) range of vehicles.

2. Terms and Abbreviations

The PIN description employs the following technical terms/abbreviations:

| Abbreviation | Explanation |
|--------------------|---|
| A-CAN | Body CAN (CAN = controller area network) |
| AUS | Switch-off of the FGR/FGB/ZDR function |
| DBG | Engine speed limiting |
| DE | Digital input |
| EMV | Electromagnetic compatibility |
| FFR | Vehicle management computer |
| FGR/FGB/ZDR | Vehicle speed control/ speed limiter/intermediate rev control |
| FIN | Vehicle identification number acc. to ISO 3779 or MAN standard M1036/7 |
| FMS | Fleet Management System |
| FUP | Function parameter set |
| GETRIEBE-N | Neutral selected at gearbox |
| GMT | Greenwich Mean Time |
| HGB | Max. speed limiting |
| High-side-Schalter | Output switching to contact 30 (+U _{BAT}) |
| HP | ZF-Automatic gearbox HP... |
| KSM | Customer-specific control module |
| KS | Short circuit |
| LED | Light-emitting diode |
| Low-side-Schalter | Output switching to contact 31 (-U _{BAT}) |
| M3135 | MAN factory standard (M + 4-digit number) |
| MAN-cats II | Computer diagnostic system in MAN workshops |
| MBG | Torque limiting |
| MEMORY | Recovery of stored function |
| NA | Power take-off |
| NMV | Power takeoff at front, engine speed-dependent |
| PIN | Plug-in connector |
| PWM | Pulse width modulation |
| PTO | Power take off |
| R-Gang | Reverse gear |
| SAE | Society of Automotive Engineers |
| SET- | Slow down or reduce engine speed, set value |
| SET+ | Speed up or increase engine speed, set value |
| SG | Control unit |
| T-CAN | Powertrain CAN (CAN = Controller Area Network) |
| +U _{BAT} | Battery + (positive) |
| -U _{BAT} | Battery – (negative) |
| UTC | Universal Time Code |
| VIN | Vehicle identification number acc. to ISO 3779 or MAN standard M 1036-7 |
| WSK | Converter lock-up clutch |
| ZBR | Central vehicle computer |
| ZDR | Intermediate engine speed control/regulator |

3. Guidelines and Standards also applicable

- Currently valid body/superstructure guidelines for commercial vehicles and semi-trailer tractors, and in particular the manual “Electrics” and the Trucknology Generation; including all supplements to the information for body constructors ([www. manted.de](http://www.manted.de)).
- MAN-purchasing documentation - relays for commercial vehicles
- MAN standard M 3285 (EMC) and EC directives 72/245/EEC incl. 95/54/EEC
- MAN standard M 3135 (electric cables)
- MAN standard M 3331/1-2
(High-speed CAN interface for electronic systems on MAN commercial vehicles)
- MAN standard M 1036-7 (Vehicle Identification Number)
- DIN 40 050
- DIN 40 839 Parts 1, 3 and 4
- DIN 57 879, Part 3
- VDE 0879, Part 3
- VG 95 370 to 95 377
- MIL-STO 461 and 462
- ISO 11898-24V
- SAE J1939/ff
- Bosch Specification 2.0B
- ISO 3779
- FMS-Standard (www.fms-standard.com)

4. Addresses and Responsibilities

Supply sources can be found in the MAN Guidelines for Body Constructors. These can be obtained from:

MAN Nutzfahrzeuge AG / Dept. ESC (Fax: +49 089 1580 4264)
Postfach 50 06 20
D-80976 München

5. General Observations on the ZDR Interface With KSM

- The interface is not included in the standard vehicle delivery specification and must be ordered separately.
- The desired parameters in the KSM control unit such as engine speed limiting, torque limiting etc. must be notified to the MAN sales team when placing the order. This information is passed on for factory programming.
- Preparation for the “Start-stop device” set-up is independent of the external engine speed control system interface and must be ordered separately.
The attachment necessary for external “Engine start-stop” control is supplied rolled up in the cable harness at the rear end of the frame.
- “Accidental reversing prevention” for garbage collection vehicles is not included in the interface and must be ordered separately.
- **Extreme care is necessary when wiring up the interface. This activity is critical because it involves actions that fundamentally affect the on board network and the wiring for the electronics.**
- Only use suitable electric wiring that conforms to MAN standard M 3135.
- Use only relays that meet the requirements set out in the MAN relay specification for external circuits.
- Make absolutely sure that wires are crimped strictly according to makers’ instructions.
- Any external controls incorporated by the constructor must meet enclosure standards according to IP69K DIN 40 050 and in addition be secure against external tampering.
- The power supply (+U_{BAT}) for body equipment and control units incorporated by the constructor must be led from the batteries via a suitable separate circuit protection device or fuse. It is not permissible to take off more than 12 volts from a single battery.
- A separate cable must be used for electrical earthing and connected to the common earth point on the engine mounting (never use the vehicle frame as an earth conductor).
- Do not link together several items of externally switched equipment with different earth potentials.
- **Circuits at the interface must be decoupled from the power supply circuit to the body control systems.**
- External switching systems must meet the demands of MAN standard M 3285 for commercial vehicle systems. For example, radio systems such as radio-operated remote control devices must not have any effect on the functions described in this MAN standard.
- **Diagrams and pictures supplied by MAN to illustrate and provide examples of electrical circuits are not to be regarded as specific assembly instructions. The responsibility for the circuits at the interface rests entirely with the party carrying out the work.**
- Changes to the functionalities of the interface as set in the factory can be made at MAN service centres or by MAN authorized dealers. This requires the use of the MAN-cats II service computer. The MAN-cats experts in the workshops can order additional system solutions from the factory which go beyond those provided on the service computer (e.g. for special cases). For this purpose, department ESC has made available the service “Vehicle Parameter Setting Ex Works” in order to assist the workshops.

6. Notes on setting up the Parameters for the KSM

6.1. Fundamental functions regulating intermediate engine speed settings

- Setting of individual ZDR parameters is carried out in the FFR. Individual modes can be selected externally (outside the driver's cabin) if required via the standard ZDR interface (FFR).
- Possible parameters and also the PIN description of the "ZDR-interface with FFR" are described in the document "ZDR-interface with vehicle management computer for external intermediate engine speed control on the TG (Trucknology Generation) range".
- Using the "ZDR-interface with KSM", the functions "SET+", "SET-", "MEMORY" and "OFF/AUS" (familiar from the cruise control) are available for external use outside the driver's cabin.
- Additionally other intermediate engine speeds can be obtained by activating an engine speed limiter.

6.2. Possibilities for setting parameters on the KSM

Parameters for various functions can be set on the KSM using MAN-cats II:

- Engine speed and torque limiting:
Activating the DrzMomBgr pins (X1997/Pin 1 and 2) permits selection of the engine speed and torque limit parameters.

Factory settings:

| Signal | Engine speed | Torque |
|-----------------------------|--------------|--------|
| Engine speed/torque limit 1 | 1.500 rpm | 100% |
| Engine speed/torque limit 2 | 1.800 rpm | 100% |
| Engine speed/torque limit 3 | 1.200 rpm | 100% |

• Parameter selection matrix for switching outputs.

A total of 5 high side switching signal outputs (Hs1_konfig...Hs5_konfig) and 3 low side switching signal outputs (Ls1_konfig,... Ls3_konfig) are available. The following table shows the signals/functions with which the total of 8 switching signal outputs (5 x high side and 3 x low side) can be set up as required. It is also possible to arrange for several switching signals to initiate the same signal/function.

| Nr. | Ls_config/Hs_config Interface X1997 max. Load | Low-side switch | | | High-side switch | | | | |
|-----|---|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|-----------------------|
| | | Ls1 Pin3 300mA | Ls2 Pin4 300mA | Ls3 Pin9 300mA | Hs1 Pin5 500mA | Hs2 Pin6 500mA | Hs3 Pin7 500mA | Hs4 Pin8 500mA | Hs5 Pin11 600mA |
| | Signals: | | | | | | | | |
| 0. | Not used (no function) | | | | | | | | |
| 1. | Gearbox N | | | x | | | | | |
| 2. | ABS active | | | | | | | | |
| 3. | Handbrake | | | | x | | | | |
| 4. | Brake | | | | | x | | | |
| 5. | Reverse | | | | | | x | | |
| 6. | Clutch | | | | | | | x | |
| 7. | Kick-down | | | | | | | | |
| 8. | Idle | | | | | | | | |
| 9. | Speed limit 1 on | | | | | | | | |
| 10. | Speed limit 1 on/off | | | | | | | | |
| 11. | Engine speed limit 1 on | | | | | | | | |
| 12. | Engine speed limit 1 on/off | | | | | | | | |
| 13. | Fuel level warning | | | | | | | | x |
| 14. | Speed limit 2 on | | | | | | | | |
| 15. | Speed limit 2 on/off | | | | | | | | |
| 16. | Engine speed limit 2 on | | | | | | | | |
| 17. | Engine speed limit 2 on/off | | | | | | | | |
| 18. | PTO 1 feedback | | | | | | | | |
| 19. | PTO 2 feedback | | | | | | | | |
| 20. | NMV feedback [front-end PTO] | | | | | | | | |
| 21. | Oil pressure warning | | x | | | | | | |
| 22. | Coolant overheat warning | x | | | | | | | |
| 23. | Split | | | | | | | | |
| 24. | Accelerator pedal threshold on/off | | | | | | | | |
| 25. | Brake pedal threshold on/off | | | | | | | | |
| 26. | Axle load 1 warning | | | | | | | | |
| 27. | Axle load 2 warning | | | | | | | | |
| 28. | Reserved | | | | | | | | |
| 29. | Reserved | | | | | | | | |
| 30. | Reserved | | | | | | | | |
| 31. | Reserved | | | | | | | | |
| 32. | Reserved | | | | | | | | |
| 33. | Cabin tilt lock | | | | | | | | |

x = Factory setting

- Function Parameters and Signal Descriptions

- Gearbox N.
The switch output parameter is active when the gearbox is in neutral.
- ABS active
The switch output parameter is active when an ABS control operation is active.
- Handbrake
The switch output parameter is active when the handbrake is applied.
- Brake
The switch output parameter is active when the brake pedal is operated.
- Reverse
The switch output parameter is active when the reverse gear is engaged.
- Clutch
 - Manual shift gearbox: The switch output parameter is active when the clutch is released.
 - Automated-shift gearbox:
The switch output parameter is active when the driveline is disconnected, i.e. when the clutch is released or the gearbox is in neutral.
 - HP gearbox: (ECOMAT):
The switch output parameter is active when the gearbox is in neutral.
- Kick down
The switch output parameter is active when the accelerator is in the “kick down” position.
- Idling
The switch output parameter is active when the accelerator pedal is in the idle position.
- Speed limit 1 on
The switch output parameter is active when vehicle speed \geq parametered speed limit. The output stays active when the speed drops below the set limit.

Factory setting:

| | |
|----------------|--------|
| Speed limit 1: | 5 km/h |
|----------------|--------|

- Speed limit 1 on/off
The switch output parameter as active when the vehicle speed \geq the parametered upper speed limit 1. The output is inactive when the vehicle speed \leq the parametered lower speed limit 1.

Factory setting:

| | |
|----------------------|--------|
| Speed limit 1_upper: | 5 km/h |
| Speed limit 1_lower: | 3 km/h |

- Engine speed limit 1 on
The switch output parameter is active when engine speed \geq parametered limit. The output remains active when the engine speed drops below the limit.

Factory setting:

| | |
|-----------------------|---------|
| Engine speed limit 1: | 640 rpm |
|-----------------------|---------|

- Engine speed limit 1 on/off

The switch output parameter is active when engine speed \geq parametered upper limit. Output inactive if engine speed \leq parametered lower limit.

Factory setting:

| | |
|-----------------------------|---------|
| Engine speed limit 1_upper: | 640 rpm |
| Engine speed limit 1_lower: | 630 rpm |

- Tank warning

The switch output parameter is active when the remaining fuel is below approx. 20% (set at factory), calculated on the maximum tank content. This information is shown at the same time on the instrument panel with the indication "REFUEL" This value can be set by means of MAN-cats II to a minimum-value parameter of 11.2%. This information is at present valid only for vehicles with a single fuel tank level sensor. with terminal 15 "on". the output is selected for approximately 3 seconds (bulb test).

- Speed limit 2 on

The switch output parameter is active when the vehicle speed \geq the parametered speed limit. The output stays active when the speed drops below the set limit.

Factory setting:

| | |
|----------------|---------|
| Speed limit 2: | 10 km/h |
|----------------|---------|

- Speed limit 2 on/off

The switch output parameter is active when the vehicle speed \geq the parametered upper speed limit 2. The output is inactive when the vehicle speed \leq the parametered lower speed limit 2.

Factory setting:

| | |
|-----------------------------|---------|
| Engine speed limit 1_upper: | 10 km/h |
| Engine speed limit 1_lower: | 8 km/h |

- Engine speed limit 2 on

The switch output parameter is active when the engine speed \geq parametered rev limit. The output also remains active when the engine speed falls back below the limit.

Factory setting:

| | |
|-----------------------|---------|
| Engine speed limit 2: | 980 rpm |
|-----------------------|---------|

- Engine speed limit 2 on/off

The switch output parameter is active when engine speed \geq parametered upper rev limit. Output inactive if engine speed \leq parametered lower rev limit.

Factory setting:

| | |
|-----------------------------|---------|
| Engine speed limit 2_upper: | 980 rpm |
| Engine speed limit 2_lower: | 970 rpm |

- NA 1 feedback

The switch output parameter is active when the indicator signal from NA 1 is present.

- NA 2 feedback

The switch output parameter is active when the indicator signal from NA 2 is present.

- NMV feedback

The switch output parameter is active when the indicator signal from the NMV is present.

- Oil pressure warning

The switch output parameter is active when the engine oil pressure is too low. This information is shown at the same time on the instrument. This function is only active when the engine is running. When terminal 15 is "on" the output is selected for approximately 3 seconds (bulb test).

- Coolant overheat warning

The switch output parameter is active when cooling water temperature is too high. This information is shown at the same time on the instrument panel. With terminal 15 “on” the output is selected for approximately 3 seconds (bulb test).

- Split

The switch output parameter is active when the corresponding splitter group is active.

Factory setting:

| | |
|-------------------|---|
| Slow split range: | X |
| Fast split range: | |

- Accelerator pedal position

The switch output parameter is active when the accelerator pedal position \geq parametered upper accelerator pedal limit. The output is inactive when the accelerator pedal position \leq parametered lower accelerator pedal setting.

Factory setting:

| | |
|--------------------------------|-------|
| Accelerator pedal limit_upper: | 10 % |
| Accelerator pedal limit_lower: | 5,2 % |

- Brake pedal position

The switch output parameter is active when the brake pedal position \geq parametered upper brake pedal limit. The output is inactive when brake pedal position \leq parametered lower brake pedal limit.

Factory setting:

| | |
|--------------------------|-------|
| Brake pedal limit_upper: | 10 % |
| Brake pedal limit_lower: | 5,2 % |

- Axle load 1 warning

The switch output parameter is active when axle load \geq parametered upper axle load limit. It is inactive when axle load \leq parametered lower axle load threshold.

Factory setting:

| | |
|------------------------------|------|
| Axle number: | 1 |
| Axle load threshold 1_upper: | 0 kg |
| Axle load threshold 1_lower: | 0 kg |

Example:

If on a two-axle vehicle the rear axle (driven axle) is evaluated, a parameter must be set for axle number “2”.

- Axle load 2 warning

The switch output parameter is active when axle load \geq parametered upper axle load limit. It is inactive when axle load \leq parametered lower axle load threshold.

Factory setting:

| | |
|------------------------------|------|
| Axle number: | 1 |
| Axle load threshold 2_upper: | 0 kg |
| Axle load threshold 2_lower: | 0 kg |

Example:

If on a two-axle vehicle the rear axle (driven axle) is evaluated, a parameter must be set for axle number “2”.

- Cabin tilt lock

The switch output parameter is active when the cabin is tilted forward or not correctly locked.

- Fault recognition for switch signal outputs.
 - high-side switch
 - Hs1_konfig (X1997/Pin 5)
 - Hs2_konfig (X1997/Pin 6)
 - Hs3_konfig (X1997/Pin 7)
 - Hs4_konfig (X1997/Pin 8)
 - Telltale light (X1997/Pin 10)
 - Operating readiness (X1997/Pin 12)
 - Hs5_konfig (X1997/Pin 11)
 - low-side switch
 - Ls1_konfig (X1997/Pin 3)
 - Ls2_konfig (X1997/Pin 4)
 - Ls3_konfig (X1997/Pin 9)

For fault recognition, the following variations are possible:

- No fault recognition
Switch signal output is not monitored
- With fault recognition
 - ⇒ Monitoring high-side switches:
 - Signal high: Short circuit to earth is monitored
 - Signal low: Short circuit +U_{BAT} and open circuit are monitored
 - ⇒ Monitoring low-side switch:
 - Signal high: Short circuit to earth and open circuit are monitored
 - Signal low: Short circuit to +U_{BAT} is monitored
- With fault recognition and test pulses (“extended fault recognition”)
 - ⇒ Test pulses during KSM system start (up to approx. 3 sec after “terminal 15 on”)
During the system start, short circuits to +U_{BAT}, short circuits to earth, and open circuits are monitored, and thereafter fault recognition is carried out according to the switch signal output version.
 - ⇒ Test pulses
Irrespective of the switch signal output version, after “terminal 15 on”, short circuits to +U_{BAT}, short circuits to earth and open circuits are monitored.

Preconditions for fault recognition:

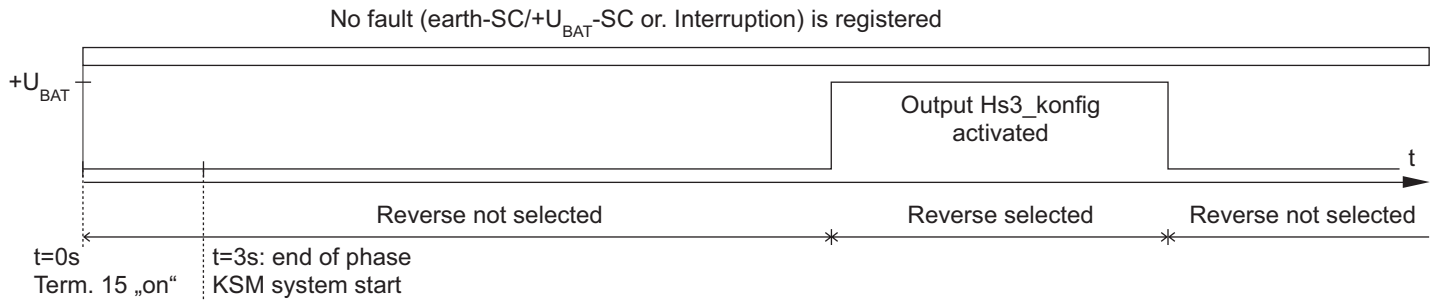
The load at the output on high-side switches must not be larger than 400Ω and for low-side switches no larger than 2000Ω.

