Daimler AG

Common Powertrain Controller
CPC4 Tier4/EU6 Engines only

Operating Manual
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Revision History

Date	Revision	Changes
2014-02-18	v2.1	Chapters revised regarding AccessLevel Changes Parameter description changed: Chapter 4.1.1: Parameters 01/05 and 01/06 changed Chapter 4.1.11: Parameters 11/67 to 11/70 changed Chapter 4.1.14: Parameter description of Parameters 15/24 changed
2014-02-18	v2.1	Chapter 5.3.2: Remark regarding ACC functionality added
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2014-02-18	v2.1	Chapter 5.6: Parameter table: entry erased
2014-02-18	v2.1	Chapter 5.8.4.1: Severe inducement enumeration changed
2014-02-18	v2.1	Chapter 5.8.5: Inputs / Manual Regeneration Push Button: Description changed
2014-02-18	v2.1	Chapter 5.8.5: Indicator table entry changed
2014-02-18	v2.1	Chapter 5.10.10: Bit table corrected
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2014-02-18	v2.1	Chapter 7.4: J1939 Rx Messages and Signals revisioned and extended
2014-02-18	v2.1	Chapter 7.5: J1939 Tx Messages and Signals revisioned and extended
2014-02-28	v2.1	Chapter 3.6.6.1: Remark regarding pull-up resistors added
2014-02-28	v2.1	Chapter 7: Remark regarding 2 J1939 CAN busses added
2014-03-03	v2.1	Chapter 7.1.2: “Engine Percent Load At Current Speed” description changed
2014-03-03	v2.1	Chapter 7.1.3: “Actual Engine Percent Torque” description changed, computation formula added
2014-03-04	v2.1	Chapter 5.10.1: “Axle Ratio (Dual Speed Axle)” added
2014-03-04	v2.1	Chapter 5.10.6: Coolant Level Sensor chapter corrected and extended
2014-03-11	v2.1	Chapter 5.7.5: Inputs / Hardwired: Entry corrected
2014-03-11	v2.1	Chapter 5.7.5: “Analog Remote Accelerator Pedal” Fig 5.18 corrected
2014-03-21	v2.1	Chapter 7.2: Table regarding gorvernor behavior extended and moved to chapter 5.1.3 „Characteristics of governor types“
2014-03-21	v2.1	Chapter 5.3.2: Name changed from “Engine start/stop” to “Engine crank/start/stop behaviour” and subchapter 5.4.1.5 “Starter Lock” added
2014-04-16	v2.1	New chapter 5.3.2 “Clutch Switch” added
2014-04-16	v2.1	Chapter 5.1 “Vehicle identification number” extended
2014-04-16	v2.1	Chapter 3.3: “Wiring diagram of CPC4” updated (Tier4 and EURO6)
2014-04-16	v2.1	Chapter 2.3: Chapter structure changed / Subchapters removed
2014-04-16	v2.1	Chapters 5.6 “Driving mode” and 5.6 “PTO speed control” merged, restructured and renamed in new chapter 5.1 “Engine operation modes”
2014-04-16	v2.1	Chapter 3.6 “Technical data of pin assignment“ renamed into 3.6 “Pin Assignment” several subchapters added e. g. 3.6.2.1 “Technical Data”, 0 ”Input Circuit” and 0 “Fault detection”. Subchapters were extracted from Chapter 5.12.1 “Inputs and Outputs of the CPC4”. Chapter 5.12.1 was restructured and splitted into the subchapters of 3.6 “pin assignment”.
2014-04-16	v2.1	Drafting errors and typos fixed
2014-05-07	v2.2	Chapter “Engine crank/start/stop behaviour” moved from 5.9 to chapter 5.3.2
2014-05-07	v2.2	Chapter 3.2.3 “Connecting up” revised and extended (cable cross-section, etc.)
2014-05-07	v2.2	Chapter 7.5 “J1939 Tx Messages and Signals” (CCVS, PropB06, etc.) CAN message revised
2014-05-07	v2.2	Chapter 5.5.3: “CC-/Limiter Mode (Temposet / ECE-R89)” inputs and outputs revised and extended
2014-05-07	v2.2	Chapter 5.1.2 “Speed Based Mode” revised (minimum/maximum values, etc.)
2014-05-07	v2.2	Chapter 7.1.2 “Engine Percent Load At Current Speed”, 7.1.3 “Actual Engine Percent Torque” formulas revised and figure (“Schematic context of the PLACS and AEPT formula”) added
2014-05-07	v2.2	Subchapter 5.1.2.2 “Speed control via Droop mode” added and subchapter overview in chapter 5.1.2 added.
2014-05-07	v2.2	Chapter 2.2 “Abbreviations” exteneded, missing abbreviations added (SEM, SUP, FFG, PWM, AGND, SFP, DI, DO, AI, AO, LP, HP, LS, HS, GND; KL: W)
2014-05-07	v2.2	Chapter 7.1.2 and 7.1.3: Figure added; formula revised
2014-05-07	v2.2	Drafting errors and typos fixed
2014-06-05	v2.3	Chapter 5.7.3 and 5.7.4: Analog Pedal chapters revised
2014-06-05	v2.3	Chapter 5.1.1 and 5.1.2.3: Torque Based / Speed Based Mode chapters revised
2014-06-05	v2.3	Chapter 5.7.6 and 5.9.4.1: Throttle inhibit / ABS detection revised and edited

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1. Safety

1.1. Symbols

Various symbols are used to identify potentially safety critical instructions.

Risk of injury!

This symbol appears at all safety instructions which must be complied with in order to avoid a direct risk of injury or death.

This symbol is used at all safety instructions which, if disregarded, could give rise to the danger of material damage or malfunctions.

1.2. General Information

Risk of potentially fatal accident!

The Common Powertrain Controller (CPC4) is essential for defining the functions of the engine and vehicle. Functions such as engine start, engine stop, accelerator pedal evaluation, actuation of engine brake etc. are relevant to safety.
Incorrectly performed modifications to the parameters or tampering with the wiring can cause far-reaching changes to the performance of the engine and/or vehicle. This can lead to personal injury or death and material damage.

The CPC4 control unit has been developed and tested in accordance with the Daimler Specifications for Operating Safety and EMC Compatibility. The manufacturer of the vehicle or equipment is solely responsible for the examination and implementation of applicable legal stipulations.

1.3. Use for the intended purpose

The Mercedes-Benz Engine and the CPC4 control unit are only to be used for the purpose stated in the contract of purchase. Any other use or an extension of the stated use will be regarded as not conforming to the engine's intended purpose.

Daimler AG cannot accept any liability for damage resulting from such use.

Liability for damage resulting from the engine not having been used for its intended purpose shall rest solely with the manufacturer of the complete machine or vehicle in which the engine is installed.

These CPC4 Operating Instructions and the engine Operating Instructions must be observed.

1.4. Personnel Requirements

Work on the electrics and programmed parameters must only be carried out by especially skilled persons or those who have received training from Daimler, or by specialists employed by a workshop authorized by Daimler.

1.5. Conversions and modifications to the CPC4

Unauthorized modifications to the CPC4 could affect the operation and safety of the vehicle/machine in which it is installed. No responsibility will be accepted by Daimler AG for any resulting damage.

1.6. Installation

The guidelines and instructions in chapter 3(3.2.2 Installation) must be heeded.

1.7. Organizational Measures

These Operating Instructions should be handed to personnel entrusted with the operation of the CPC4 and should, whenever possible, be stored in an easily accessible place.
With the aid of these Operating Instructions, personnel must be familiarized with the operation of the CPC4, paying special attention to the safety-relevant instructions applicable to the engine.
This applies in particular to personnel who only work on the engine and CPC4 occasionally. In addition to these Operating Instructions, compliance with local legal stipulations and any other obligatory accident prevention and environmental protection regulations which may apply in the country of operation must be ensured.

1.8. Safety precautions for engines with electronic control units

Risk of accident!

When the vehicle electrics are put into operation for the first time, the drive train must not be engaged (transmission in neutral). The engine could start unexpectedly due to incorrect wiring or unsuitable parameter settings. If the drive train is engaged (transmission not in neutral), the vehicle could unexpectedly start moving or set the working machine into operation, constituting a risk of injury or death.

The safety precautions stated below must be applied at all times in order to avoid damage to the engine, its components and wiring, and to avoid possible personal injury.

- **Only start the engine with the batteries securely connected.**
- **Do not disconnect the batteries when the engine is running.**
- **Only start the engine with the engine speed sensor connected.**
- **Do not start the engine with the aid of a battery charger or jump starter. If emergency starting is necessary, only start using separate batteries.**
- **The battery terminal clamps must be disconnected before a battery charger or jump starter is used. Comply with the operating instructions for the battery charger or jump starter.**
- **If electric welding work is to be performed, the batteries must be disconnected and both cables (+ and -) secured to prevend short-circuits.**
- **Work is only to be performed on the wiring and connectors are only to be plugged / unplugged with the electrical system switched off.**
- **The first time starting up the engine, the possibility must be provided to switch off the voltage supply to the MCM2 engine control and to the CPC4 controller module in an emergency. If it is incorrectly wired up, it may no longer be possible to switch off the engine.**
- **Interchanging the poles of the control unit's voltage supply (e.g. by interchanging the battery poles) can damage the control unit beyond repair.**
- **Fasten connectors on the fuel injection system with the specified tightening torque.**

Only use proper test leads for measurements on plug connectors (Daimler connector set).

If temperatures in excess of 80 °C (e.g. in a drying kiln) are to be expected, the control units must be removed as they could be damaged by such temperatures.

Telephones and two-way radios which are not connected to an external aerial can cause malfunctions in the vehicle electronics and thus jeopardize the engine's operating safety.

1.9. Daimler original parts

Daimler original parts are subject to the most stringent quality checks and guarantee maximum functional efficiency, safety and retention of value.
Each part is specially designed, produced, selected and approved for Daimler. For this reason, we are obliged to disclaim all liability for damage resulting from the use of parts and accessories which do not meet the above requirements.

In Germany and various other countries, certain parts (for instance parts relevant to safety) are only officially approved for installation or conversion work if they comply with valid legal stipulations.
These regulations are assured to be satisfied by Daimler original parts.

If other parts, which have not been tested and approved by Daimler, are installed - even if in individual circumstances they have been granted an official operating permit - Daimler is unable to assess them or grant any form of warranty, although the company endeavors to monitor market developments as far as possible. The installation of such parts may therefore restrict the validity of the warranty.

1.10. Safety and emergency running mode

The CPC4 and MCM2 electronic engine control units monitor the engine and carry out self-diagnosis. As soon as a fault is detected it is evaluated by the control unit and one of the following measures is initiated:

- Faults during operation are indicated by the warning lamps.
- Switch-over to a suitable substitute function for continued, albeit restricted engine operation (e.g. constant emergency engine speed).

Have any faults rectified without delay by the responsible Daimler Service Station.

Note:
The Daimler diagnosis tester SDconnect is connected to the J1939 communication lines on socket 2 of the CPC4. The SDconnect in conjunction with the Xentry Diagnostic Open Shell software, running on a PC, users can read off the fault codes of the CPC4. CPC4 fault codes and their meanings are described in chapter 6.2.2.

Note:
Defective units which are still within the warranty period (6 months from Daimler dispatch date) must be returned to the Daimler field service organization.

2. Operation

2.1. Introduction

Daimler MDEG (Medium Duty Engine Generation) and HDEP (Heavy Duty Engine Platform) series engines are equipped with an electronic engine control (MCM2). The MCM2 monitors and determines all values which are required for the operation of the engine (e.g. begin of injection, load level, ambient conditions, sensor evaluation, etc.).
The connection to the vehicle is made via a CAN interface, which digitally transmits the nominal values (e.g. torque, engine speed specification etc.) and the actual values (e.g. engine speed, oil pressure etc.).

The vehicle controller CPC4 contains the CAN interface required by the MCM2 and allows the operator to implement his requirements on the engine. On the one hand the CPC4 allows the use of conventional gauges and at the same time provides a conventional interface for special functions. Predefined engine control settings, e.g. torque/rpm limitations or a specified, predefined set engine speed, can be selected using signal switches. Routines stored in the control unit can be optimally adapted to the respective application with parameter programming. A diagnosis interface is provided to connect to an external diagnosis tester (e.g. Xentry Open Shell with SDconnect).

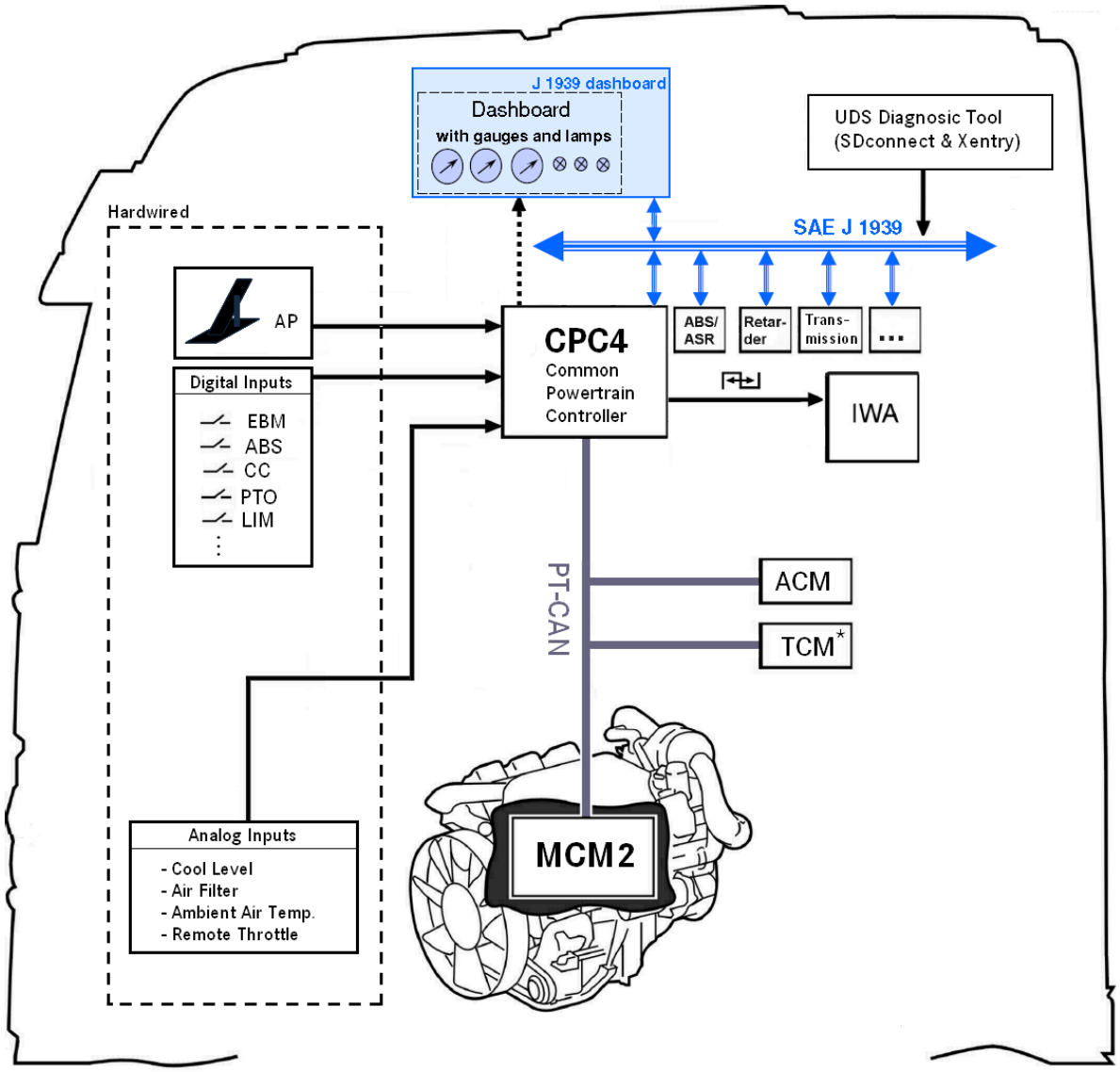


Fig 2.1: CPC4 as vehicle control

2.2. Abbreviations

Abbreviation	Description
ABS	= Anti-lock brake system
ABS/ASR	= Control unit for anti-lock brake system or traction control
ACC	= Adaptive Cruise Control
ACM	= Aftertreatment Control Module, after-treatment of exhaust gases to meet legal regulations
AGND	= Analog Ground (electrical)
AI	= Analog Input
AO	= Analog Output
AP	= Accelerator Pedal: torque demand (driving mode) or speed demand (PTO operating mode)
CC	= Cruise Control
CPC	= Common Powertrain Controller
DAI	= Daimler
DI	= Digital Input
DO	= Digital Output
DPF	= Diesel Particulate Filter
DTC	= Diagnostic Trouble Code
EBR	= Engine Brake
EBM	= Engine Brake Management
FFG	= Fußfahrgeber
GND	= Ground (electrical)
HDEP	= Heavy Duty Engine Platform
HMI	= Human-Machine-Interface
HP	= High Power
HS	= High Side
IWA	= Actual value output (PWM signal for automatic transmission, customer-specific electronics)
J1939 CAN	= Data bus according to standard SAE J1939
Kl. W	= Klemme W
LIM	= Limitations
LP	= Low Power
LS	= Low Side
MCM	= Motor Control Module for the injection principle pump-line-nozzle (is in this case MCM2)
MDEG	= Medium Duty Engine Generation
MIL	= Malfunction Indicator Lamp
PT-CAN	= Powertrain-CAN
PTO	= Power Take Off speed control
PWM	= Pulse Width Modulation
Retarder	= Control unit for a retarder
Stalk Switch	= EBR lever (e. g. A-Sach. 008 545 10 24 5B21)
SCR	= Selective Catalytic Reduction
SUP	= Supply (electrical)
TCM	= Transmission Control Module

2.3. Tasks

Functions

- Driving mode: torque demand to engine control (MCM2)
- PTO speed control: Specified rpm to engine control (MCM2).
- Engine start, engine stop
- Accelerator pedal evaluation, monitoring, fault evaluation
- Engine brakes
- Speed limitation
- Cruise control
- Temposet
- Parameter memory
- Fault memory
- Diagnosis interface (UDS) for a diagnosis unit via SAE J1939
- Linking with SAE J1939 (High-Speed-CAN-Bus)
- IWA, actual value output

Inputs

The CPC4 has **digital inputs** for:

- Miscellaneous special functions (Misc), e.g. linkup with conventional ABS control unit
- External engine start and engine stop
- Engine protection shutdown override
- Engine auxiliary shutdown
- Activating limitations, Limiter (0/1)
- Parking brake and service brake
- Cruise control (On/Off, Set/ Coast)
- Throttle Inhibit
- Remote PTO activation
- Engine brake management (low, medium, high)
- Transmission „neutral“ position
- Air condition status

The CPC4 has **analog inputs** for:

- Accelerator pedal (analog foot throttle actuator, PWM Pedal)
- Remote accelerator pedal (analog manual throttle actuator)
- Coolant level sensor
- Air filter sensor
- Ambient air temperature Sensor

Outputs

The CPC4 has outputs for

- Indicator and warning lamps
  - Oil level, oil pressure
  - Stop engine lamp (SEL)
  - Check engine lamp (CEL)
  - Buzzer
  - Air Filter Lamp (when connected to CPC)
  - Water in Fuel Lamp (when connected to MCM)
  - PTO active
  - Battery Voltage
  - Comparator outputs with adjustable thresholds for:
    - actual torque
    - road speed
    - engine speed
    - coolant temperature
    - pedal torque
    - boost temperature
    - oil pressure (threshold)
    - coolant temperature (Eng. Controller threshold)
    - optimized idle active
    - deceleration lamp
    - cruise / PTO active lamp
    - Check Transmission Lamp
    - Battery Charge Indicator

- Supported analog instruments
  - Oil pressure (analog output)
  - Coolant temperature (analog output)
  - Engine speed (analog output)
  - Road Speed (PWM output)

- Customer-specific electronics
  - Actual value output IWA (e.g. for automatic transmission)
  - Relay1…Relay4 outputs (e.g. kick down)

3. Construction

3.1. Images of Common Powertrain Controller CPC4

Fig 3.1: Diagonal view of CPC4

Black space for the type label
Connector index from left to right:
- Connector ST1
- Connector ST2
- Connector ST3
- Connector ST4

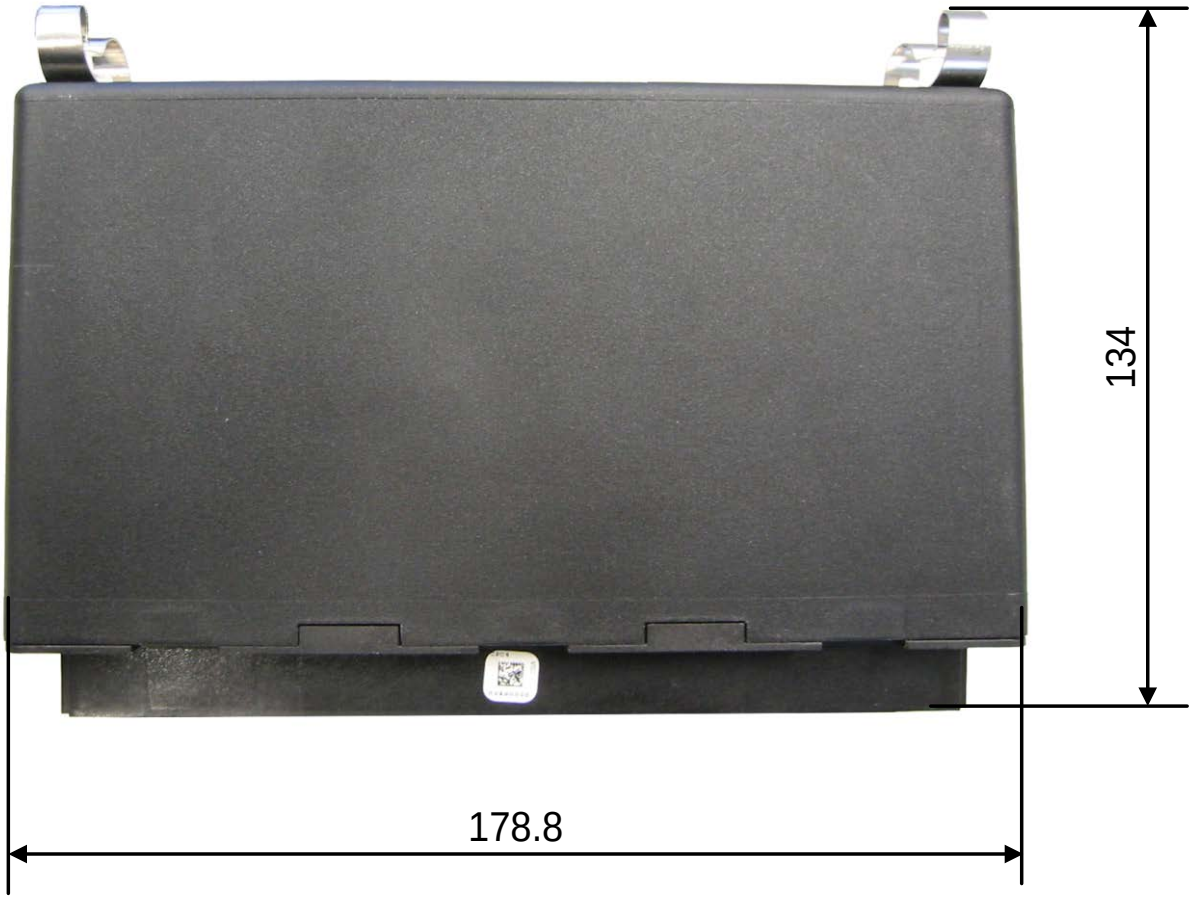


Fig 3.2: View of the bottom side of the CPC4

Connector sizes from the left to the right:
Connector ST4
Connector ST3
Connector ST2
Connector ST1

Fig 3.3: View of connector side of CPC4

Connector sizes from the left to the right:
Connector ST1 (A)
Connector ST2 (B)
Connector ST3 (C)
Connector ST4 (D)

3.2. Fitting and Connecting

3.2.1. CPC4 Ambient Conditions

Environmental conditions for CPC4:	
Protection against dust and water:	IP30 according to DIN 40050-9
Ambient air temperature:	-40°C …+80°C
Storage temperature:	-40°C …+85°C
Vibration:	Decoupled cabin: ISO 16750-3, chapter 4.1.2.8 Stationary motor: ISO 16750-3, chapter 4.1.2.2.2.1

- The CPC is not waterproof and cannot be subject to water spray. It must be mounted in an enclosed, protected environment.
- Main part is the plastic housing with slid in PCB which carries all electrical components and the connector.
- The CPC4 is designed to work as a cabin mounted part. It is designed to withstand all specified ambient influences. These are the typical mechanical, thermal, electrical and chemical stresses.
- 4 chambers with 3x18 pins (connector socket A, B and C) and 1x21 pins (connector socket D)
- As mentioned below the cross-section of the used cables should be selected as 1mm². There are two expectations from this:
    a) Power supply cables are to be selected as 1.5mm²;
    b) If multiconducter cables are used (e. g. CAN cable, accelerator pedal cable) a crosssection of 0.75mm² is also possible.

Electrical Supply - Current Consumption:	
Full functionality:	8V <= KL30 <= 32V
Startup voltage:	>= 8V
Restricted functionality:	6.5V <= KL30 <= 8V
Max. DC Voltage:	> 32V
Quiescent current (sleep mode):	< 0.25mA@24V
Under voltage shutdown of microcontroller:	KL30 < 6.5V
Max current consumption:	KL15: 1A, KL30: 8A, KL31: 10A
Cable Cross-section:	KL30/31: 1.5mm², otherwise 1.0mm² if multiconductor cables are used: 0.75mm² is also possible
Quiescent current (sleep mode):	< 0.25mA@2V
Typical current consumption(no actuators driven):	~ 0.2A

3.2.2. Installation

Install the CPC4 on a flat surface in a dry place with the connectors facing downwards:
Fit the central diagnosis socket in an easily accessible place.