Note:

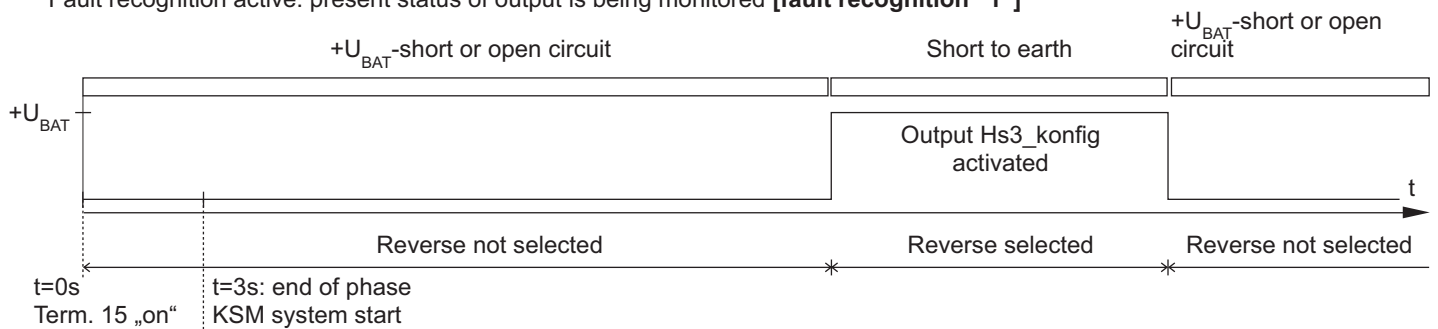
By activating the fault recognition, the depth of diagnosis for the components connected to the “ZDR interface with KSM” is considerably improved, with a consequent increase in functional reliability and vehicle availability.

For example, the recognition of faults on the output Hs3_konfig-delegt with signal R-gear is prevented according to the set parameters:

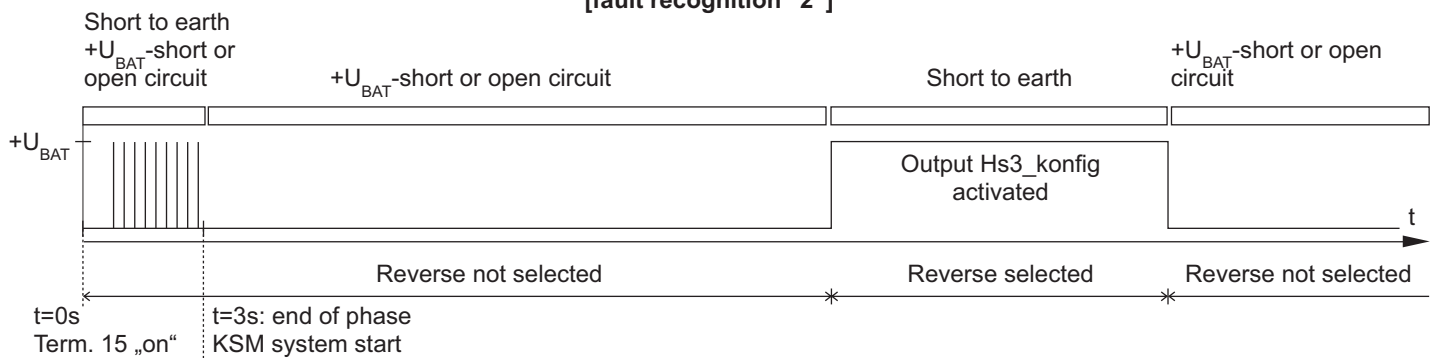
- Output not supported (load is connected):
Fault recognition not active [**fault recognition "zero"**]



- Output supported (load must be connected!):
Fault recognition active: present status of output is being monitored [**fault recognition "1"**]



- Output supported (load must be connected!):
Fault recognition active: present status of output is being monitored and test pulses are only produced during start-up of KSM (checking of short circuits to earth negative for high-side switches and checking of U_{BAT}- short circuits for low-side switches) [**fault recognition "2"**]

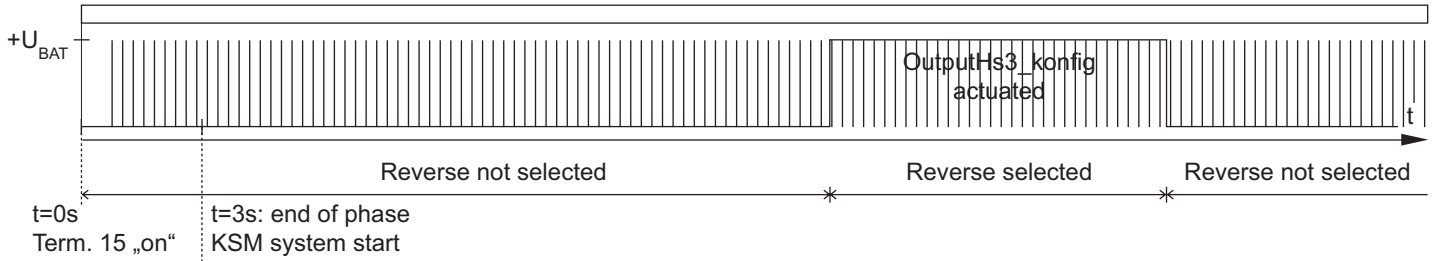


- Output supported (load must be connected!):

Fault recognition active: present status of output is being monitored and test impulses are cyclical (permanent monitoring of short circuits to earth for high-side switches and permanent monitoring of UBAT short circuits for low-side switches

Short to earth/+U_{BAT}-short or open circuit

[fault recognition "3"]



Note:

Test pulses have a duration of approx. 1ms and a repeat interval of approx. 300ms.

Fault recognition for switch outputs, factory settings:

| Switch output: | Fault recog. "0" | Fault recog. "1" | Fault recog. "2" | Fault recog. "3" |
|---------------------|------------------|------------------|------------------|------------------|
| Hs1_konfig | X | | | |
| Hs2_konfig | X | | | |
| Hs3_konfig | X | | | |
| Hs4_konfig | X | | | |
| Hs5_konfig | X | | | |
| Telltale lamp | X | | | |
| Operating readiness | X | | | |
| Ls1_konfig | X | | | |
| Ls2_konfig | X | | | |
| Ls3_konfig | X | | | |

- "Fail safe" operation of signal outputs

For various signals, parameters can be set in order to control how the corresponding switch signal output operates in the event of a fault. If the driver is energised, the reaction can be parametered to allow for the case of unknown/defective information (CAN failure/signal (sensor) failure):

- "Do not freeze" signal

The driver which is parametered for this signal (Hs1 konfig...Hs5 konfig...Ls1 konfig...Ls3 konfig) changes from the active energised status to the passive status in the case of CAN failure/signal (sensor) failure.

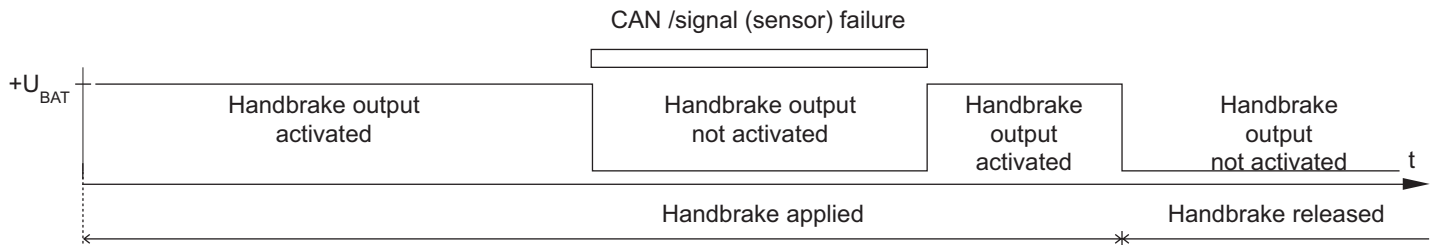
- "Freeze" signal

The driver parametered for the signal (Hs1 konfig...Hs5 konfig...Ls1 konfig...Ls3 konfig) is frozen in the active energised status, if there is a CAN failure/signal (sensor) failure, until a valid signal is present again. After a "terminal 15 reset" and a continuing CAN failure/signal (sensor) failure, the driver remains passive.

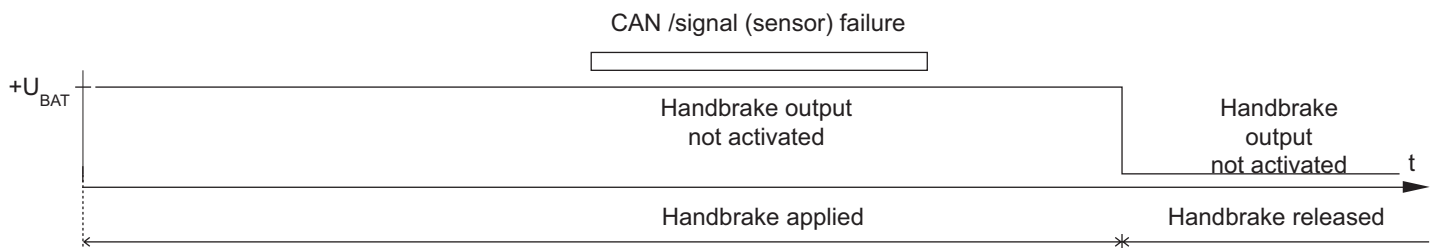
This parameter facility avoids an undesired reaction (release/blocking/switching off of equipment etc) for components connected to the interface, due to the occurrence of a CAN failure/signal (sensor) failure.

As an example of the parameter setting for “fail-safe” operation on output Hs1_konfig -occupied by the handbrake signal - the following is shown, depending on the parameters:

- Handbrake “do not freeze” signal:
Output Hs_konfig changes to the passive state in the case of CAN/signal (sensor) failure



- Handbrake “freeze” signal:
Output stays active in the address status in the case of CAN/signal (sensor) failure



Factory settings for “fail safe” operation of signals:

| Signal: | Freeze | Do not freeze |
|------------------------------------|--------|---------------|
| Gearbox N | | X |
| ABS active | | X |
| Handbrake | | X |
| Brake | | X |
| Reverse | | X |
| Clutch | | X |
| Kick-down | | X |
| Idling | | X |
| Speed threshold 1on/off | | X |
| Engine speed threshold 1 on/off | | X |
| Tank warning | | X |
| Speed threshold 2 on/off | | X |
| Engine speed threshold 2 on/off | | X |
| NV1 feedback | X | |
| NV2 feedback | X | |
| NMV feedback | X | |
| Oil pressure warning | X | |
| Coolant overheat warning | X | |
| Splitter | | X |
| Accelerator pedal threshold on/off | | X |
| Brake pedal threshold on/off | | X |
| Axle load1 warning | X | |
| Axle load 2 warning | X | |
| Cabin tilt lock | X | |

- Engine speed

Parameters can be set for the revolution pulse number (number of pulses per revolution of the engine) and the engine speed threshold after which the square wave signal is emitted (sensing ratio 50/50).

Factory settings:

| Signal | Engine speed pulse number | Engine speed threshold |
|--------------|---------------------------|------------------------|
| Engine speed | 6 | 60rpm |

- Evaluation of the request for digital inputs/A-CAN

- ZDR operation:

Parameters can be set which determine whether the inputs (set+/-, MEMORY OFF) are supported. If the inputs are supported, a corresponding instruction from the A-CAN will be ignored. If the inputs are not supported, an instruction from the A-CAN will be relayed and possible connections from the digital inputs will be ignored.

Factory settings:

| ZDR operation | Digital inputs | A-CAN request |
|------------------|----------------|---------------|
| SET+/-, MEM, OFF | X | |

- Clutch released/ext. gearbox N request:

Parameters can be set determining whether this input is supported. If the input is supported, any corresponding instruction from the A-CAN will be ignored. If the input is not supported, an instruction from the A-CAN will be relayed and a possible connection from the digital input will be ignored.

Factory settings:

| | Digital inputs | A-CAN request |
|---------------------------|----------------|---------------|
| Clutch off/ext. gearbox N | X | |

- Converter lockup clutch (WSK) open/up-shift interlock:

Parameters can be set as to whether these inputs are supported. If the inputs are supported, any corresponding instruction from the A-CAN will be ignored. If the inputs are not supported, an instruction from the A-CAN will be relayed and a possible connection from the digital inputs will be ignored.

Factory settings:

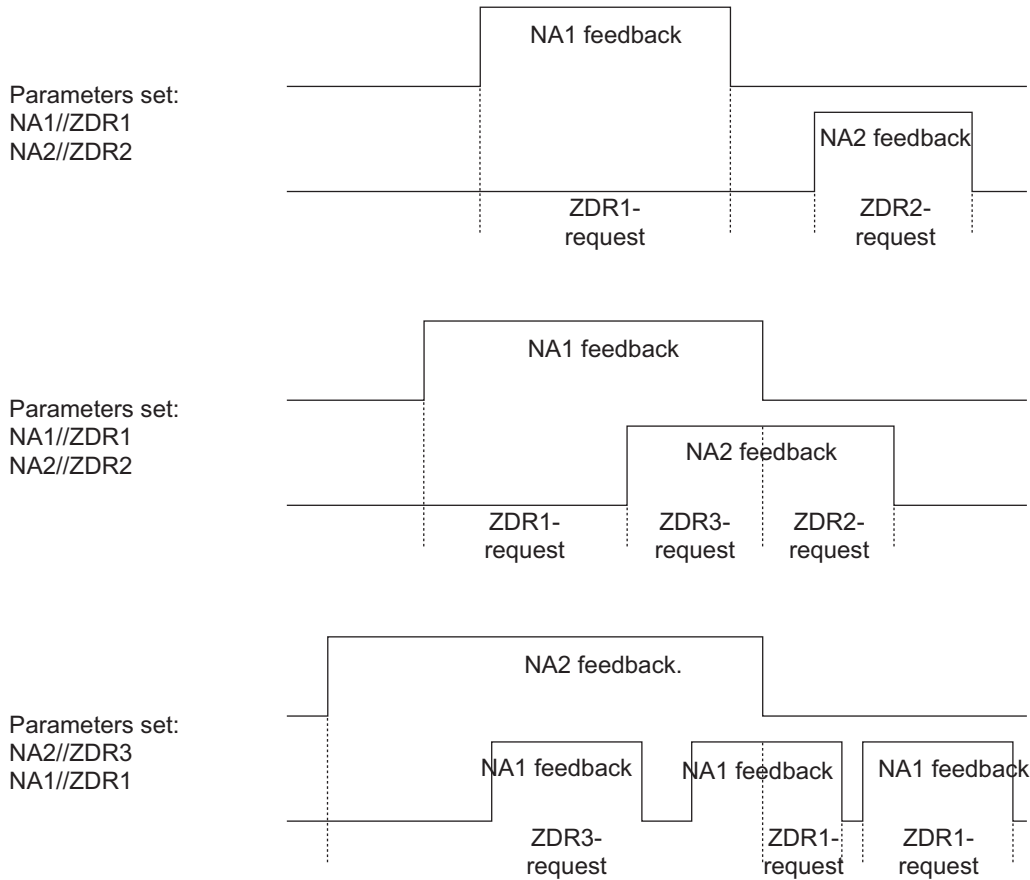
| | Digital inputs | A-CAN request |
|--------------------|----------------|---------------|
| WSK open | X | |
| Up-shift interlock | X | |

- NA-ZDR connection:

For each power take-off (NA1, NA2, NMV) any ZDR mode can be ascribed. The ZDR request is created when a feedback signal is present (for NA1 and NA2). For NMV, the ZDR request is created by a feedback signal or an NMV request (parameter). The ZDR mode which is allocated to the power take-offs is only processed when the parameter is set at "evaluate" (see table, page 15). If several power take-offs are activated at the same time, the resulting ZDR mode is created from the association of the values set as parameters, as though the corresponding ZDR pins were activated on the VMC (FFR) interface. The request for a ZDR mode via the KSM has precedence over possible connections from the ZDR pins on VMC module X1996.

| FFR interface | X1996/2 | X1996/7 | X1996/8 |
|---------------|---------|---------|---------|
| ZDR1 | X | | |
| ZDR2 | | X | |
| ZDR3 | X | X | |
| ZDR4 | | | X |
| ZDR5 | X | | X |
| ZDR6 | | X | X |
| ZDR7 | X | X | X |

Examples:



Important:

The requested ZDR is only activated in the VMC (FFR) when corresponding conditions are set as parameters in the requested ZDR mode (e.g. gearbox N).

Factory setting:

Parameter "NA-ZDRx link" in the KSM:

| NA-ZDR link | NA1 (FFR) | NA2 (FFR) | NMV (KSM) |
|---|-------------------|-------------------|-----------|
| ZDR1 | X | X | |
| ZDR2 | | | |
| ZDR3 | | | X |
| ZDR4 | | | |
| ZDR5 | | | |
| ZDR6 | | | |
| ZDR7 | | | |
| ZDR mode not evaluated | X | X | X |
| ZDR mode - evaluate if there is NA feedback | | | |
| ZDR mode - evaluate if there is NA feedback | --- ¹⁾ | --- ¹⁾ | |

¹⁾ Parameters not possible with NA1 and NA2, only with NMV.

- A-CAN interface
For possible parameters which can be set, see Chapter 7.2

7. A-CAN Interface with FMS Interface

7.1. General points

For communication purposes the A-CAN (body constructors' CAN) offers a High-Speed CAN-interface ISO 11898-24V and specification 2.0B. The data transmission speed is 250kbit/s. To protect the MAN CAN-integrated net system on the vehicle against external interference/influences, the CAN is fully galvanically separated.

A 120Ω terminal resistor is included in the KSM as A-CAN bus termination; a CAN filter choke is also provided.

The CAN-data communication lead is a 2-wire twisted lead running up to the interface (MAN part number: 07.08132.4384). The lead from the interface to the body-side control unit (e.g. telematics module) should be as short as possible – for electromagnetic reasons – and must be in twisted form (see ISO 11898-24V). Here too, use leads with MAN article number 07.08132.4384.

For this MAN recommends leads with MAN article number 07.08132.4384 (FLRY-2x0.75-B-28-or-bror).

Important:

Untwisting of the CAN leads must be avoided at all costs, in order to exclude electromagnetic influences which could interfere with the operation of the CAN bus.

If it is not possible to avoid untwisting, for example at a plug connection, the untwisted part of the lead should be kept as short as possible.

MAN's definition of the A-CAN is based on SAE J1939/ff.

The identification numbers in brackets relate to SAE J1939/71 "VEHICLE APPLICATION LAYER". Implementation of the FMS interface is based on the "FMS-standard interface" jointly specified by several European truck manufacturers (www.fms-standard.com).

7.2. Setting parameters for the A-CAN

- Every message which the KSM receives on the T-CAN can also be sent to the A-CAN.
- By means of MAN-cats II, parameters can be set for every A-CAN message received (KSM1_A, KSM2_A), causing them to be either ignored or further processed by the KSM.

Factory setting:

| Message | "Not received" | "Received" |
|---------|----------------|------------|
| KSM1_A: | X | |
| KSM2_A: | X | |

- Parameters can also be set for the reception time-out, and if required, for the identifier of the received message as well.
- Using MAN-cats II, parameters can be set for both received messages to provide a "dead time" starting with terminal 15 "on". The actual time-out monitoring of the messages from the body electronics to the KSM will only start upon expiry of this period. By this means it is possible to make an adjustment to the KSM to allow for the possible "run-up time" of the body electronic equipment, without it being necessary to extend the actual time-out monitoring period for the KSM received messages (KSM1_A, KSM2_A).