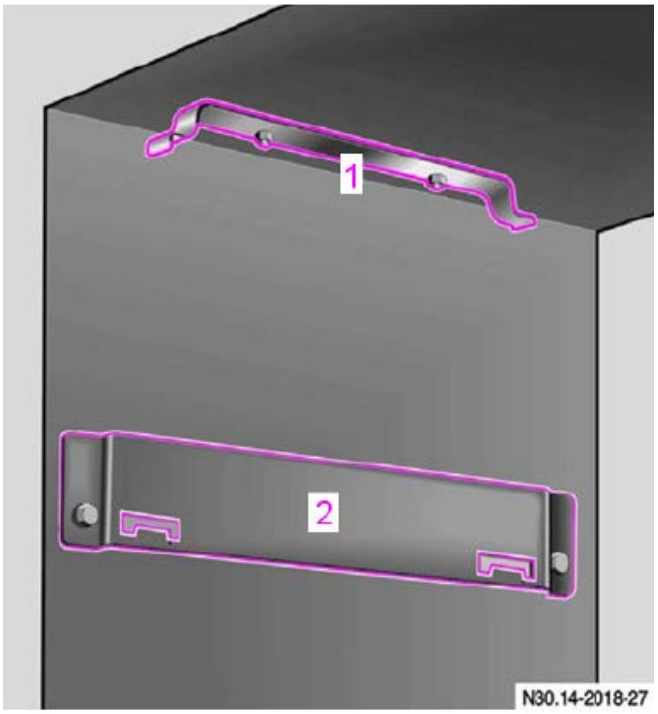


Fig 3.4: Brackets of CPC4

Connectors and Pins:

Type	Size	Daimler order number
Connector (ST1) Coding B – white	18-pole	A018 545 67 26
Connector (ST2) Coding A – grey	18-pole	A013 545 64 26
Connector (ST3) Coding A – grey	21-pole	A013 545 65 26
Connector (ST4) Coding C – blue	18-pole	A018 545 68 26
Possible terminal / pin for ST1…ST4	1,0 mm² (single crimp, silver plated) or 0,5mm² (double crimp, silver plated)	A013 545 76 26 (loose piece) or A013 545 75 26 (strip form)
Possible terminal / pin for ST1…ST4	1,5 – 2,5mm² (single crimp, silver plated)	A014 545 82 26 (loose piece) or A014 545 79 26 (strip form)
Possible terminal / pin for ST1…ST4	2,5mm² (single crimp, silver plated) or 1,5mm² (double crimp, silver plated)	A013 545 78 26 (loose piece) or A013 545 77 26 (strip form)

Only use Daimler brackets for the installation of the CPC4. This will guarantee that the CPC4 is securely mounted.

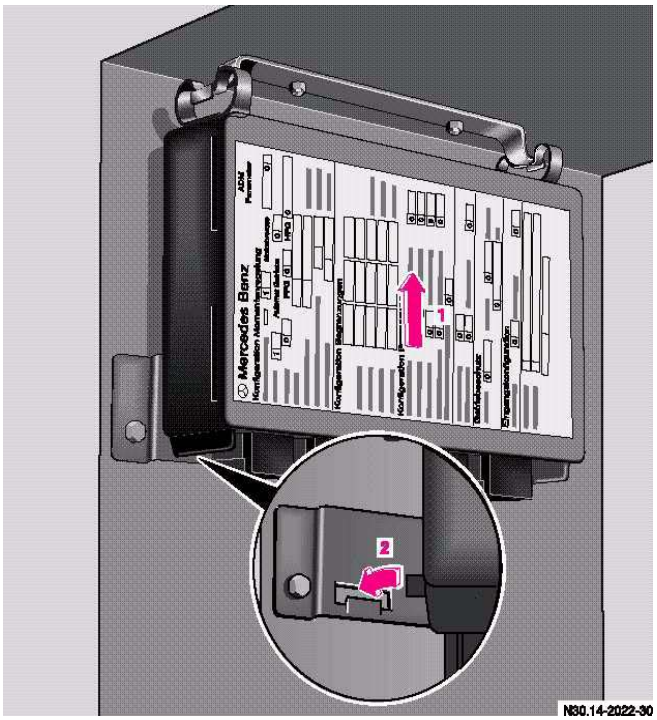


Fig 3.5: Mounting the CPC4

To install:

1) 1 Press the CPC4 against the upper bracket with the mounting springs
2) 2 Guide the support lugs into the recesses in the lower bracket.

To remove:

Press the CPC4 against the upper bracket with the mounting springs until the support lugs can be taken from the recesses in the lower bracket.

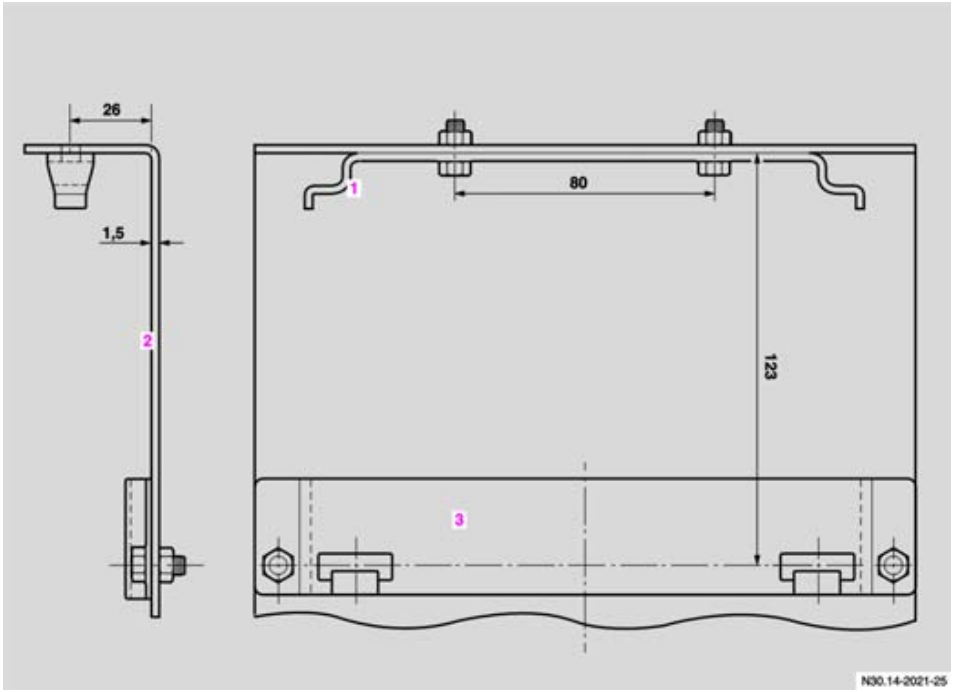


Fig 3.6: Dimensioned block diagram of the bracket

All bores Ø = 5,5mm
No. 1 bracket MB - part number A 670 542 06 40
No. 2 mounting face
No. 3 bracket MB - part number A 670 542 05 40

Ensure that appropriate ambient conditions for the CPC4 are provided! Detailed information on this topic, a more precise description of the functionality and the used components are to be found in the installation guidelines!

3.2.3. Connecting up

Risk of accident!

„Terminal 15“ and „Terminal 50“ of the control units are high-resistance signal inputs which draw current in the order of mA. Impermissible residual voltage at these inputs could affect LOW level detection.
Consequence:
- **engine starts unexpectedly (terminal 50)**
- **the engine can no longer be switched off (terminal 15)**

If the engine starts unexpectedly and the drive train is closed (transmission not in neutral), the vehicle could unexpectedly start moving or set the working machine in operation, constituting a risk to of danger to cause injury or death.

A battery isolator switch is only to be connected to the positive battery terminal. Wiring a switched ground connection is not permissible and could result in damage to all ECUs (e. g. CPC4, MCM, ACM, etc.) due to EOS (Electrical Over Stress)!

Observe the following guidelines when connecting up the CPC4:

- Only use Daimler star quad cables to wire up CAN connections. These cables are specially designed for vehicle CAN application (EMC).
- Switching off the power supply (terminal 30) is only permissible at the end of the control unit’s shutdown phases. These shutdown phases begin when terminal 15 is switched off and lasts for 2 minutes in case of the CPC4 and the MCM2 and up to 40 minutes in case of the ACM. If necessary, new fault codes are written into the fault code memory during the shutdown phase and stored in the control unit CPC4, in order to preserve these new values when the CPC4 is switched off.
- To avoid fault entries, the input „terminal 15“ shall be switched simultaneously for all control units.
- To avoid fault entries, the input „terminal 50“ (engine start) shall be switched simultaneously for the CPC4 and MCM2 control units.
- The ground connection of all electrical consumers should be distributed in a star formation from the central ground point. If the ground connection is not arranged in a star formation, or if the current flows through frame members with poor conductivity, malfunctions may develop due to ground offset or EMC effects.

3.3. Wiring Diagram of CPC4

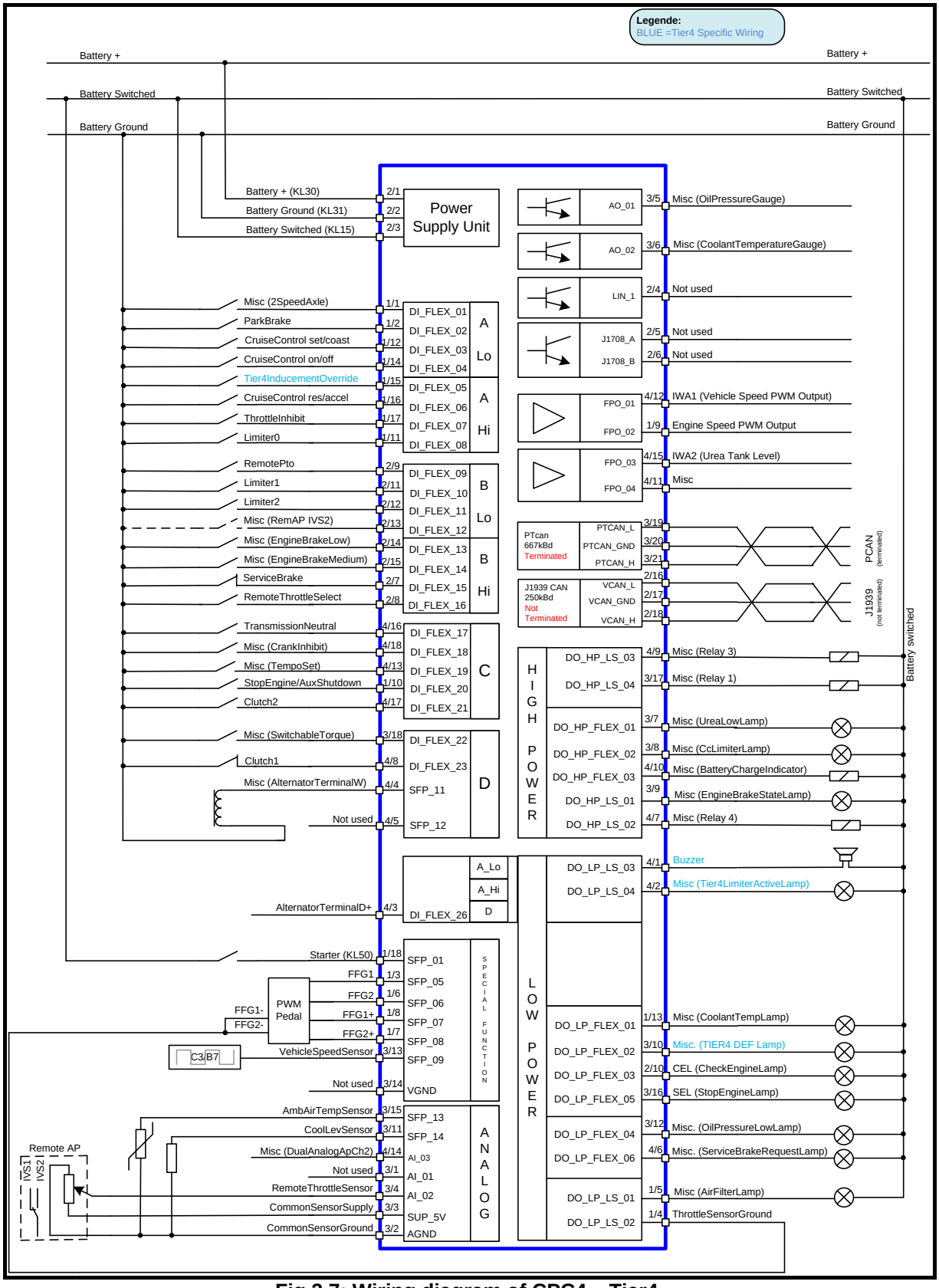


Fig 3.7: Wiring diagram of CPC4 – Tier4

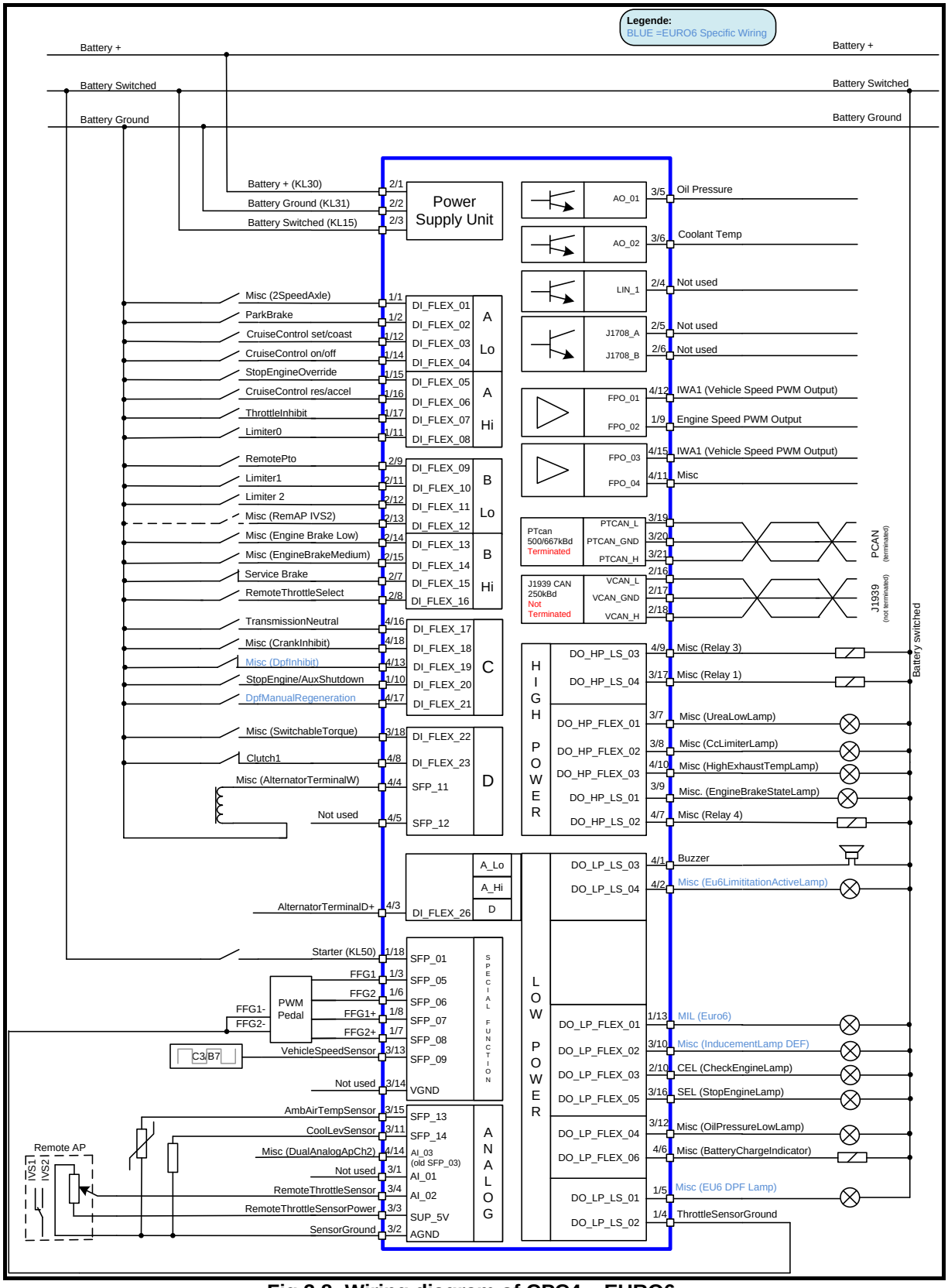


Fig 3.8: Wiring diagram of CPC4 – EURO6

3.4. Functional Description of the CPC4 Pins

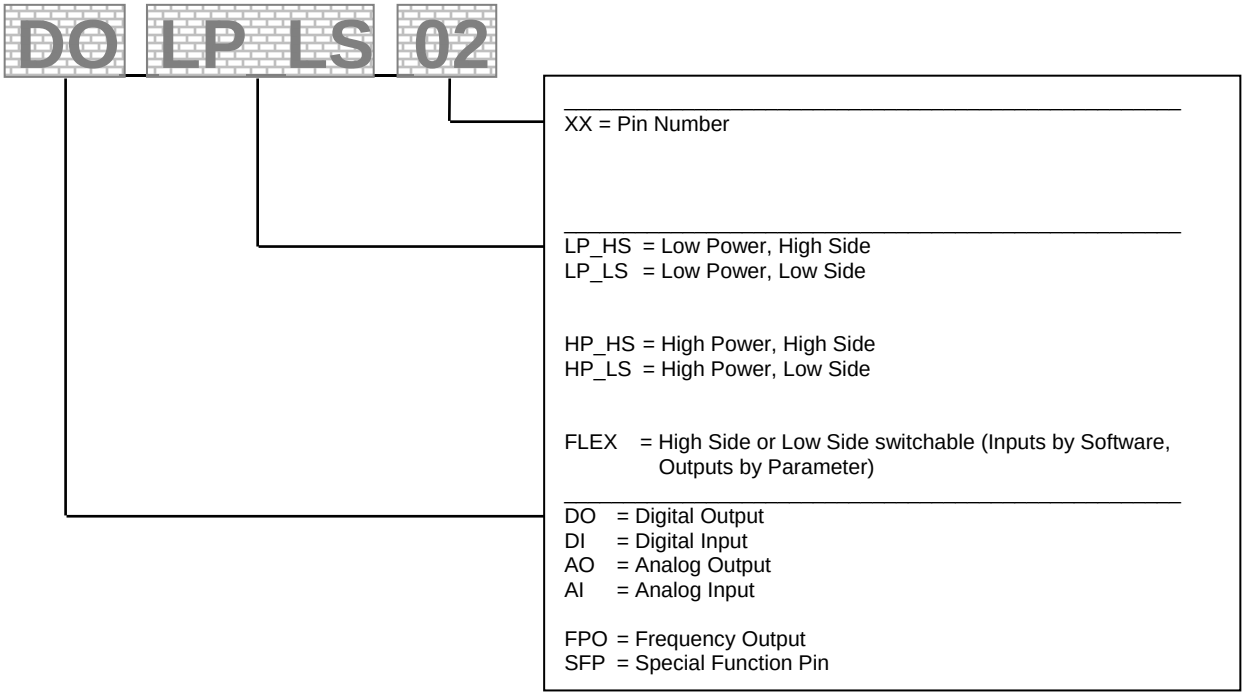


Fig 3.9: Labelling template for CPC4 pins

3.4.1. Connector ST1

Connector 1				
CPC4 pin **ADM3 pin**	**type**	**function**	**CPC4 shortcut** **ADM3 shortcut**	**description**
1/01 15/02	DI	Misc.(e. g. Dual Speed Axle)	DI_FLEX_01 HA	Switch to ground, normally open, sets speed ratio, if closed Values of parameter 13/01: 0 = disable, 1 = enable Dual Speed Axle, 2 = enable transmission retarder input, 3 = clutch switch, 4 = Evobus Cruise Control Lever Quit signal
1/02 21/16	DI	Park brake interlock	DI_FLEX_02 FSBE	Switch to ground, switch closed if park brake is engaged. Values of parameter 13/02: 0 = disable, 1 = enable park brake interlock
1/03 21/12	PI	FFG1 Signal	SFP_05 GAS1	PWM throttle signal, path 1, e.g. AB-Elektronik pedal terminal 2/9
		idle validation switch 2 (throttle active)		e.g. Williams pedal terminal D
1/04 21/14	SUP	Ground throttle pedal analog or PWM	DO_LP_LS_02 FP-	PWM pedal ground, e.g. AB-Elektronik pedal terminal 1/9 and 3/9 or analog pedal ground, e.g. Williams pedal terminal B. Values of parameter 35/01: 0 = disabled, 1 = ground, idle validation switches / analog accelerator pedal
1/05	DO	Misc.(e. g.Air Filter Lamp)	DO_LP_LS_01	usage of Output DoLpLs01 Values of parameter 35/02: 0 = disabled, 1 = ground, idle validation switch, 2 = DPF regeneration lamp, 3 = Air filter lamp
1/06 21/13	PI	FFG2 Signal	SFP_06 GAS_2	PWM throttle signal, path 2, e.g. AB-Elektronik pedal terminal 4/9

Connector 1				
CPC4 pin ADM3 pin	**type**	**function**	**CPC4 shortcut** ADM3 shortcut	**description**
		Idle validation switch 1 (throttle active)		e.g. Williams pedal terminal E
1/07 21/11	AI	FFG2 Power Supply	SFP_08 AFPS	Sensor voltage proportional to pedal position e.g. input of Williams pedal terminal A.
		Throttle pedal signal analog		Power supply for PWM pedal, e.g. AB-Elektronik pedal terminal 2/9
1/08 15/05 (PWM) 21/09 (analog)	SUP/ OUT	FFG1 Power Supply	SFP_07 FP+	Configurable high side output, Values of parameter : 0 = disabled 1 = Power supply PWM accelerator pedal (AB Elektronik terminal 6/9), 2 = analog pedal, e.g. Williams pedal term. C
		Throttle pedal signal analog		
1/09 12/06	OUT	Engine Speed	FPO_02 N_MOT	Low side output, for engine speed gauge (signal definition for speed gauges driven by generator terminal W, ratio configurable) Values of parameter 09/01: 0 = disabled, 1 = engine speed
1/10 12/11	DI	Misc.(e. g. Enable Auxiliary Shutdown)	DI_FLEX_20 STOP_EXT	Switch to ground, normally open, stops engine, if closed Values of parameter 13/03: 0 = disable, 1 = enable aux shutdown, 2 = reserved (FUSO Accelerator switch), 3 = Evobus retarder lever stage0
1/11 18/11	DI	Misc.(e. g. LIM0)	DI_FLEX_08 LIM0	Switch to ground, normally open, During active input the LIM0 limitations are effective. Values of parameter 13/66: 0 = disable, 1 = LIM0, 2 = PTO (old style, adjustable via cdi_p_Ptocc.SpeedSelMod_u8)
1/12 18/04	DI	Cruise control (Set / Coast Enable)	DI_FLEX_03 CC-	Push-button, normally open,for cruise control „set and decelerate“
1/13	OUT	Misc.(e. g. MIL Lamp)	DO_LP_FLEX_01	MI-Lamp Values of parameter 35/03: 0 = disabled, 1 = MIL lamp 2 = Urea Low Lamp 3 = Coolant temperature lamp
1/14 18/06	DI	Cruise Control enable	DI_FLEX_04 CC_EIN	Switch to ground, normally open, enables cruise control, if closed
1/15 18/13	DI	Shutdown / Tier4 Inducement Override	DI_FLEX_05 MABSCH_SP	Switch to ground, normally open, disables automatic engine shut down, if engine shutdown is enabled Values of parameter 13/04: 0 = disable, 1 = Shutdown / TIER4 Inducement override, 2 = CC-cancel
1/16 18/05	DI	Cruise Control CC+ (Resume / Accel Enable)	DI_FLEX_06 CC+	Push-button, normally open, for cruise control „resume and accelerate“
1/17 18/16	DI	Misc. (e. g. Throttle Inhibit)	DI_FLEX_07 FP_SP	Switch to ground, normally open, disables accelerator pedal and remote pedal, if closed Values of parameter 13/05: 0 = disable, 1 = throttle inhibit, 2 = Evobus retarder lever stage4
1/18 12/01	PI	Run Start, terminal 50	SFP_01 Kl. 50	Switch to battery voltage, normally open, activates starter, if closed

OUT = output
DI = digital input
PI = pulse input
I/O = input/output (bidirectional)
AI = analog input

3.4.2. Connector ST2

Connector 2				
CPC4 pin ADM3 pin	**type**	**function**	**CPC4 shortcut** ADM3 shortcut	**Description**
2/01 21/01	SUP	Main Battery Voltage	Kl. 30	Supply voltage (12V/24V)
2/02 21/03	SUP	Main Battery Ground	Kl. 31	Battery ground
2/03 21/02	SUP	Ignition (Switched Battery)	Kl. 15	Ignition switch (terminal 15)
2/04 12/02	OUT	LIN_1	LIN_1	LIN communication line
2/05 21/17	I/O	SAE 1708, A	J1708A	J1708 communication line A
2/06 21/18	I/O	SAE 1708, B	J1708B	J1708 communication line B
2/07 21/15	DI	Service Brake Release	DI_FLEX_15 BRE	Switch to ground, switch closed if service brake pedal is released.
2/08 18/07	DI	Misc. (e. g. Remote Throttle enable)	DI_FLEX_16 FG_WAHL	Switch to ground, normally open, disables accelerator pedal and enables remote pedal, if closed Values of parameter 13/06: 0 = disable, 1 = Remote-Throttle enable, 2 = Fast Engine Heat Up Switch, 3 = Evobus retarder lever stage3
2/09 18/10	DI	Remote PTO	DI_FLEX_09 PTO	Switch to ground, normally open, input to activate remote PTO control
2/10 21/06	OUT	Check engine lamp (yellow)	DO_LP_FLEX_03 LA_ADM	 Output active if faults active, e.g. oil pressure too low or ECU detects external input and output faults. If output is active while engine is running, shut down engine immediately and initiate maintenance respectively an error diagnosis as soon as possible. Values of parameter 35/04: 0 = disabled, 1 = check engine lamp yellow
2/11 18/12	DI	Misc. (e. g. Limiter 1)	DI_FLEX_10 LIM1	Switch to ground, normally open, During active input the LIM1 limitations are effective. Values of parameter 13/65: 0 = disable, 1 = Limiter1, 2 = RemAP IVS1
2/12 18/14	DI	Limiter 2	DI_FLEX_11 KLIMA	Switch to ground, normally open, During active input the LIM2 limitations are effective (e.g. increased idle speed for air conditioner).
2/13 18/15	DI	Misc. (e. g. Fan Control Override)	DI_FLEX_12 LUEFTER	Switch to ground, normally open, activates fan, if closed Values of parameter 13/08: 0 = disable, 1 = Fan Control Override, 2 = EvoBus retarder Lever Stage 2 input, 3 = Rockout Mode 4 = RemAP IVS2
2/14 18/08	DI	Misc. (e. g. Engine Brake Low)	DI_FLEX_13 MBR_L	Engine brake input switches DI_FLEX_13 and DI_FLEX_14: switch to ground, normally open, Configuration DiFlex13 (parameter 13/09): 0 = disable,

<table>
<tr><th colspan="5">Connector 2</th></tr>
<tr><th>CPC4 pin
ADM3 pin</th><th>type</th><th>function</th><th>CPC4 shortcut
ADM3 shortcut</th><th>Description</th></tr>
<tr><td>2/15
18/09</td><td>DI</td><td>Misc. (e. g. Engine Brake Low)</td><td>DI_FLEX_14
MBR_H</td><td>1 = Engine Brake Low,
2 = Evobus retarder lever stage1 input,
3 = CC hysteresis low
4 = RemAP IVS1

Configuration DiFlex14 (parameter 13/10):
0 = disable,
1 = engine brake medium,
2 = Evobus retarder lever stage2 input,
3 = CC hysteresis high
4 = RemAP IVS2

<u>DiFlex 13 and 14 calibrated to ‘1’:</u>

<table>
<tr><th colspan="2">Input value</th><th>Function</th></tr>
<tr><th>DI13</th><th>DI14</th><th></th></tr>
<tr><td>0</td><td>0</td><td>engine brakes disabled</td></tr>
<tr><td>0</td><td>1</td><td>engine brake stage 1 (low)</td></tr>
<tr><td>1</td><td>0</td><td>engine brake stage 2 (med)</td></tr>
<tr><td>1</td><td>1</td><td>engine brake stage 3 (high)</td></tr>
</table>
</td></tr>
<tr><td>2/16
21/21</td><td>I/O</td><td>SAE J1939 CAN Low (Vehicle CAN)</td><td>VCAN_L
1939_L</td><td>SAE J1939 vehicle CAN low line</td></tr>
<tr><td>2/17
21/20</td><td>I/O</td><td>CAN HF ground</td><td>VCAN_GND
1939_GND</td><td>SAE J1939 HF ground</td></tr>
<tr><td>2/18
21/19</td><td>I/O</td><td>SAE J1939 CAN High (Vehicle CAN)</td><td>VCAN_H
1939_H</td><td>SAE 1939 vehicle CAN high line</td></tr>
</table>

OUT = output
DI = digital input
PI = pulse input
I/O = input/output (bidirectional)
AI = analog input

3.4.3. Connector ST3

Connector 3				
CPC4 pin **ADM3 pin**	**type**	**function**	**CPC4 shortcut** **ADM3 shortcut**	**Description**
3/01 15/08	AI	Air Filter Sensor	AI_01 LF_SE	Analog differential pressure sensor for air filter load Values of parameter 13/11: 0 = disabled, 1 = air filter restriction sensor, 2 = OI Thermostat input, 3 = FUSO Idle Volume sensor input
3/02	SUP	Sensor Ground	AGND	Ground for remote throttle, ambient air temperature and coolant level sensor Values of parameter 35/05: 0 = disabled, 1 = ground, analog sensors
3/03 18/17	SUP	power supply remote throttle, air filter sensor	SUP_5V HFG+	Supply voltage for remote throttle and air cleaner sensor.
3/04 18/18	AI	Remote Throttle Sensor	AI_02 HFGS	Output voltage of sensor is proportional to the remote pedal position. Values of parameter 13/63: 0 = no sensor, 1 = Remote throttle sensor, 2 = Expansion tank pressure sensor

Connector 3				
CPC4 pin **ADM3 pin**	**type**	**function**	**CPC4 shortcut** **ADM3 shortcut**	**Description**
3/05 12/03	OUT	Misc. (e. g. Oil Pressure Lamp)	AO_01 P_OEL	Configuration of Analog Ouput/Input Pin AO_01 Values of parameter 09/03: 0 = disabled, 1 = oil pressure lamp, 2 = 5 bar oil pressure cluster, 3 = 10 bar oil pressure cluster, 4 = fuel filter sensor
3/06 12/04	OUT	Misc. (e. g. Coolant Temperature Lamp)	AO_02 T_MOT	Configuration of Analog Output/Input Pin AO_02 Values of parameter 09/04: 0 = disabled, 1 = coolant temperature lamp, 2 = coolant temperature cluster
3/07 15/10	OUT	Misc. (e. g. Service Brake Request Lamp)	DO_HP_FLEX_01	usage of Output DoHpFlex01 Values of parameter 35/06: 0 = disabled, 1 = decompression valve, 2 = grid heater, 3 = not used, 4 = extent tank pressure control valve 1, 5 = Service brake request lamp, 6 = Urea Low Lamp, 7 = Tier4 DEF lamp, 8 = EU6 Inducement lamp,
3/08 15/06	OUT	Misc. (e. g. CC Limiter Active Lamp)	DO_HP_FLEX_02	usage of Output DoHpFlex02 Values of parameter 35/07: 0 = disabled, 1 = exhaust brake only, 2 = exhaust and decompression brake via single valve, 3 = not used, 4 = not used, 5 = not used, 6 = not used, 7 = expansion tank pressure control valve 2, 8 = CC Limiter active lamp, 9 = CC Limiter active lamp with ECE R89, 10 = CC Limiter lamp ECE R89 only, 11 = Tier4 Limitation active lamp, 12 = EU6 Limitation active lamp
3/09 15/09	OUT	Misc. (e. g. Engine Brake State Lamp)	DO_HP_LS_01 REL2	Configurable low side output Values of parameter 35/08: 0 = disabled, 1 = grid heater hardwired, 2 = not used, 3 = engine brake active lamp, 4 = engine brake valves ground, 5 = FUSO engine brake active lamp, 6 = Water in Fuel Indicator, 7 = extent tank pressure control valve ground, 8 = Urea Low Lamp, 9 = Tier4 DEF lamp 10 = EU6 Inducement lamp, 11 = engine brake state lamp
3/10 21/08	OUT	Misc.(e. g. TIER4 DEF Lamp)	DO_LP_FLEX_02 LA_LUFT	Configurable low side output Values of parameter 35/09: 0 = disabled 1 = air filter lamp 2 = not used 3 = not used 4 = not used 5 = FUSO retarder control 1 6 = Urea Low Lamp 7 = Tier4 DEF lamp 8 = EU6 Inducement lamp
3/11 15/07	AI	Low Coolant Level Sensor	SFP_14 KW_SE	Analog input for coolant level sensor Values of parameter 32/02:

Connector 3				
CPC4 pin **ADM3 pin**	**type**	**function**	**CPC4 shortcut** **ADM3 shortcut**	**Description**
				0 = disable, 1 = dual level probe sensor (IMO_ACTROS), fix threshold evaluation, 2 = single level probe sensor (Rusty Nail), temperature dependent evaluation, 3 = dual level float sensor (FTL), fix threshold evaluation, 4 = single level probe sensor (Rusty Nail), fix threshold evaluation 5 = dual level probe sensor (IMO_SFTP), fix threshold evaluation
3/12 21/04	OUT	Misc.(e. g. Oil Level Lamp)	DO_LP_FLEX_04 LA_OELST	Values of parameter 35/10: 0 = disabled, 1 = oil level lamp, 2 = not used, 3 = oil pressure low lamp, 4 = cruise / PTO active lamp, 5 = Fuso retarder control 2, 6 = battery voltage low lamp, 7 = Fuel Filter Restriction Lamp, 8 = RockOutMode  Output active if oil level too low. Feature only available if oil level sensing enabled. If output is active while engine is running, shut down engine immediately and initiate maintenance respectively an error diagnosis as soon as possible.
3/13 15/03	PI	Vehicle Speed (C3/B7)	SFP_09 C3/B7	Vehicle speed input for tachometer or signal C3/B7 Values of parameter 08/13: 0 = no sensor, 1 = C3 sensor, 3 = J1939 ETC1  The use of calibration ‘0’ (no sensor) is only permitted for Off-Highway applications!
3/14	SUP	tachometer sensor ground	VGND	Not used (Ground for tachometer speed input)
3/15	AI	Ambient Air Temperature Sensor	SFP_13	Analog input for ambient air temperature sensor. Values of parameter 31/01: 0 = not available, 1 = hardwired, 2 = J1939 PGN 65269, 3 = J1587, 4 = PTCAN
3/16 21/05	OUT	Misc.(e. g. SEL (Stop Engine Lamp))	DO_LP_FLEX_05 LA_STOP	Values of parameter 35/11: 0 = disabled, 1 = stop engine lamp red, 2 = Buzzer  Output active if major faults active, e.g. oil pressure very low. If output is active while engine is running, shut down engine immediately and initiate maintenance respectively an error diagnosis as soon as possible.

Connector 3				
CPC4 pin **ADM3 pin**	**type**	**function**	**CPC4 shortcut** **ADM3 shortcut**	**Description**
3/17 15/12	OUT	Misc. (e. g. Enable Starter Lockout)	DO_HP_LS_04 REL1	Configurable low side output Values of parameter 35/12: 0 = disabled, 1 = enable starter lockout, 2 = enable kick down output, 3 = not used, 4 = optimized idle alarm, 5 = split valve 2, 6 = starter lockout and AGS2 run signal / starter lockout, 7 = engine brake disabled for over speed, 8= battery voltage low lamp, 9 = coolant level low lamp 10 = PTO1valve2
3/18 12/09	DI	Misc. (e. g. Enable ABS Input)	DI_FLEX_22 DSF1	Configurable input, switch to ground, normally open Values of parameter 13/12: 0 = disable, 1 = enable ABS input, 2 = enable retarder input, 3 = enable tempo set, 4 = enable grid heater detection, 5 = switchable torque demand, 6 = drive on super structure, 7 = throttle inhibit super structure, 8 = split select, 9 = FUSO Engine brake stage 2 cancel switch 10 = DPF inhibt switch 11 = PTO2stat, 12 = Engine shutdown/Tier4 inducement override
3/19 15/15	I/O	Powertrain CAN low	PTCAN_L MCAN_L	powertrain CAN low line
3/20 15/14	I/O	Powertrain CAN ground	PTCAN _GND MCAN_GND	powertrain CAN (HF-ground)
3/21 15/13	I/O	Powertrain CAN high	PTCAN _H MCAN_H	powertrain CAN high line

OUT = output
DI = digital input
PI = pulse input
I/O = input/output (bidirectional)
AI = analog input

3.4.4. Connector ST4

Connector 4				
CPC4 pin **ADM3 pin**	**type**	**function**	**CPC4 shortcut** **ADM3 shortcut**	**description**
4/01	OUT	Buzzer	DO_LP_LS_03	Configuration of low side output Values of parameter 35/13: 0 = disabled, 1 = Buzzer
4/02	OUT	Misc.(e. g. CC Limiter Active Lamp)	DO_LP_LS_04	Configuration of low side output Values of parameter 35/14: 0 = disabled, 1 = CC Limiter active lamp, 2 = CC Limiter active lamp with ECE R89, 3 = CC Limiter active lamp ECE R89 only, 4 = Tier4 Limitation active lamp, 5 = EU6 Limitation active lamp,
4/03	DI	D+	DI_FLEX_26	Switch to ground, normally open Values of parameter 13/13: 0 = disabled, 1 = D+ signal

Connector 4				
CPC4 pin ADM3 pin	**type**	**function**	**CPC4 shortcut** ADM3 shortcut	**description**
4/04 12/12	PI	Transmission Shaft Speed Sensor KL. W	SFP_11 Kl. W	SFP11, Pin 4/4, see also Parameter 56/01 Values of parameter 13/14: 0 = disabled Transmission Input Speed Sensor Configuration Values of parameter 56/01: 0 = disabled 1 = Transmission Shaft Speed Sensor 2 = KL_W
4/05 15/04	SUP	Transmission Shaft Speed Sensor Ground	SFP_12 VSS_GND	transmition shaft speed sensor ground Values of parameter 13/15: 0 = disable, 1 = Transmission Shaft Speed Sensor Ground
4/06 21/07	OUT	Misc.(e. g. Battery Charge Indicator)	DO_LP_FLEX_06 LA_GRID	Output active while preheating phase. Lamp is off when engine start is enabled. Values of parameter 35/15: 0 = disabled 1 = grid heater lamp 2 = accelarator pedal idle position 3 = run signal/starter lockout 4 = Battery Charge Indicator 5 = Maneuver Mode 6 = Service brake request lamp
4/07 18/01	OUT	Misc. (e. g. Acceleration Pedal Kickdown)	DO_HP_LS_02 REL4	Configurable low side output, Values of parameter 35/16: 0 = disabled, 1 = accelerator pedal kick down, 2 = actual torque, 3 = road speed, 4 = engine speed, 5 = coolant temperature, 6 = pedal torque, 7 = boost air temperature, 8 = oil pressure (threshold), 9 = coolant temperature (Eng.Controller threshold), 10 = vehicle power shutdown / ignition relay 11 = optimized idle ACC bus (ignition relay) 12 = split valve 1 13 = High Exhaust Temperature Lamp 14 = Aux-Relay 15 = PTO2valve2
4/08 18/02	DI	Clutch Released	DI_FLEX_23 KUP1	Switch to ground, switch open if clutch is depressed. Values of parameter 13/16: 0 = disable, 1 = clutch switch
4/09 15/11	OUT	Misc. (e. g. Acceleration Pedal Idle Position)	DO_HP_LS_03 REL3	Configurable low side output of the actual value comparator 3 (IWK3). Values of parameter 35/17: 0 = disabled, 1 = accelerator pedal idle position, 2 = actual torque, 3 = road speed, 4 = engine speed, 5 = coolant temperature, 6 = pedal torque, 7 = boost air temperature, 8 = oil pressure (threshold), 9 = coolant temperature (Eng. Controller threshold), 10 = optimized idle active lamp, 11 = deceleration lamp, 12 = not used 13 = WIF-Lamp 14 = cruise / PTO active lamp 15 = Check Transmission Lamp 16 = Battery Charge Indicator 17 = PTO1valve1

Connector 4				
CPC4 pin **ADM3 pin**	**type**	**function**	**CPC4 shortcut** **ADM3 shortcut**	**description**
4/10	DO	Misc. (e. g. Engine Brake State)	DO_HP_FLEX_03	usage of Output DoHpFlex03 Values of parameter 35/18: 0 = disabled 1 = not used 2 = not used 3 = Vehicle Power Shutdown / Ignition Relay 4 = engine brake active lamp 5 = Battery Charge Indicator 6 = PTO2valve1 7 = high exhaust temp lamp 8 = engine brake state lamp
4/11	FPO	Misc (e. g. KL_W)	FPO_04	Configuration FPO_04 Values of parameter 09/05: 0 = disabled, 1 = Remote Throttle, 2 = Kl. W (Klemme W)
4/12 12/05	OUT	Actual Value Output (Misc.)	FPO_01 IWA	Configurable output for actual values. Values of parameter 09/06: 0 = disabled, 1 = throttle torque 10%..90%, 2 = difference torque, 3 = throttle torque 90%..10%, 4 = actual torque, 5 = load torque (no idle torque for automatic transmission), 6 = road speed, 7 = demand speed, 8 = demand speed CC+, 9 = Urea Tank Level 10..90%,
4/13 12/10	DI	Misc. (e. g. Enable ABS Input)	DI_FLEX_19 DSF0	Configurable input, switch to battery voltage, normally open Values of parameter 13/17: 0 = disable, 1 = enable ABS input, 2 = enable transmission retarder input, 3 = enable tempo set, 4 = enable grid heater detection, 5 = switchable torque demand, 6 = drive on super structure, 7 = throttle inhibit super structure, 8 = split select, 9 = FUSO Engine brake stage 2 cancel switch 10 = DPF inhibit switch 11 = Engine shutdown / Tier4 Inducement override
4/14	AI	Dual Channel Analog Throttle, Channel 2 Signal	AI_03	analog input three configuration, AI_03 Values of parameter 13/64: 0 = no sensor, 1 = Dual channel analog throttle, channel 2 signal 2 = Expansion tank pressure sensor
4/15	OUT	Actual Value Output (Misc.)	FPO_03	Configurable output for actual values. Values of parameter 09/07: 0 = disabled, 1 = throttle torque 10%..90%, 2 = difference torque, 3 = throttle torque 90%..10%, 4 = actual torque, 5 = load torque (no idle torque for automatic transmission), 6 = road speed, 7 = demand speed, 8 = demand speed CC+, 9 = Urea Tank Level 10..90%, 10 = FUSO Accelerator PWM output
4/16 15/01	DI	Neutral Switch	DI_FLEX_17 NE	switch to ground, normally open, closed if transmission is in neutral position, disables engine start, if open
4/17 12/07	DI	Clutch2	DI_FLEX_21 DSF2	Configurable input, switch to ground, normally open.

Connector 4				
CPC4 pin ADM3 pin	**type**	**function**	**CPC4 shortcut** ADM3 shortcut	**description**
				Values of parameter 13/18: 0 = disable, 1 = 2 Clutch Switch, 2 = DPF regeneration switch, 3 = PTO1stat
4/18 12/08	DI	Misc. (e. g. Enable Crank Inhibit)	DI_FLEX_18 MOKL	Switch to ground, normally open. If switch is closed: indicates opened engine-hood. Engine start via terminal 50 or J1939 ESS is locked. Values of parameter 13/19: 0 = disable, 1 = enable crank inhibit, 2 = enable engine hood, 3 = not used, 4 = RPM Freeze, 5 = Engine Brake Disable, 6 = Fast Engine Heat Up Switch, 7 = Service-Brace active, 8 = Driver Requests Engine Brake Lookout, 9 = Maneuver Mode

OUT = output
DI = digital input
PI = pulse input
I/O = input/output (bidirectional)
AI = analog input

3.5. Power Supply CPC4

To guarantee that even after the power main switch is shut off the shutdown of the different control modules is done properly, it is necessary to implement an additional circuit to manage this circumstance. The power supply lines shall be protected via fuses.

This variant supplies the Daimler devices permanent, independently from an open or closed Main Power Switch.

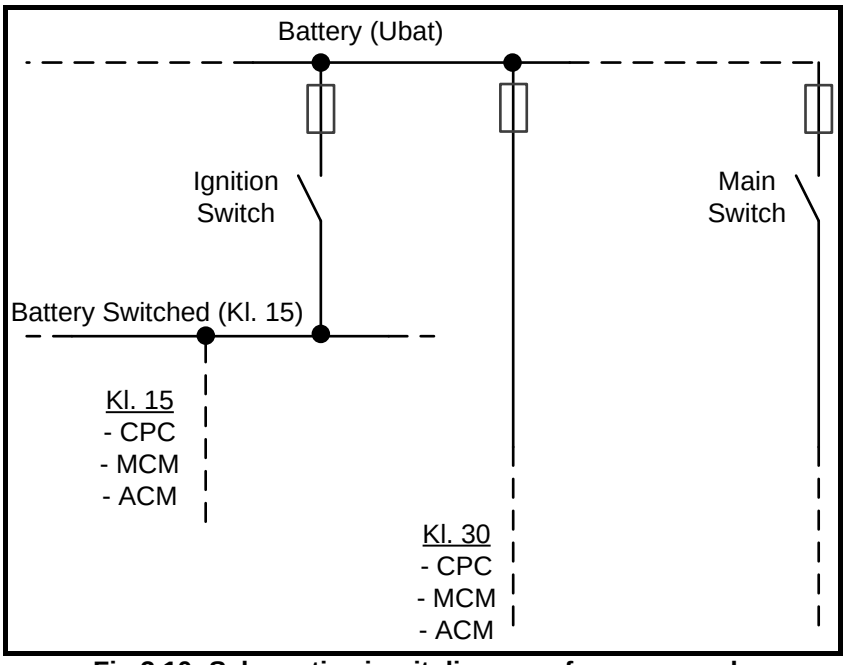


Fig 3.10: Schematic circuit diagram of power supply

3.5.1. Start-up and Shutdown behavior of CPC

The following tables show the different conditions and circumstances which have to be met to start up / shutdown the CPC4:

For the **startup** of the CPC4 the following conditions have to be met:

Signal	Level	Condition
Kl. 30 AND Kl. 15	>8V	OR
Kl. 30 AND Kl. 50	>8V (ON)	

Limp Home (if connection to Kl. 30 is interrupted):

Signal	Level	Condition
Kl. 15	>8V	$I_{kl.\ 15}$ <1A à only reduced functionality possible (dig-inputs, throttle pedal, CAN communication, CERY lamp)

For the **correct shutdown** of the CPC4 the following conditions have to be met:

Signal	Level	Condition	
"Kl. 15" (CPC4 / Pin 2/3)	OFF	AND	
CAN-Message	"Kl. 15 = OFF" (MCM)	AND	
Engine Speed	<= 80 rpm	AND	
MCM ignition state CAN-Message: "MCM_C02" Signal: "EngIgn_Stat_MCM	= 0	AND	
J1939 Message: CAN-Message: "PropB06" Signal: "AwakeCmd	= 0	AND	
Post-run (off-carriage)	Finished	necessary with Daimler Transmission only	

Note: If the ECU contains no valid software the shutdown must be possible with "Kl. 15 = OFF" only!

Start-up behavior

Kl. 30	Kl. 15	Kl. 50	Start-up	Remark
0	0	0	No	Sleep mode
0	0	1	No	Sleep mode
0	1	0	Yes	Kl. 15 limp mode home
0	1	1	Yes	Kl. 15 limp mode home
1	0	0	No	Sleep mode
1	0	1	Yes	Regular operation Kl. 15 over CAN
1	1	0	Yes	Regular operation
1	1	1	Yes	Start mode

3.6. Pin Assignment

3.6.1. Supply Pins (SUP)

3.6.1.1. Technical Data

Power supply						
CPC4 pin **ADM3 pin**	**function**	**shortcut**	**U_{MAX}**	**U_{MIN}**	**I_{MAX}**	**further data**
1/04 21/14	Ground throttle pedal analog or PWM	DO_LP_LS_02	U_{BAT}	U_{BAT} -0,9V	250mA	Total current over all low side outputs is limited to 10A.
1/07 21/11	FFG2 Power Supply	SFP_08	U_{BAT}		50mA	Power supply for PWM pedal
1/08 21/09 15/05	FFG1 Power Supply	SFP_07	U_{BAT} 5 V		50mA	Power supply PWM throttle pedal
2/01 21/09	Main Battery Voltage	Kl. 30	<= 32V	>= 8V	8A	Max Batt.+ current
					200mA	Typ. current (no actuators)
					< 200µA	Quiescent current (sleep)
2/02 21/14	Main Battery Ground	Kl. 31			10 A	Voltage supply ground

Power supply						
CPC4 pin **ADM3 pin**	**function**	**shortcut**	**U_{MAX}**	**U_{MIN}**	**I_{MAX}**	**further data**
2/03 18/17	Ignition (Switched Battery)	Kl. 15	U_{BAT}		1 A	Ignition switch
3/02	Sensor Ground	AGND			100mA	
3/03 18/17	Power supply remote throttle, air filter sensor	SUP_5V	5V	5V	60mA	
3/14	Tachometer Sensor Ground	VGND			50mA	Reserved (Connected to GND)
4/05 15/04	Transmission Shaft Speed Sensor Ground	SFP_12			50mA	Reserved (Connected to GND)

3.6.2. Digital Inputs (DI)

3.6.2.1. Technical Data

The digital inputs of the CPC4 are divided into 6 different groups with 4 inputs each (A Lo, A Hi, B Lo, B Hi, C and D). This has to be taken into consideration due to the concept with which the input switch conditions are detected.

The input evaluation is done with the Pull-Up and Pull-Down switches shown in the figure below. These switches are actuated with a sampling rate of 10ms. Within these 10ms the two switches are closed one after another with the resulting voltage value read in by the corresponding ADC. This detection is done for each group of inputs and it is not possible to do it for different inputs of a group separately.

Therefore it is not recommended to connect inputs of different input groups with one and the same switch because the input groups are not evaluated in parallel but with a little time offset.
In case of connected inputs, it will be difficult to detect the status of the input switch properly. In the worst case scenario the input status cannot be determined at all or occurring faults can't be detected.

input group	assigned input	input group	assigned input
A Lo	DI_FLEX_01 DI_FLEX_02 DI_FLEX_03 DI_FLEX_04	B Hi	DI_FLEX_13 DI_FLEX_14 DI_FLEX_15 DI_FLEX_16
A Hi	DI_FLEX_05 DI_FLEX_06 DI_FLEX_07 DI_FLEX_08	C	DI_FLEX_17 DI_FLEX_18 DI_FLEX_19 DI_FLEX_20 DI_FLEX_21
B Lo	DI_FLEX_09 DI_FLEX_10 DI_FLEX_11 DI_FLEX_12	D	DI_FLEX_22 DI_FLEX_23 SFP_11 SFP_12

Digital inputs (DI)							
CPC4 pin **ADM3 pin**	**function**	**shortcut**	**U_{MAX}**	**U_{MIN}**	**U_{LOW}**	**U_{HIGH}**	**further data**
1/01 15/02	Two Speed Axle Enable Retarder Input EvoBus Cruise Control Lever	DI_FLEX_01	U_{BAT}	0V	<= 1/3 U_{BAT}	>= 2/3 U_{BAT}	pull up resistor 2,7kΩ

Digital inputs (DI)							
CPC4 pin **ADM3 pin**	**function**	**shortcut**	**U_{MAX}**	**U_{MIN}**	**U_{LOW}**	**U_{HIGH}**	**further data**
1/02 21/16	Park brake interlock	DI_FLEX_02	U_{BAT}	0V	<= 1/3 U_{BAT}	>= 2/3 U_{BAT}	pull up resistor 2,7kΩ
1/10 12/11	Stop Engine / Aux Shutdown EvoBus Retarder Lever Stage0	DI_FLEX_20	U_{BAT}	0V	<= 1/3 U_{BAT}	>= 2/3 U_{BAT}	pull up resistor 2,7kΩ
1/11 18/11	Limiter 0 PTO	DI_FLEX_08	U_{BAT}	0V	<= 1/3 U_{BAT}	>= 2/3 U_{BAT}	pull up resistor 2,7kΩ
1/12 18/04	Cruise control (Set / Coast Enable)	DI_FLEX_03	U_{BAT}	0V	<= 1/3 U_{BAT}	>= 2/3 U_{BAT}	pull up resistor 2,7kΩ
1/14 18/06	Cruise Control enable	DI_FLEX_04	U_{BAT}	0V	<= 1/3 U_{BAT}	>= 2/3 U_{BAT}	pull up resistor 2,7kΩ
1/15 18/13	Shutdown / Tier4 Inducement Override	DI_FLEX_05	U_{BAT}	0V	<= 1/3 U_{BAT}	>= 2/3 U_{BAT}	pull up resistor 2,7kΩ
1/16 18/05	Cruise Control CC+ (Resume / Accel Enable)	DI_FLEX_06	U_{BAT}	0V	<= 1/3 U_{BAT}	>= 2/3 U_{BAT}	pull up resistor 2,7kΩ
1/17 18/16	Throttle inhibit EvoBus Retarder Lever Stage4	DI_FLEX_07	U_{BAT}	0V	<= 1/3 U_{BAT}	>= 2/3 U_{BAT}	pull up resistor 2,7kΩ
2/07 21/15	Service Brake Release	DI_FLEX_15	U_{BAT}	0V	<= 1/3 U_{BAT}	>= 2/3 U_{BAT}	pull up resistor 2,7kΩ
2/08 18/07	Remote Throttle enable EvoBus Retarder Lever Stage3	DI_FLEX_16	U_{BAT}	0V	<= 1/3 U_{BAT}	>= 2/3 U_{BAT}	pull up resistor 2,7kΩ
2/09 18/10	Remote PTO	DI_FLEX_09	U_{BAT}	0V	<= 1/3 U_{BAT}	>= 2/3 U_{BAT}	pull up resistor 2,7kΩ
2/11 18/12	Limiter 1 RemAP IVS 1	DI_FLEX_10	U_{BAT}	0V	<= 1/3 U_{BAT}	>= 2/3 U_{BAT}	pull up resistor 2,7kΩ
2/12 18/14	Air condition status / LIM2	DI_FLEX_11	U_{BAT}	0V	<= 1/3 U_{BAT}	>= 2/3 U_{BAT}	pull up resistor 2,7kΩ
2/13 18/15	Fan Control Override EvoBus Retarder Lever Stage5 RemAP IVS 2	DI_FLEX_12	U_{BAT}	0V	<= 1/3 U_{BAT}	>= 2/3 U_{BAT}	pull up resistor 2,7kΩ
2/14 18/08	Engine Brake Low EvoBus Retarder Lever Stage1 CC Hyst Low RemAP IVS 1	DI_FLEX_13	U_{BAT}	0V	<= 1/3 U_{BAT}	>= 2/3 U_{BAT}	pull up resistor 2,7kΩ
2/15 18/09	Engine Brake Medium CC Hyst High RemAP IVS 2	DI_FLEX_14	U_{BAT}	0V	<= 1/3 U_{BAT}	>= 2/3 U_{BAT}	pull up resistor 2,7kΩ
3/18 12/09	Enable ABS Input Enable Retarder Input	DI_FLEX_22	U_{BAT}	0V	<= 1/3 U_{BAT}	>= 2/3 U_{BAT}	pull up resistor 2,7kΩ

Digital inputs (DI)							
CPC4 pin **ADM3 pin**	**function**	**shortcut**	**U_{MAX}**	**U_{MIN}**	**U_{LOW}**	**U_{HIGH}**	**further data**
	Enable Tempo Set						
	Switchable Torque Demand						
	Drive On Superstructure						
	Throttle Inhibit Superstructure						
	Split Select						
	Engine Shutdown / Tier4 Inducement Override						
4/03	D+	DI_FLEX_26	U_{BAT}	0V	<= 1/3 U_{BAT}	>= 2/3 U_{BAT}	pull up resistor 2,7kΩ
4/08 18/02	Clutch Released	DI_FLEX_23	U_{BAT}	0V	<= 1/3 U_{BAT}	>= 2/3 U_{BAT}	pull up resistor 2,7kΩ
	Enable ABS Input						
	Enable Retarder Input						
	Enable Tempo Set						
	Switchable Torque Demand						
4/13 12/10	Drive On Superstructure	DI_FLEX_19	U_{BAT}	0V	<= 1/3 U_{BAT}	>= 2/3 U_{BAT}	pull up resistor 2,7kΩ
	Throttle Inhibit Superstructure						
	Split Select						
	Engine Shutdown / Tier4 Inducement Override						
4/16 15/01	Neutral Switch	DI_FLEX_17	U_{BAT}	0V	<= 1/3 U_{BAT}	>= 2/3 U_{BAT}	pull up resistor 2,7kΩ
4/17 12/07	Clutch2	DI_FLEX_21	U_{BAT}	0V	<= 1/3 U_{BAT}	>= 2/3 U_{BAT}	pull up resistor 2,7kΩ
	Enable Crank Inhibit						
4/18 12/08	Engine Brake Disable	DI_FLEX_18	U_{BAT}	0V	<= 1/3 U_{BAT}	>= 2/3 U_{BAT}	pull up resistor 2,7kΩ
	Driver Requested Engine Brake Lockout						

3.6.2.2. Input Circuit

The following figure shows the schematic of a digital diflex input pin oft he CPC4.