Factory setting:

| | |
|---|--------|
| Dead time start time-out recognition KSM1_A | 5000ms |
| Dead time start time-out recognition KSM2_A | 5000ms |

7.3. Information on vehicle operating status on the A-CAN

Depending on the amount of equipment on the vehicle and the parameters set in the KSM, it is possible to make available the following information from the body electronic equipment via the A-CAN:

| A-CAN messages sent | KSM with body equipment functions | KSM with FMS and body equipment functions (FUP 81.25890.0444) | KSM with FMS without body equipment functions (FUP 81.25890.1111) |
|-------------------------------|-----------------------------------|---|---|
| ETC1 | x | x | |
| ETC2 | x | x | |
| ETC3 | x | x | |
| EBC1 | x | x | |
| Amb_Cond | x | x | |
| Aux_Stat_ZBR1 | x | x | |
| ECAM1 | x | x | |
| Time_date | x | x | |
| EngFlui_LevPressure | x | x | |
| ERC1_Rx | | x | |
| ERC1_RD/ERC1_RE | | | |
| Fuel_ECO | x | x | |
| Aux_Stat_KSM1 | x | x | |
| Veh_distance | x | x | x |
| Veh_weight EBS/ECAS | x | x | x |
| Eng_hours, Revolutions | x | x | x |
| TCO1 | x | x | x |
| CCVS | x | x | x |
| Eng_Temp | x | x | x |
| EEC1 | x | x | x |
| EEC2 | | x | x |
| Fuel_consumption | | x | x |
| FMS_SW_Identification | | x | x |
| Dash_display | | x | x |
| Service | | x | x |
| BAM_MTCO_VIN | | x | x |
| P_MTCO_VIN | | x | x |

Note:

x = message to be sent to the A-CAN

Bold = messages included in the "FMS standard interface" specification

ERC1_RE is only sent if a primary retarder is installed; ERC1_RB is only sent if a secondary retarder is installed. The signals which are available for the CAN messages are stated in Chapter 7.5.

Important:

When the KSM is configured with function parameter 81.25816.1111 (FMS without KSM functionality), this only prepares the FMS interface - the usual KSM functions (output of switching signals, carrying out engine intervention functions (limiting engine speed/torque/demands etc.)) are not available.

7.4. Possible requests to the KSM via the A-CAN

The KSM can accept on the A-CAN the following requests from the body electronic equipment for further processing by the KSM/FFR:

- Torque request/torque limiting
- Engine speed request/rev limiting
- Request for intermediate engine speed controller ZDR mode S, 1-7
- Request for ZDR operation (SET+/-, MEM, OFF)
- Maximum speed limiting
- External engine start/stop (on engines with inline injection pumps [EDC MS6.1] only engine stop is possible; on common rail engines [EDC7] engine start and stop are possible.
- NMV demand
- External neutral demand for gearboxes with automated gear shift and automatic transmissions
- Demand: WSK open/blocking of up-shift for HP transmissions (ECOMAT)

7.5 A-CAN output messages

The following output messages can be prepared by the KSM on the A-CAN:
ETC1: Electronic Transmission Controller #1 (3.3.5 = Chapter of SAE J1939/ff)

0CF00203

| Transmission repetition rate | Data length | PDU format | PDU specific | Default priority | Parameter group number | Identifier |
|------------------------------|-------------|------------|--------------|------------------|------------------------|------------|
| 10 ms | 8 bytes | 240 | 2 | 3 | 0x00F002 | 0x0CF00203 |

| Byte | Bit | Description | | |
|---------|---------|---|----------------------|-----------------------------|
| 1 | 8 to 3 | XX (non-essential information for body constructor) | | |
| | 2 and 1 | [driveline_engaged] (3.2.2.6) | | |
| | | 00 | Driveline disengaged | |
| | | 01 | Driveline engaged | |
| | | 10 | error | |
| | 11 | not available | | |
| 2 and 3 | --- | [output_speed_TCU] (3.2.1.14) | | |
| | | rpm per Bit = 0.125 | Offset [rpm] = 0 | Range [rpm] = 0 to 8031,875 |
| 4 | --- | [clutch_slip] (3.2.1.20) | | |
| | | % per Bit = 0,4 | Offset [%] = 0 | Range [%] = 0 to 100 |
| 5 | --- | XX | | |
| 6 and 7 | --- | [input_speed] (3.2.5.55) | | |
| | | rpm per bit = 0,125 | Offset [rpm] = 0 | Range [rpm] = 0 to 8031,875 |
| 8 | --- | XX | | |

ETC2: Electronic Transmission Controller #2 (3.3.8)

18F00503

| Transmission repetition rate | Data length | PDU format | PDU specific | Default priority | Parameter group number | Identifier |
|------------------------------|-------------|------------|--------------|------------------|------------------------|------------|
| 100 ms | 8 bytes | 240 | 5 | 6 | 0x00F005 | 0x18F00503 |

| Byte | Bit | Description | | |
|---------|-----|--------------------------------|------------------------------------|----------------------|
| 1 | --- | [selected_gear] (3.2.1.23) | | |
| | | Offset = -125 ¹⁾ | Range = -125 ... 125 ¹⁾ | |
| 2 and 3 | --- | [actual_gear_ratio] (3.2.1.25) | | |
| | | 0.001 per Bit | Offset = 0 | Range = 0 ... 64.255 |
| 4 | --- | [current_gear] (3.1.2.22) | | |
| | | Offset = -125 ¹⁾ | Range = -125 ... 125 ¹⁾ | |
| 5 to 8 | --- | XX | | |

Note:

Values with a positive sign represent forward gears, values with a negative sign reverse gears. The value "0" is used for gearbox neutral, the value "126" for the "Park" position (automatic transmissions).

| Transmission repetition rate | Data length | PDU format | PDU specific | Default priority | Parameter group number | Identifier |
|-----------------------------------|-------------|------------|--------------|------------------|------------------------|------------|
| Every second, or on status change | 8 bytes | 254 | 199 | 7 | 0x00FEC7 | 0x1CFEC703 |

| Byte | Bit | Description | |
|---------|-----------------------------------|---|-------------|
| 1 and 2 | --- | XX | |
| 3 | 8 to 5 | XX | |
| | 4 and 3 | Engagement indicator [shift_finger_status_1] (3.2.6.20) | |
| | | 00 | off |
| | | 01 | on |
| | | 10 | error |
| | 11 | not available | |
| | 2 and 1 | Neutral indicator (3.2.6.19) | |
| | | 00 | off |
| | | 01 | on |
| | | 10 | error |
| 11 | not available | | |
| 4 to 6 | --- | XX | |
| 7 | PTO status (not acc. to J1939/71) | | |
| | 8 and 7 | NMV_state | |
| | | x1 | activated |
| | | 1x | engaged |
| | 6 to 4 | [PTO2_state] | |
| | | 0x1 | activated |
| | | 01x | engaged |
| | | 1xx | Not defined |
| | 3 to 1 | [PTO1_state] | |
| | | 0x1 | activated |
| | | 01x | engaged |
| | | 1xx | Not defined |
| 8 | --- | XX | |

Note:
The power take off status is not defined according to SAE 1939/71.

Ccveh_speed: Cruise control/vehicle speed (3.3.31)

18FEF100

| Transmission repetition rate | Data length | PDU format | PDU specific | Default priority | Parameter group number | Identifier |
|------------------------------|-------------|------------|--------------|------------------|------------------------|------------|
| 100 ms | 8 bytes | 254 | 241 | 6 | 0x00FEF1 | 0x18FEF100 |

| Byte | Bit | Description | | |
|---------|---------------|-------------------------------|-----------------------------|--------------------------|
| 1 | 8 to 5 | XX | | |
| | 4 and 3 | [park_brake_switch] (3.2.6.8) | | |
| | | 00 | Parking brake not set | |
| | | 01 | Parking brake set | |
| | | 10 | error | |
| | 11 | not available | | |
| 2 and 1 | XX | | | |
| 2 and 3 | --- | [veh_speed_FFR] (3.2.1.12) | | |
| | | km/h per Bit = 1/256 | Offset [km/h] = 0 | Range [km/h] = 0 ... 251 |
| 4 | 8 and 7 | [clutch_switch] (3.2.6.12) | | |
| | | 00 | Clutch pedal released | |
| | | 01 | Clutch pedal depressed | |
| | | 10 | error | |
| | | 11 | not available | |
| | 6 and 5 | [brake_switch] (3.2.6.11) | | |
| | | 00 | Brake pedal released | |
| | | 01 | Brake pedal depressed | |
| | | 10 | error | |
| | 11 | not available | | |
| | 4 and 3 | XX | | |
| | 2 and 1 | [CC_active] (3.2.6.9) | | |
| | | 00 | Cruise control switched off | |
| | | 01 | Cruise control switched on | |
| 10 | | error | | |
| 11 | not available | | | |
| 5 to 6 | --- | XX | | |
| 7 | 8 to 6 | XX | | |
| | 5 to 1 | [PTO_state] (3.2.2.19) | | |
| | | 00000 | Off/disabled | |
| | | 00101 | Set | |
| 11111 | not available | | | |
| 8 | --- | XX | | |

| Transmission repetition rate | Data length | PDU format | PDU specific | Default priority | Parameter group number | Identifier |
|------------------------------|-------------|------------|--------------|------------------|------------------------|------------|
| 100 ms | 8 bytes | 240 | 1 | 6 | 0x00F001 | 0x18F0010B |

| Byte | Bit | Description | | |
|--------|---------|---|---------------------------|---------------------|
| 1 | 8 and 7 | XX | | |
| | 6 and 5 | [ABS_active] (3.2.2.9) | | |
| | | 00 | ABS passive but installed | |
| | | 01 | ABS active | |
| | | 10 | reserved | |
| | 11 | don't care | | |
| 4 to 1 | XX | | | |
| 2 | --- | Brake pedal position [BP_position] (3.2.1.18) | | |
| | | 0.4% per Bit | Offset = 0 % | Range = 0% ... 100% |
| 3 to 8 | --- | X | | |

AUX_STAT_ZBR1: Auxiliary state I/O body controller #1

0x18FFA121

| Transmission repetition rate | Data length | PDU format | PDU specific | Default priority | Parameter group number | Identifier |
|-----------------------------------|-------------|------------|-----------------------|------------------|------------------------|------------|
| Every second, or on status change | 8 bytes | 255 | 161/A1 _{hex} | 6 | 0x00FFA1 | 0x18FFA121 |

| Byte | Bit | Description | |
|--------|---------|---|---------------|
| 1 | 8 and 7 | Reverse gear engaged | |
| | | 00 | off |
| | | 01 | on |
| | | 10 | error |
| | | 11 | not available |
| | 6 and 5 | Info fuel level too low in current tank | |
| | | 00 | off |
| | | 01 | on |
| | | 10 | error |
| | | 11 | not available |
| 4 to 1 | XX | | |
| 8 to 3 | XX | | |
| 2 | 2 and 1 | Info NOT-OFF | |
| | | 00 | off |
| | | 01 | on |
| | | 10 | error |
| | | 11 | not available |
| 3 to 8 | --- | XX | |

ETC1: Electronic engine controller #1 (3.3.7)

OCF00400

| Transmission repetition rate | Data length | PDU format | PDU specific | Default priority | Parameter group number | Identifier |
|------------------------------|-------------|------------|--------------|------------------|------------------------|------------|
| 20 ms | 8 bytes | 240 | 4 | 3 | 0x00F004 | OCF00400 |

| Byte | Bit | Description | | |
|---------|-----|---|-----------------|--------------------------------|
| 1 and 2 | --- | XX | | |
| 3 | --- | Actual engine torque [act_eng_torque] (3.2.1.5) | | |
| | | 1% per Bit | Offset = -125 % | Range = -125% ... 125% |
| 4 and 5 | --- | Engine speed [engine_speed] (3.2.1.9) | | |
| | | 0.125 rpm per Bit | Offset = 0 rpm | Range = 0 rpm ... 8031.875 rpm |
| 6 to 8 | --- | XX | | |

ETC2: Electronic engine controller #2 (3.3.6)

OCF00300

| Transmission repetition rate | Data length | PDU format | PDU specific | Default priority | Parameter group number | Identifier |
|------------------------------|-------------|------------|--------------|------------------|------------------------|------------|
| 50 ms | 8 bytes | 240 | 3 | 3 | 0x00F003 | 0x00F00300 |

| Byte | Bit | Description | | |
|--------|---------------|---|------------------------------|---------------------|
| 1 | 8 to 5 | not defined | | |
| | 4 to 3 | Accelerator pedal (AP) kickdown switch [AP_kickdown_sw] (3.2.2.5) | | |
| | | 00 | Kickdown passive | |
| | | 01 | Kickdown active | |
| | | 10 | error | |
| | 11 | not available | | |
| | 2 and 1 | Idle position (AP low idle switch) [AP_low_idle_sw] (3.2.2.4) | | |
| | | 00 | AP not in low idle condition | |
| | | 01 | AP in low idle condition | |
| | | 10 | error | |
| 11 | not available | | | |
| 2 | --- | Accelerator pedal (AP) position [AP_position] (3.2.1.8) | | |
| | | 0.4 % per Bit | Offset = 0 % | Range = 0% ... 100% |
| 3 | --- | Load at current speed [load_curr_speed] (3.2.1.7) | | |
| | | 1 % per Bit | Offset = 0 % | Range = 0% ... 100% |
| 4 to 8 | --- | XX | | |

EngFlui_LevPre: Engine fluid level/pressure (3.3.29)

18FEEF00

| Transmission repetition rate | Data length | PDU format | PDU specific | Default priority | Parameter group number | Identifier |
|------------------------------|-------------|------------|--------------|------------------|------------------------|------------|
| 500 ms | 8 bytes | 254 | 239 | 6 | 0x00FEEF | 0x00FEEF0 |

| Byte | Bit | Description | | |
|--------|-----|--|-----------------|--------------------------|
| 1 to 3 | --- | XX | | |
| 4 | --- | Engine oil pressure [eng_oil_press] (3.2.5.28) | | |
| | | 40 mbar per Bit | Offset = 0 mbar | Range = 0 bar ... 10 bar |
| 5 to 8 | --- | XX | | |

Eng_Temp: Engine Temperature (3.3.28)

18FEEE00

| Transmission repetition rate | Data length | PDU format | PDU specific | Default priority | Parameter group number | Identifier |
|------------------------------|-------------|------------|--------------|------------------|------------------------|------------|
| 1 s | 8 bytes | 254 | 238 | 6 | 0x00FEEE | 0x00FEEE0 |

| Byte | Bit | Description | | |
|---------|-----|--|------------------|---------------------------|
| 1 | --- | Engine coolant temperature [eng_cool_temp] (3.2.5.5) | | |
| | | 1 °C per Bit | Offset = -40 °C | Range = -40 °C ... 210 °C |
| 2 | --- | Fuel temperature [fuel_temp] (3.2.5.14) | | |
| | | 1 °C per Bit | Offset = -40 °C | Range = -40 °C ... 210 °C |
| 3 and 4 | --- | Engine oil temperature [eng_oil_temp] (3.2.5.15) | | |
| | | 0.03125 °C per Bit | Offset = -273 °C | Range = -273°C ... 1735°C |
| 5 to 8 | --- | XX | | |

ECAM1: Supply pressure 3.3.75 (ECAM1)

18FEAE30

| Transmission repetition rate | Data length | PDU format | PDU specific | Default priority | Parameter group number | Identifier |
|------------------------------|-------------|------------|--------------|------------------|------------------------|------------|
| 1 s | 8 bytes | 254 | 174 | 6 | 65,198 | 0x18FEAE30 |

| Byte | Bit | Description |
|--------|-----|---|
| 1 | --- | SAE: parking and /or trailer air pressure (MAN: circuit 3 {23}) [park_trailer_press] |
| 2 | --- | SAE: Parking and /or trailer air pressure (MAN: circuit 3 {23}) [park_trailer_press] |
| 3 | --- | SAE: Service brake air pressure, circuit #1 (MAN: circuit 1 {21}) [serv_brake_press1] |
| 4 | --- | SAE: Service brake air pressure, circuit #2 (MAN: circuit 2 {22}) [serv_brake_press2] |
| 5 | --- | SAE: Auxiliary equipment supply pressure (MAN: circuit 4 {24}) [aux equip_press] |
| 6 | --- | SAE: Air suspension pressure (MAN: pilot circuit) [air_susp_press] |
| 7 to 8 | --- | XX |

Note:

| | | |
|---|-----------------|--------------------------|
| For MAN byte 6 does not reflect the air suspension pressure | | |
| Resolution for Byte 1 to 6 | | |
| 80 mbar per Bit | Offset = 0 mbar | Range = 0 bar ... 20 bar |

Amb_Cond: Ambient conditions (3.3.35)

18FEF500

| Transmission repetition rate | Data length | PDU format | PDU specific | Default priority | Parameter group number | Identifier |
|------------------------------|-------------|------------|--------------|------------------|------------------------|------------|
| 1 s | 8 bytes | 254 | 245 | 6 | 0x00FEF5 | 0x00FEF500 |

| Byte | Bit | Description |
|---------|-----|---|
| 1 | --- | Barometric pressure [barometric_press] (3.2.5.43)* |
| | | 5 mbar per Bit Offset = 0 mbar Range = 0 ... 1.25 bar |
| 2 and 3 | --- | XX |
| 4 and 5 | --- | Ambient air temperature [amb_air_temp] (3.2.5.12) |
| | | 0.03125 °C per Bit Offset = -273 °C Range = -273 ... 1735.0°C |
| 6 to 8 | --- | XX |

*Important:
These values cannot be calibrated

Time_Date: Time /Date (3.3.20)

18FEE6EE

| Transmission repetition rate | Data length | PDU format | PDU specific | Default priority | Parameter group number | Identifier |
|------------------------------|-------------|------------|--------------|------------------|------------------------|------------|
| 1 s | 8 bytes | 254 | 230 | 6 | FF0A | 18FEE6EE |

| Byte | Bit | Description | | |
|------|-----|--|----------------------|--------------------------------|
| 1 | --- | Seconds [seconds] (3.2.5.93) | | |
| | | 0,25 s per Bit | Offset = 0 s | Range = 0 ... 59.75 s |
| 2 | --- | Minutes [minutes] (3.2.5.94) | | |
| | | 1 min per Bit | Offset = 0 min | Range = 0 ... 59 min |
| 3 | --- | Hours [hours] (3.2.5.110) | | |
| | | 1 h per Bit | Offset = 0 h | Range = 0 ... 23 h |
| 4 | --- | Month [month] (3.2.5.112) ¹ | | |
| | | 1 Month per Bit | Offset = 0 months | Range = 0 ... 12 months |
| 5 | --- | Day [day] (3.2.5.111) ² | | |
| | | 0.25 days per Bit | Offset = 0 days | Range = 0 ... 31.75 days |
| 6 | --- | Year [year] (3.2.5.113) | | |
| | | 1 year per Bit | Offset = +1985 years | Range = 1985 ... 2235 years |
| 7 | --- | (Local Minute Offset) (3.2.5.296) | | |
| | | 1 min per Bit | Offset = -125 min | Range = from -59min to +59 min |
| 8 | --- | (Local Hour Offset) (3.2.5.297) | | |
| | | 1 h per Bit | Offset = -125 h | Range = from -23 h to +23 h |

Note:

¹ The value "0" is not used. The value "1" corresponds to the month of January, the value "2" to the month of February etc.