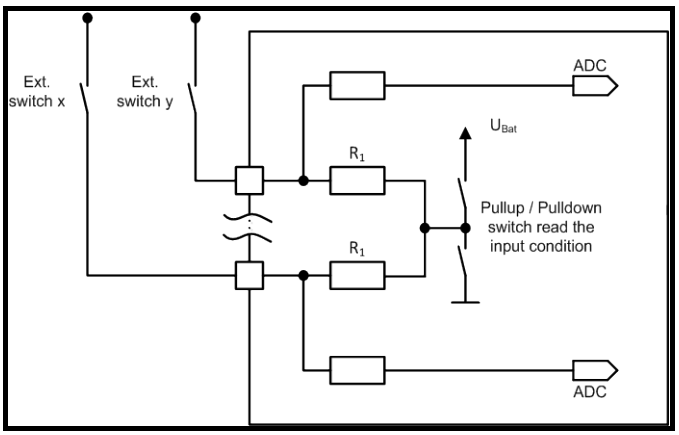


Fig 3.11: Internal wiring of a digital diflex input

3.6.2.3. Fault detection

There are several parameters (35/20 (“1 04 DO Fault Detection”) to 35/37 (“4 10 DO Fault Detection”)) that allow the setting of a fault memory entry in the event of a detected digital input failure. Figure (Fig 3.12) shows the fault detection possibilities of the digital inputs of the CPC4.

Inputs (DI)		
	Low Side Switch	
	Switch Active	Switch inactive
Short Circuit GND	N	N
Short Circuit Ubat	Y	Y
Open Load	N	N

Fig 3.12: Schematic fault detection possibility (digital inputs only)

Remark: There are two exceptions for the faultt detection for digital input pins (Fig 3.13):

1) **If the fault detection is activated and the according digital input pin is triggered by a semiconductor output (of e. g. another ECU), it is important to ensure that the input pin is not connected to U_{bat} (e. g. via a pull-up resistor). In this case a short circuit to U_{bat} would be detected.**
2) **Digital input 4/03 (“AlternatorTerminalD+”, DI_FLEX_26) is used for charging control of the generator. It is permanently connected to U_{bat} and therefore it is recommended to not activate the fault detection for this input pin. Otherwise there would be a short circuit to U_{bat} detected.**

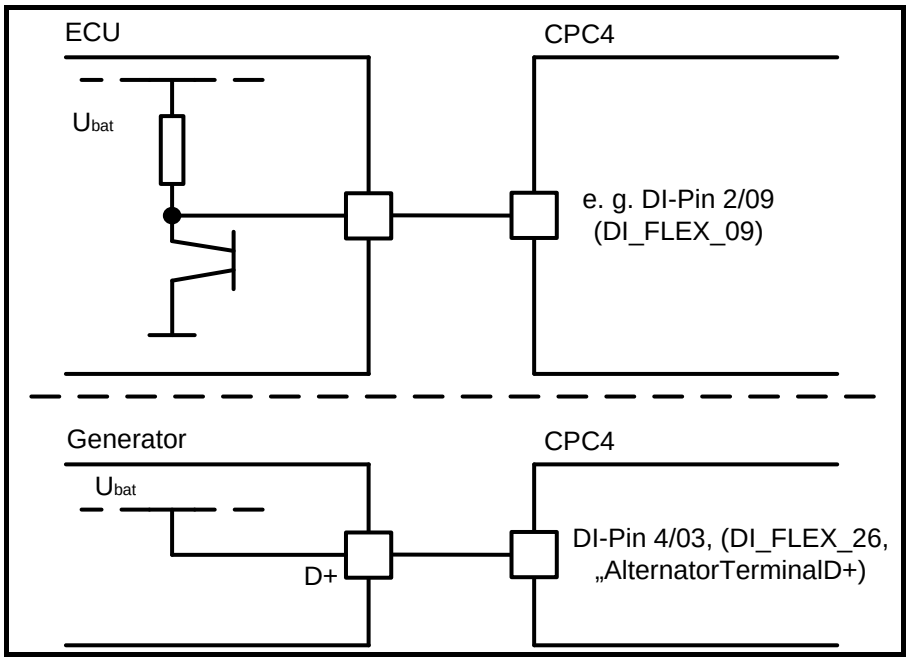


Fig 3.13: Example for exceptions from fault detection for digital input pins

3.6.3. Special Function Pin (SFP)

3.6.3.1. Technical Data

Special function pin (SFP)						
CPC4 pin **ADM3 pin**	**function**	**shortcut**	**f / U_{MAX}**	**U_{LOW}**	**U_{HIGH} / I_{MAX}**	**further data**
1/03 21/12	FFG1 Signal (PWM AP (VDO), ABE AP)	SFP_05	400Hz	<= 1/3 U_{BAT}	>= 2/3 U_{BAT}	pull up resistor to U_{BAT}, 20kΩ
	IVS2 (Analog AP with IVS)		U_{BAT}			pull up resistor to U_{BAT}, 2,6kΩ
1/06 21/13	FFG2 Signal (PWM AP (VDO), ABE AP)	SFP_06	400Hz	<= 1/3 U_{BAT}	>= 2/3 U_{BAT}	pull up resistor to U_{BAT}, 20kΩ
	IVS1 (Analog AP with IVS)		U_{BAT}			pull up resistor to U_{BAT}, 2,6kΩ
1/07 21/11	FFG2 Power Supply	SFP_08	U_{BAT}		50mA	Power supply for PWM pedal
	Throttle Sensor Signal (Analog AP with IVS)					
	Throttle Sensor Signal Channel 1 (Dual Channel Analog AP)					
1/08 21/09 15/05	FFG1 Power Supply	SFP_07	U_{BAT}		50mA	Power supply PWM throttle pedal
	Throttle Sensor Power Supply (Analog AP with IVS)		5 V			Power supply analog AP with IVS
	Throttle Sensor Power Supply (Dual Channel Analog AP)		5 V			Power supply dual channel analog AP
1/18	Run Start	SFP_01		< 2,0V	> 5,2V	U_{MIN} = -0,2V, U_{MAX}=

Special function pin (SFP)						
CPC4 pin **ADM3 pin**	**function**	**shortcut**	**f / U_{MAX}**	**U_{LOW}**	**U_{HIGH} / I_{MAX}**	**further data**
12/01						36V
3/13 15/03	Vehicle Speed (C3/B7)	SFP_09	10kHz	< 1,8V	> 5,2V	Sensor resistances should be between 700Ω...3,3kΩ
4/04 12/12	Transmission Shaft Speed Sensor Kl. W	SFP_11	10kHz	< 1,8V	> 5,2V	Sensor resistances should be between 700Ω...3,3kΩ
4/05 15/04	Transmission Shaft Speed Sensor Ground	SFP_12			50mA	Reserved (Connected to GND)

3.6.4. Analog Inputs (AI)

3.6.4.1. Technical Data

Analog inputs (AI)					
CPC4 pin **ADM3 pin**	**function**	**shortcut**	**U_{MAX}**	**U_{MIN}**	**further data**
3/01 15/08	Air Filter Sensor	AI_01	5 V	0 V	21kΩ input resistance to ground
3/04 18/18	Remote Throttle Sensor	AI_02	5 V	0 V	21kΩ input resistance to ground
3/11 15/07	Low Coolant Level Sensor	SFP_14	5 V	0 V	pull up resistor 400Ω to 5 V
3/15	Ambient Air Temperature Sensor	SFP_13	5 V	0 V	pull up resistor 10kΩ to 5 V
4/14	Dual Channel Analog Throttle, Channel 2 Signal	AI_03	5 V	0 V	21kΩ input resistance to ground

3.6.5. Driver Outputs (DO)

3.6.5.1. Technical Data

This paragraph addresses the parameterization of the digital outputs of the CPC4. To use one of the mentioned digital outputs not already setup with the default configuration there are at least 2, in some cases 3 parameters which have to be set beforehand. These 3 parameters include:

Parameter	Description
DO Selection	This parameter determines for what purpose the output is going to be used. There is an individual list of possible parameter values for each available output, which can be found in the parameters chapter 4.1.26
DO Fault Detection	It is always mandatory to set the fault detection parameter associated with the output pin which is going to be used. Otherwise no fault detection is possible! It is recommended that this parameter is at least set to parameter value 9. (for further information see chapter 3.6.5.3)
DO Configuration	The configuration parameter determines whether the pin is switches to Ubat(high side) or Ground(low side)

The recommended order of parameterization is:

“DO Fault Detection” à “DO Configuration” à “DO Selection”

Driver outputs (OUT)						
CPC4 pin **ADM3 pin**	**function**	**shortcut**	**I_{MAX}**	**U_{MAX}**	**P_{MAX} lamp**	**further data**
1/05	Air Filter Lamp DPF Regeneration Lamp(EURO6)	DO_LP_LS_01	250mA	U_{BAT}	2 W @ 12 V	low side driver, short protected
1/13	MIL (EURO6) Urea Low Lamp (EURO6) Coolant Temperature Lamp (EURO6)	DO_LP_FLEX_01	250mA	U_{BAT}	2 W @ 12 V	low / high side driver, short protected
2/10 21/06	Check engine lamp (yellow)	DO_LP_FLEX_03	250mA	U_{BAT}	2 W @ 12 V	low side driver, short protected
3/07* 15/10	Service Brake Request Lamp Urea Low Lamp Tier4 DEF Lamp	DO_HP_FLEX_01	2 A	U_{BAT}		low / high side driver, short protected
3/08* 15/06	CC Limiter Active Lamp CC Limiter Active Lamp with ECE-R89 CC Limiter Lamp ECE-R89 only Tier4 Limitation Active Lamp	DO_HP_FLEX_02	2 A	U_{BAT}		low / high side driver, short protected
3/09** 15/09	Engine Brake State Lamp Urea Low Lamp Tier4 DEF Lamp	DO_HP_LS_01	2 A	U_{BAT}		low side driver, short protected
3/10* 21/08	Urea Low Lamp Tier4 DEF Lamp Air Filter Lamp	DO_LP_FLEX_02	250mA	U_{BAT}	2 W @ 12 V	low / high side driver, short protected
3/12* 21/04	Oil Level Lamp Oil Pressure Lamp Cruise / PGS Active Lamp Battery Voltage Low Lamp Filter Restriction Lamp	DO_LP_FLEX_04	250mA	U_{BAT}	2 W @ 12 V	low / high side driver, short protected
3/16* 21/05	SEL (Stop Engine Lamp) Buzzer	DO_LP_FLEX_05	250mA	U_{BAT}	2 W @ 12 V	Lamp or buzzer
3/17** 15/12	Enable Starter Lockout Enable Kickdown Output Split Valve 2 Battery Voltage Low Lamp Coolant Level Low Lamp	DO_HP_LS_04	2 A	U_{BAT}		low side driver, short protected

Driver outputs (OUT)						
CPC4 pin **ADM3 pin**	**function**	**shortcut**	**I_{MAX}**	**U_{MAX}**	**P_{MAX} lamp**	**further data**
4/01	Buzzer	DO_LP_LS_03	250mA	U_{BAT}		low side driver, short protected
4/02	CC Limiter Active Lamp	DO_LP_LS_04	250mA	U_{BAT}		low side driver, short protected
	CC Limiter Active Lamp with ECE-R89					
	CC Limiter Lamp ECE-R89 only					
	Tier4 Limitation Active Lamp					
4/06* 21/07	Battery Charge Indicator	DO_LP_FLEX_06	250mA	U_{BAT}	2 W @ 12 V	low / high side driver, short protected
	Service Brake Request Lamp					
4/07** 18/01	Acceleration Pedal Kickdown	DO_HP_LS_02	2 A	U_{BAT}		low side driver, short protected
	Actual Torque					
	Road Speed					
	Engine Speed					
	Coolant Temperature					
	Pedal Torque					
	Boost Temperature					
	Oil Pressure Lamp					
	Coolant Temperature Lamp					
	Split Valve 1					
	AUX-Relay (Reverse to battery charge indicator)					
4/09** 15/11	Acceleration Pedal Idle Position	DO_HP_LS_03	2 A	U_{BAT}		low side driver, short protected
	Actual Torque					
	Road Speed					
	Engine Speed					
	Coolant Temperature					
	Pedal Torque					
	Boost Temperature					
	Oil Pressure Lamp					
	Coolant Temperature Lamp					
	Deceleration Lamp					
	Cruise / PGS Active Lamp					
	Battery Charge Indicator					
4/10	Engine Brake State	DO_HP_FLEX_03	2 A	U_{BAT}		low / high side

Driver outputs (OUT)						
CPC4 pin ADM3 pin	**function**	**shortcut**	**I_{MAX}**	**U_{MAX}**	**P_{MAX} lamp**	**further data**
	Battery Charge Indicator					driver, short protected
	High Exhaust Temperature Lamp					

* The total current over all digital high side outputs is limited to 8A
** The total current over all digital low side outputs is limited to 10A

3.6.5.2. Output Circuit

The following figures show an example for a digital output with a “Low Side Switch” and a “High Side Switch” Configuration:

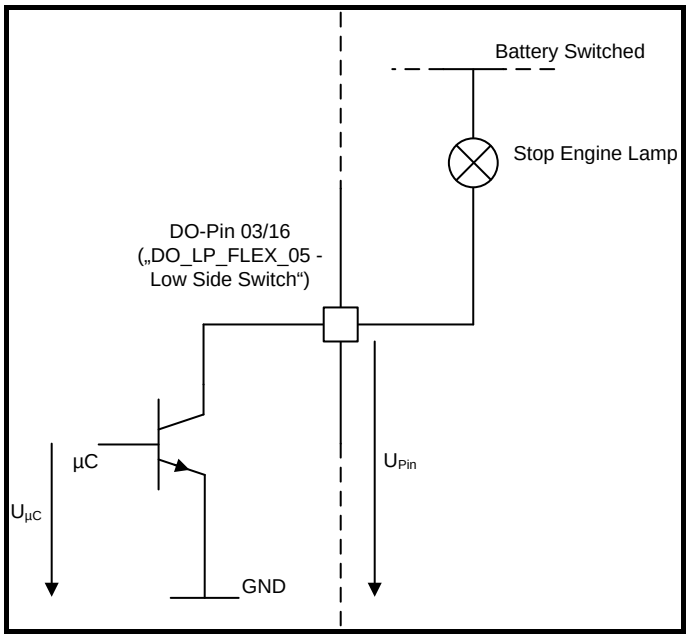


Fig 3.14: Schematic circuit diagram of the Stop Engine Lamp Output Pin (Low Side Configuration)

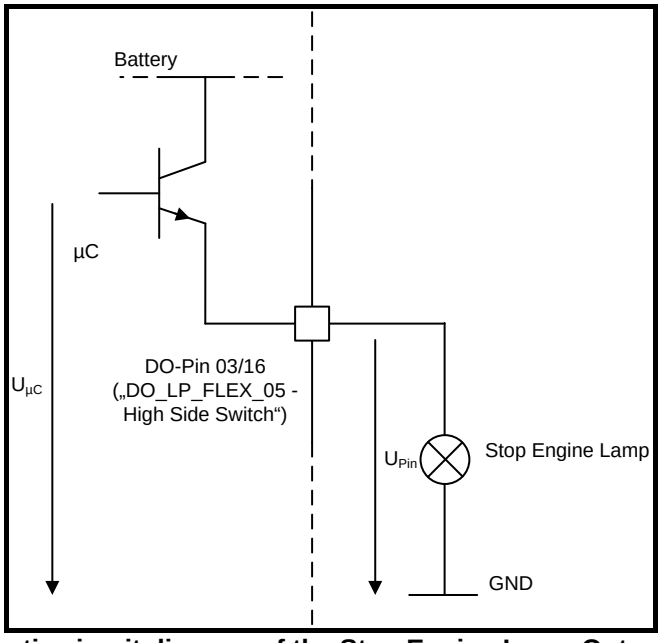


Fig 3.15: Schematic circuit diagram of the Stop Engine Lamp Output Pin (High Side Configuration)

3.6.5.3. Fault detection

Parameterization examples for fault detection

The following parameterizations are recommended for the according digital output pin fault detections:

- For the use as low side switch:
  - Set Output Fault Detection Mask to “15 = SetFault + PulseWhenOn + PulseWhenOff + Diag”
  - Set Output Configuration to “Low Side only”

- For the use as high side switch:
  - Set Output Fault Detection Mask to “9 = SetFault + Diag”
  - Set Output Configuration to “High Side only”

- Deactivated output:
  - Ser Output Fault Detection Mask to “1 = Diag”
  - Set Output Configuration to “Disabled”

Low-current LED

If the digital outputs are used with a low-current LED instead of a lamp it is recommended to set the fault detection mask to:

- For the use as low side switch:
  - Output Fault Detection Mask: “9 = SetFault + Diag”
  - Output Configuration: “Low Side only”

- For the use as high side switch:
  - Fault Detection Mask: “9 = SetFault + Diag”
  - Output Configuration: “High Side only”

Additionally if high side switches are used it is mandatory that a resistor is wired parallel to the low-current LED (and its pre-resistor) to prevent the open load fault from occurring. The value of the resistor has to be about the same size as the pre-resistor of the low current LED.

Now follows a description of the fault detection mechanism of the digital outputs As shown in the chart below, the parameter used to activate and configure the fault detection of the output pins, allow several options to choose from. (Not recommended options are marked grey)

Example: Values for Parameter 09/10 “3 06 AO_02 Fault Detection”
Parameter values:
0 = Fault Detection Off,
1 = Diag,
2 = PulseWhenOff,
3 = PulseWhenOff + Diag,
4 = PulseWhenOn,
5 = PulseWhenOn + Diag,
6 = PulseWhenOn + PulseWhenOff,
7 = PulseWhenOn + PulseWhenOff + Diag,
8 = SetFault,
9 = SetFault + Diag,
10 = SetFault + PulseWhenOff,
11 = SetFault + PulseWhenOff + Diag,
12 = SetFault + PulseWhenOn,
13 = SetFault + PulseWhenOn + Diag,
14 = SetFault + PulseWhenOn + PulseWhenOff,
15 = SetFault + PulseWhenOn + PulseWhenOff + Diag

For a better understanding, the single parameter values will be explained:

Parameter	Bit	Description
Fault Detection Off	0000	No occurring fault regarding this specific output is detected (not recommended)
Diag	**0001**	**Activates or deactivates the diagnostics at all**
Pulse When Off	0010	Activates a diagnostic pulse to detect a short-circuit to ground / Ubat if output is not actuated
Pulse When On	0100	Activates a diagnostic pulse to detect a short-circuit to ground / Ubat if output is actuated
Set Fault	**1000**	**In combination with an activated diagnostic, in case of an occurring fault, an error memory entry is set.**

The fault detection configurations in the table above that are marked in bold letters are recommended settings if the corresponding output pin is used! Otherwise proper fault detection won't be possible! If an before active output is deactivated, the corresponding fault detection parameter also has to be set to "Diag".

Note: If the occurring fault entails a flowing current, an error memory entry is set, regardless of the configured fault detection behavior. Although the fault detection parameters are configured by means of absolute numbers, the actual bit code is made up of 4 bits, each with a specified meaning:

	Bit no.			
Value	Bit #3	Bit #2	Bit #1	Bit #0
0	no information to FCM	no test pulse with output turned on	no test pulse with output turned off	diagnostics off
1	information to FCM	test pulse with output turned on	test pulse with output turned off	diagnostics on

Fig 3.16: Bit coding of the digital input fault detection methods

Therefore all of the above mentioned parameter values can be set as shown in this example:
"Parameter 09/10 "3 06 AO_02 Fault Detection":

Bit-code	Decimal-code	Description
"0101"	8*0 + 4*1 + 2*0 + 1*1 = 5	"PulseWhenOn + Diag,"
"1101"	8*1 + 4*1 + 2*0 + 1*1 = 13	"SetFault + PulseWhenOn + Diag"

Pulse When On / Off

These two functions provide a method of extended fault detection. As shown in the table below (figure 10), it is not possible to detect each and every occurring fault type / output parameterization pairing. Therefore by the use of a diagnostic pulse send on designated occasions it is possible to cover additional fault cases.

Outputs (Digital Outputs)				
	Low Side Switch		High Side Switch	
	Off	On	Off	On
Short Circuit GND	Y	Y*	N	Y
Short Circuit Ubat	Y*	Y	Y	N
Open Load	Y	Y*	Y	N

Fig 3.17: Schematic fault detection possibility (digital outputs only)

The entries that are highlighted with an asterisk are the ones that are only detectable when one of the extended fault detection methods is used:

Low Side Switch / On / Short Circuit GND à "Pulse When On"
Low Side Switch / Off / Short Circuit Ubat à "Pulse When Off"

Low Side Switch / On / Open Load à “Pulse When On”

Example for the diagnostic pulse:

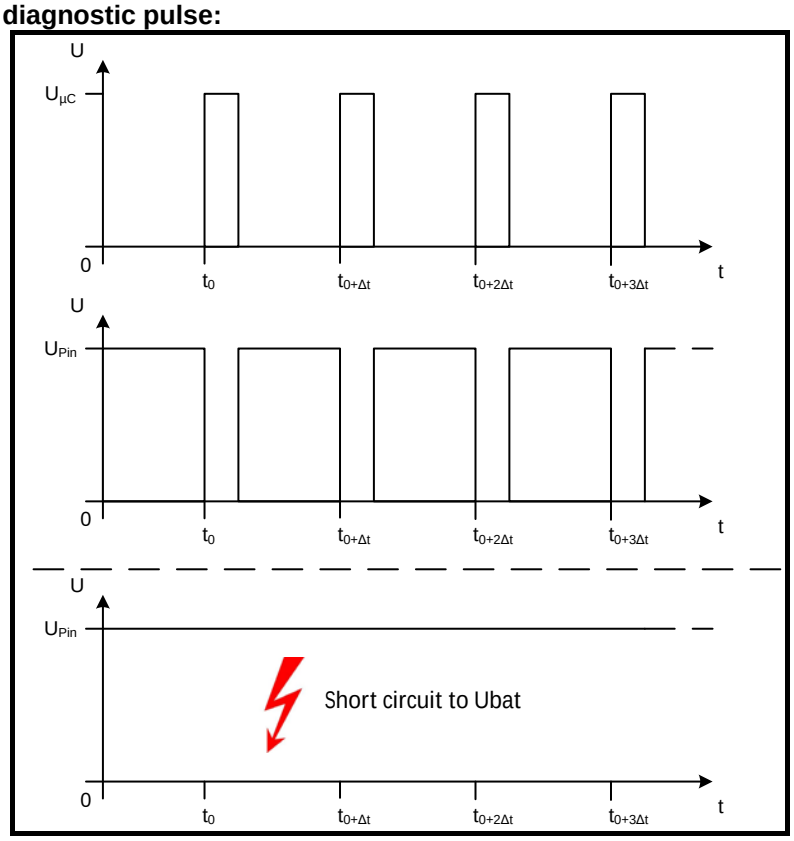


Fig 3.18: Schematic Progress of the "Pulse When Off" signal (Low Side Switch)

This figure (Fig 3.18) shows an example of the output signal of a low side switch while the diagnostic pulse is active. As seen, the output is switched to ground periodically. If now a short circuit to Ubat occurs the voltage of the output won’t drop to zero and thus the fault is detected. The Outputs, for which this kind of individual configurable fault detection is available, are listed in the following chart:

Digital Outputs
Pin 01/04 (“DO_LP_LS_02”)
Pin 01/05 (“DO_LP_LS_01”)
Pin 01/13 (“DO_LP_FLEX_01”)
Pin 02/10 (“DO_LP_FLEX_03”)
Pin 03/02 (“DO_LS_AGND”)
Pin 03/07 (“DO_HP_FLEX_01”)
Pin 03/08 (“DO_HP_FLEX_02”)
Pin 03/09 (“DO_HP_LS_01”)
Pin 03/10 (“DO_LP_FLEX_02”)
Pin 03/12 (“DO_LP_FLEX_04”)
Pin 03/16 (“DO_LP_FLEX_05”)
Pin 03/17 (“DO_HP_LS_04”)
Pin 04/01 (“DO_LP_LS_03”)
Pin 04/02 (“DO_LP_LS_04”)
Pin 04/06 (“DO_LP_FLEX_06”)
Pin 04/07 (“DO_HP_LS_02”)
Pin 04/09 (“DO_HP_LS_03”)
Pin 04/10 (“DO_HP_FLEX_03”)

If the output pins 01/04 and/or 03/02 are used as ground pins it is mandatory to <u>not</u> use the fault detection mask with the configuration options “PulseWhenOn” or “PulseWhenOff” for them.

3.6.6. Analog Output (AO/FPO)

3.6.6.1. Technical Data

Frequency Outputs

FPO_01/FPO_02 (Low-Side Output) à these two outputs are configured permanently as Low Side switches. The much- needed pull-up resistors are built-in, but have to be activated manually with the corresponding parameters 09/14 (“1 9 FPO_02 Resistor Enable”) and 09/16 (“4 12 FPO_1 Resistor Enable”). Their default value is set to “switched off”.

FPO_03/FPO_04 (Flex Output) à Since these two outputs don’t have built-in pull-up / pull-down resistors it is necessary to include either a pull-up or a pull-down resistor as part of the output circuit. The kind of the needed resistor is defined by whether the output is used as a low- or high-side output (parameters 09/17, “4 15 FPO_03 Output Configuration” and 09/15, “4 11 FPO_04 Output Configuration”).

Output for indicating instruments (OUT)							
CPC4 pin ADM3 pin	**function**	**shortcut**	**I_{MAX}**	**U_{MAX}**	**U_{MIN}**	**f**	**further data**
1/09 12/06	Engine Speed	FPO_02	50mA	U_{BAT}	0 V	0…5kHz	frequency low side driver pull up resistor 1,2kΩ@12V or 2,7kΩ@24V, short protected
3/05 12/03	Oil Pressure Lamp	AO_01	50mA (analog mode) 250mA (switched mode)	U_{BAT}	0 V		a) analog low side driver oil pressure cluster, short protected
	Oil Pressure Cluster (5bar / 10bar)						b) low side switch for warning lamp
3/06 12/04	Coolant Temperature Lamp	AO_02	50mA (analog mode) 250mA (switched mode)	U_{BAT}	0 V		a) analog low side driver coolant temperature cluster, short protected
	Coolant Temperature Cluster						b) low side switch for warning lamp
4/11	Remote Throttle	FPO_04	50mA	U_{BAT}	0 V	0…5kHz	frequency low side driver pull up resistor 1,2kΩ@12V or 2,7kΩ@24V, short protected
	KL_W						
4/12 12/05	Actual Value Output (Misc.)	FPO_01	50mA	U_{BAT}	0 V	0…5kHz	frequency low side driver pull up resistor 1,2kΩ@12V or 2,7kΩ@24V, short protected
4/15	Actual Value Output (Misc.)	FPO_03	50mA	U_{BAT}	0 V	0…5kHz	frequency low side driver pull up resistor 1,2kΩ@12V or 2,7kΩ@24V, short protected

3.6.6.2. Fault detection

Outputs (Analog Outputs / FPO)				
	Low Side Switch		High Side Switch	
	Off	On	Off	On
Short Circuit GND	Y	N	N	Y
Short Circuit Ubat	N	Y	Y	N
Open Load	Y	N	Y	N

Fig 3.19: Schematic fault detection possibility (analog outputs / FPO)

Because of the configuration of the analog signals it is not possible to provide these outputs with the extended fault detection methods mentioned in chapter 3.6.5.3. Additionally in dependence of the purpose a specific analog or FPO output is used e. g. for throttle torque or road speed signal, it may be possible that specific faults are not trackable. The figure above (Fig 3.19) shows the optimal fault detection posibilites of the analog / FPO outputs regardless of the actual usage.

3.6.7. Communication Interface (CAN/LIN)

3.6.7.1. Technical Data

Communication interface (I/O)						
CPC4 pin ADM3 pin	**function**	**shortcut**	**U_{MAX}**	**U_{LOW}**	**U_{HIGH}**	**further data**
2/04	LIN	LIN_1				
2/05 21/17	SAE 1708, A	J1708A				Only CPC related faultcodes are supported
2/06 21/18	SAE 1708, B	J1708B				Only CPC related faultcodes are supported
2/16 21/21	SAE J1939 CAN (Low)	VCAN_L	5 V			Ext. termination needed
2/17 21/20	CAN-HF-Ground	VCAN_GND	GND			100 nF to ground
2/18 21/19	SAE J1939 CAN (High)	VCAN_H	5 V			Ext. termination needed
3/19 15/15	ISO11898 CAN (Low)	PTCAN_L	5 V			2x60Ω split termination
3/20 15/14	CAN-HF-Ground	PTCAN_GND	GND			100 nF to ground
3/21 15/13	ISO11898 CAN (High)	PTCAN_H	5 V			2x60Ω split termination

4. Parameters

Parameters highlighted in blue are used inside the Application chapter! Parametervalues highlighted in grey are not available!

The parameters of the CPC4 are divided into various parameter groups (PGR's). Each parameter group corresponds to a functional group.

4.1. List of Parameters

4.1.1. PGR001 – Communication

No.	Parameter	min	max	default	unit	description
1	ABS Source Address SAE J1939	0	255	11		SAE J1939 Source Address ABS 0..255=signal
3	AGS2 DM1 SPN Convert Method	0	1	0		conversion method 0=CPC2 style, 1=VCU style
4	CC1 Source Address SAE J1939	0	255	23		SAE J1939 Source Address #1 CCVS1 (PGN 65265). 0..255=signal
5	CC2 Source Address SAE J1939	0	255	33		SAE J1939 Source Address #2 CCVS1 (PGN 65265). 0..255=signal
6	CC3 Source Address SAE J1939	0	255	49		SAE J1939 Source Address #3 CCVS1 (PGN 65265). 0..255=signal
7	CM1 DPF Source Addr SAE J1939	0	255	49		SAE J1939 Source Address Cm1 for cyclic Dpf message, 0..255=signal
8	CM1 Fan Source Addr1 SAE J1939	0	255	25		SAE J1939 Source Address Cm1,for A/C fan requests, 0..255=signal
9	CM1 Fan Source Addr2 SAE J1939	0	255	49		SAE J1939 Source Address Cm1,for hardwired switch fan requests 0..255=signal
10	EBC1 Source Address SAE J1939	0	255	33		SAE J1939 Source Address EBC1 0..255=signal
14	Eng Brake Source Address J1939	0	255	15		SAE J1939 Source Address Engine Retarder 0..255=signal
15	Engine CAN Limp Home Mode	0	3	0		Engine CAN Limp Home Mode Limp home mode if engine CAN fails 0=idle speed, 1=engine stop, 2=limp home speed, 3=limp home speed
16	Engine Source Address J1939	0	255	0		SAE J1939 Source Address Engine 0..255=signal
20	J1939 AMB Source Address	0	255	33		ex. Reserved Parameter.Now, SAE J1939 Source Address AMB 0..255=signal
32	J1939 Initial Rx Timeout	0	255	5	s	initial timeout setting for J1939 RX messages- allows for potential device power loss during engine cranking 0..255=signal
33	J1939 Log Bus Off Fault	0	1	1		enables the logging of J1939 link failure fault code SID231 - FMI 12 whenever the J1939 link goes into a Bus-off state 0=disabled, 1=enabled
42	J1939 Second Engine Address	0	255	2		Source address 2 for receiving EEC2 and EBC1 CAN messages, 0..255=signal
43	J1939 Source Addr Evobus Lever	0	255	33		SAE J1939 Source Address Transmission Retarder Lever (EvoBus), 0..255=signal
44	J1939 SPN1716 Mode	0	1	1		Mode witch Retarder Request should be use (SPN1716 or 520) and allow CC operation during Transmission Retarder is active 0=allow CC operation during J1939

No.	Parameter	min	max	default	unit	description
						TransRetarder is active and use SPN 520, 1=not allow CC operation during J1939 TransRetarder is active and use SPN 1716
48	J1939 TSC1 Source Address4	0	255	59		SAE J1939 4. Source Address TSC1 e.g. fire truck pump ECU 0..255=signal
52	PTO Source Address SAE J1939	0	255	23		SAE J1939 Source Address PTO message 0..255=signal
54	Trans Retarder Srce Addr J1939	0	255	16		SAE J1939 Source Transmission Retarder 0..255=signal
55	Trans Source Address J1939	0	255	3		SAE J1939 Source Address Transmission 0..255=signal
56	TSC1 Source Address SAE J1939	0	255	231		SAE J1939 3. Source Address TSC1 e.g. jack knife control 0..255=signal
57	VDC1 Source Address SAE J1939	0	255	62		SAE J1939 Source Address Vehicle Dynamic Stability Control 0..255=signal
62	J1939 Source Addr Tachograph	0	255	238		SAE J1939 Source Address Tachograph 0..255=signal
63	J1939 PropB04 Source Address	0	254	254		SAE J1939 Source Address PropB04 message (PropB4) 0..254=signal, 255=snv
70	J1939 Tsc1 Eng Var Rate Stat	0	1	1		variable rate for Tsc1EngToutTick 0=use cal -J1939 Tsc1 Tout Sel- for timeout detection, 1=Use SPN 3349 three times for timeout detection
71	J1939 Tsc1 Tout Sel	0	1000	10		the interval after which an active J1939 TSC1 control message will timeout and be deactivated 0..1000=signal
72	Source Address OHECS	0	255	23		SAE J1939 Source Address OHECS 0..255=signal
73	J1939 Source Addr Instrument Cluster	0	255	23		SAE J1939 Source Address Instrument (Cascadia) 0..255=signal
74	J1939 Source Addr Dlcd1	0	255	23		SAE J1939 Source Address DLCD1 0..255=signal
76	J1939 Source Addr Reset	0	255	254		SAE J1939 Source Address RESET 0..255=signal
81	EEC2 Cycle Time Selection	0	2	2		cycle time selection for EEC2 0=10ms, 1=20ms, 2=50ms
82	J1939 Cm3 Timeout Timer Ticks	0	10000	3000		the interval after which an J1939 Cm3 message will timeout and be deactivated 0..10000=signal
83	Cm3 Source Address SAE J1939	0	255	49		Source Address of CM3 Message 0..255=signal
86	PROP07 Source Address SAE J1939	0	255	231		SAE J1939 Source Address PROP07 0..255=signal
87	BM Source Address SAE J1939	0	255	50		SAE J1939 Source Address BM 0..255=signal
94	Spn 92 Conversion Mode	0	1	1		mode on how SPN92 (Engine Percent Load at Current Speed) should be sent on J1939. Either smoke limitation is considered (for AGS2) or not 0=Smoke Limitation not considered, 1=Smoke Limitation considered
100	PropB50 Source Address SAE J1939	0	255	5		SAE J1939 Source Address PROP B50 0..255=signal
108	PTODE Source Address SAE J1939	0	255	254		SAE J1939 Source Address PTODE 0..255=signal
109	CM1 Source Address 5 SAE J1939	0	255	231		SAE J1939 Source Address 5 CM1 0..255=signal
112	TBD_cdi_p_Can.J1939PROP02VRDUE3TOUTTICK	0	1000	10		the interval after which an active J1939 Prop02VRDUE3 control message will

No.	Parameter	min	max	default	unit	description
						timeout and be deactivated 0..1000=signal
114	Lim En Max Vspeed via Pgn Cm1	0	3	0		Enable max Vspeed via PGN CM1 0=disable, 1=enable, 2=reserved, 3=SNA

4.1.2. PGR002 – Vehicles Parameters I

No.	Parameter	min	max	default	unit	description
9	Transmission Type	0	9	3		Transmission Type 0=Manual, without Neutral Switch, 1=not used in NAFTA: automated, 2=Allison, Eaton Ultrashift/Ultrashift ASW, Autoshift, ZF ASTronic, AGS2 without ETC2, 3=Manual, with Neutral Switch, 4=not used in NAFTA: automated with starter lock, 5=Eaton Autoshift, Ultrashift, ZF ASTronic, AGS2 with ETC2, 6=Allison, Eaton Ultrashift ASW: MCM start, 7=reserved, 8=Eaton Ultrashift PLUS, 9=Detroit Transmission
24	GVC Emission Standard Conf	0	15	13		GVC Vehicle Brand Configuration 0=Euro 3 and less, 1=Euro 4, 2=Euro 5, 3=Euro 6, 4=reserved, 5=reserved, 6=reserved, 7=reserved, 8=reserved, 9=reserved, 10=Euromot 3a / Tier3, 11=Euromot 3b, 12=Tier4 interim, 13=Eurostage 4 / Tier4 final, 14=Non Standard, 15=SNA
27	TBD_cdi_p_Veh1.GvcIppcSysMessConf_u2	0	3	0		GVC Vehicle Model Configuration 0..1=signal, 2=not defined, 3=SNA

4.1.3. PGR003 – Common Limiters

No.	Parameter	min	max	default	unit	description
1	Idle Configuration for Limiter Inputs	0	4	0		Idle Configuration for Limiter Inputs 0=disabled, 1=enabled, 2=enabled if neutral, 3=enabled if neutral and park brake, 4=enabled if park brake
3	Enable Limiting Torque Ramp	0	1	0		Enable Limiting Torque Ramp 0=disabled, 1=enabled
4	Eng Speed Limit While Veh Stop	0	4200	4200	1/min	Engine Speed Limit while vehicle stop (vehicle road speed = 0) 0..4000 = signal
5	Engine Speed Max Ramp Rate	0	1000	1000	(1/min)/s	Engine Speed Ramp for sudden maxspeed changes 0..8000=signal
6	Engine Speed Min Ramp Rate	0	1000	200	(1/min)/s	Engine Speed Ramp for sudden minspeed changes 0..8000=signal

No.	Parameter	min	max	default	unit	description
13	Limiting Torque Ramp Increment	0	5000	3	Nm/10 ms	Limiting Torque Ramp Increment 0..25000=signal
19	Max Adjusted Idle Speed	0	1000	500	1/min	Maximum Adjusted Idle Speed 0..32000=signal
20	Max Engine Speed	0	4000	4000	1/min	Maximum Engine Speed. Is only active with a manual transmission type (parameter 02/09 à 0=Manual without Neutral switch or 3=Manual with neutral switch), 0..32000=signal
22	Max Engine Torque	0	5000	5000	Nm	Maximum Engine Torque 0..25000=signal
23	Max Road Speed	10	152	90	km/h	Maximum Road Speed (legal) 1280..19456=signal
24	Max Torque Engine Retarder	0	50000	50000	Nm	Maximum Torque Scaled to transmiss. output torque. 0..50000=signal
26	Max VSpeed for Idle Adjust	0	48	10	km/h	Max. Road Speed for Idle Inc./Dec. Maximum Speed 0..6144=signal
27	Min Engine Speed	0	1000	496	1/min	Minimum Engine Speed 0/min N min 0..32000=signal
28	Minimum TSC1 Under Speed	0	4000	496	1/min	Minimum Engine Speed allowed during Tsc1 Underspeed Request 0..32000=signal
29	Ramp Rate Adjusted Idle Spd	0	8192	100	(1/min)/s	Desired Idle Speed Ramp Rate Inc./Dec. 0..65535=signal
31	Single Step Adjusted Idle Spd	0	100	16	1/min	Desired Idle Speed Single Step Inc./Dec. 0..800=signal
36	Trans Torque Limit Enable	0	1	0		Enable Transmission Torque Limitation in lower gears (SPN 1845). For Allison Transmissions. If the CAN link is erroneous, the torque limitation is enabled. 0=disabled, 1=enable
37	TSC1 Under Speed Enable	0	1	1		enables TSC1 Momentary Engine Underspeed Request to be honored 0=disable, 1=enable
40	Lim MVS Max Lim1 Vspeed	5	255	5	km/h	to be transmitted to SPN 2588 5..250=signal, 255=SNA
41	Lim MVS Max Lim2 Vspeed	5	255	10	km/h	to be transmitted to SPN 2589 5..250=signal, 255=SNA
42	Lim MVS Max Lim3 Vspeed	5	255	15	km/h	to be transmitted to SPN 2590 5..250=signal, 255=SNA
43	Lim MVS Max Lim4 Vspeed	5	255	30	km/h	to be transmitted to SPN 2591 5..250=signal, 255=SNA
44	Lim MVS Max Lim5 Vspeed	5	255	50	km/h	to be transmitted to SPN 2592 5..250=signal, 255=SNA
45	Lim MVS Max Lim6 Vspeed	5	255	60	km/h	to be transmitted to SPN 2593 5..250=signal, 255=SNA
46	Lim MVS Max Lim7 Vspeed	5	255	80	km/h	to be transmitted to SPN 2594 5..250=signal, 255=SNA

4.1.4. PGR004 – Surge Damp

No.	Parameter	min	max	default	unit	description
1	Acelerator Surge Damp Thresh	-100	100	25	%	Accelerator Pedal threshold value for surge damper activation -32000..32000=signal
2	Configuration Surge Damper	0	255	0		Surge damper selected

No.	Parameter	min	max	default	unit	description
						0..255=signal
3	surge damper frequency	0	25	10	Hz	surge damper frequency 0..250=signal
4	surge damper gain	0	5	0,3	%/rpm	surge damper gain 0..250=signal
5	surge damper limit / LIM speed	0	8000	900	1/min	Torque threshold value for surge damper activation 0..64000=signal
6	surge damper threshold torque	-5000	5000	50	Nm	engine speed threshold for surge damper activation -25000..25000=signal

4.1.5. PGR005 – Limiters LIM0 and LIM1

No.	Parameter	min	max	default	unit	description
3	Limiter0 Max Eng Speed Enabled	0	4000	4000	1/min	Maximum Engine Speed when Limiter0 is enabled 0..32000=signal
4	Limiter0 Max Eng Trq Enabled	0	5000	5000	Nm	Maximum Engine Torque when Limiter0 is enabled 0..25000=signal
5	Limiter0 Max Road Spd Enabled	0	152	152	km/h	Maximum Road Speed when Limiter0 is enabled 0..19456=signal
6	Limiter0 Max Trq Curve Select	0	2	0		input selection for enable limited full load torque curve PowerRatingCurve) selected on LIM0 or J1939 0=disable, 1=hardwired, 2=J1939 OHECS
7	Limiter0 Max Vehicle Accel	-15,6	15,6	10	m/s²	Maximum acceleration of vehicle speed governor in LIM0 -32000..32000=signal
8	Limiter0 Min Eng Speed Enabled	0	1000	496	1/min	Minimum Engine Speed when Limiter0 is enabled 0..32000=signal
9	Limiter1 Max Eng Speed Enabled	0	4000	4000	1/min	Maximum Engine Speed when Limiter1 is enabled 0..32000=signal
10	Limiter1 Max Eng Trq Enabled	0	5000	5000	Nm	Maximum Engine Torque when Limiter1 is enabled 0..25000=signal
11	Limiter1 Max Road Spd Enabled	0	152	152	km/h	Maximum Road Speed when Limiter1 is enabled 0..19456=signal
12	Limiter1 Max Vehicle Accel	-15,6	15,6	10	m/s²	Maximum acceleration of vehicle speed governor in LIM1 -32000..32000=signal
13	Limiter1 Min Eng Speed Enabled	0	1000	496	1/min	Minimum Engine Speed when Limiter1 is enabled 0..32000=signal
15	Max Trq Curve Selection	1	3	1		If cdi_p_Lim01.Lim0MaxTrqCurvSel_u2 is set to rating #1, #2 or #3, then that rating is used when LIM0 is active. 1=Curve #1, 2=Curve #2, 3=Curve #3, 4..255=snv

4.1.6. PGR006 – Limiters AC and Lim2

No.	Parameter	min	max	default	unit	description
2	Fast Idle Spd Air Cond Input	500	3000	600	1/min	Fast Idle Speed on Air Condition 4000..24000=signal
3	Limiter2 Max Eng Speed Enabled	0	4000	4000	1/min	Maximum Engine Speed LIM2 Enabled 0..32000=signal
4	Limiter2 Max Eng Torque	0	5000	5000	Nm	Maximum Engine Torque LIM2 Enabled

No.	Parameter	min	max	default	unit	description
						0..25000=signal
5	Limiter2 Max Vehicle Accel	-15,6	15,6	10	m/s²	Maximum acceleration of vehicle speed governor in LIM2 -32000..32000=signal
6	Limiter2 Max VSpeed	0	152	152	km/h	Maximum Road Speed LIM2 Enabled 0..19456=signal
7	Limiter2 Min Eng Speed Enabled	0	1000	496	1/min	Minimum Engine Speed LIM2 Enabled 0..32000=signal
8	Mode of AC Status Input	0	4	0		Mode of Air Conditioner Status Input for Fast Idle and Fan Activation (Pin 2/12) 0=disabled, 1=AC active closed, 2=AC active open, 3=LIM active closed, 4=LIM active open

4.1.7. PGR007 – PTO Control on PTO and CC pin

No.	Parameter	min	max	default	unit	description
1	Config PTO Speed Control	0	7	0		Configuration PTO Speed Control 0=disabled, 1=Cab/Remote PTO enabled (neutral not conf.), 2=Cab/Remote PTO enabled if neutral, 3=Cab/Remote PTO enabled if neutral and park brake, 4=Cab/Remote PTO enabled if park brake, 5=Cab PTO while driving, 6=Cruise PTO with park brake, 7=Cab/Remote PTO while driving
2	Cruise Switch Hold Time	20	5100	1000	ms	Resume Hold delay time.Time threshold which defines whether the CC+ or - switch has been toggled or held 1..255=signal
3	Max PTO Spd Resume Accel Sw	500	3000	1200	1/min	General Maximum PTO Speed 4000..24000=signal
4	Max Road Speed in PTO Mode	0	128	9,6	km/h	Maximum Road Speed in PTO Mode 0..16384=signal
5	Min PTO Spd Set Coast Sw	464	3000	700	1/min	General Minimum PTO Speed 3712..24000=signal
6	No of Speeds via Remote PTO	1	3	1		Number of Speeds via Remote PTO (Pin 2/9) 1..3=signal
7	PTO Dropout on Clutch Enabled	0	1	0		PTO dropout on clutch enabled 0=No PTO drop out with clutch pedal, 1=Causes PTO to drop out if the Clutch is being depressed
8	PTO Dropout Serv Brk Prk Brk	0	3	0		PTO dropout on Service Brake or Park Brake Activation 0=No PTO drop out on service brake or park brake activation, 1=Causes PTO to drop out on Service Brake or Park Brake activation, 2=Drop out on Service Brake activation, 3=Drop out on Park Brake activation
9	PTO Ramp Rate	25	2500	250	(1/min)/s	PTO Ramp Rate 200..20000=signal
10	PTO Spd Governor with CC+ sw	1	11	1		PTO Speed Governor# with CC+ Switch Governor type selection, if PTO mode has been activated via CC+ 1..11=signal
11	PTO Speed 1 Governor Type	1	11	1		PTO Speed #1 Governor Type Governor type selection, if fixed speed #1 has been activated 1..11=signal
12	PTO Speed 2 Governor Type	1	11	1		PTO Speed #2 Governor Type Governor type selection, if fixed speed #2 has been activated 1..11=signal

No.	Parameter	min	max	default	unit	description
13	PTO Speed 3 Governor Type	1	11	1		PTO Speed #3 Governor Type Governor selection, if fixed speed #3 has been activated 1..11=signal
14	PTO Speed Gov Set Coast Switch	1	11	1		PTO Speed Governor# with CC- Switch Governor type selection, if PTO mode has been activated via CC- 1..11=signal
15	PTO Remote Throt Override Mode	0	2	0		PTO Remote Throttle Override Mode 0=disable, 1=always On, 2=only at speed #0
16	Remote PTO Spd Selection Mode	0	2	0		Input selection (calculation) 0=1 pulsed input (RemPTO), 1=2 gray coded inputs (PTO), 2=2 binary coded inputs (PTO)
17	Resume Accel Max PTO Torque	0	5000	5000	Nm	Max. PTO Torque with CC+ Switch 0..25000=signal
18	Resume Accel Sw PTO Set Spd	0	3000	500	1/min	PTO Set Speed with CC+ Switch 0..24000=signal
19	RPM Increment	0,125	500	25	1/min	Cruise PTO Increment Rate for toggling CC+ and CC- 1..4000=signal
20	Set Coast Max PTO Torque	0	5000	5000	Nm	Max. PTO Torque with CC- Switch 0..25000=signal
21	Set Coast Switch PTO Set Speed	0	3000	500	1/min	PTO Set Speed with CC- Switch 0..24000=signal
22	Spd 1 Max Eng Trq Remote PTO	0	5000	5000	Nm	PTO Speed #1 Maximum Engine Torque 0..25000=signal
23	Spd 1 via Remote PTO	464	3000	900	1/min	PTO Speed #1 3712..24000=signal
24	Spd 2 Max Eng Trq Remote PTO	0	5000	5000	Nm	PTO Speed #2 Maximum Engine Torque 0..25000=signal
25	Spd 2 via Remote PTO	500	3000	1250	1/min	PTO Speed #2 4000..24000=signal
26	Spd 3 Max Eng Trq Remote PTO	0	5000	5000	Nm	PTO Speed #3 Maximum Engine Torque 0..25000=signal
27	Spd 3 via Remote PTO	500	3000	1850	1/min	PTO Speed #3 4000..24000=signal
28	Throttle Override Max Eng Spd	0	3000	1400	1/min	Max. Engine Speed for Throttle Override 0..24000=signal
29	PTO Accel Pedal Override Mode	0	2	0		PTO Accelerator Pedal Override Mode 0=disable, 1=always On, 2=only at speed #0
30	PTO Cab Switches Mode	0	2	0		PTO Cab Switches Mode 0=always On, 1=disable, 2=only at speed #0

4.1.8. PGR008 – Vehicle Speed Sensor

No.	Parameter	min	max	default	unit	description
4	Axle Ratio	1	20	4,3		Axle Ratio 1024..20480=signal
9	Tire Revs per Unit Distance	160	1599	313	1/km	Tire Revolutions per Distance 160..1599=signal
10	Top Gear Ratio	0,1	2,5	0,7		Top Gear Ratio 102..2612=signal
11	Two Spd Axle Second Axle Ratio	1	20	1		Two Speed Axle - Second Axle Ratio 1024..20480=signal
13	Vehicle Speed Sensor	0	11	1		Vehicle Speed Sensor Configuration 0=no sensor, 1=C3 sensor, 3=J1939 ETC1, 5=J1939 TCO,

No.	Parameter	min	max	default	unit	description
24	Wheel Revs Front Axle Nr	160	1599	313	1/km	Tire Revolutions per Distance 160..1599=signal