² The value "0" is not used. The values 1 to 4 (0,25 days/Bit) correspond to the first day of the month, the values 5 to 8 to the second day of the month etc.

Veh_dist: Vehicle Distance high resolution (3.3.54)

18FEC1EE

| Transmission repetition rate | Data length | PDU format | PDU specific | Default priority | Parameter group number | Identifier |
|------------------------------|-------------|------------|--------------|------------------|------------------------|------------|
| 1 s | 8 bytes | 254 | 193 | 6 | FEC1 | 18FEC1EE |

| Byte | Bit | Description | | |
|--------|-----|---|--------------|-----------------------------|
| 1 to 4 | --- | Total kilometrage (high resolution total vehicle distance) [tot_veh_dist] (3.2.5.106) | | |
| | | 5 m per Bit | Offset = 0 m | Range = 0 ... 21 055 406 km |
| 5 to 8 | --- | Daily kilometre counter (high resolution trip distance) [trip_distance] (3.2.5.107) | | |
| | | 5 m per Bit | Offset = 0 m | Range = 0 ... 21 055 406 km |

Eng_HourRev: Engine Hours, Revolutions (3.3.19)

18FEE527

| Transmission repetition rate | Data length | PDU format | PDU specific | Default priority | Parameter group number | Identifier |
|------------------------------|-------------|------------|--------------|------------------|------------------------|------------|
| 1 s | 8 bytes | 254 | 229 | 6 | 0x00FEE5 | 18FEE527 |

| Byte | Bit | Description | | |
|--------|-----|---|--------------|--------------------------------|
| 1 to 4 | --- | Total engine hours [total_eng_hours] (3.2.5.61) | | |
| | | 0,05 h per Bit | Offset = 0 h | Range = 0 ... 210 554 060.75 h |
| 5 to 8 | | XX | | |

Veh_Weight_EBS: Vehicle weight EBS

18FEEA0B

| Transmission repetition rate | Data length | PDU format | PDU specific | Default priority | Parameter group number | Identifier |
|------------------------------|-------------|------------|--------------|------------------|------------------------|------------|
| 1 s | 8 bytes | 254 | 234 | 6 | 65,258 | 18FEEA0B |

| Byte | Bit | Description | | |
|---------|---------|--|---------------|-----------------------------|
| 1 | 8 to 5 | Axle location [axle_location] (3.2.5.95) | | |
| | | 0000 | Axle 1 | |
| | | 0001 | Axle 2 | |
| | | 0010 | Axle 3 | |
| | | 0011 | Axle 4 | |
| | | 0100 | Axle 5 | |
| | | 0101 | Axle 6 | |
| | | 0110 | Axle 7 | |
| | | 0111 | Axle 8 | |
| | | 1000 | Axle 9 | |
| | | 1001 | Axle 10 | |
| | | 1010 | Axle 11 | |
| | | 1011 | Axle 12 | |
| | | 1100 | Axle 13 | |
| | | 1101 | Axle 14 | |
| | | 1110 | Axle 15 | |
| 1111 | Axle 16 | | | |
| | 4 to 1 | --- | not available | |
| 2 and 3 | --- | Axle weight [axle_weight] (3.2.5.80) | | |
| | | 0,5 kg per Bit | Offset = 0 kg | Range = 0 kg ... 32127.5 kg |
| 4 to 8 | --- | XX | | |

Important:

The axle loads shown cannot be calibrated; variations of up to some hundred kilograms are normal.

The information shown does not represent a standard part of the instrument display functions.

The functions shown here depend on vehicle equipment and are restricted to this interface.

Veh_Weight_EACS: Vehicle weight EACS

18FEEA2F

| Transmission repetition rate | Data length | PDU format | PDU specific | Default priority | Parameter group number | Identifier |
|------------------------------|-------------|------------|--------------|------------------|------------------------|------------|
| 1 s | 8 bytes | 254 | 234 | 6 | 00FEEA | 18FEEA2F |

| Byte | Bit | Description | | |
|---------|--------|--|---------------|-----------------------------|
| 1 | 8 to 5 | Axle location [axle_location] (3.2.5.95) | | |
| | | 0000 | Axle 1 | |
| | | 0001 | Axle 2 | |
| | | 0010 | Axle 3 | |
| | | 0011 | Axle 4 | |
| | | 0100 | Axle 5 | |
| | | 0101 | Axle 6 | |
| | | 0110 | Axle 7 | |
| | | 0111 | Axle 8 | |
| | | 1000 | Axle 9 | |
| | | 1001 | Axle 10 | |
| | | 1010 | Axle 11 | |
| | | 1011 | Axle 12 | |
| | | 1100 | Axle 13 | |
| | | 1101 | Axle 14 | |
| | | 1110 | Axle 15 | |
| | | 1111 | Axle 16 | |
| | 4 to 1 | --- | not available | |
| 2 and 3 | --- | Axle weight [axle_weight] (3.2.5.80) | | |
| | | 0,5 kg per Bit | Offset = 0 kg | Range = 0 kg ... 32127.5 kg |
| 4 to 8 | --- | XX | | |

| Transmission repetition rate | Data length | PDU format | PDU specific | Default priority | Parameter group number | Identifier |
|------------------------------|-------------|------------|--------------|------------------|------------------------|------------|
| 50 ms | 8 bytes | 254d | 108d | 3 | FE6C | 0CFE6CEE |

| Byte | Bit | Description | |
|------|---------|------------------------------------|---------------------------------|
| 1 | 8 and 7 | Drive recognition (3.2.6.78) | |
| | | 00 | off/vehicle motion not detected |
| | | 01 | on/vehicle motion detected |
| | | 10 | error |
| | | 11 | not available |
| | 6 to 4 | Driver 2 Working status (3.2.6.77) | |
| | | 000 | rest |
| | | 001 | available |
| | | 010 | work |
| | | 011 | drive |
| | | 100 | reserved |
| | | 101 | reserved |
| | | 110 | reserved |
| | 111 | not available | |
| | 3 to 1 | Driver 1 Working status (3.2.6.78) | |
| | | 000 | rest |
| | | 001 | available |
| | | 010 | work |
| | | 011 | drive |
| | | 100 | reserved |
| | | 101 | reserved |
| | | 110 | reserved |
| | 111 | not available | |

TCO1: Tachograph

0CFE6CEE

| Transmission repetition rate | Data length | PDU format | PDU specific | Default priority | Parameter group number | Identifier |
|------------------------------|-------------|------------|--------------|------------------|------------------------|------------|
| 50 ms | 8 bytes | 254d | 108d | 3 | FE6C | 0CFE6CEE |

| Byte | Bit | Description | |
|------|-------------------------|---|-------------------------|
| 2 | --- | Not used by MTCO | |
| | 8 and 7 | overspeed (3.2.6.81) | |
| | | 00 | no overspeed |
| | | 01 | overspeed |
| | | 10 | error |
| | | 11 | not available |
| | 6 and 5 | driver card 1 (3.2.6.80) | |
| | | 00 | no card present |
| | | 01 | card present |
| | | 10 | driver card malfunction |
| | | 11 | not available |
| | 4 and 1 | driver 1 time related states (3.2.6.79) | |
| | | 0000 | no warning |
| | | 0001 | warning #1 |
| | | 0010 | warning #2 |
| | | 0011 | warning #3 |
| | | 0100 | warning #4 |
| | | 0101 | warning #5 |
| | | 0110 | reserved for future use |
| | | 0111 | reserved for future use |
| | | 1000 | reserved for future use |
| | | 1001 | reserved for future use |
| | | 1010 | reserved for future use |
| 1011 | | reserved for future use | |
| 1100 | reserved for future use | | |
| 1101 | reserved for future use | | |
| 1110 | error | | |
| 1111 | not available | | |

| Transmission repetition rate | Data length | PDU format | PDU specific | Default priority | Parameter group number | Identifier |
|------------------------------|-------------|------------|--------------|------------------|------------------------|------------|
| 50 ms | 8 bytes | 254d | 108d | 3 | FE6C | 0CFE6CEE |

| Byte | Bit | Description | |
|------|---------------|---|-------------------------|
| 3 | --- | Not used by MTCO not defined | |
| | 8 and 7 | driver card 2 (3.2.6.80) | |
| | 6 and 5 | 00 | no card present |
| | | 01 | card present |
| | | 10 | driver card malfunction |
| | | 11 | not available |
| | 4 to 1 | driver 2 time related states (3.2.6.79) | |
| | | 0000 | no warning |
| | | 0001 | warning #1 |
| | | 0010 | warning #2 |
| | | 0011 | warning #3 |
| | | 0100 | warning #4 |
| | | 0101 | warning #5 |
| | | 0110 | reserved for future use |
| | | 0111 | reserved for future use |
| | | 1000 | reserved for future use |
| | | 1001 | reserved for future use |
| | | 1010 | reserved for future use |
| | | 1011 | reserved for future use |
| | | 1100 | reserved for future use |
| 1101 | | reserved for future use | |
| 1110 | | error | |
| 1111 | not available | | |

Table to identify the warnings in parameter driver x time related states
 Type: European Community regulation

| | | |
|------|------------|--------------------|
| 0000 | no warning | [0h .. 4 1/4h] |
| 0001 | warning #1 | [4 1/4h .. 4 1/2h] |
| 0010 | warning #2 | [4 1/2h .. 8 3/4h] |
| 0011 | warning #3 | [8 3/4h .. 9h] |
| 0100 | warning #4 | [9h .. 15 3/4h] |
| 0101 | warning #5 | [15 3/4h .. 16h] |

TCO1: Tachograph

0CFE6CEE

| Transmission repetition rate | Data length | PDU format | PDU specific | Default priority | Parameter group number | Identifier |
|------------------------------|-------------|------------|--------------|------------------|------------------------|------------|
| 50 ms | 8 bytes | 254d | 108d | 3 | FE6C | 0CFE6CEE |

| Byte | Bit | Description | | |
|---------|--------|--|---|---------------------------------|
| 4 | 8 to 7 | not defined | | |
| | 6 to 5 | system performance (3.2.6.84) | | |
| | | 00 | system performance o.k. | |
| | | 01 | faulty system performance | |
| | | 10 | error | |
| | 4 to 3 | 11 | not available | |
| | | handling information e.g. no record sheet (3.2.6.83) | | |
| | | 00 | no handling info | |
| | | 01 | handling info | |
| | 2 to 1 | 10 | error | |
| | | 11 | not available | |
| | | system event (3.2.6.82) | | |
| | | 00 | no system event | |
| | | 01 | system event | |
| | | 10 | error | |
| | | 11 | not available | |
| 5 and 6 | | --- | XX | |
| 7 and 8 | --- | Tachograph vehicle speed [veh_speed_MTCO] (3.2.1.12) | | |
| | | 1/256 km/h per Bit | Offset = 0 km/h (upper byte resolution 1.0 km/h/bit) | Range = 0 km/h ... 250,996 km/h |

ERC1_RX: Electronic retarder controller retarder exhaust (5.3.3)

18F00029

| Transmission repetition rate | Data length | PDU format | PDU specific | Default priority | Parameter group number | Identifier |
|------------------------------|-------------|------------|--------------|------------------|------------------------|------------|
| 100 s | 8 bytes | 240 | 0 | 6 | 0x00F000 | 0x18F00029 |

| Byte | Bit | Description | | |
|---------|-----|--|---------------|----------------------|
| 1 | --- | XX | | |
| 2 | --- | Actual retarder torque ¹ [act_rx_torque] (3.2.1.17) | | |
| | | 1% per Bit | Offset = 125% | Range = -125% ... 0% |
| 3 bis 8 | | XX | | |

¹ Only used if engine brake is fitted (parameters set via FFR)

Important:
It is not permissible to deactivate any ERC1 message that may be present.

| Transmission repetition rate | Data length | PDU format | PDU specific | Default priority | Parameter group number | Identifier |
|------------------------------|-------------|------------|--------------|------------------|------------------------|------------|
| 10 ms | 8 bytes | 253 | 109 | 7 | FDD1 | 1CFDD1FD |

| Byte | Bit | Description | |
|------------|---------|--|------------------------------|
| 1 | 8 to 5 | Reserved for FMS-standard | |
| | 4 and 3 | requests supported | |
| | | 00 | request is not supported |
| | | 01 | request is supported |
| | | 10 | reserved |
| | 2 and 1 | 11 | don't care |
| | | diagnostics supported | |
| | | 00 | diagnostics is not supported |
| | | 01 | diagnostics is supported |
| | 2 to 5 | 10 | reserved |
| | | 11 | don't care |
| | | software version supported | |
| Byte 2 = a | | The Software Version is represented in ASCII-Code in the following Format: ab.cd(SW-Version number in the format ab.cd (ASCII) representing) | |
| Byte 3 = b | | | |
| Byte 4 = c | | | |
| Byte 5 = d | | | |
| 5 and 6 | --- | XX | |
| 6 to 8 | --- | Reserved for FMS-standard | |

| Transmission repetition rate | Data length | PDU format | PDU specific | Default priority | Parameter group number | Identifier |
|------------------------------|-------------|------------|--------------|------------------|------------------------|------------|
| 1 s | 8 bytes | 254 | 192 | 6 | FECO | 18FEC027 |

| Byte | Bit | Description | | |
|---------|-----|---|---------------------|----------------------------------|
| 1 | --- | XX | | |
| 2 and 3 | --- | Service distance [service_distance] (3.2.5.103) | | |
| | | 5 km per Bit | Offset = -160635 km | Range = -160635 km ... 160640 km |
| 3 to 8 | --- | XX | | |

Fuel_cons: Fuel consumption (3.3.23)

18FEE927

| Transmission repetition rate | Data length | PDU format | PDU specific | Default priority | Parameter group number | Identifier |
|------------------------------|-------------|------------|--------------|------------------|------------------------|------------|
| 1 s | 8 bytes | 254 | 233 | 6 | FEE9 | 18FEE927 |

| Byte | Bit | Description | | | |
|--------|-----|--|--------------|--------------------------------|--|
| 1 to 4 | --- | XX | | | |
| 5 to 8 | --- | Total fuel used [total:fuel_used] (3.2.5.66) | | | |
| | | 0,5 l per bit | Offset = 0 l | Range = 0 l ... 2105540607.5 l | |

VIN: Vehicle identification number (3.3.26)

18FEECEE

| Transmission repetition rate | Data length | PDU format | PDU specific | Default priority | Parameter group number | Identifier |
|------------------------------|-------------|------------|--------------|------------------|------------------------|------------|
| 10 s | variable | 254 | 236 | 6 | FEEC | 18FEECEE |

As the VIN for MAN consists of more than 8 Bytes it is transmitted according to SAE1939/21 (Multipacket – Transport mechanism):

18ECFFEE (TP.BAM=Transport protocol_broadcast announce message)

18EBFFEE (TP.DT=Transport protocol_data transfer)

TP.BAM:

| | | |
|---------------|---------------------------------------|--------|
| Byte 1: | Control Byte | 20h |
| Byte 2 und 3: | Total message size, number of packets | 0011h |
| Byte 4: | Total number of packets | 03h |
| Byte 5: | Reserved | FFh |
| Byte 6 bis 8: | PGN of requested information (VIN) | 00FEEC |

TP.DT: Packet 1:

| | | |
|---------------|------------------|-------|
| Byte 1: | Sequence number | 01h |
| Byte 2 bis 8: | Bytes 1-7 of VIN | ASCII |

TP.DT: Packet 2:

| | | |
|---------------|-------------------|-------|
| Byte 1: | Sequence number | 02h |
| Byte 2 bis 8: | Bytes 8-14 of VIN | ASCII |

TP.DT: Packet 3:

| | | |
|---------------|--------------------|---------|
| Byte 1: | Sequence number | 03h |
| Byte 2 bis 4: | Bytes 15-17 of VIN | ASCII |
| Byte 5: | * = Delimiter | 2Ah |
| Byte 6 bis 8: | Filler bytes | FFFFFFh |

Dash display (3.3.042)

18FEFC21

| Transmission repetition rate | Data length | PDU format | PDU specific | Default priority | Parameter group number | Identifier |
|------------------------------|-------------|------------|--------------|------------------|------------------------|------------|
| 1 s | 8 bytes | 254 | 252 | 6 | FEFC | 18FEFC21 |

| Byte | Bit | Description | | | |
|--------|-----|------------------------------------|--------------|----------------------|--|
| 1 | --- | XX | | | |
| 2 | --- | Fuel level [fuel_level] (3.2.5.71) | | | |
| | | 0,4 % per Bit | Offset = 0 % | Range = 0 % ... 100% | |
| 3 to 8 | --- | XX | | | |

ERC1_RE (Primärretarder): Electronic Retarder Controller (3.3.3)

18F0000F

| Transmission repetition rate | Data length | PDU format | PDU specific | Default priority | Parameter group number | Identifier |
|------------------------------|-------------|------------|--------------|------------------|------------------------|------------|
| 100 s | 8 bytes | 240 | 0 | 6 | 0x00F000 | 18F0000F |

| | | | | | | |
|--------|-----|--|-----------------|-----------------------|--|--|
| 1 | --- | XX | | | | |
| 2 | --- | Actual retarder torque [act_ret_torque] (3.2.5.17) | | | | |
| | | 1 % per Bit | Offset = -125 % | Range = -125 % ... 0% | | |
| 3 to 8 | --- | XX | | | | |

ERC1_RD (Sekundärretarder): Electronic Retarder Controller (3.3.3)

18F00010

| Transmission repetition rate | Data length | PDU format | PDU specific | Default priority | Parameter group number | Identifier |
|------------------------------|-------------|------------|--------------|------------------|------------------------|------------|
| 100 s | 8 bytes | 240 | 0 | 6 | 0x00F000 | 18F00010 |

| | | | | | | |
|--------|-----|--|-----------------|-----------------------|--|--|
| 1 | --- | XX | | | | |
| 2 | --- | Actual retarder torque [act_ret_torque] (3.2.5.17) | | | | |
| | | 1 % per Bit | Offset = -125 % | Range = -125 % ... 0% | | |
| 3 to 8 | --- | XX | | | | |

Fuel_Eco: Fuel Economy (3.3.32)

18FEF227

| Transmission repetition rate | Data length | PDU format | PDU specific | Default priority | Parameter group number | Identifier |
|------------------------------|-------------|------------|--------------|------------------|------------------------|------------|
| 100 s | 8 bytes | 254 | 242 | 6 | 0x00FEF2 | 18FEF227 |

| | | | | | | |
|--------|-----|--|---|----------------------------------|--|--|
| 1 to 2 | --- | Fuel ratee [fuel_rate] (3.2.5.63) | | | | |
| | | 0,05 l/h per Bit | Offset = 0 l/h (13,9x10 ⁻⁶ l/s per bit) | Range = 0 ... 210 554 060,75 l/h | | |
| 3 to 4 | --- | Instantaneous fuel economy [instant_fuel_eco] (3.2.5.67) | | | | |
| | | 1/512 km/l per Bit | Offset = 0 km/l | Range = 0% ... 125,5 km/l | | |
| 5 to 8 | --- | XX | | | | |