4.1.9. PGR009 – Analog Outputs

No.	Parameter	min	max	default	unit	description
1	1 9 FPO_02 Selection	0	1	0		Configuration FPO_02 0=disabled, 1=engine speed
2	1 9 FPO_02 Engine Speed Display N Mot	200	30000	1604	counts/ rev	Engine Speed Display N Mot Scaling: Pulses per 100 rpm 200..30000=signal
3	3 05 AO_01 Selection	0	4	0		Configuration of Analog Ouput/Input Pin AO_01 0=disabled, 1=oil pressure lamp, 2=5 bar oil pressure gauge, 3=10 bar oil pressure gauge, 4=fuel filter sensor
4	3 06 AO_02 Selection	0	2	0		Configuration of Analog Output/Input Pin AO_02 0=disabled, 1=coolant temperature lamp, 2=coolant temperature gauge
5	4 11 FPO_04 Selection	0	2	0		Configuration FPO_04 0=disabled, 1=Remote Throttle, 2=Kl.W (Klemme W)
6	4 12 FPO_01 Selection	0	10	0		Configuration FPO_01 0=disabled, 1=throttle torque 10%..90%, 2=difference torque (extern load control), 3=throttle torque 90%..10%, 4=actual torque, 5=load torque (no idle torque for automatic transmission), 6=road speed, 7=demand speed, 8=demand speed CC+, 9=Urea Tank Level 10..90%, 10=FUSO Accelerator PWM output
7	4 15 FPO_03 Selection	0	10	0		Configuration FPO_03 0=disabled, 1=throttle torque 10%..90%, 2=difference torque (extern load control), 3=throttle torque 90%..10%, 4=actual torque, 5=load torque (no idle torque for automatic transmission), 6=road speed, 7=demand speed, 8=demand speed CC+, 9=Urea Tank Level 10..90%, 10=FUSO Accelerator PWM output
08 09 10 11 12 13	1 9 FPO_02 Fault Detection 3 5 AO_01 Fault Detection 3 6 AO_02 Fault Detection 4 11 FPO_04 Fault Detection 4 12 FPO_01 Fault Detection 4 15 FPO_03 Fault Detection	0 0 0 0 0 0	15 15 15 15 15 15	1 1 1 1 1 1		0=Fault Detection Off, 1=Diag, 2=PulseWhenOff, 3=PulseWhenOff + Diag, 4=PulseWhenOn, 5=PulseWhenOn + Diag, 6=PulseWhenOn + PulseWhenOff, 7=PulseWhenOn + PulseWhenOff + Diag, 8=SetFault, 9=SetFault + Diag, 10= SetFault + PulseWhenOff, 11=SetFault + PulseWhenOff + Diag, 12=SetFault + PulseWhenOn, 13=SetFault + PulseWhenOn + Diag, 14=SetFault + PulseWhenOn + PulseWhenOff, 15=SetFault + PulseWhenOn +

No.	Parameter	min	max	default	unit	description
						PulseWhenOff + Diag
14	1 9 FPO_02 Resistor Enable	0	1	0		FPO resistance 0=switched off, 1=switched on
15	4 11 FPO_04 Output Configuration	0	2	0		FPO_04 output configuration 0=switched off, 1=switched to low side, 2=switched to high side
16	4 12 FPO_01 Resistor Enable	0	1	0		FPO resistance 0=switched off, 1=switched on
17	4 15 FPO_03 Output Configuration	0	2	0		FPO_03 output configuration 0=switched off, 1=switched to low side, 2=switched to high side

4.1.10. PGR010 – Engine Brake

No.	Parameter	min	max	default	unit	description
2	Cruise Control Enable Eng Brk	0	1	1		Enable Engine Brakes on Cruise Control 0=disable, 1=enable automatic engine brake operation with cruise control
5	Eng Brk Drvline Clsd Min Spd	800	4000	800	1/min	Minimum Engine Speed for Engine Brakes for closed driveline 0/min, 6400..32000=signal
8	Engine Brake Configuration	0	3	3		Engine Brake Configuration 0=no engine brake, 1=Decompression Valve Only or Exhaust Flap Only, 2=Decompression Valve + Exhaust Flap or Fuso 2-stage Jake, 3=Jake Compression Brake or Decompression Valve + Brake Gate
9	Hysteresis minimum speed	0	500	200	1/min	Hysteresis for engine brake activation speed threshold 0..4000=signal
11	J1939 Steps Engine Brake	0	255	3		Retarder Control Mode (SPN 557) for J1939 message RC 0=variable controlled brake, 1=1 step, 2=low/high steps, 3=low/medium/high steps, 255=not configured
12	Max Throttle Pos for Eng Ret	0	100	4	%	Maximum Throttle Position for Engine Brakes 0..32000=signal
13	Min Eng Spd for Engine Brakes	1000	4000	1100	1/min	Minimum Engine Speed for Engine Brakes for open driveline 8000..32000=signal
14	Min Road Spd Eng Brk Operation	0	200	0	km/h	Minimum Road Speed for Engine Brake Operation. 0..25600=signal
17	Road Spd Limit Max Stage Num	0	5	0		Enable Engine Brake on Road Speed Limiter Engine brakes will come on automatically if value. >0 0=off, 1=low, 2=medium, 3=high, 4=stage #4, 5=stage #5
18	Service Brk Enable Eng Brakes	0	3	0		Enable Engine Brakes on Service Brake 0=disable, 1=enable automatic engine brake and hold when applied service brake, 2=operator selection and service brake for engine brake activation, 3=enable automatic engine brake when

No.	Parameter	min	max	default	unit	description
						applied service brake
19	Stage 1 Factor Engine Brake	0	100	100	%	Engine Brake Stage 1 Factor 0..32000=signal
20	Stage 1 Mask Engine Brake	0	81	81		Engine Brake Stage 1 Mask 0=no engine brake activation, 16=Exhaust Flap only or Fuso Jake Brake stage 2, 17=Jake Brake 2nd stage, 64=decompression valve only or Jake Brake 1st stage, 80=decompression valve and exhaust flap, 81=decompression valve and turbo brake or Jake Brake 3rd stage
25	Stage 2 Factor Engine Brake	0	100	100	%	Engine Brake Stage 2 Factor 0..32000=signal
26	Stage 2 Mask Engine Brake	0	81	81		Engine Brake Stage 2 Mask 0=no engine brake activation, 16=Exhaust Flap only or Fuso Jake Brake stage 2, 17=Jake Brake 2nd stage, 64=decompression valve only or Jake Brake 1st stage, 80=decompression valve and exhaust flap, 81=decompression valve and turbo brake or Jake Brake 3rd stage
30	Stage 3 Factor Engine Brake	0	100	100	%	Engine Brake Stage 3 Factor 0..32000=signal
32	Stage 3 Mask Engine Brake	0	81	81		Engine Brake Stage 3 Mask 0=no engine brake activation, 16=Exhaust Flap only or Fuso Jake Brake stage 2, 17=Jake Brake 2nd stage, 64=decompression valve only or Jake Brake 1st stage, 80=decompression valve and exhaust flap, 81=decompression valve and turbo brake or Jake Brake 3rd stage
39	TSC1 Eng Brake Cool Temp Min	-40	200	65	°C	Minimum Coolant Temp for Engine Brake Activation via TSC1 -1280..6400=signal
40	Eng Brk Stage On Service Brake	1	5	3		Brake stage for automatic engine brakes when service brake applied 1=low, 2=medium, 3=high, 4=stage #4, 5=stage #5
41	Eng Brake Activation Del Time	0	5	0	s	Delay time for engine brake activation 0..50=signal
52	TBD_cdi_p_Er.UpperThreshPerc_u8	0	200	115	%	Engine brakes upper threshold percentage 0..200=signal
53	TBD_cdi_p_Er.LowerThreshPerc_u8	0	200	84	%	Engine brakes lower threshold percentage 0..200=signal
54	TBD_cdi_p_Er.BrkStagePrio_u8	0	2	0		Selects the preferred engine brake stage if both stages are valid 0=No fixed priority, 1=Stage1 priority, 2=Stage2 priority

4.1.11. PGR011 – Accelerator Pedal

No.	Parameter	min	max	default	unit	description
4	Accel Pedal Type	0	7	0		Accelerator Pedal Type, Item 1, FP 0=none, 1=PWM throttle (VDO), 4=Analog Accelerator Pedal with IVS, 6=Williams Dual-Channel Analog Pedal, 7=ABE Pedal (PWM)
6	Accelerator Curve X ae 0	-100	100	100	%	AP characteristic line, x-values (%)

No.	Parameter	min	max	default	unit	description
						-32000..32000=signal
7	Accelerator Curve X ae 1	-100	100	100	%	AP characteristic line, x-values (%) -32000..32000=signal
8	Accelerator Curve X ae 2	-100	100	100	%	AP characteristic line, x-values (%) -32000..32000=signal
9	Accelerator Curve X ae 3	-100	100	100	%	AP characteristic line, x-values (%) -32000..32000=signal
10	Accelerator Curve X ae 4	-100	100	100	%	AP characteristic line, x-values (%) -32000..32000=signal
11	Accelerator Curve X ae 5	-100	100	100	%	AP characteristic line, x-values (%) -32000..32000=signal
12	Accelerator Curve Y ae 0	-100	100	100	%	AP characteristic line, y-values (%) -32000..32000=signal
13	Accelerator Curve Y ae 1	-100	100	100	%	AP characteristic line, y-values (%) -32000..32000=signal
14	Accelerator Curve Y ae 2	-100	100	100	%	AP characteristic line, y-values (%) -32000..32000=signal
15	Accelerator Curve Y ae 3	-100	100	100	%	AP characteristic line, y-values (%) -32000..32000=signal
16	Accelerator Curve Y ae 4	-100	100	100	%	AP characteristic line, y-values (%) -32000..32000=signal
17	Accelerator Curve Y ae 5	-100	100	100	%	AP characteristic line, y-values (%) -32000..32000=signal
18	Accelerator Max Decrement Pos	0	100	100	%	Max. decrement ap position. 0..32000=signal
19	Accelerator Max Increment Pos	0	100	100	%	Max. increment ap position. 0..32000=signal
20	Accelerator Wide Range Low Pos	50	74	70	%	Wide-Range lower threshold for all analog pedals 16000..23680=signal
29	AP Type4 Idle Range Max Perc	16	40	20	%	Analog Pedal Type 4 (FTL), Idle-Range upper threshold 5120..12800=signal
30	AP Type4 Idle Range Min Perc	0	15	10	%	Analog Pedal Type 4 (FTL), Idle-Range lower threshold 0..4800=signal
31	AP Type4 Wide Range Max Perc	75	100	85	%	Analog Pedal Type 4 (FTL), Wide-Range upper threshold 24000..32000=signal
32	Dual-Chan AP Idle Range Max Perc Chan1	0	30	20	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Idle-Range upper threshold of channel1 0..9600=signal
33	Dual-Chan AP Idle Range Min Perc Chan1	0	30	18	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Idle-Range lower threshold of channel1 0..9600=signal
34	Dual-Chan AP Wide Range Max Perc Chan1	0	100	74	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Wide-Range upper threshold of channel1 0..32000=signal
37	Full Load range percent	0	100	2	%	AP full load range 0..32000=signal
39	idle range percent	0	100	1	%	PWM/FUSO-Analog AP: AP idle range 0..32000=signal
43	kick down off percent	-100	100	24	%	Dual Channel AP: Position-Threshold for Kickdown Off -32000..32000=signal
44	kick down on percent	-100	100	21	%	Dual Channel AP: Position-Threshold for Kickdown On -32000..32000=signal
46	Ramp down percent	-100	100	80	%	AP-position ramp factor for falling positions. Before low-pass. -32000..32000=signal
53	Throttle Inhibit Selection	0	2	0		Accelerator Pedal inhibit mode 0=Cab and Remote Throttle,

No.	Parameter	min	max	default	unit	description
						1=Cab Throttle, 2=Remote Throttle
57	Zero Torque Ramp Enable	0	1	1		Enable Zero Torque Ramp 0=disabled, 1=enabled
59	Max Brake Pedal Pos for RC	0	100	20	%	Brake Pedal Position exceeding this value means Service Brake active for Throttle Pedal Rationality Check 0..250=signal, 255=snv
62	Dual-Chan AP Wide Range Min Perc Chan1	0	100	72	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Wide-Range lower threshold of channel1 0..32000=signal
63	Dual-Chan AP Idle Range Min Perc Chan2	0	30	18	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Idle-Range lower threshold of channel2 0..9600=signal
64	Dual-Chan AP Idle Range Max Perc Chan2	0	30	20	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Idle-Range upper threshold of channel2 0..9600=signal
65	Dual-Chan AP Wide Range Max Perc Chan2	0	100	74	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Wide-Range upper threshold of channel2 0..32000=signal
66	Dual-Chan AP Wide Range Min Perc Chan2	0	100	72	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Wide-Range lower threshold of channel2 0..32000=signal
67	Dual Chan1 Sig Diag Max Volt	0	250	4,55	V	Dual Channel Analog Pedal: chan1 max signal voltage (Type 6 (Williams) only) 0..50000=signal, 65535=snv
68	Dual Chan2 Sig Diag Max Volt	0	250	2,5	V	Dual Channel Analog Pedal: chan2 max signal voltage (Type 6 (Williams) only) 0..50000=signal, 65535=snv
69	Dual Chan1 Sig Diag Min Volt	0	250	0,75	V	Dual Channel Analog Pedal: chan1 min signal voltage (Type 6 (Williams) only) 0..50000=signal, 65535=snv
70	Dual Chan2 Sig Diag Min Volt	0	250	0,35	V	Dual Channel Analog Pedal: chan2 min signal voltage (Type 6 (Williams) only) 0..50000=signal, 65535=snv
71	Dual Chan Span Max Perc	0	100	5	%	Dual Channel Pedals: Max allowed difference between channel1 and channel2 0..32000=signal

4.1.12. PGR013 – Inputs

No.	Parameter	min	max	default	unit	description
1	1 01 DI Selection	0	4	0		Configuration input DiFlex01 0=disable, 1=enable Dual Speed Axle, 2=enable transmission retarder input, 3=clutch switch, 4=Evobus Cruise Control Lever Quit signal
2	1 02 DI Selection	0	1	1		Configuration input Diflex02 0=disable, 1=enable park brake interlock
3	1 10 DI Selection	0	3	0		Configuration input DiFlex20 0=disable, 1=enable aux shutdown, 2=FUSO Accelerator switch, 3=Evobus retarder lever stage0
4	1 15 DI Selection	0	2	0		Configuration input DiFlex05

No.	Parameter	min	max	default	unit	description
						0=disable, 1=Shutdown override, 2=FUSO CC-Cancel
5	1 17 DI Selection	0	2	1		Configuration input DiFlex07 0=disable, 1=throttle inhibit, 2=Evobus retarder lever stage4
6	2 08 DI Selection	0	3	0		Configuration input DiFlex16 0=disable, 1=Remote-Throttle enable, 2=Fast Engine Heat Up Switch, 3=Evobus retarder lever stage3
7	2 09 DI Selection	0	2	0		Configuration input DiFlex09 0=disable, 1=hardwired, 2=J1939 PTO
8	2 13 DI Selection	0	4	1		Configuration input DiFlex12 0=disable, 1=fan override switch, 2=Evobus retarder lever stage5, 3=RockOutMode, 4=RemAP IVS2
9	2 14 DI Selection	0	4	0		Configuration input DiFlex13 0=disable, 1=engine brake low, 2=Evobus retarder lever stage1, 3=CC hysteresis low, 4=RemAP IVS1
10	2 15 DI Selection	0	4	0		Configuration input DiFlex14 0=disable, 1=engine brake high, 2=Evobus retarder lever stage2, 3=CC hysteresis high, 4=RemAP IVS2
11	3 01 AI Selection	0	3	0		analog input One configuration 0=no sensor, 1=air filter restriction sensor, 2=OI Thermostat input, 3=FUSO Idle Volume sensor input
12	3 18 DI Selection	0	12	0		CPC2: Configuration input Sfp02 DSF1 # CPC4: DIFLEX_22 0=disable, 1=enable ABS input, 2=enable transmission retarder input, 3=enable tempo set, 4=enable grid heater detection, 5=switchable torque demand, 6=drive on super structure, 7=throttle inhibit super structure, 8=split select, 9=FUSO Engine brake stage 2 cancel switch, 10=DPF Inhibit Regen Switch, 11=PTO2stat, 12=engine shutdown/Tier4 inducement override
13	4 03 DI Selection	0	1	0		DI_FLEX_26 0=disable, 1=D+ signal
15	4 05 DI Selection	0	1	0		SFP12, Pin 4/5 0=disable, 1=Transmission Shaft Speed Sensor Ground
16	4 08 DI Selection	0	1	0		CPC2: Configuration input DiFlexE1 # CPC4: DI_FLEX_23 0=disable, 1=clutch switch
17	4 13 DI Selection	0	11	0		Configuration input DiFlex19 DSF0 0=disable, 1=enable ABS input, 2=enable transmission retarder input, 3=enable tempo set,

No.	Parameter	min	max	default	unit	description
						4=enable grid heater detection, 5=switchable torque demand, 6=drive on super structure, 7=throttle inhibit super structure, 8=split select, 9=FUSO Engine brake stage 2 cancel switch, 10=DPF Inhibit Regen Switch, 11=engine shutdown/Tier4 inducement override
18	4 17 DI Selection	0	3	2		Configuration parameter for input Di_Flex21 0=disable, 1=2 Clutch Switch, 2=DPF regeneration switch, 3=PTO1stat
19	4 18 DI Selection	0	9	0		Configuration input DiFlex18 0=disable, 1=enable crank inhibit, 2=enable engine hood (Optimized Idle), 3=not used, 4=RPM Freeze, 5=Engine Brake Disable, 6=Fast Engine Heat Up Switch, 7=Service-Brace active, 8=Driver Requested Engine Brake Lockout, 9=ManeuverMode
20	2nd Axle Speed Switch Config	0	3	0		Source Dual Speed Axle Switch (hardwired or from J1939) 0=hardwired, 1=Ccvs1 from Source Address #1, 2=Ccvs1 from Source Address #2, 3=Ccvs1 from Source Address #3
21	Cab PTO Switch Config	0	6	0		Source of the CC switches for Cab PTO mode 0=hardwired, 1=Ccvs1 from Source Address #1, 2=Ccvs1 from Source Address #2, 3=Ccvs1 from Source Address #3, 4= Ccvs1 from Source Address #1 or hardwired, 5= Ccvs1 from Source Address #2 or hardwired, 6= Ccvs1 from Source Address #3 or hardwired
22	CC ON OFF Switch Config	0	3	0		Source CC On/Off Switch for CruiseControl Mode 0=hardwired, 1=Ccvs1 from Source Address #1, 2=Ccvs1 from Source Address #2, 3=Ccvs1 from Source Address #3
23	CC Pause Switch Config	0	14	0		Source CC pause switch CC 0=hardwired, 1=Ccvs1 from Source Address #1, 2=Ccvs1 from Source Address #2, 3=Ccvs1 from Source Address #3, 4=Ccvs1 from SA1# or SA#2, 5=Ccvs1 from SA2# or SA#3, 6=Ccvs1 from SA1# or SA#3, 7=Ccvs1 from SA1# or SA#2 or SA#3, 8=Ccvs1 from SA#1 or hardwired, 9=Ccvs1 from SA#2 or hardwired, 10=Ccvs1 from SA#3 or hardwired, 11=Ccvs1 from SA1# or SA#2 or hardwired, 12=Ccvs1 from SA2# or SA#3 or hardwired, 13=Ccvs1 from SA1# or SA#3 or hardwired, 14=Ccvs1 from SA1# or SA#2 or SA#3 or hardwired
24	CC Set Cst Res Accel Sw Config	0	3	0		Source CC set/reset switch for CruiseControl Mode, only for Set-switch, ccminus-switch and ccplus-switch 0=hardwired, 1=Ccvs1 from Source Address #1, 2=Ccvs1 from Source Address #2,

No.	Parameter	min	max	default	unit	description
						3=Ccvs1 from Source Address #3
25	Clutch Switch Config	0	7	0		Source and configuration clutch switch(es) info 0=no clutch switch, 1=1 Clutch Switch, 2=2 Clutch Switch, 3=Ccvs1 from source address #1, 4=Ccvs1 from source address #2, 5=Ccvs1 from source address #3, 6=ETC1, 7=1 Clutch switch, clutch info via PTCan
26	Engine Brake Switch Config	0	255	0		Source EBM switch (hardwired or from J1939) 0=hardwired, 1=info from J1939 (muxed), 2=Info from LIN, 255=not available
27	Evobus Retarder Lever Enable	0	3	0		Evobus 5 stage retarder switch enable cal 0=disabled, 1=enabled via ERC1, 2=enabled via TSC1, 3=enabled for EBM only
28	Park Brake Switch Config	0	3	0		Source park brake switch (hardwired or from J1939) 0=hardwired, 1=Ccvs1 from Source Address #1, 2=Ccvs1 from Source Address #2, 3=Ccvs1 from Source Address #3
29	Service Brake Switch Config	0	5	0		Source service brake switch (hardwired or from J1939) 0=hardwired, 1=Ccvs1 from Source Address #1, 2=Ccvs1 from Source Address #2, 3=Ccvs1 from Source Address #3 4=Ebc1 (SPN 1121), 5=J1939 PROP6 (T4PP Cab only)
30	Stop Eng Override Sw Config	0	3	0		Source of Stop Engine Override/Diagnostic Request Switch 0=hardwired, 1=Ccvs1 from Source Address #1, 2=Ccvs1 from Source Address #2, 3=Ccvs1 from Source Address #3
31	Switchable Torque via 3 18	-5000	5000	-5000	Nm	switchable torque demand via Diflex22 -25000..25000=signal
32	Switchable Torque via 4 13	-5000	5000	-5000	Nm	switchable torque demand via Diflex19 -25000..25000=signal
33	Trans Neutral Input Config	0	255	0		Source neutral switch (hardwired or from J1939) 0=hardwired, 1=info from J1939 (muxed), 255=not available
34	Evobus Cc Lever Enable	0	1	0		Evobus cruise control enable cal 0=disable, 1=enable
35	1 01 Diflex01 Fault Detect Enable	0	1	0		Fault Detection of digital input DIFLEX_01 0=no information to FCM, 1=information to FCM
36	1 02 Diflex02 Fault Detect Enable	0	1	0		Fault Detection of digital input DIFLEX_02 0=no information to FCM, 1=information to FCM
37	1 10 Diflex20 Fault Detect Enable	0	1	0		Fault Detection of digital input DIFLEX_20 0=no information to FCM, 1=information to FCM
38	1 11 Diflex08 Fault Detect Enable	0	1	0		Fault Detection of digital input DIFLEX_08 0=no information to FCM, 1=information to FCM
39	1 12 Diflex03 Fault Detect Enable	0	1	0		Fault Detection of digital input DIFLEX_03 0=no information to FCM, 1=information to FCM
40	1 14 Diflex04 Fault Detect Enable	0	1	0		Fault Detection of digital input DIFLEX_04

No.	Parameter	min	max	default	unit	description
						0=no information to FCM, 1=information to FCM
41	1 15 Diflex05 Fault Detect Enable	0	1	0		Fault Detection of digital input DIFLEX_05 0=no information to FCM, 1=information to FCM
42	1 16 Diflex06 Fault Detect Enable	0	1	0		Fault Detection of digital input DIFLEX_06 0=no information to FCM, 1=information to FCM
43	1 17 Diflex07 Fault Detect Enable	0	1	0		Fault Detection of digital input DIFLEX_07 0=no information to FCM, 1=information to FCM
44	2 07 Diflex15 Fault Detect Enable	0	1	0		Fault Detection of digital input DIFLEX_15 0=no information to FCM, 1=information to FCM
45	2 08 Diflex16 Fault Detect Enable	0	1	0		Fault Detection of digital input DIFLEX_16 0=no information to FCM, 1=information to FCM
46	2 09 Diflex09 Fault Detect Enable	0	1	0		Fault Detection of digital input DIFLEX_09 0=no information to FCM, 1=information to FCM
47	2 11 Diflex10 Fault Detect Enable	0	1	0		Fault Detection of digital input DIFLEX_10 0=no information to FCM, 1=information to FCM
48	2 12 Diflex11 Fault Detect Enable	0	1	0		Fault Detection of digital input DIFLEX_11 0=no information to FCM, 1=information to FCM
49	2 13 Diflex12 Fault Detect Enable	0	1	0		Fault Detection of digital input DIFLEX_12 0=no information to FCM, 1=information to FCM
50	2 14 Diflex13 Fault Detect Enable	0	1	0		Fault Detection of digital input DIFLEX_13 0=no information to FCM, 1=information to FCM
51	2 15 Diflex14 Fault Detect Enable	0	1	0		Fault Detection of digital input DIFLEX_14 0=no information to FCM, 1=information to FCM
52	3 18 Diflex22 Fault Detect Enable	0	1	0		Fault Detection of digital input DIFLEX_22 0=no information to FCM, 1=information to FCM
58	4 08 Diflex23 Fault Detect Enable	0	1	0		Fault Detection of digital input DIFLEX_23 0=no information to FCM, 1=information to FCM
59	4 13 Diflex19 Fault Detect Enable	0	1	0		Fault Detection of digital input DIFLEX_19 0=no information to FCM, 1=information to FCM
60	4 16 Diflex17 Fault Detect Enable	0	1	0		Fault Detection of digital input DIFLEX_17 0=no information to FCM, 1=information to FCM
61	4 17 Diflex21 Fault Detect Enable	0	1	0		Fault Detection of digital input DIFLEX_21 0=no information to FCM, 1=information to FCM
62	4 18 Diflex18 Fault Detect Enable	0	1	0		Fault Detection of digital input DIFLEX_18 0=no information to FCM, 1=information to FCM
63	3 04 AI_02 Selection	0	2	0		analog input two configuration, AI_02 0=no sensor, 1=Remote throttle sensor, 2=Expansion tank pressure sensor
64	4 14 AI_03 Selection	0	2	0		analog input three configuration, AI_03 0=no sensor, 1=Dual channel analog throttle, channel 2 signal, 2=Expansion tank pressure sensor
65	2 11 DI Selection	0	2	0		Configuration input DiFlex10 0=disable, 1=LIM1, 2=RemAP IVS1
66	1 11 DI Selection	0	2	0		Configuration input DiFlex08 0=disable, 1=LIM0,

No.	Parameter	min	max	default	unit	description
						2=PTO part 1 (adjustable via -Remote PTO Spd Selection Mode-), 3=Torque Curve Selection, Bit 0