Aux_Stat_KSM1

18FED9FD

| Transmission repetition rate | Data length | PDU format | PDU specific | Default priority | Parameter group number | Identifier |
|------------------------------|-------------|------------|--------------|------------------|------------------------|------------|
| 1 s | 8 bytes | 255 | 253 | 6 | FED9 | 18FED9FD |

| | Bit | Description | |
|---|---------|---|-------|
| 1 | 8 to 5 | XX | |
| | 4 and 3 | Oil pressure warning (oil pressure too low) | |
| | | 00 | off |
| | | 01 | on |
| | | 10 | error |
| | 11 | not available | |
| | 2 and 1 | Cooling water excess temperature warning (cooling water temperature too high) | |
| | | 00 | off |
| | | 01 | on |
| | | 10 | error |
| | 11 | not available | |

7.6 A-CAN input messages

The following received messages can be processed by the KSM and relayed to the FFR:
KSM1_A: Customer-specific control module #1– body

0CEFFD55

| Transmission repetition rate | Data length | PDU format | PDU specific | Default priority | Parameter group number | Identifier |
|------------------------------|-------------|------------|--|------------------|------------------------|-------------|
| 10 ms | 8 bytes | 1 | destination address KSM = FD _{hex} | 3 | Proprietary A: EF00 | 0C EF FD 55 |

| Byte | Bit | Description | | |
|----------|-----------------------------------|---|-------------------|-----------------------------|
| 1 | 8 and 7 | Not defined | | |
| | 6 and 5 | Override control mode priority [ksma_ocmp] (3.2.3.3) not supported | | |
| | 4 and 3 | Requested speed control conditions [ksma_rsc] (3.2.3.2) not supported | | |
| | 2 and 1 | Override control mode [ksma_ocr] (3.2.3.1) | | |
| | | 00 | override disabled | |
| 01 | | speed control | | |
| 10 | | torque control | | |
| 2 and 3 | --- | Requested speed/Speed limit [ksma_req_speed] (3.2.1.19) | | |
| | | 0.125 rpm per Bit | Offset = 0 rpm | Range = 0 ... 8031.875 rpm |
| 4 | --- | Requested torque/Torque limit [ksma_req_torque] (3.2.1.15) | | |
| | | 1 % per Bit | Offset = -125 % | Range = 0% ... 1250% |
| 5 | --- | Requested road speed limit [ksma_HGB] | | |
| | | 1 km/h per Bit | Offset = 0 km/h | Range = 0 km/h ... 250 km/h |
| 6 | ZDR [ksma_sw_status] | | | |
| | Values described in SAE J1939/ff | | | |
| | 8 and 7 | Cruise control accelerate switch (3.2.6.17) | | |
| | 6 and 5 | Cruise control resume switch (3.2.6.16) | | |
| | 4 and 3 | Cruise control coast switch (3.2.6.15) | | |
| | 2 and 1 | Cruise control set switch (3.2.6.14) | | |
| | Are interpreted by MAN as follows | | | |
| | 00000000 | | Neutral | |
| | 00000001 | | Off | |
| | 00000100 | | Set - | |
| 00010000 | | Resume | | |
| 01000000 | | Set + | | |
| 10101010 | | Fault | | |

| Byte | Bit | Description | |
|--------|--------------------------------|---------------------------------|----------------|
| 7 | 8 to 5 | ZDR mode request [ZDR_mode_req] | |
| | | 0000 | Mode S |
| | | 0001 | Mode 1 |
| | | 0010 | Mode 2 |
| | | 0011 | Mode 3 |
| | | 0100 | Mode 4 |
| | | 0101 | Mode 5 |
| | | 0110 | Mode 6 |
| | | 0111 | Mode 7 |
| | | 1000 | ZDR switch off |
| | | 1001 | reserved |
| | | 1010 | reserved |
| | | 1011 | reserved |
| | | 1100 | reserved |
| | | 1101 | reserved |
| | 1110 | reserved) | |
| | 1111 | not available | |
| | 4 and 3 | Engine stop [ksma_MotorStop] | |
| | | 00 | no request |
| | | 01 | Motor Stop |
| 10 | | reserved | |
| 11 | | don't care/take no action | |
| 2 to 1 | Engine start [ksma_MotorStart] | | |
| | 00 | no request | |
| | 01 | Motor Start | |
| | 10 | reserved | |
| | 11 | don't care/take no action | |
| 8 | --- | XX | |

Important:

ZDR mode 7 is reserved for internal MAN purposes; its setting cannot be changed.

| Transmission repetition rate | Data length | PDU format | PDU specific | Default priority | Parameter group number | Identifier |
|------------------------------|-------------|------------|--------------|------------------|------------------------|------------|
| 50 s | 8 bytes | 255 | 202 | 3 | Prop.B:FFCA | 0CFFCA55 |

| | Bit | Description | |
|--------|---------|---|-----------------------------------|
| 1 | 8 to 7 | --- | XXX |
| | 6 to 5 | disengage driveline request (3.2.3.6) [dis_driveline_req] | |
| | | 00 | allow driveline engagement |
| | | 01 | disengage driveline |
| | | 10 | invalid |
| | | 11 | take no action |
| | 4 to 3 | torque converter lockup disable request (3.2.3.5) [tor_conv_lock_dis] | |
| | | 00 | allow torque converter lockup |
| | | 01 | disengage torque converter lockup |
| | | 10 | invalid |
| | | 11 | take no action |
| | 2 to 1 | gear shift inhibit request (3.2.3.4) [gear_shift_inh_req] | |
| | | 00 | gear shifts allowed |
| | | 01 | gear shift inhibited |
| | | 10 | invalid |
| | | 11 | take no action |
| 2 to 6 | --- | XX | |
| 7 | 8 to 5 | not defined | |
| | 4 to 1 | Request PTO 3 NMV [ksm_PTO3_req] | |
| | | xxx0 | no request |
| xxx1 | request | | |
| | 8 | --- | XXKK |

7.7. Information processing in KSM/VMC as specified by KSM1_A-message

The "override control mode" (OCM) in the KSM1_A message (ASM1_A_OCM) is of great importance for processing engine speed and torque. At the same time the engine speed and torque values in the ASM1_A message are checked for validity. The following description (cases 1-4) describes how the corresponding KSM1_OCM is generated from the KSM1_A_OCM. KSM1 is the T-CAN message from the KSM to the VMC (FFR). In the standard situation the KSM supports the OCM=11 (speed/torque limit control) of the KSM1 message. Processing of the modes OCM=01 (speed control) and OCM=10 (torque control) from the KSM1 message is not activated in the VMC, but if required can be switched on within the VMC.

1. KSM1_A_ocm=11 → KSM1_ocm=11 11 (Speed/torque limit control) at $n < 8031,875$ rpm or $m < 100\%$ otherwise KSM1_A_OCM = 00 (disabled)
 - The limits (KSM1_A) are linked with the digital inputs (torque and engine speed) in such a way that the smallest value in each case is used as the KSM1 message.
 - Demand ZDR S, 1-7 is relayed via the KSM1:
Activation in the VMC (FFR) depends on the switching conditions that have been set as parameters in the VMC.
 - A demand for ZDR operating input (SET +/-, MEM, OFF) via KSM1_A or digital inputs KSM - depending on the KSM parameters - is relayed via KSM1 and implemented within the VMC.
2. KSM1_A_ocm=01 → KSM1_ocm= 01 (speed control) at $n < 8031,875$ rpm, otherwise KSM1_A_OCM = 00 (disabled) or 11
 - The definition of the engine speed target value is only possible with a valid value in KSM1_A ($n \leq 8031, 875$ rpm). Limiting in KSM1 is possible by means of the KSM digital engine speed/torque limit inputs.
 - Torque limiting (KSM1_A) is linked with the digital "engine speed/torque limiting" inputs in such a way that in each case the lowest value is used as the KSM1 message.
3. KSM1_A_ocm=10 → KSM1_ocm=10 (torque control) at $m \leq 100\%$, otherwise KSM1_A_OCM = 00 (disabled) or 11
 - Definition of the torque target value is only possible for a valid value in KSM1_A ($m \leq 100\%$); limiting in KSM1 is possible through digital KSM engine speed/torque limiting inputs.
 - Engine speed limiting (KSM1_A) is linked with the digital "engine speed/torque limiting" inputs in such a way that in each case the lowest value is used as the KSM1 message.

4. KSM1_A_ocm=00 → KSM1_ocm=11 (speed/torque limit control) on activation of digital inputs, otherwise KSM1_A_OCM = 00 (disabled)
- No processing/ relaying of KSM1_A/Byte 2,3,4.
 - Engine speed/torque limits via digital “engine speed/torque limiting” inputs possible at KSM.
 - Demand ZDR S, 1-7 is relayed via KSM 1.
Activation in the VMC (FFR) depends on the switching conditions set as parameters in the VMC.
 - A request for ZDR operating input (SET +/-, MEM, OFF) via KSM1_A or digital KSM inputs - depending on the KSM parameters - is relayed via KSM1: implementation is within the VMC.

The following applies in all cases:

- Choice of ZDR mode via CAN has priority over ZDR pins on the VMC.
- Limits are so linked within the KSM and the VMC that the lowest value is chosen as the KSM1 message.
- Set target values are restricted to limits.

Note:

If an input value from the A-CAN (A-CAN bus off, KSM1_A failure message) is invalid, the limits (engine speed/torque/maximum speed) are frozen until the A-CAN is available again or until valid values are present (for example: the previously requested limits are frozen, or until terminal 15 “Reset”).

If at the time of the failure of the A-CAN (A-CAN Bus off, failure of KSM1_A message) there is a valid demand for an engine speed or torque value (KSM1_A_OCM = 01/10), the engine reverts to idling speed; if in addition there is a valid limit for engine speed or torque, this value is frozen until the A-CAN is available again or until valid values are present (alternatively until terminal 15 “Reset”).

If at the time of the failure of the A-CAN (A-CAN Bus off failure KSM2_A message) there is a request for ZDR mode (KSM1_A_OCM = 00/11), the engine reverts to idling speed until the A-CAN is available again or until valid values are present (alternatively until terminal 15 “Reset”).

If at the time of the failure of the A-CAN (A-CAN Bus off failure KSM2_A message) there is a demand for ZDR operating input (SET +/-SET-, MEM, OFF) (KSM1_A_OCM = 00/11), the present engine speed is maintained until the A-CAN is available again or until valid values are present (alternatively until terminal 15 “Reset”).

If at the time of the failure of the A-CAN (A-CAN Bus off failure KSM2_A message) there is an NMV demand (KSM1_A_OCM = 01/10), this is frozen until the A-CAN is available again or until valid values are present (alternatively until terminal 15 “Reset”).

If at the time of the failure of the A-CAN (A-CAN Bus off failure KSM2_A message) there is a NMV demand for Clutch open/ external gearbox N or converter lockup clutch open, these are also frozen until the A-CAN is available again or until valid values are present (alternatively until terminal 15 “Reset”).

8. Pin Description and Circuit Diagrams

DrzMomBgr 1+3 (Plug connection X1997/Pin 1)

+U_{Bat} -switching signal input for activating engine speed/torque limiting 1 and 3.

Function:

If the input is connected to +U_{Bat} (operating readiness; X1997 Pin12) the engine is limited to “Engine speed/torque limiting 1” for which the parameters can be set via MAN-cats II.

If +U_{Bat} is removed, the chosen “Engine speed/torque limiting 1” is cancelled again. If at the same time the DRZMomBgr 2+3 input (X1997/Pin2) is connected along with +U_{Bat} (operating readiness: X1997/PIN12), the engine is limited to “Engine speed/torque limiting 3”, the parameters for which can be set via MAN-cats II.

If +U_{Bat} is removed from both inputs, the selected “Engine speed/torque limiting 3” is cancelled again.

This function can also be used as another intermediate engine speed control by setting a higher engine speed limit with it initially.

Functional enablement:

As soon as +U_{Bat} (operating readiness or terminal 15) is present.

Factory settings:

See table for DRZMomBgr 2+3 (plug connector X1997/Pin2).

DrzMomBgr 2+3 (Plug connection X1997/Pin 2)

+U_{Bat} switching signal input for activating engine speed/torque limiting 2 and 3.

Function:

If the input is connected to +U_{Bat} (operating readiness; X1997 Pin12) the engine is limited to “engine speed/torque limiting 2” for which the parameters can be set via MAN-cats II.

If +U_{Bat} is removed, the chosen “engine speed/torque limiting 2” is cancelled again. If at the same time the input DRZMomBgr 1+3 (X1997/Pin1) is connected along with +U_{Bat} (operating readiness: X1997/PIN12) the engine is limited to “Engine speed/torque limiting 3”, the parameters for which can be set via MAN-cats II.

If +U_{Bat} is removed from both inputs, the selected “Engine speed/torque limiting 3” is cancelled again.

This function can also be used as another intermediate engine speed control by setting a higher engine speed limit with it initially.

Functional enablement:

As soon as +U_{Bat} (operating readiness or terminal 15) is present.

Factory settings:

| | DrzMomBgr 1+3 (Plug X1997/Pin 1) | DrzMomBgr 2+3 (Plug X1997/Pin 2) | Engine speed | Torque |
|-----------------------------|-------------------------------------|-------------------------------------|--------------|--------|
| Engine speed/torque limit 1 | +U _{Bat} | ----- | 1.500 rpm | 100 % |
| Engine speed/torque limit 2 | ----- | +U _{Bat} | 1.800 rpm | 100 % |
| Engine speed/torque limit 3 | +U _{Bat} | +U _{Bat} | 1.200 rpm | 100 % |

Each of the possible input combinations is assigned a pair of values consisting of an engine speed limit and a torque limit.

LS1_KONFIG (PLUG CONTACT X1997/Pin 3)

-U_{Bat} switching signal output. When the load is connected and in the passive/not activated status, the high level is set (approx. +U_{Bat}).

Load:

Max 300mA

Function:

Output of signal, depending on what parameters are set (see Chapter 6.2 "Parameter setting matrix for switch outputs").

Factory setting:

| |
|--------------------------|
| Signal: |
| Coolant overheat warning |

Important:

In order to ensure that short circuits and open circuits are reliably identified when the load is connected and when the error recognition system is activated, the connected load must be $\leq 2\text{k}\Omega$. When the error recognition system is activated the load (X1996/PIN1) must be connected after terminal 15, but "Operating readiness" (X1997/PIN12) must not be used. If "Operating readiness" is used instead of terminal 15, once the error recognition system has been activated, entries are made to the error memory during system start-up (monitoring is already active during the phase system start, but operating readiness is only active following the phase system start).

LS2_KONFIG (PLUG CONTACT X1997/Pin 4)

-U_{Bat} switching signal output. When the load is connected and in the passive/not activated status, the high level is set (approx. +U_{Bat}).

Load:

Max 300mA

Function:

Output of signal, depending on which parameters are set (see Chapter 6.2 "Parameter setting matrix for switch outputs").

Factory setting:

| |
|--------------------------|
| Signal: |
| Low oil pressure warning |

Achtung:

In order to ensure that short circuits and open circuits are reliably identified when the load is connected and when the error recognition system is activated, the connected load must be $\leq 2\text{k}\Omega$. When the error recognition system is activated, the load (X1996/PIN1) must be connected after terminal 15, but "Operating readiness" (X1997/PIN12) must not be used. If "Operating readiness" is used instead of terminal 15, once the error recognition system has been activated, entries are made to the error memory during system start-up (monitoring is already active during the system start phase, but operating readiness is only active following the system start phase).

HS1_KONFIG (PLUG CONTACT X1997/Pin 5)

+U_{Bat} switching signal output. When the load is connected and in the passive/not activated status, the low level is set at $U_{low} < 2V$.

Load:
Max 500mA

Function:
Output of signal, depending on which parameters are set (see Chapter 6.2 "Parameter setting matrix for switch outputs").

Factory setting:

| |
|-----------|
| Signal: |
| Handbrake |

Important:
In order to ensure that short circuits and open circuits are reliably identified when the load is connected and when the error recognition system is activated, the connected load must be $< 400\Omega$.

HS2_KONFIG (PLUG CONTACT X1997/Pin 6)

+U_{Bat} switching signal output. When the load is connected and in the passive/not activated status, the high level is set at $U_{low} < 2V$.

Load:
Max 500mA

Function:
Output of signal, depending on which parameters are set (see Chapter 6.2 "Parameter setting matrix for switch outputs").

Factory setting:

| |
|---------|
| Signal: |
| Brake |

Important:
In order to ensure that short circuits and open circuits are reliably identified when the load is connected and when the error recognition system is activated, the connected load must be $< 400\Omega$.

HS3_KONFIG (PLUG CONTACT X1997/Pin 7)

+U_{Bat} switching signal output. When the load is connected and in the passive/not activated status, the low level is set at $U_{low} < 2V$.

Load:
Max 500mA

Function:
Output of signal, depending on which parameters are set (see Chapter 6.2 "Parameter setting matrix for switch outputs").

Factory setting:

| |
|--------------|
| Signal: |
| Reverse gear |

Important:
In order to ensure that short circuits and open circuits are reliably identified when the load is connected and when the error recognition system is activated, the connected load must be $< 400\Omega$.

HS4_KONFIG (PLUG CONTACT X1997/Pin 8)

+U_{Bat} switching signal output. When the load is connected and in the passive/not activated status, the low level is set at $U_{low} < 2V$.

Load:
Max 500mA

Function:
Output of signal, depending on which parameters are set (see Chapter 6.2 "Parameter setting matrix for switch outputs").

Factory setting:

| |
|---------|
| Signal: |
| Clutch |

Important:
In order to ensure that short circuits and open circuits are reliably identified when the load is connected and when the error recognition system is activated, the connected load must be $< 400\Omega$.

LS3_KONFIG (PLUG CONTACT X1997/Pin 9)

-U_{Bat} switching signal output. When load is connected and in the passive/not activated status the high level is set (approx. +U_{Bat}).

Load:
Max 300mA

Function:
Output of signal, depending on which parameters are set (see Chapter 6.2 "Parameter setting matrix for switch outputs").

Factory setting:

| |
|-----------|
| Signal: |
| Gearbox N |

Important:
In order to ensure that short circuits and open circuits are reliably identified when the load is connected and when the error recognition system is activated, the connected load must be $< 2k\Omega$. When the error recognition system is activated the load (X1996/PIN1) must be connected after terminal 15, but "Operating readiness" (X1997/PIN12) must not be used. If "Operating readiness" is used instead of terminal 15, once the error recognition system has been activated, entries are made into the error memory store during system start-up (monitoring is already active during the system start phase, but operating readiness is only active following the system start phase).

TELLTALE LAMP (plug connector X1997/Pin 10)

+U_{Bat} switch signal output. With the load connected and in a fault-free state of the KSM control unit or the connected peripheral equipment, a low level of $U_{low} < 2V$ is set.

Load:
Max 600mA

Function:
Information that a fault has occurred in the KSM control unit or in peripheral equipment connected to it.

Important:
In order to ensure that short circuits and open circuits are reliably identified when the load is connected and when the error recognition system is activated, the connected load must be $< 400\Omega$. After terminal 15 "on" the output is automatically connected for approx. 3 seconds (bulb test).

HS5_KONFIG (plug connector X1997/Pin 11)

+U_{Bat} -switch signal output. With the load connected and in the passive/non activated state, a low level of U_{low} <2V is set.

Load:
Max 600mA

Function:
Output of the signal depending on which parameters are set (see Chapter 6.2 "Parameter setting matrix for switch outputs").

Factory setting:

| |
|--------------|
| Signal: |
| Fuel warning |

Important:
In order to ensure that short circuits and open circuits are reliably identified when the load is connected and when the error recognition system is activated, the connected load must be <400Ω.

OPERATING READINESS (plug connector X1997/Pin 12)

+U_{Bat} switch signal output. The final stage is switched to "high" approx. 3 sec. after terminal 15 "on". With a load connected and with the KSM control unit (still) not in state of operating readiness, a low level is set at U_{low} <2V.

Load:
Max 2A

Function:
Information that the KSM control unit is ready to operate. Can be used to enable a function. After terminal 15 "off" the signal is emitted for approx. 2 seconds to allow for body electronic equipment that may be connected to allow the control unit to run on if necessary.

Important:
In order to ensure that short circuits and open circuits are reliably identified when the load is connected and when the error recognition system is activated, the connected load must be <400Ω. The output is activated after system start (approx. 3 sec.).

SET+ (plug connector X1997/Pin 13)

+U_{Bat} -switch signal input for activation of the function "Increase engine speed".

Function:

Increases engine speed.

If the input is connected to +U_{Bat} (Operating readiness: X1997/PIN12) the engine speed rises continuously towards the upper rev limit; if activation is interrupted, the engine management regulates engine speed value to the value reached at that moment.

The upper engine speed limit can be:

- The engine's maximum speed limit
 - The upper engine speed limit for ZDR S, ZDR1, ...ZDR7 for which the parameters can be set by means of MAN-cats II
 - Any engine speed limit which was activated and for which parameters have been set in the VMC or KSM by means of MAN-cats II.
- The set engine speed value is cancelled, i.e. the engine reverts to idling speed (ZDR S) or the "lower engine speed limit" (ZDR1, ...ZDR7) by means of the "open" command for the standard bridge between "Operating readiness" (X1997/PIN12) and "OFF" (X1997/PIN15).

Function enablement:

As soon as the engine is running, the function can be activated by connecting with +U_{Bat} (Operating readiness or terminal 15).

Important:

The implementation of SET+/SET- via the KSM interface is only possible in the ZDR modes for which the condition "Steering column lever active" is set. Ensure that the steering column lever is secured against undesirable interference within the driver's cab during operation, for example via an external remote control.

SET- (plug connector X1997/Pin 14)

+U_{Bat} -switch signal input for activation of the function "Decrease engine speed".

Function:

Decreases engine speed.

If the input is connected to +U_{Bat} (Operating readiness: X1997/PIN12) the engine speed setting decreases continuously towards the idle speed setting (ZDR S) or the lower engine speed limit (ZDR1, ...ZDR7). If activation is interrupted, the engine management regulates engine speed value to the value reached at that moment.

The set engine speed value is cancelled, i.e. the engine goes to the idling speed (ZDR S) or the "lower engine speed limit" (ZDR1, ...ZDR7) by means of the "open" command for the standard bridge between "Operating readiness" (X1997/PIN12) and "OFF" (X1997/PIN15).

Function enablement:

As soon as the engine is running, the function can be activated by connecting to +U_{Bat} (Operating readiness or terminal 15).

Important:

The implementation of SET+/SET- via the KSM interface is only possible in the ZDR modes for which the condition "Steering column lever active" is set. It should be ensured that the steering column lever is secured against undesirable interference within the driver's cab during operation, for example via an external remote control.

OFF (plug connector X1997/Pin 15)

+U_{Bat} -switch signal input for enablement/cancelling of the ZDR functions.

Function:

If the input is connected to +U_{Bat} (Operating readiness: X1997/PIN12) the ZDR functions are enabled. By setting "OPEN" for the external bridge between "Operating readiness" (X1997/PIN12) and "OFF" (X1997/PIN15) the ZDR and cruise control functions are cancelled.

Important:

If the external bridge between X1997/PIN12) and X1997/PIN15) is not present, the "OFF" function is permanently activated/cruise control functions are not possible.

MEMORY (plug connector X1997/Pin 16)

+U_{Bat} -switch signal input for retrieval/storage of an engine speed value.

Function:

If the input is connected to +U_{Bat} the engine, on expiry of the checking signal ($t_{\max} \leq 1\text{sec.}$) goes to the values ZDR S, ZDR1, ... ZDR7 for which the parameters can be set by means of MAN-cats II, and regulates them. Following a change, for example by "SET+" or "SET-", the new engine speed value can be stored by connecting the input with +U_{Bat} ($t \geq 2\text{sec.}$).

The new engine speed value is cancelled, i.e. the engine goes to idle speed (ZDR S) or the lower rev. limit (ZDR1, ... ZDR7) by means of the "OPEN" command for the external bridge between X1997/PIN12 and X1997/PIN15, by operating the "OFF control switch" on the control panel in the cabin, or if one of the cancellation conditions is fulfilled.

Function enablement:

As soon as the engine is running, the function can be activated by connecting with +U_{Bat} (Operating readiness or terminal 15) subject to time "t" referred to above.

Important:

The MEM function only takes effect when the control switch is enabled (change of input flank from "high" to "low"). The storage of a target engine speed value that was set using SET+/- is only possible in the corresponding ZDR mode if at the FFR the operator input of the parameter "active with storage in memory" is set and the switch held down for at least 2 seconds.

A-CAN-H (plug connector X1997/Pin 17)

CAN-high cable for FMS/body CAN interface.

A-CAN-L (plug connector X1997/Pin 18)

CAN-low Leitung der FMS/Aufbau-CAN-Schnittstelle.

NMV (PIUG CONTACT X3311/Pin 1)

+U_{Bat} –signal input. When the NMV switch is not activated (contact open) the setting is at the “low” level for the KSM PIN (digital input, 4,75kΩ-pull-down, switching level: U_{low} <3 / U_{high} >16V) “NMV request”. With this PIN the NMV can also be requested. This only applies if the NMV switch is fitted.

Load:
Max 500mA

Function:
Information that the NMV was requested or can be used to request NMV. However, the NMV is only activated if the conditions which have been set as parameters in the KSM (by means of the vehicle data file) apply; these are:

- Only engage NMV if Gearbox N: “active”/”not active”
- Only engage NMV if handbrake has been applied: “active”/”not active”
- Only engage NMV if vehicle is stationary: “active”/”not active”

Note: If the conditions for connecting for Gearbox N, handbrake, clutch or speed signal have been given “active” parameters, they must be fulfilled as soon as the NA request is made, so that the valve can be energised. Once the power take-off has been activated, it remains so even if the conditions for connection are no longer fulfilled later. The connection conditions are considered to be AND-linked.

- NMV with parameter “Engine speed threshold on”: “active”/not active”

Note: Regarding the switching condition “Engine speed threshold on”: providing that that the connection conditions (Gearbox N, handbrake, vehicle stationary) are fulfilled (if they have been given “active” parameters) and if the power take-off is requested, the valve is energised as soon as the engine speed exceeds the threshold at which the parameter has been set. The valve remains energised even if the engine speed subsequently drops below this threshold.

- NMV with the parameter “engine speed threshold ‘on/off’”: “active”/”not active”

Note: Regarding conditions for switching on and off if “engine speed threshold on/off”:

Providing that the connection conditions (Gearbox N, handbrake, vehicle stationary) are fulfilled (if they are given “active” parameters) and if the power take-off is requested, the valve is energised as soon as the engine speed exceeds the threshold to which the parameter has been set. The power is cut off if the engine speed drops below the lower threshold. The conditions for re-energising the valve if the upper engine speed threshold is exceeded are that the request is still active and the connection conditions are still fulfilled.

- NMV request

Parameters can be set to determine whether the switch (digital KSM input) is supported. If the input is supported, then a possible instruction from the A-CAN is ignored. If the input is not supported, then a possible demand from the A-CAN is processed and the switch (digital KSM input) is ignored. Both requests can also be logically linked with “OR” and a demand via A CAN and the digital input is possible.

Function enablement:

As soon as +U_{Bat} is connected following a successful engine start.

Factory settings:

| | |
|--|--|
| Connection condition, gearbox N | “active” |
| Connection condition, handbrake | “active” |
| Connection condition, vehicle stationary | “active” |
| Engine speed threshold “on” | “not active” |
| Engine speed threshold “on-off” | “active” |
| Upper engine speed threshold | 800 rpm |
| Lower engine speed threshold | 200 rpm |
| NMV demand (digital input or A-CAN) | Digital input and A-CAN linked with “OR” |

Important:

The NMV circuit is not included in the standard equipment supplied with the vehicle and must be ordered separately.

COMPRESSED AIR SWITCH NMV (plug connector X3311/Pin 2)

-U_{Bat} -switch signal output, same potential as at LED for the NMV switch of the compressed air switch when the NMV is switched on. When the NMV is not operating, the switch signal output of the compressed air switch is at the "high" level (approx. +U_{Bat}) (only if NMV switch is fitted).

Load:
Max 500mA

Function:

Information that the NMV is switched on.

Can be used for enabling the engine speed or power take-off functions in order to prevent undesired external access to operating controls from outside the driver's cabin.

Important:

The NMV switch is not included in the standard equipment of the vehicle and must be ordered separately.

Converter lockup clutch (WSK) OPEN/ UPSHIFT INHIBIT (plug connector X3311/Pin 3)

+U_{Bat} -switch signal for request "WSK/upshift inhibit" for HP transmission (ECOMAT).

Function:

If the input is connected to +U_{Bat} no upshifts will be carried out as long as the function is activated. If the function is activated when the vehicle is stationary and with Gearbox N, the appropriate starting gear will be selected, by movement of the DNR switch from "N" to a drive position, or if the DNR switch is at a drive position by deactivating the external Gearbox N request. In both cases the drive-off gear will only be engaged if the brake pedal is operated.

Function enablement:

As soon as +U_{Bat} (Operating readiness or terminal 15) is present.

PWM_KONFIG (PLUG CONTACT X3311/Pin 4)

PWM signal output. The signal has the following specification:

- Maximum output current: 10 mA
- Output voltage "low" is below 20% +U_{Bat}
- Output voltage (high) is above 80% +U_{Bat}
- The internal pull-up resistance is 15 kΩ; the basic status on the PIN is therefore "high"
- The output frequency can be set via a parameter.

Function:

Output of the signal depending on which parameters have been set.

Parameter which can be set:

- Output active with signal "driver's desired torque" (SAE J1939/71: „drivers`demand engine torque")
- Output active with signal "actual engine torque" (SAE J1939/71: „actual engine torque")
- Output active with signal "load current speed" (SAE J1939/71: „load at current speed")
- The output frequency can be set by parameters in a range of 100 ... 400Hz

Note:

The checking ratio of the PWM signal describes the "high time" (e.g. 10% = 10% "high" and 90% "low").

For example.: Torque 0%: checking ratio 10%
Torque 50%: checking ratio 50%
Torque 100%: checking ratio 100%

Factory setting:

| | |
|------------------------|------------|
| Signal: | Frequency: |
| Degree of engine load: | 200 Hz |

EXTERNAL GEARBOX-N DEMAND/CLUTCH RELEASED (plug connector X3311/Pin 5)

+U_{Bat} -switch signal input for demand "Interrupt drive line".

Function:

- For automated shift gearboxes and HP transmissions:
If the input is connected to +U_{Bat} the gearbox is switched to Neutral. When +U_{Bat} is removed, a gear is engaged again. The gearbox is only switched an external N below a speed threshold for which a parameter has been set. The request for this can also be set above the speed threshold for which the parameter has been set.
- Only for HP transmissions:
When the vehicle is stationary and with Gearbox N, the corresponding drive-off gear is engaged by movement of the DNR switch from "N" to a drive position, or if the DNR switch is already at a drive position by de-activating the external Gearbox N demand. In both cases the drive-off is only selected if the brake pedal has been operated. New parameters can be set which cause the request to be carried out as a "switch function" or a "check function".
The "check function" is only effected when the switch is released (change of input flank from "high" to "low").

Function enablement:

Approximately 3.5 seconds after terminal 15 "on", the function can be activated by connecting to +U_{Bat} (Operating readiness or terminal 15).

Factory settings:

| | |
|---|---|
| External gearbox N/clutch released: "switch function" | X |
| External gearbox N/clutch released: "check function" | |

HP TRANSMISSION [ECOMAT] PROGRAMME CHANGE (plug connector X3311/Pin 6)

+U_{Bat} -switch signal input for activating the function "HP transmission programme change".

Function:

If the input is connected to +U_{Bat}, the corresponding programme for which the parameters have been set will be active; this is a gearbox range and shift programme. Compared with the ECO switching programme, upshifts at higher engine speed occur with the POWER switching programme. Depending on the connections or parameters and on the position of the DNR switch, the transmission control unit will select the drive-off gear.

Factory settings: Refuse collection vehicle (ASF)/Fire engine /(FWF)

| | Progr. change (Plug X3311/Pin 6) | Gear range | | Change programme | |
|------------------------------|-------------------------------------|---------------------------------------|---------------------------------------|------------------|-------|
| | | ASF | FWF | ASF | FWF |
| Programme change, passive | ----- | D: 2-6 D3: 1-3 D2: 1-2 D1: 1 | D: 2-6 D3: 1-3 D2: 1-2 D1: 1 | ECO | ECO |
| Programme change, active | +U _{Bat} | D: 3-6 D3: 1-3 D2: 1-2 D1: 1 | D: 2-6 D3: 1-3 D2: 1-2 D1: 1 | ECO | POWER |

Function enablement:

As soon as +U_{Bat} (Operating readiness or terminal 15) is connected.

DISTANCE SIGNAL FROM TACHOGRAPH (plug connector X1428/Pin1)

Output of distance signal from tachograph PINB/8 (according to tachograph specification).

SPEED SIGNAL FROM TACHOGRAPH (plug connector X1428/ Pin 2)

Output of v-signal from tachograph PINB/6 (according to tachograph specification).

EARTH (GROUND) (plug connector X1428/Pin 3)

-U_{Bat} (earth) signal output, vehicle earth, same potential as earth supply point on the central electrical system in the cabin.

Load:
Max 2A

Function:
Provides an earthing point for external (body) connections.

SIGNAL "ENGINE RUNNING" (X1428/Pin 4)

+U_{Bat} – switching signal output.

Load:
Max 2A

Function:
Information that the engine is running.

REVERSING LIGHT OPERATION (plug connector X1428/Pin 5)

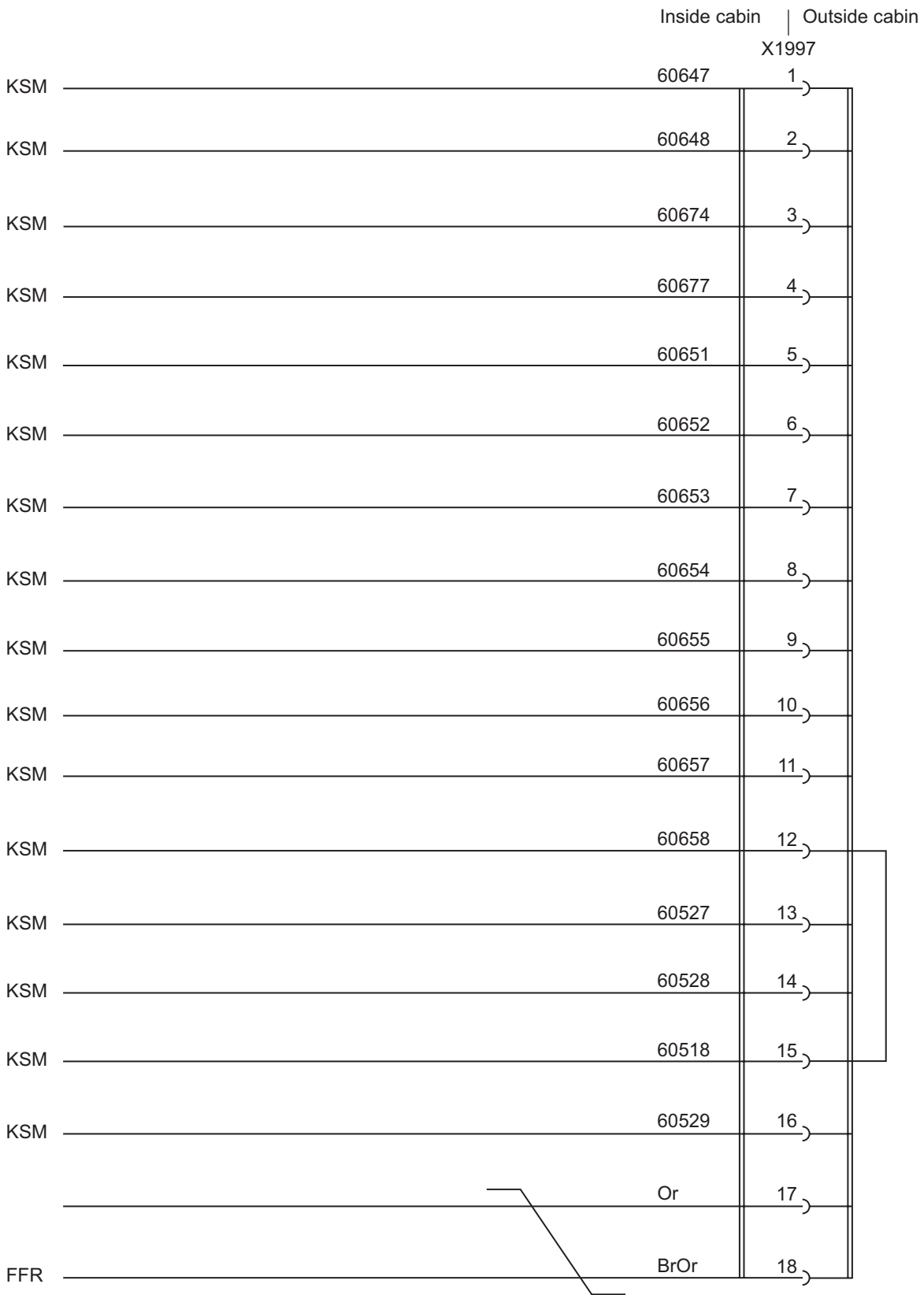
+U_{Bat} –switching signal output.