4.1.13. PGR014 – Relay 3 and 4

No.	Parameter	min	max	default	unit	description
1	Comparator 3 Eng Speed	0	4000	3998	1/min	reserved, Item 6 0..32000=signal
2	Comparator 3 Speed Hysteresis	0	4000	50	1/min	reserved, Item 7 0..32000=signal
3	Comparator 3 Temperature	-50	200	200	°C	reserved, Item 8 -1600..6400=signal
4	Comparator 3 Temp Hysteresis	-50	200	5	°C	reserved, Item 9 -1600..6400=signal
5	Comparator 3 Torque	-5000	5000	4999	Nm	reserved, Item 2 -25000..25000=signal
6	Comparator 3 Torque Hysteresis	-5000	5000	50	Nm	reserved, Item 3 -25000..25000=signal
7	Comparator 3 VSpeed	0	250	150	km/h	reserved, Item 4 0..32000=signal
8	Comparator 3 VSpeed Hysteresis	0	250	5	km/h	reserved, Item 5 0..32000=signal
9	Comparator 4 Eng Speed	0	4000	3998	1/min	reserved, Item 15 0..32000=signal
10	Comparator 4 Speed Hysteresis	0	4000	50	1/min	reserved, Item 16 0..32000=signal
11	Comparator 4 Temperature	-50	200	200	°C	reserved, Item 17 -1600..6400=signal
12	Comparator 4 Temp Hysteresis	-50	200	5	°C	reserved, Item 18 -1600..6400=signal
13	Comparator 4 Torque	-5000	5000	4999	Nm	reserved, Item 11 -25000..25000=signal
14	Comparator 4 Torque Hysteresis	-5000	5000	50	Nm	reserved, Item 12 -25000..25000=signal
15	Comparator 4 VSpeed	0	250	150	km/h	reserved, Item 13 0..32000=signal
16	Comparator 4 VSpeed Hysteresis	0	250	5	km/h	reserved, Item 14 0..32000=signal

4.1.14. PGR015 – Cruise Control

No.	Parameter	min	max	default	unit	description
1	Clutch Switch Toggle Required	0	1	1		Driveline State must have toggled once before CC can be activated 0=no toggle required, 1=toggle required before CC operation possible
4	Disable CC On Drive Train Open	0	255	0		if enabled, Cruise Control is disabled when out of gear is detected. 0=disabled, 1=enabled, 255=SNA
5	Enable Cruise Auto Resume	0	3	3		Enable Cruise Auto Resume 0=disable, 1=enable automatic cruise resume function after clutch has been released once, 2=release clutch twice, 3=Resume AMT style
6	Master Switch Toggle Required	0	1	1		Master Switch Toggle Required 0=no toggle required, 1=toggle required before CC operation possible
9	Min Cruise Set Speed low	15	125	15	km/h	minimum activation speed speed for vehicles with ATC

No.	Parameter	min	max	default	unit	description
						30..250=signal, 255=snv
10	Service Brake Toggle Required	0	1	1		Service Brake Toggle Required 0=no toggle required, 1=toggle required before CC operation possible
13	pause CC on VDC1	0	255	1		CC Pause in case of Veh. Dynamic Controller intervention via J1939, message VDC1 0=ROP,YC Brake Control, 1=ROP,YC Engine and Brake Control, 255=SNA
14	CC Pause On ASR	0	1	1		CC Pause in case of ATC Controller intervention via J1939, message EBC 0=disabled, 1=ASR Engine or Brake Control
19	CC Set Speed Mode	0	255	0		Step Ramp - driver uses a display to capture the set speed shown on a driver display.Engine-Vehicle ramps up-down to the speed. Continuous - set speed is captured when the switch is released. 0=Step-Ramp-Mode, 1=Continuous-Ramp-Mode, 255=SNA
22	Set-Speed Increment Mode	0	1	0		CC Set-Speed Increment-Mode km/h vs. Mph 0=km/h, 1=mph
23	Switch Variant	0	255	0		CC HMI-Switches, Variant A - SFTP (Set/Plus:Resume/Minus), Variant B - NAFTA (Resume/Plus:Set/Minus) 0=Variant A, 1=Variant B, 255=SNA
24	HMI Concept Mode	0	255	0		CC HMI-Concept-Mode, Variant A - SFTP, Variant B - NAFTA, Note: Adapt Parameter 15/23 Switch Variant (cdi_p_Cc.CcSwitchVarSel_u8) 0=Variant A, 1=Variant B, 255=SNA
25	CC Function Stat	0	3	0		Cruise Control CC / Adaptive Cruise Control ACC / Adaptive Cruise Control Plus / ACCP CAN available 0=not available, 1=Cruise Control, 2=adaptive CC, 3=adaptive CC+
26	CC Brake Mode available	0	1	1		Cruise control brake function available 0=not available, 1=available
27	CC Start Function Mode	0	15	1		Cruise control start function mode, after ignition on 0=not used, 1=Cruise Control, 2=adaptive CC, 3=adaptive CC+, 4=Limiter, 15=SNA
28	Max Hyst Offset Vspeed	0	250	0	km/h	Maximum hysteresis above actual maximal vehicle speed (e. g. Leg. max vehicle speed). 0..50000=signal, 65535=snv
54	Norm Hyst Vspeed	0	250	2	km/h	Default hysteresis if no cc band switch is installed or any hysteresis error occur. (If parameter 15/82 = 3 and TorqueBasedMode = active à Norm Hyst Vspeed = 6km/h. If parameter 15/82 = 3 and OverSpdBasedMode = active à Norm Hyst

No.	Parameter	min	max	default	unit	description
						Vspeed = 2km/h.) 0..50000=signal, 65535=snv
55	Min Hyst Vspeed	0	250	2	km/h	SFTP = Minimum hysteresis in no economy mode, NAFTA = hysteresis value for cc-band-switch position low. (If parameter 15/82 = 3 à Min Hyst Vspeed = inactive), 0..50000=signal, 65535=snv
56	Max Hyst Vspeed	0	250	15	km/h	SFTP = maximum hysteresis, NAFTA = hysteresis value for cc-band-switch position maximum (250 = no engine brakes in retarder switch position zero), D = no meaning. (If parameter 15/82 = 3 à Min Hyst Vspeed = inactive), 0..50000=signal, 65535=snv
57	Lim Hyst Vspeed	0	250	0	km/h	Hysteresis value in limiter mode 0..50000=signal, 65535=snv
59	LIM Increment Mode	0	1	1		Value for single step incrementation in Limiter mode 0=Increment 0,5 (km/h, mph), 1=Increment 1,0 (km/h, mph), 2=not defined, 3=snv
60	CC Regular Increment Mode	0	1	1		CC Regular Increment Mode 0=Increment 0,5 (km/h, mph), 1=Increment 1,0 (km/h, mph)
61	CC Deact by Brake Pedal	0	1	0		Paramter to switch off Cc when Brake Pedal is pressed, except: vehicle standstill (DTR+ Funktion), Limiter mode 0=do not switch off CC, 1=switch off CC
62	CC Deact by Retarder Switch	0	2	0		Paramter to switch off Cc when Retarder Switch is activated, 0=do not switch off CC, 1=switch off CC, 2=switch off CC if lever is actuated and switched back to 0, 3=snv
74	Soft Cruise Manual Activation	0	1	0		Flag for permanently SoftCruise Activation 0=not active, 1=active
75	Max Offs Accel Vehicle Speed	0	327,6	10	km/h	Maximum positive offset between current vehicle speed and maximum setable set speed (except resume function). Used for single step limitation (CC+). 0..50000=signal, 65535=SNA
76	Max Offs Decel Vehicle Speed	0	327,6	10	km/h	Maximum negative offset between current vehicle speed and maximum setable set speed (except resume function) Used for single step limitation (CC-). 0..50000=signal, 65535=SNA
77	Min Hyst High Vspeed	0	327,6	2	km/h	Variant: SFTP = Minimum hysteresis in economy mode set to 2km/h, NAFTA = hysteresis value for cc-band-switch position medium. Set to 4km/h. (If parameter 15/82 = 3 à Min Hyst Vspeed = inactive) 0..50000=signal, 65535=SNA
78	Min Hyst Code	0	255	255		Minimal hysteresis encoding. Not used anymore. 0..255=signal
81	CC Deact Error ABS	0	255	1		If enabled, ABS error will drop out Cruise Control

No.	Parameter	min	max	default	unit	description
						0=disable, 1=enable, 255=inactive
82	CC Hyst Variant	0	255	3		Cruise Control Hystesis concept: A = continuous and store, B = continuous wihtout store, C = CC Limit Switch, D = Single hysteresis 0=Variant A, 1=Variant B, 2=Variant C, 3=Variant D, 255=inactive

4.1.15. PGR017 – Idle and PTO Shutdown

No.	Parameter	min	max	default	unit	description
1	CEL Time Idle PTO Shutdown	3	120	20	s	Time for CEL before Idle/PTO Shutdown 3..120=signal
2	Enable Idle PTO Shtdn Override	0	4	1		Idle/PTO Shutdown Override Configuration 0=vehicle speed, throttle pedal, 1=vehicle speed, throttle pedal, SEO, clutch, service brake, 2=vehicle speed, throttle pedal, SEO, 3=vehicle speed, throttle pedal, continuous override with throttle pedal, SEO, 4=disable
3	Enable Idle Shutdown	0	3	1		Idle Shutdown Configuration 0=disable, 1=enable idle shutdown with Park Brake status, 2=enable idle shutdown without Park Brake status, 3=enable idle shutdown with edge triggered accelerator pedal
4	Enable PTO Shutdown	0	3	0		Enable Engine Shutdown while PTO is active 0=disable, 1=enable PTO shutdown with Park Brake status, 2=enable PTO shutdown without Park Brake status, 3=enable PTO shutdown with edge triggered accelerator pedal
11	Hi Amb Air Override Temp	-40	75	32	°C	Defines the ambient air temperature limit above which the shutdown override is allowed -1280..2400=signal
12	Idle Override Cancel Time	0	5000	0	s	Continuous Idle Shutdown Override Cancel Time 0..5000=signal
13	Idle Shutdown Auto Override	0	1	0		Flag to select the feature for automatic shutdown override by ambient air temperature 0=no automatic override performed, 1=automatic override performed
14	Idle Shutdown Time	1	5000	300	s	Idle Shutdown Time 1..5000=signal
15	Lo Amb Air Override Temp	-40	75	-4	°C	Defines the ambient air temperature limit below which the shutdown override is allowed -1280..2400=signal
16	Max Amb Air Override Temp	-40	75	75	°C	Defines the ambient air temperature limit above which the shutdown override is disallowed -1280..2400=signal
17	Max Engine Load PTO Shutdown	0	5000	100	Nm	Maximum Engine Load for PTO Shutdown 0..25000=signal
18	Min Coolant Temp	-40	200	10	°C	Minimum Coolant Temp for Engine Shutdown

No.	Parameter	min	max	default	unit	description
						-1280..6400=signal
19	PTO Shutdown Time	1	5000	300	s	PTO Shutdown Time 1..5000=signal
20	Restart Enable	0	1	0		Idle Shutdown : enables restart in the same ignition cycle in which a shutdown has happened 0=disable restart in the same ignition cycle, 1=enable restart in the same ignition cycle
21	SEL Time Idle PTO Shutdown	3	120	10	s	Time for SEL before Idle/PTO Shutdown 3..120=signal
22	Inactv Shtd Conf	0	1	1		Inactive Shutdown Configuration 0=disable, 1=enable inactive shutdown
23	Inactv Shtd Time	1	5000	1800	s	Inactive Shutdown Time 1..5000=signal
24	Inactv Shtd Max Trq	0	5000	100	Nm	Maximum Engine Load for Inactive Shutdown 0..25000=signal
25	Lo Amb Air Temp Idle Time	0	65534	0	s	Idle Time for low Ambient Temperature based Shutdown 0..65534=signal
26	Hi Amb Air Temp Idle Time	0	65534	0	s	Idle Time for high Ambient Temperature based Shutdown 0..65534=signal
27	max Shutd Delay Time	0	65535	3600	s	Max. time a tool may defer an idle or PTO shutdown. 0..65535=signal

4.1.16. PGR018 – Engine Protection Shutdown

No.	Parameter	min	max	default	unit	description
1	Cool Level Eng Protect Shtdn	0	1	0		Engine Protection Shutdown on Coolant Level 0=warning, 1=engine shutdown
2	Coolant Temp Eng Protect Shtdn	0	1	0		Engine Protection Shutdown on Coolant Temperature 0=warning, 1=engine shutdown
3	Oil Level Eng Protect Shtdn	0	1	0		Engine Protection Shutdown on Oil Level 0=warning, 1=engine shutdown
4	Oil Press Eng Protect Shtdn	0	1	0		Engine Protection Shutdown on Oil Pressure 0=warning 1=engine shutdown
7	Eng Prot ext Stop Behaviour	0	1	0		Selection of external engine stop request behaviour 0=external engine stop immediate shutdown, 1=external engine stop delayed shutdown
8	CEL Time Engine Prot Shutdown	3	120	20	s	Time for CEL before Engine Protection Shutdown 150..6000=signal
9	SEL Time Engine Prot Shutdown	3	120	10	s	Time for SEL before Engine Protection Shutdown 150..6000=signal
10	Engine Prot Shutdown Time	1	120	60	s	Engine Protection Shutdown Time 50..6000=signal
11	Eng Prot ext Stop Shutdwn Time	1	120	30	s	Engine Protection Shutdown Time for external engine stop requests 50..6000=signal
12	Oil Pressure Shtdn Time	30	60	30	s	Engine Protection Shutdown Time on Oil Pressure 1500..3000=signal
13	Oil Level Shutdown Time	0,02	100	5	s	Oil Level Shutdown Time 1..5000=signal

No.	Parameter	min	max	default	unit	description

4.1.17. PGR019 – Automatic Fan Activation

No.	Parameter	min	max	default	Unit	description
1	AC Fan Speed Active Pct	0	100	100	%	fan speed when air condition is active 0..32000=signal
2	AC Fan Vehicle Speed Enable	0	1	0		Activates the road speed threshold for A/C feature 0=disable, 1=enable
3	AC Fan Vehicle Speed Thresh	0	250	32,1	km/h	Road speed threshold above which the A/C fan request is not using the hold time 0..32000=signal
4	Air Condition Enable Auto Fan	0	1	0		Enable Automatic Fan Activation on Air Conditioner 0=disable, 1=enable
5	Cool Temp at 0 Pct Fan	0	200	180	°C	Coolant Temperature Threshold above which the fan feature requests fan power 0..6400=signal
6	Cool Temp at 100 Pct Fan	0	200	200	°C	Coolant Temperature at which the fan feature requests 100 % fan power 0..6400=signal
7	Eng Brake Enable Auto Fan	0	1	0		Enable Automatic Fan Activation on Engine Brake 0=disable, 1=enable
8	Eng Brake Fan Min Cool Temp	-50	200	-50	°C	Coolant temperature threshold below which the EBM fan request will be ignored -1600..6400=signal
9	Eng Brake Fan Min Vspeed	0	250	32,1	km/h	Vehicle speed temperature threshold below which the engine brake fan request will be ignored 0..32000=signal
10	Engine Brk Fan On Delay Time	0	10	2	s	Delay time in seconds for Fan on engine brakes 0=inactive, 1..10=signal
11	Fan AC Hold Time	0	600	180	s	Hold Timer for fan with an AC request 0..30000=signal
12	Fan Activation Min Cool Temp	-50	200	-40	°C	minimum coolant temperature above which CPC is allowed to request fan activation -1600..6400=signal
13	Fan Power on Fan Override	0	100	100	%	Fan Power on Fan Override Enabled via fan override pin,DI_FLEX12 0..32000=signal
14	Fan Speed Perc for Eng Ret	0	100	100	%	fan speed when engine brake is active 0..32000=signal
15	Fan Vehicle Speed Enable	0	1	0		Activates the road speed threshold feature 0=disable, 1=enable
16	Fan Vehicle Speed Threshold	0	250	0	km/h	Vehicle Speed threshold below which the fan request will be ignored 0..32000=signal
17	Hold Time Fan	0	600	0	s	hold time Fan - minimum fan on time 0..30000=signal
18	J1939 Fan Request Enable	0	3	0		Fan request from J1939 (PGN 57344) 0=disable, 1=CM1 from SA1 (see 001/008) and SA2 (see 001/009), 2=CM1 from SA1 (see 001/008) only, 3=CM1 from SA2 (see 001/009) only
19	PTO Enable Auto Fan Activation	0	1	0		Enable Automatic Fan Activation on PTO 0=disable, 1=enable
20	PTO Fan On Delay Time	0	10	2	s	Delay time in seconds for Fan on PTO 0=inactive,

No.	Parameter	min	max	default	Unit	description
						1..10=signal
21	Ramp Fan	1	100	100	%/s	ramp Fan 320..32000=signal
22	speed PTO active percent	0	100	100	%	fan speed when PTO is active 0..32000=signal
23	Trans Retard Fan Min Cool Temp	-50	200	-50	°C	Coolant temperature threshold below which the transmission retarder fan request will be ignored -1600..6400=signal
24	Trans Retard Fan Min Oil Temp	-40	210	-40	°C	Hydraulic oil temperature threshold below which the transmission retarder fan request will be ignored -1280..6720=signal
25	Trans Retard Fan Min Vspeed	0	250	32,1	km/h	Vehicle speed temperature threshold below which the transmission retarder fan request will be ignored 0..32000=signal
26	Trans Retard Fan On Delay Time	0	10	2	s	Delay time in seconds for Fan on transmission retarder 0=inactive, 1..10=signal
27	Trans Retarder Fan Percent	0	100	0	%	fan speed when retarder active 0..32000=signal

4.1.18. PGR020 – Remote Accelerator Pedal

No.	Parameter	min	max	default	unit	description
4	Remote Accelerator Enable	0	3	0		Remote Accelerator Pedal Input Configuration 0=Remote AP disabled, 1=Remote AP without IVS (idle validation switches), 2=Remote AP with 1 IVS, 3=Remote AP with 2 IVS

4.1.19. PGR021 – Droop Control Mode

No.	Parameter	min	max	default	unit	description
1	Configuration Droop Ctrl Mode	0	2	0		Droop Control Mode 0=disable, 1=normal droop mode, 2=limited droop mode
2	Droop Ctrl Mode Governor Type	1	11	1		Governor Type for the Droop Control Mode 1..11=signal
3	Droop Maximum Engine Torque	0	5000	5000	Nm	Maximum Allowed Engine Torque in Droop Mode 0..25000=signal

4.1.20. PGR022 – Limiter Governor

No.	Parameter	min	max	default	unit	description
1	0 Speed Gov TSC1 Condition	1	16	1		Speed Gov# TSC1 condition #0 PLD speed governor# with is used for TSC1 requested speed control condition #0. See J1939/71 4.2.3.2 1..16=signal
2	1 Speed Gov TSC1 Condition	1	16	1		Speed Gov# TSC1 condition #1 PLD speed governor# with is used for TSC1 requested speed control condition #1. See J1939/71 4.2.3.2 1..16=signal
3	2 Speed Gov TSC1 Condition	1	16	1		Speed Gov# TSC1 condition #2 PLD speed governor# with is used for TSC1 requested speed control condition #2. See J1939/71 4.2.3.2 1..16=signal
4	3 Speed Gov TSC1 Condition	1	16	1		Speed Gov# TSC1 condition #3 PLD speed

No.	Parameter	min	max	default	unit	description
						governor# with is used for TSC1 requested speed control condition #3. See J1939/71 4.2.3.2 1..16=signal

4.1.21. PGR023 – Limiters II

No.	Parameter	min	max	default	unit	Description
1	ADM 1 Trans Prot 1 Veh Speed	0	250	0	km/h	Torque limitation dependent on vehicle speed for Allison Transmissions without CAN connection. 0..32000=signal
2	ADM 1 Trans Prot 2 Veh Speed	0	250	0	km/h	Torque limitation dependent on vehicle speed for Allison Transmissions without CAN connection. 0..32000=signal
3	ADM 1 Trans Prot Torque	-5000	5000	5000	Nm	reserved -25000..25000=signal
27	Gear Ratio for High Gear Power	0	2	0,02		Gear ratio for high gear power Torque reduction occurs to gear ratios below this value. See also parameter 23/3 0..2000=signal
28	Gear Ratio Gear Down Protect	0	2	0,01		Gear ratio for gear down protection Torque reduction occurs to gear ratios below this value. See also parameter 23/1 0..2000=signal
64	Torque Factor Gear Dwn Protect	0	1	1		Torque factor gear down protection Torque reduction factor in gears below the ratio that is set in parameter 23/2 0..1000=signal
65	Torque Factor High Gear Power	0	1	1		Torque factor high gear power Torque reduction factor in gears below the ratio that is set in parameter 23/4 0..1000=signal
67	Gear Down Protection Mode	0	1	1		Operation of gear down protection and high gear power 0=in all gears (legacy), 1=not in top gear or top gear -1

4.1.22. PGR024 – Vehicle Parameters II

No.	Parameter	min	max	default	unit	description
1	CC Power Rating Selection	0	1	0		Power Rating with Cruise Control 0=no dedicated CC curve rating, 1=use the curve selected by parameter 05/15 or OHECS
4	Power Rating Factor 1 ae 0	0	1	0,9		Power Rating Curve 1, Value #0 0..1024=signal
5	Power Rating Factor 1 ae 1	0	1	0,9		Power Rating Curve 1, Value #0 0..1024=signal
6	Power Rating Factor 1 ae 2	0	1	0,9		Power Rating Curve 1, Value #0 0..1024=signal
7	Power Rating Factor 1 ae 3	0	1	0,9		Power Rating Curve 1, Value #0 0..1024=signal
8	Power Rating Factor 1 ae 4	0	1	0,9		Power Rating Curve 1, Value #0 0..1024=signal
9	Power Rating Factor 1 ae 5	0	1	0,9		Power Rating Curve 1, Value #0 0..1024=signal
10	Power Rating Factor 1 ae 6	0	1	0,9		Power Rating Curve 1, Value #0 0..1024=signal
11	Power Rating Factor 1 ae 7	0	1	0,9		Power Rating Curve 1, Value #0 0..1024=signal
12	Power Rating Factor 1 ae 8	0	1	0,9		Power Rating Curve 1, Value #0 0..1024=signal
13	Power Rating Factor 1 ae 9	0	1	0,9		Power Rating Curve 1, Value #0 0..1024=signal
14	Power Rating Factor 1 ae 10	0	1	0,9		Power Rating Curve 1, Value #0

No.	Parameter	min	max	default	unit	description
						0..1024=signal
15	Power Rating Factor 1 ae 11	0	1	0,9		Power Rating Curve 1, Value #0 0..1024=signal
16	Power Rating Factor 1 ae 12	0	1	0,9		Power Rating Curve 1, Value #0 0..1024=signal
17	Power Rating Factor 1 ae 13	0	1	0,9		Power Rating Curve 1, Value #0 0..1024=signal
18	Power Rating Factor 1 ae 14	0	1	0,9		Power Rating Curve 1, Value #0 0..1024=signal
19	Power Rating Factor 1 ae 15	0	1	0,9		Power Rating Curve 1, Value #0 0..1024=signal
20	power rating selection	0	5	0		Power Rating Enable 0=off, 1=enable in TrqCntrlMode, 2=enable in SpdCntrlMode PTO, 3=enable in SpdCntrlMode Sa3TSC1, 4=enable in SpdCntrlMode Sa3TCS1 and PTO, 5=enable in Trq/SpdCntrlMode Sa3TSC1 and PTO
21	power rating speed ae 0	0	4000	2400	1/min	speed characteristic that corresponds to torque limitation factor characteristic (see. Cdi_p_Veh2.PowerRatingFactXNr_s16) 0..32000=signal
22	power rating speed ae 1	0	4000	2400	1/min	speed characteristic that corresponds to torque limitation factor characteristic (see. Cdi_p_Veh2.PowerRatingFactXNr_s16) 0..32000=signal
23	power rating speed ae 2	0	4000	2400	1/min	speed characteristic that corresponds to torque limitation factor characteristic (see. Cdi_p_Veh2.PowerRatingFactXNr_s16) 0..32000=signal
24	power rating speed ae 3	0	4000	2400	1/min	speed characteristic that corresponds to torque limitation factor characteristic (see. Cdi_p_Veh2.PowerRatingFactXNr_s16) 0..32000=signal
25	power rating speed ae 4	0	4000	2400	1/min	speed characteristic that corresponds to torque limitation factor characteristic (see. Cdi_p_Veh2.PowerRatingFactXNr_s16) 0..32000=signal
26	power rating speed ae 5	0	4000	2400	1/min	speed characteristic that corresponds to torque limitation factor characteristic (see. Cdi_p_Veh2.PowerRatingFactXNr_s16) 0..32000=signal
27	power rating speed ae 6	0	4000	2400	1/min	speed characteristic that corresponds to torque limitation factor characteristic (see. Cdi_p_Veh2.PowerRatingFactXNr_s16) 0..32000=signal
28	power rating speed ae 7	0	4000	2400	1/min	speed characteristic that corresponds to torque limitation factor characteristic (see. Cdi_p_Veh2.PowerRatingFactXNr_s16) 0..32000=signal
29	power rating speed ae 8	0	4000	2400	1/min	speed characteristic that corresponds to torque limitation factor characteristic (see. Cdi_p_Veh2.PowerRatingFactXNr_s16) 0..32000=signal
30	power rating speed ae 9	0	4000	2400	1/min	speed characteristic that corresponds to torque limitation factor characteristic (see. Cdi_p_Veh2.PowerRatingFactXNr_s16) 0..32000=signal
31	power rating speed ae 10	0	4000	2400	1/min	speed characteristic that corresponds to torque limitation factor characteristic (see. Cdi_p_Veh2.PowerRatingFactXNr_s16) 0..32000=signal
32	power rating speed ae 11	0	4000	2400	1/min	speed characteristic that corresponds to torque limitation factor characteristic (see. Cdi_p_Veh2.PowerRatingFactXNr_s16) 0..32000=signal