Load:
Max 2A

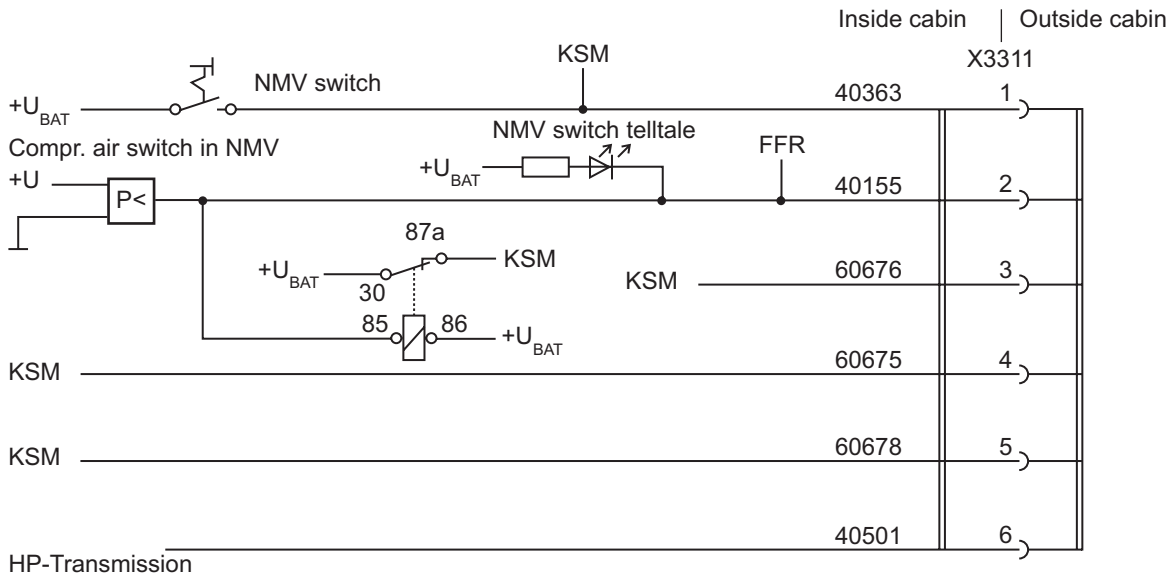
Function:
Information that the reversing lights are switched on.

Important:
This output should not be used for external activation of the reversing lights via +U_{Bat}.

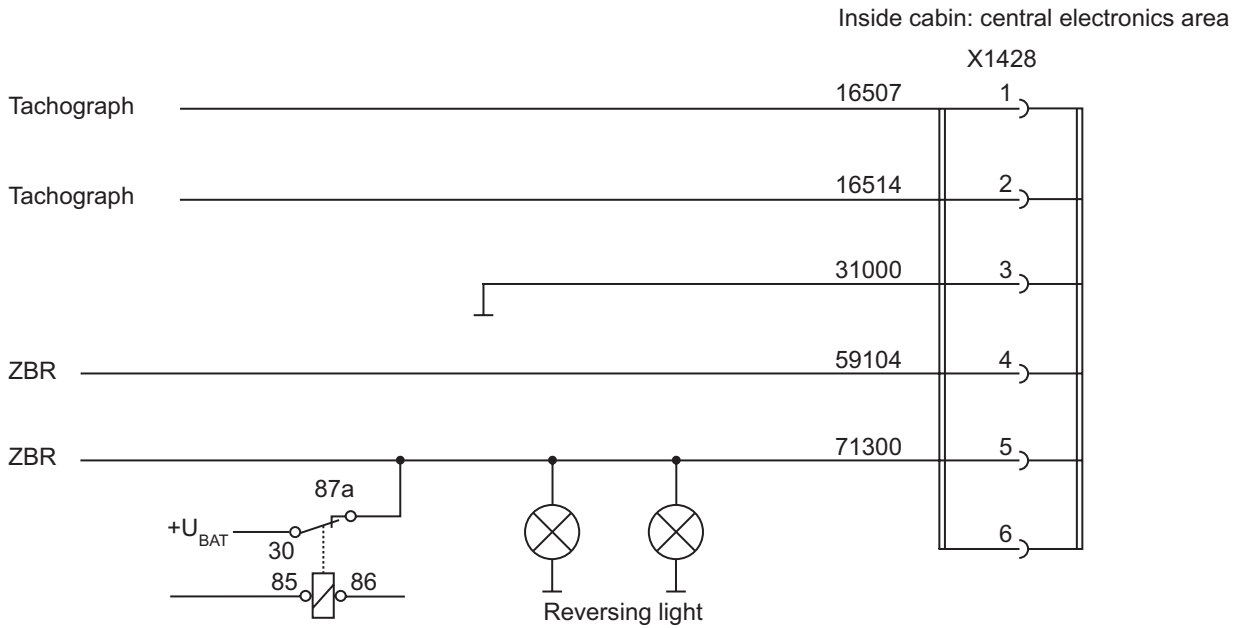
Circuit diagram X1997



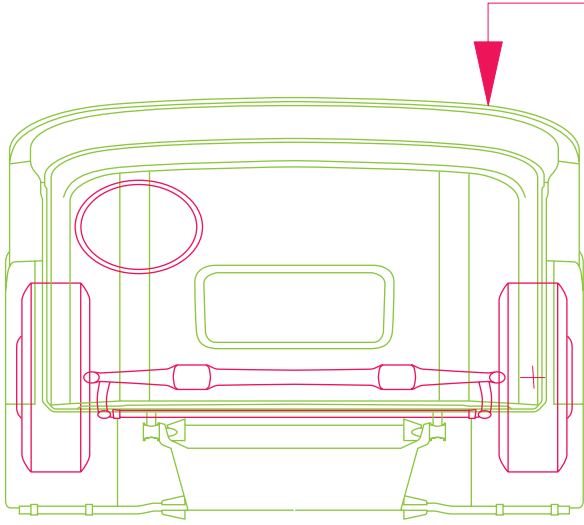
Circuit diagram X3311



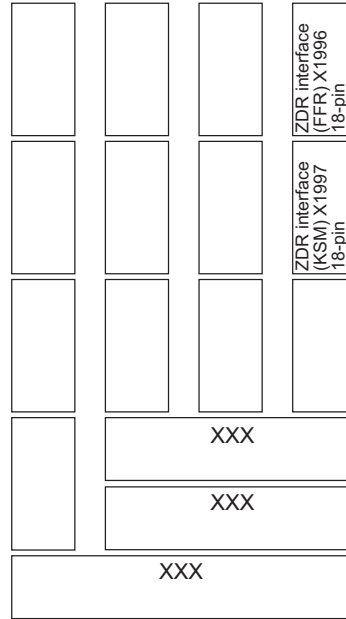
Circuit diagram X1428



9. Interface Design and Installation Point



View after removing cover:



The complete interface consists of an 18-pin plug connector **X1997** and the 6-pin plug connectors **X3311** and **X1428**.

These plug references are used on all circuit diagrams. The plugs in the vehicle are correspondingly colour coded. Access from the outside is by removing the cover.

XXX: Installation area for plug connectors X3311 and X2334/X679.

Plug connector X1428 is in the central electrics area (if the KSM interface is fitted at the factory).

| Plug connector | Colour and coding: | MAN item number | |
|---------------------------|--------------------|-----------------|----------------|
| | | Plug housing | Socket housing |
| 18-pin: X1997 | natural/6 | 81.25475.0046 | 81.25435.0927 |
| Secondary lock for casing | | 81.25475.0065 | 81.25435.0913 |

| Contacts (individual/ strip) | MAN item number |
|--|-------------------------------|
| Flat plug with detent 2.8'1/0.5-1 | 07.91202.0848 / 07.91202.0858 |
| Flat plug with detent 2.8'2.5/1.5-2.5 | 07.91202.0849 / 07.91202.0859 |
| Spring contact with detent 2.8'1/0.5-1 | 07.91201.0222 / 07.91201.0221 |
| Spring contact with detent 2.8'2.5/1.5-2.5 | 07.91201.0224 / 07.91201.0223 |

| Plug connector, 6-pin: X3311 | Colour and coding: blue/3 | MAN item number | |
|---------------------------------|------------------------------|-----------------|----------------|
| | | Male housing | Female housing |
| | | 81.25435.0789 | 81.25435.0739 |
| Secondary lock for casing | | 81.25435.0698 | 81.25435.0698 |

| Contacts (individual/ strip) | MAN item number |
|--|-------------------------------|
| Flat plug with detent 2.8'1/0.5-1 | 07.91202.0610 / 07.91202.0830 |
| Flat plug with detent 2.8'2.5/1.5-2.5 | 07.91202.0611 / 07.91202.0831 |
| Spring contact with detent 2.8'1/0.5-1 | 07.91201.0222 / 07.91201.0221 |
| Spring contact with detent 2.8'2.5/1.5-2.5 | 07.91201.0224 / 07.91201.0223 |

| Plug connector, 6-pin: X1428 | MAN item number | |
|---------------------------------|---------------------|-----------------------|
| | Plug housing, white | Socket housing, black |
| | 81.25435.0057 | 07.91601.0601 |

| Contacts (individual/ strip) | MAN item number |
|--|-------------------------------|
| Flat plug with detent 6.3'1/0.5-1 | 07.91202.2618 / 07.91202.2818 |
| Flat plug with detent 6.3'2.5/1.5-2.5 | 07.91202.2619 / 07.91202.2819 |
| Spring contact with detent 6.3'1/0.5-1 | 07.91201.2512 / 07.91201.2811 |
| Spring contact with detent 6.3'2.5/1.5-2.5 | 07.91201.2613 / 07.91201.2813 |

The interface "ZDR interface with customer-specific control module for external engine speed control for TG-A" consists of the 18-pin plug connector **X1996** and is included in the vehicle's standard specification.

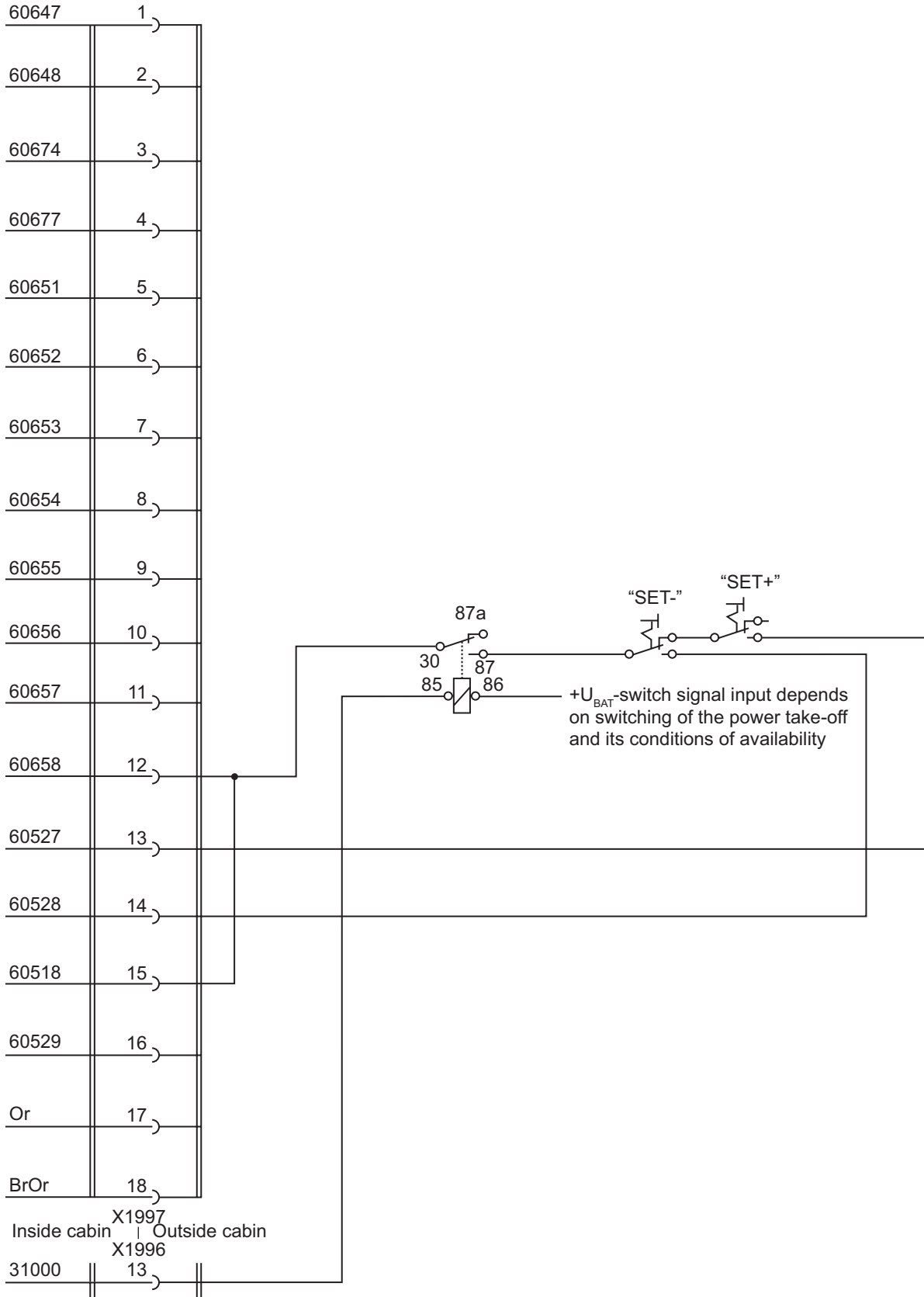
The version „Reverse gear block for refuse collection vehicles“ consists of the 6-pin plug connector **X2334** or **X679**. This connector reference is used on all circuit diagrams, the plug in the vehicle is coloured accordingly. Access from outside is by means of removing the cover.

| Plug connector, 6-pin: X2334 or X679 | Colour and coding: blue/4 | MAN item number | |
|---|------------------------------|-----------------|----------------|
| | | Plug housing | Socket housing |
| | | 81.25435.0794 | 81.25435.0744 |
| Secondary lock for casing | | 81.25435.0698 | 81.25435.0698 |

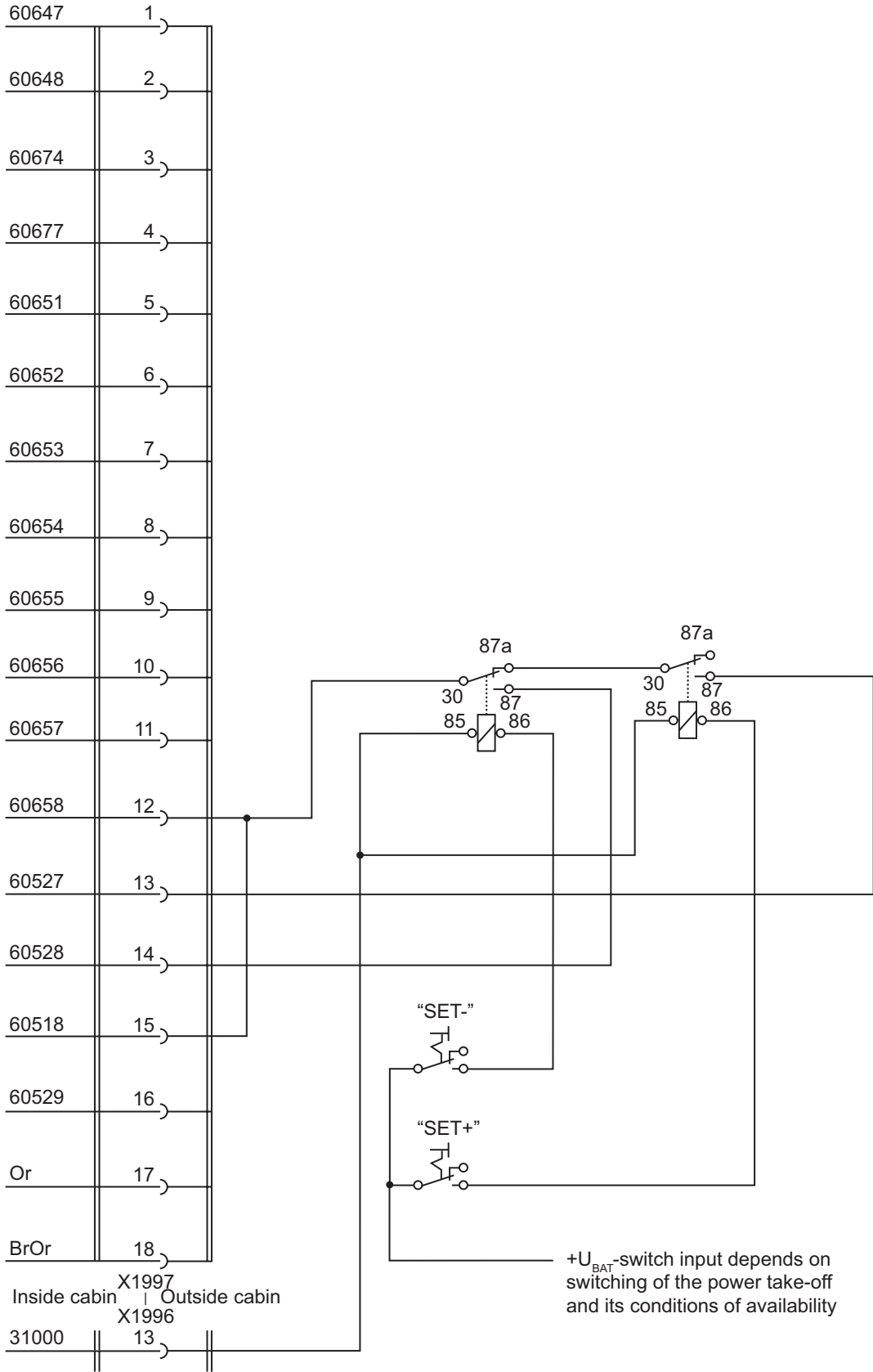
| Contacts (individual/ strip) | MAN item number |
|--|-------------------------------|
| Flat plug with detent 2.8'1/0.5-1 | 07.91202.0610 / 07.91202.0830 |
| Flat plug with detent 2.8'2.5/1.5-2.5 | 07.91202.0611 / 07.91202.0831 |
| Spring contact with detent 2.8'1/0.5-1 | 07.91201.0222 / 07.91201.0221 |
| Spring contact with detent 2.8'2.5/1.5-2.5 | 07.91201.0224 / 07.91201.0223 |

10. Sample Circuits

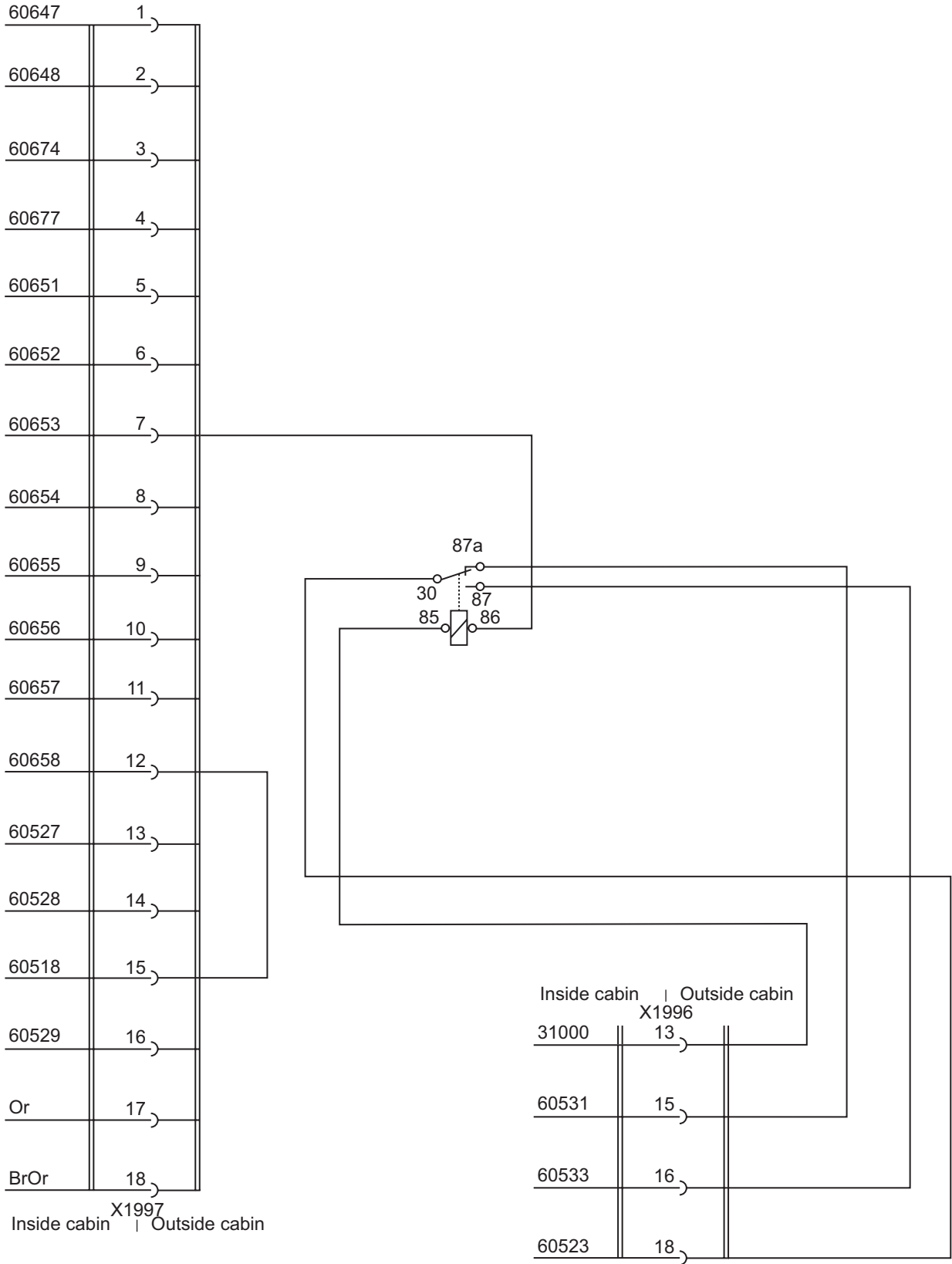
Sample engine speed circuit. External control with functions "SET+" and "SET-"



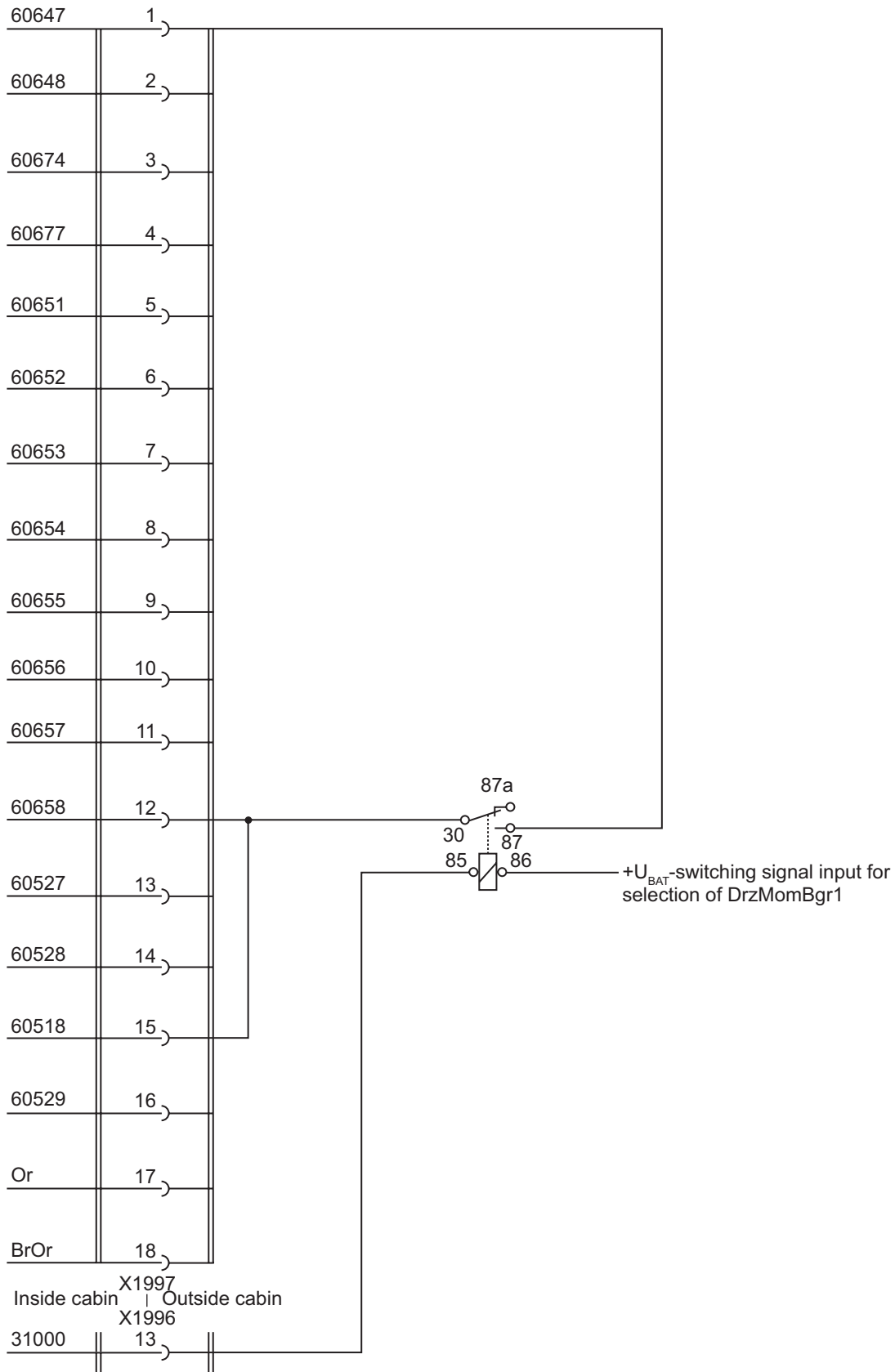
Sample circuit for external engine speed control with functions "SET+" and "SET-"



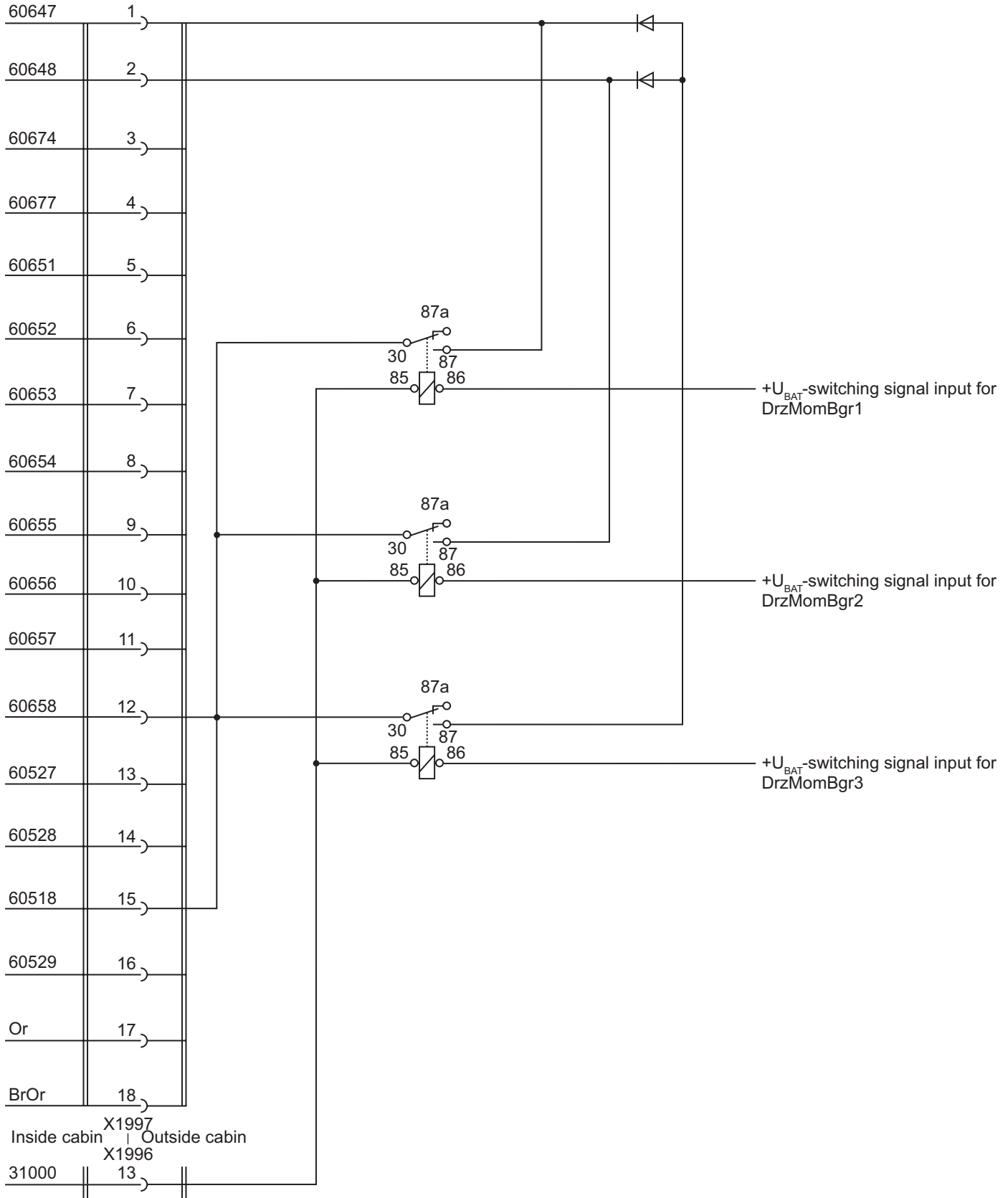
Sample circuit for "Maximum speed limiting 2" depending on the reverse gear engaged



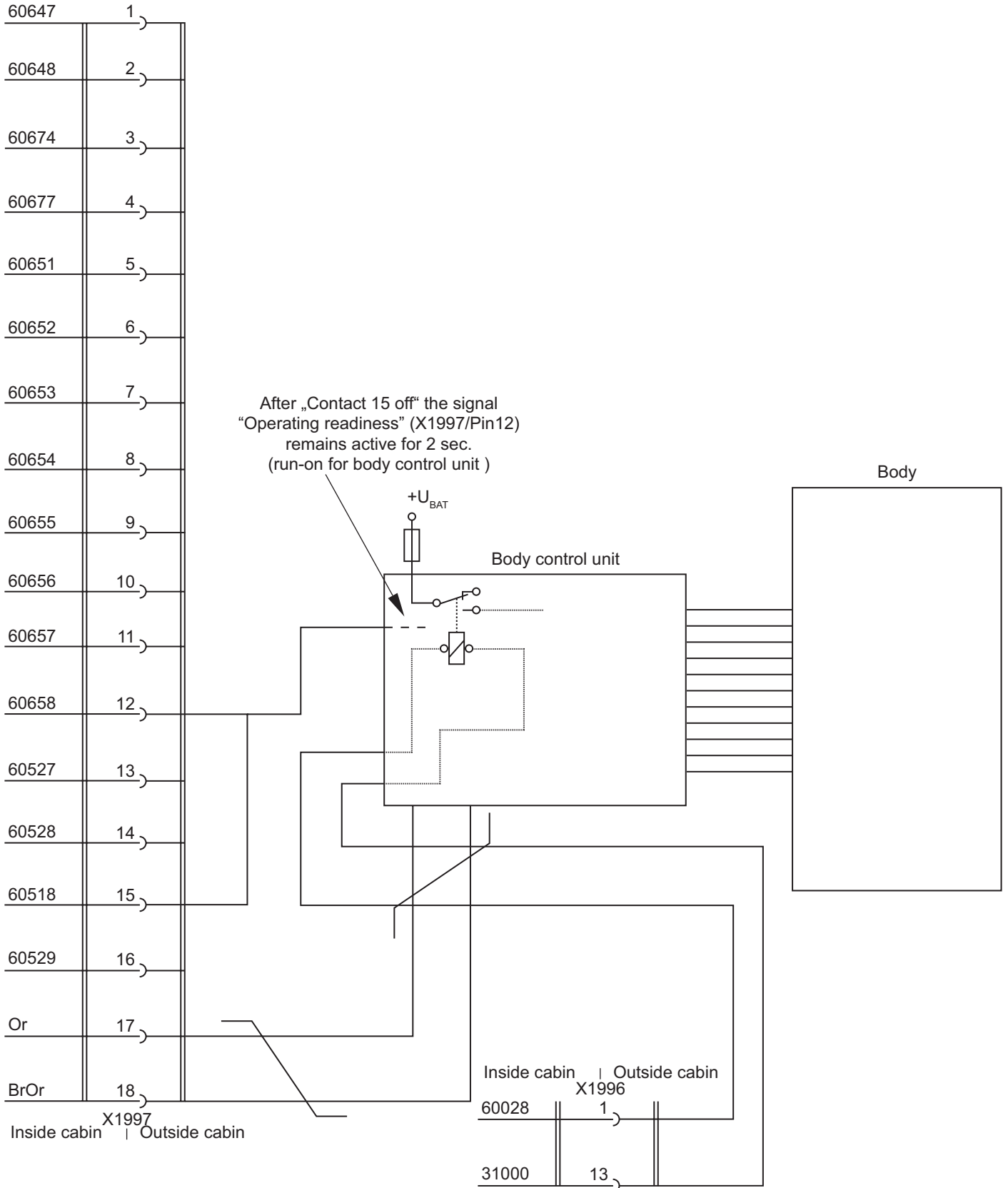
Sample circuit for activation of "Engine speed/torque limiting 1"



Sample circuit for activation of "Engine speed/torque limiting 1, 2 and 3"



Sample circuit for connection of body electronics via CAN interface



11. Quick Reference for Interface Assignments

ZDR interface (FFR)* / series-production

118-pin plug connector X1996 (natural/code 4)

Installed position: cabin separating point, right

| Connecting plug | Cable number Cable cross-section | Function |
|-----------------|----------------------------------|---|
| X1996/1 | 60043 0,75 | Term.15, central electrics (circuit breaker F582/6 A) |
| X1996/2 | 60525 0,75 | ZDR 1+3+5+7 |
| X1996/3 | 40354 | NA1 demand |
| X1996/4 | 40141 | NA1 status1 |
| X1996/5 | 40355 | NA2 demand1 |
| X1996/6 | 40142 | NA2 status1 |
| X1996/7 | 60526 0,75 | ZDR 2+3+6+7 |
| X1996/8 | 60641 0,75 | ZDR 4+5+6+7 |
| X1996/9 | 60524 0,75 | MDB input; external bridge between Pins 9 and 12 |
| X1996/10 | 60534 0,75 | MDB 2 (3,09 kΩ) |
| X1996/11 | 60535 0,75 | MDB 1 (1,37 kΩ) |
| X1996/12 | 60530 0,75 | MDB 0 (511 Ω) |
| X1996/13 | 31000 1 | Earth for external circuits |
| X1996/14 | 60105 0,75 | Engine speed ² |
| X1996/15 | 60531 0,75 | HGB 1 (511 Ω) |
| X1996/16 | 60533 0,75 | HGB 2 (1,37 kΩ) |
| X1996/17 | 60639 0,75 | HGB 3 (3,09 kΩ) |
| X1996/18 | 60523 0,75 | HGB input; external bridge between Pins 15 and 18 |

* A description of this interface can be found by

- MAN Service workshops and dealers in SI 68102
- Body constructors as "Intermediate engine speed control via interface to vehicle management computer (ZDR at FFR)" at www.manted.de

¹ only when power take-off is fitted

² only when "ZDR interface with KSM" is fitted

ZDR-Schnittstelle (KSM) / Sonderausstattung:

18-pin plug connector X1997 (natural/ code 6)
 Installed position: cabin separating point, right

| Connecting plug | Cable number Cable cross-section | Function |
|-----------------|----------------------------------|--|
| X1997/1 | 60647/0,75 | DrzMomBgr 1+3 |
| X1997/2 | 60648/0,75 | DrzMomBgr 2+3 |
| X1997/3 | 60674/0,75 | LS1_Config (factory setting: coolant overheat warning) |
| X1997/4 | 60677/0,75 | LS2_Config (factory setting: low oil pressure warning) |
| X1997/5 | 60651/0,75 | HS1_Config (factory setting: hand brake) |
| X1997/6 | 60652/0,75 | HS2_Config (factory setting: Brake) |
| X1997/7 | 60653/0,75 | HS3_Config (factory setting: R_Gear) |
| X1997/8 | 60654/0,75 | HS4_Config (factory setting: Clutch) |
| X1997/9 | 60655/0,75 | LS3_Config (factory setting: Gearbox N) |
| X1997/10 | 60656/0,75 | Telltale lamp |
| X1997/11 | 60657/0,75 | HS5_Config (factory setting: Tank warning) |
| X1997/12 | 60658/1 | Operating readiness |
| X1997/13 | 60527/0,75 | SET+ |
| X1997/14 | 60528/0,75 | SET- |
| X1997/15 | 60518/0,75 | OFF; external bridge between Pins 12 and 15 |
| X1997/16 | 60529/0,75 | MEM |
| X1997/17 | orange/0.75 | A-CAN – H |
| X1997/18 | brown-orange/0.75 | A-CAN – L |

6-pin plug connector X3311 (blue/ code 3)
 Installed position: cabin separating point, right

| Connecting plug | Cable numberCable cross-section | Function |
|-----------------|---------------------------------|--|
| X3311/1 | 40363/0,75 | NMV 1 |
| X3311/2 | 40155/0,75 | Pressure switch, NMV 1 |
| X3311/3 | 60676/0,75 | WSK open /upshift inhibit |
| X3311/4 | 60675/0,75 | PWM_configuration |
| X3311/5 | 60678/0,75 | Clutch released/external Gearbox N request |
| X3311/6 | 40501/0,75 | Programme change HP transmission |

¹ only with NMV fitted

6-pin plug connector X1428 (black)
 Installed position: central electrics area

| Connecting plug | Cable numberCable cross-section | Function |
|-----------------|---------------------------------|-----------------------------|
| X1428/1 | 16507/1 | Distance signal, tachograph |
| X1428/2 | 16514/1 | Speed signal, tachograph |
| X1428/3 | 31000/1 | Earth for external circuits |
| X1428/4 | 59104/1 | Signal "Engine running" |
| X1428/5 | 71000/1 | Signal "Reversing light on" |
| X1428/6 | Not in use | Not in use |