No.	Parameter	min	max	default	unit	description
33	power rating speed ae 12	0	4000	2400	1/min	speed characteristic that corresponds to torque limitation factor characteristic (see. Cdi_p_Veh2.PowerRatingFactXNr_s16) 0..32000=signal
34	power rating speed ae 13	0	4000	2400	1/min	speed characteristic that corresponds to torque limitation factor characteristic (see. Cdi_p_Veh2.PowerRatingFactXNr_s16) 0..32000=signal
35	power rating speed ae 14	0	4000	2400	1/min	speed characteristic that corresponds to torque limitation factor characteristic (see. Cdi_p_Veh2.PowerRatingFactXNr_s16) 0..32000=signal
36	power rating speed ae 15	0	4000	2400	1/min	speed characteristic that corresponds to torque limitation factor characteristic (see. Cdi_p_Veh2.PowerRatingFactXNr_s16) 0..32000=signal
37	Power Rating Factor 2 ae0	0	1	0,8		Power Rating Curve 2, Value #0 0..1024=signal
38	Power Rating Factor 2 ae1	0	1	0,8		Power Rating Curve 2, Value #0 0..1024=signal
39	Power Rating Factor 2 ae2	0	1	0,8		Power Rating Curve 2, Value #0 0..1024=signal
40	Power Rating Factor 2 ae3	0	1	0,8		Power Rating Curve 2, Value #0 0..1024=signal
41	Power Rating Factor 2 ae4	0	1	0,8		Power Rating Curve 2, Value #0 0..1024=signal
42	Power Rating Factor 2 ae5	0	1	0,8		Power Rating Curve 2, Value #0 0..1024=signal
43	Power Rating Factor 2 ae6	0	1	0,8		Power Rating Curve 2, Value #0 0..1024=signal
44	Power Rating Factor 2 ae7	0	1	0,8		Power Rating Curve 2, Value #0 0..1024=signal
45	Power Rating Factor 2 ae8	0	1	0,8		Power Rating Curve 2, Value #0 0..1024=signal
46	Power Rating Factor 2 ae9	0	1	0,8		Power Rating Curve 2, Value #0 0..1024=signal
47	Power Rating Factor 2 ae10	0	1	0,8		Power Rating Curve 2, Value #0 0..1024=signal
48	Power Rating Factor 2 ae11	0	1	0,8		Power Rating Curve 2, Value #0 0..1024=signal
49	Power Rating Factor 2 ae12	0	1	0,8		Power Rating Curve 2, Value #0 0..1024=signal
50	Power Rating Factor 2 ae13	0	1	0,8		Power Rating Curve 2, Value #0 0..1024=signal
51	Power Rating Factor 2 ae14	0	1	0,8		Power Rating Curve 2, Value #0 0..1024=signal
52	Power Rating Factor 2 ae15	0	1	0,8		Power Rating Curve 2, Value #0 0..1024=signal
53	Power Rating Factor 3 ae0	0	1	0,7		Power Rating Curve 3, Value #0 0..1024=signal
54	Power Rating Factor 3 ae1	0	1	0,7		Power Rating Curve 3, Value #0 0..1024=signal
55	Power Rating Factor 3 ae2	0	1	0,7		Power Rating Curve 3, Value #0 0..1024=signal
56	Power Rating Factor 3 ae3	0	1	0,7		Power Rating Curve 3, Value #0 0..1024=signal
57	Power Rating Factor 3 ae4	0	1	0,7		Power Rating Curve 3, Value #0 0..1024=signal
58	Power Rating Factor 3 ae5	0	1	0,7		Power Rating Curve 3, Value #0 0..1024=signal
59	Power Rating Factor 3 ae6	0	1	0,7		Power Rating Curve 3, Value #0 0..1024=signal
60	Power Rating Factor 3 ae7	0	1	0,7		Power Rating Curve 3, Value #0 0..1024=signal
61	Power Rating Factor 3 ae8	0	1	0,7		Power Rating Curve 3, Value #0

No.	Parameter	min	max	default	unit	description
						0..1024=signal
62	Power Rating Factor 3 ae9	0	1	0,7		Power Rating Curve 3, Value #0 0..1024=signal
63	Power Rating Factor 3 ae10	0	1	0,7		Power Rating Curve 3, Value #0 0..1024=signal
64	Power Rating Factor 3 ae11	0	1	0,7		Power Rating Curve 3, Value #0 0..1024=signal
65	Power Rating Factor 3 ae12	0	1	0,7		Power Rating Curve 3, Value #0 0..1024=signal
66	Power Rating Factor 3 ae13	0	1	0,7		Power Rating Curve 3, Value #0 0..1024=signal
67	Power Rating Factor 3 ae14	0	1	0,7		Power Rating Curve 3, Value #0 0..1024=signal
68	Power Rating Factor 3 ae15	0	1	0,7		Power Rating Curve 3, Value #0 0..1024=signal
69	Trq Ramp sw for Power Rating	0	10000	2000	Nm/s	Torque Ramp used to switch between Power Rating curves 0..500=signal
70	Spd Ramp sw for Power Rating	0	24000	3200	rad/s	Speed Ramp used to switch between Power Rating curves 0..1200=signal

4.1.23. PGR027 – Fleet Management

No.	Parameter	min	max	default	unit	description
1	Air Filter Diff Press Hyst	0	16383,5	2	mbar	Hysteris for Airfilter Differencial Pressure High Failure Condition 0..32767=signal
2	Air Filter Diff Press Thresh	0	16383,5	40	mbar	Threshold for Airfilter Differencial Pressure High Failure Condition 0..32767=signal

4.1.24. PGR031 – Vehicle Parameters III

No.	Parameter	min	max	default	unit	description
1	Ambient Air Temp Sensor Enable	0	5	5		Environment temperature sensor selection 0=not available, 1=hardwired DDC sensor, 2=J1939 PGN 65269, 3=J1587, 4=PTCAN, 5=hardwired MBTrucks sensor
13	Buzzer Selection -bit coded-	0	255	167		to activate some buzzer activation, bit coded. Bit0:non silent mode, Bit1:buzzer from FCM, Bit2:buzzer from MCM, Bit3:all short buzzers, Bit4: all long buzzers, Bit5: buzzer from Tier4 #1 MCM, Bit6: buzzer from TIER4 #2 CCM request (VIAB), Bit7: buzzer from TIER4 #3 OverSpeedRequest 0..255=signal
16	Activate PGrade	0	25,1	0	%	to activate P-Grade 0=disabled, 10=1 %, 20=2 %, 30=3 %, 40=4 %, 50=5 %, 60=6 %, 70=7 %, 80=8 %, 90=9 %,

No.	Parameter	min	max	default	unit	description
						100=10 %, 110=11 %, 120=12 %, 130=13 %, 140=14 %, 150=15 %, 251=use SPN 5568

4.1.25. PGR032 – Coolant Level Sensor

No.	Parameter	min	max	default	unit	description
2	Cool Level Sensor Input Enable	0	5	3		Coolant Level Sensor Type Input (KW_SE) 0=disable, 1=dual level probe sensor (IMO_ACTROS), fix threshold evaluation, 2=single level probe sensor (Rusty Nail), temperature dependent evaluation, 3=dual level float sensor (FTL), fix threshold evaluation, 4=single level probe sensor (Rusty Nail), fix threshold evaluation, 5=dual level probe sensor (IMO_SFTP), fix threshold evaluation

4.1.26. PGR035 – Digital Outputs

No.	Parameter	min	max	default	unit	description
1	1 04 DO Selection	0	1	1		usage of Output DoLpLs02 0=disabled, 1=ground, idle validation switches/analog accelerator pedal
2	1 05 DO Selection	0	3	0		usage of Output DoLpLs01 0=disabled, 1=ground, analog accelerator pedal, 2=DPF Lamp, 3=air filter lamp
3	1 13 DO Selection	0	3	0		usage of Output DoLpFlex01 0=disabled, 1=MIL lamp, 2=Urea Low Lamp, 3=coolant temperature lamp
4	2 10 DO Selection	0	1	1		usage of Output Dolpflex03 0=disabled, 1=check engine lamp yellow
5	3 02 DO Selection	0	1	1		usage of Output Analog Ground 0=disabled, 1=ground, analog sensors
6	3 07 DO Selection	0	8	0		usage of Output DoHpFlex01 0=disabled, 1=decompression valve, 2=grid heater, 3=not used, 4=expansion tank pressure control valve 1, 5=Service Brake Request Lamp, 6=Urea Low Lamp, 7=TIER4 DEF Lamp, 8=EU6 Inducement Lamp
7	3 08 DO Selection	0	12	0		usage of Output DoHpFlex02 0=disabled, 1=exhaust brake only, 2=exhaust and decompression brake via single valve, 3=not used, 4=not used, 5=not used, 6=not used, 7=expansion tank pressure control valve 2, 8=CC Limiter Active Lamp, 9=CC Limiter Active Lamp with ECE R89, 10=CC Limiter Lamp ECE R89 only, 11=Tier4 Limitation Active Lamp,

No.	Parameter	min	max	default	unit	description
						12=EU6 Limitation Active Lamp
8	3 09 DO Selection	0	11	0		usage of Output DoHpLs01 0=disabled, 1=grid heater hardwired, 2=not used, 3=engine brake active, 4=engine brake valves ground, 5=FUSO engine brake relay, 6=WIF-Lamp, 7=expansion tank pressure control valve ground, 8=Urea Low Lamp, 9=TIER4 DEF Lamp, 10=EU6 Inducement Lamp, 11=Engine Brake State Lamp
9	3 10 DO Selection	0	8	7		usage of Output DoLpFlex02 0=disabled, 1=air filter lamp, 2=not used, 3=not used, 4=not used, 5=Fuso retarder control 1, 6=Urea Low Lamp, 7=TIER4 DEF Lamp, 8=EU6 Inducement Lamp
10	3 12 DO Selection	0	8	0		usage of Output DoLpFlex04 0=disabled, 1=oil level lamp, 2=not used, 3=oil pressure low lamp, 4=cruise / PTO active lamp, 5=Fuso retarder control 2, 6=battery voltage low lamp, 7=Fuel Filter Restriction Lamp, 8=RockOutMode
11	3 16 DO Selection	0	2	1		usage of Output DoLpFlex05 0=disabled, 1=stop engine lamp red, 2=Buzzer
12	3 17 DO Selection	0	10	0		usage of Output DoHpLs04 0=disabled, 1=enable starter lockout, 2=enable kick down output, 3=not used, 4=optimized idle alarm, 5=split valve 2, 6=starter lockout and AGS2 run signal / starter lockout, 7=engine brake disabled for over speed, 8=battery voltage low lamp, 9=coolant level low lamp, 10=PTO1valve2
13	4 01 DO Selection	0	1	1		usage of Output DoLpLs03 0=disabled, 1=Buzzer
14	4 02 DO Selection	0	5	4		usage of Output DoLpLs04 0=disabled, 1=CC Limiter Active Lamp, 2=CC Limiter Active Lamp with ECE R89, 3=CC Limiter Lamp ECE R89 only, 4=Tier4 Limitation Active Lamp, 5=EU6 Limitation Active Lamp
15	4 06 DO Selection	0	6	0		usage of Output DoLpFlex06 0=disabled, 1=grid heater lamp, 2=accelerator pedal idle position, 3=run signal / starter lockout, 4=Battery Charge Indicator, 5=ManeuverMode, 6=Service Brake Request Lamp
16	4 07 DO Selection	0	15	0		usage of Output DoHpLs02,[2..6]:Compares the actual value against a configured threshold.,[8..13]

No.	Parameter	min	max	default	unit	description
						PTCAN [1+10] digital state 0=disabled, 1=accelerator pedal kick down, 2=actual torque, 3=road speed, 4=engine speed, 5=coolant temperature, 6=pedal torque, 7=boost temperature, 8=oil pressure (threshold), 9=coolant temperature (Eng.Controller threshold), 10=vehicle power shutdown / ignition relay, 11=optimized idle ACC bus (ignition relay), 12=split valve 1, 13=High Exhaust Temperature Lamp, 14=AUX-Relay, 15=PTO2valve2
17	4 09 DO Selection	0	17	0		usage of Output DoHpLs03 0=disabled, 1=accelerator pedal idle position, 2=actual torque, 3=road speed, 4=engine speed, 5=coolant temperature, 6=pedal torque, 7=boost temperature, 8=oil pressure (threshold), 9=coolant temperature (Eng.Controller threshold), 10=optimized idle active lamp, 11=deceleration lamp, 12=not used, 13=WIF-Lamp, 14=cruise / PTO active lamp, 15=Check Transmission Lamp, 16=Battery Charge Indicator, 17=PTO1valve1
18	4 10 DO Selection	0	8	0		usage of Output DoHpFlex03 0=disabled, 1=not used, 2=not used, 3=vehicle power shutdown / ignition relay, 4=engine brake active, 5=Battery Charge Indicator, 6=PTO2valve1, 7=High Exhaust Temperature Lamp, 8=Engine Brake State Lamp
20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37	1 04 DO Fault Detection 1 05 DO Fault Detection 1 13 DO Fault Detection 2 10 DO Fault Detection 3 02 DO Fault Detection 3 07 DO Fault Detection 3 08 DO Fault Detection 3 09 DO Fault Detection 3 10 DO Fault Detection 3 12 DO Fault Detection 3 16 DO Fault Detection 3 17 DO Fault Detection 4 01 DO Fault Detection 4 02 DO Fault Detection 4 06 DO Fault Detection 4 07 DO Fault Detection 4 09 DO Fault Detection 4 10 DO Fault Detection	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15	9 1 1 9 9 1 1 1 9 1 9 1 9 9 1 1 1 1		Fault Detection of output - bit coded as follows: # Bit0: 0=diagnostic off, 1=diagnostic on # Bit1: 0=no test pulse with output turned off, 1=test pulse with output turned off # Bit2: 0=no test pulse with output turned on, 1=test pulse with output turned on # Bit3: 0=no information to FCM, 1=information to FCM ---------- 0=Fault Detection Off, 1=Diag, 2=PulseWhenOff, 3=PulseWhenOff + Diag, 4=PulseWhenOn, 5=PulseWhenOn + Diag, 6=PulseWhenOn + PulseWhenOff, 7=PulseWhenOn + PulseWhenOff + Diag, 8=SetFault, 9=SetFault + Diag, 10= SetFault + PulseWhenOff, 11=SetFault + PulseWhenOff + Diag, 12=SetFault + PulseWhenOn, 13=SetFault + PulseWhenOn + Diag, 14=SetFault + PulseWhenOn + PulseWhenOff, 15=SetFault + PulseWhenOn +

No.	Parameter	min	max	default	unit	description
						PulseWhenOff + Diag
38 39	1 04 DO Configuration 1 05 DO Configuration	0 0	1 1	1 0		binary Output Configuration, lp: low power, ls: low side 0=disabled, 1=enabled
40 41 42 43	1 13 DO Configuration 2 10 DO Configuration 3 07 DO Configuration 3 08 DO Configuration	0 0 0 0	2 2 2 2	0 0 0 0		Binary Output Configuration, lp: low power, ls: low side, hs: high side, flex: switching either to ls or hs 0=disabled, 1=Low side only, 2=High side only
44	3 09 DO Configuration	0	1	0		Binary Output Configuration, hp: high power, ls: low side 0=disabled, 1=enabled
45 46 47	3 10 DO Configuration 3 12 DO Configuration 3 16 DO Configuration	0 0 0	2 2 2	1 0 1		Binary Output Configuration, lp: low power, ls: low side, hs: high side, flex: switching either to ls or hs 0=disabled, 1=Low side only, 2=High side only
48	3 17 DO Configuration	0	1	0		Binary Output Configuration, hp: high power, ls: low side 0=disabled, 1=enabled
49 50	4 01 DO Configuration 4 02 DO Configuration	0 0	1 1	1 1		binary Output Configuration, lp: low power, ls: low side 0=disabled, 1=enabled
51	4 06 DO Configuration	0	2	0		Binary Output Configuration, lp: low power, ls: low side, hs: high side, flex: switching either to ls or hs 0=disabled, 1=Low side only, 2=High side only
52 53	4 07 DO Configuration 4 09 DO Configuration	0 0	1 1	0 0		Binary Output Configuration, hp: high power, ls: low side 0=disabled, 1=enabled
54	4 10 DO Configuration	0	2	0		Binary Output Configuration, lh: high power, ls: low side, hs :high side, flex :switching either to ls or hs 0=disabled, 1=Low side only, 2=High side only

4.1.27. PGR038 – Vehicle Speed Governor

No.	Parameter	min	max	default	unit	description
4	Limiters Maximum Acceleration	-15,6	15,6	10	m/s²	maximum acceleration of vehicle speed governor -32000..32000=signal

4.1.28. PGR039 – Vehicle Mass

No.	Parameter	min	max	default	unit	description
3	difference Total ratio	0	6400	30	%	Difference in total ratio for out of gear detection 0..65535=signal
5	Maximum Vehicle Mass	0	655350	108000	kg	Maximum vehicle mass 0..65535=signal
6	Minimum Vehicle Mass	0	655350	3500	kg	Minimum vehicle mass 0..65535=signal

4.1.29. PGR046 – Diesel Particulate Filter

No.	Parameter	min	max	default	unit	description
3	DPF CM1 Source Address J1939	0	255	241		Source Address of the special DPF Factory test CM1 Message 0..255=signal
10	DPF J1939 Inhibit Sw Enable	0	1	0		When set, CPC2 shall no longer process DPF inhibit regen hardwired,switch, but shall expect to receive regular periodic switch status,messages via J1939. 0=not active, 1=active
11	DPF J1939 Regen Sw Enable	0	1	0		When set, CPC2 shall no longer process DPF regen hardwired,switch, but shall expect to receive regular periodic switch status,messages via J1939. 0=not active, 1=active

4.1.30. PGR048 – Ptconf

No.	Parameter	min	max	default	unit	description
168	Mechanical Transmission Type	0	255	0		Mechanical type of built in transmission. (Mechanical Transmission Type) 0=not used, 1=unsynchronized gearbox, 2=synchronized gearbox, 3=automatic transmission, 255=SNA

4.1.31. PGR055 – Transmission Retarder

No.	Parameter	min	max	default	unit	description
01	Trans Ret Number of Stages	0	5	0		Max. no. of transmission retarder stages 0=disabled, 1..5=signal
03	Trans Ret Min Eng Spd	0	4000	700	1/min	Minimum Engine Speed for Transmission Retarder for closed driveline 0..32000=signal
04	Trans Ret Hysteresis Min Speed	0	500	50	1/min	Hysteresis for Transmission Retarder activation engine speed threshold 0..4000=signal
05	Trans Ret Min Vspeed	0	200	8	km/h	Minimum Road Speed for Transmission Retarder Operation. 0..25600=signal
12	TBD_Offset torque for retarder ramp	0	5000	120	Nm	Offset torque for retarder ramp 0..25000=signal
13	TBD_Torque gradient for retarder ramp	0	5000	80	Nm/10ms	Torque gradient for retarder ramp 0..25000=signal

4.1.32. PGR056 – Transmission

No.	Parameter	min	max	default	unit	description
1	Trans Inshaft Sens Sel	0	2	0		Transmission Input Speed Sensor Configuration 0=no sensor, 1=magnetic pickup transmission speed sensor, 2=Klemme W

4.1.33. PGR066 – RAT

No.	Parameter	min	max	default	unit	description
01	Rat Dual Chan1 Idle Range Min Perc	0	30	8	%	Dual Channel RAT Pedal Type 5 (FUSO) Type 6 (Williams), Type 7 (AEB Pwm-Pedal) Idle-Range lower threshold of channel1. 0..9600=signal
03	Rat Dual Chan2 Idle Range Min Perc	0	30	8	%	Dual Channel RAT Pedal Type 5 (FUSO) Type 6 (Williams), Type 7 (AEB Pwm-Pedal) Idle-Range lower threshold of channel2. 0..9600=signal
09	Rat Idle Range Perc		100	1	%	PWM/FUSO-Analog RAT: AP idle range. 0..32000=signal

5. Application

The following pages describe the areas of application of the CPC4 and the associated inputs/input data, outputs/output data and parameters.

The different methods mentioned in this chapter for limiting the engine torque (like e. g. limiters, calibrations and the powerrating function) are only allowed to be used temporarily or for component protection.

5.1. Engine Operation Modes

The vehicle controller (CPC4) differentiates between the **driving mode** and the **PTO speed control**.

This two operating modes are

a) **Driving mode - torque based mode**:
The Driving mode is a torque based mode, requested to the engine controller MCM2
b) **PTO speed control - speed based mode**:
The PTO speed control mode is a speed based mode, requested to the engine controller MCM2

To a) In the operating state „**driving mode**“ the CPC4 preselects the status „torque demand“ from the MCM2 engine management. CPC4 determines a nominal engine torque and transmits simultaneously a minimum engine speed and a maximum engine speed to the MCM2 engine management.

To b) In the operating state „**PTO speed control**“, the CPC4 preselects the status „speed control“ from the MCM2 engine management. The CPC4 determines a nominal speed and transmits simultaneously a governor type and a maximum torque to the MCM2 engine management. The limits preset in the MCM2 engine management cannot be exceeded.

5.1.1. Torque Based Mode

The default factory setting of the CPC4 is the driving mode. There are several options to operate the engine. Basically:

a) the accelerator pedal
b) the remote accelerator pedal
c) a torque demand via J1939 CAN

To a) In the CPC4 default factory there is no accelerator pedal active. The CPC4 supports several PWM and analogue accelerator pedals. Refer to chapter 0.

To b) An additional remote accelerator pedal can be enabled by configuration, refer to chapter 5.7.5.

To c) The demand of an engine torque is, possible via J1939 CAN message TSC1 (PGN 0, “Torque/Speed Control 1”). For safety reasons the two J1939 signals “Message Counter” (SPN 4206) and “Message Checksum” (SPN 4207) are monitored by the CPC4 to detect missing messages and occurring errors. These have to be filled in addition to the other CAN signals.

Although it is possible to set the “Message Counter” and “Message Checksum” values to 0xF to omit fault reactions, this is only recommended temporarily for means of prototyping and/or testing.

The CPC4 calculates a nominal torque value for the MCM2 engine management on the basis of the accelerator pedal position, the remote accelerator pedal or the J1939 CAN demand, and transmits it to the MCM2 via the CAN data bus. The adjustment range of the nominal torque value ranges between the currently active minimum- and maximum torque.

The CPC4 output value in the driving mode is the engine torque. Simultaneously a minimum and a maximum engine speed are transmitted to the MCM2.

To adjust or limit the engine torque values are defined by the parameters of group 03 „Common Limiters“ or group 05 „Limiters LIM0 and LIM1“ or group 06 „Limiters AC and LIM2“ (see chapter 5.11).

Diagnostics:
- Analog Value: Torque Speed Command Sender (chapter 6.3.1)

Inputs:
- SAE J1939 Signal: PGN 0, “Torque/Speed Control 1” (TSC1)
  SPN 695, “Engine Override Control Mode”
- SAE J1939 Signal: PGN 0, “Torque/Speed Control 1” (TSC1)
  SPN 518, “Engine Requested Torque/Torque Limit”
- SAE J1939 Signal: PGN 0, “Torque/Speed Control 1” (TSC1)
  SPN 4191, “Engine Requested Torque – High Resolution”
- SAE J1939 Signal: PGN 0, “Torque/Speed Control 1” (TSC1)
  SPN 3349, “TSC1 Transmission Rate”
- SAE J1939 Signal: PGN 0, “Torque/Speed Control 1” (TSC1)
  SPN 4206, “Message Counter”
- SAE J1939 Signal: PGN 0, “Torque/Speed Control 1” (TSC1)
  SPN 4207, “Message Checksum”

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
01	16	Engine Source Address J1939	0	255	0		SAE J1939 Source Address Engine. 0..255=signal. 0..255=signal
01	48	J1939 TSC1 Source Address4	0	255	59		SAE J1939 4. Source Address TSC1 e.g. fire truck pump ECU.
01	56	TSC1 Source Address SAE J1939	0	255	231		SAE J1939 3. Source Address TSC1 e.g. jack knife control. 0..255=signal
01	70	J1939 Tsc1 Eng Var Rate Stat	0	1	1		variable rate for Tsc1EngToutTick 0=use cal -J1939 Tsc1 Tout Sel- for timeout detection, 1=Use SPN 3349 three times for timeout detection
01	71	J1939 Tsc1 Tout Sel	0	1000	10		the interval after which an active J1939 TSC1 control message will timeout and be deactivated 0..1000=signal
01	72	Source Address OHECS	0	255	23		SAE J1939 Source Address OHECS 0..255=signal

It is recommended to not use the standard source addresses like parameter 01/01 (“ABS Source Address SAE J1939”) or parameter 01/55 (“Trans Source Address J1939”) but to send the TSC1 CAN message from the source addresses parameter 01/48 (“J1939 TSC1 Source Address4”) or parameter 01/56 (“TSC1 Source Address SAE J1939”).

TSC1 CAN message Timeout

The period of time after which a TSC1 message will be considered missing can be configured in two different ways.

1) Via parameter 01/71 (“J1939 Tsc1 Tout Sel”). This parameter sets the TSC1 timeout period in “ticks”. One tick equals 10ms which means if the parameter is set to “10” (=default) the message will be considered missing after: 10 * 10ms = 100ms.
2) Via J1939 CAN signal “TSC1 Transmission Rate” (SPN 3349) send with J1939 CAN message TSC1 (PGN 0, “Torque/Speed Control 1”) a transmission rate for the TSC1 message can be defined. If now the parameter 01/70 (“J1939 Tsc1 Eng Var Rate Stat”) is set to “1” (“Use SPN 3349 three times for timeout detection”) the timeout period will be equal to three times the transmission rate. The “TSC1 Transmission Rate” signal consists of 3 bits which encode the possible transmission rates in fixed steps as shown in the following table:

bit setting	transmission rate
000	1000ms
001	750ms
010	500ms
011	250ms

100	100ms
101	50ms
110	20ms
111	Use standard TSC1 transmission rate of 10ms to engine

Parameterization example:

Engine torque control via J1939 CAN message TSC1:

- Set SAE J1939 TSC1 Destination Address to 0x0 (CPC4);
- Set SAE J1939 TSC1 Source Address to e.g. 0xE7 (“TSC1 Source Address SAE J1939”);
- Set SAE J1939 TSC1 signal SPN 695 (“Engine Override Control Mode”) to 1 (“TrqCtrlCntrlTrqTIncldd DsrdTrqVl”);
- Set SAE J1939 TSC1 signal SPN 518 (“Engine Requested Torque/Torque Limit”) to the desired engine torque in percent: e. g. 50%;
- Send the TSC1 message with the appropriate repetition rate: e. g. 10ms.
- Set SAE J1939 TSC1 signal SPN 4206 (“Message Counter”) to 0. The transmitting device will have to increase the message counter in every cycle. The message counter will count from 0 to 7 and then wrap.
- Calculate the message checksum as described in the SAE J1939 standard and set the SAE J1939 TSC1 signal SPN 4207 (“Message Checksum”) according to the outcome.

5.1.2. Speed Based Mode (PTO Control Mode)

PTO (Power Take Off) means, that the engine is in a speed control mode. The output value of the CPC4 in the PTO mode is the engine speed. Simultaneously a governor type and a maximum engine torque are transmitted to the MCM2.

The nominal speed value is determined by the CPC4 on the basis of the input values listed below, and transmitted to the MCM2 engine control via the CAN data bus. The adjustment range of the nominal speed value and the engine torque limit value ranges between the currently active minimum- and maximum values.

The PTO speed control is applied with e. g.:
cranes, piste maintenance equipment, harvesters, sweeping machines, garbage trucks, compressors, power generating aggregates, pumps etc.

There are three different possibilities to utilize the speed based mode with the CPC4:

- **Speed control via PTO mode** (several methods including e. g. control via CC+/CC- or J1939 CAN messages)(chapter 5.1.2.1)
- **Speed control via Droop mode** (engine speed request via accelerator pedal)(chapter 5.1.2.2)
- **Speed control via TSC1 – J1939 CAN message** (engine speed request via SAE J1939 TSC1 CAN message)(chapter 5.1.2.3)

Remark: The PTO shutdown is activated with the default setting of calibrations (depends on Park Brake Status). Set Parameter 03/04 (“Enable PTO Shutdown”) to a value other than “0” to enable the PTO shutdown.

Diagnostics:

- Analog Value: Speed Path State (chapter 6.3.1)

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
03	04	Enable PTO Shutdown	0	3	0		Enable Engine Shutdown while PTO is active 0=disable, 1=enable PTO shutdown with Park Brake status, 2=enable PTO shutdown without Park

PGR	No.	Parameter	min	max	default	unit	description
							Brake status, 3=enable PTO shutdown with edge triggered accelerator pedal
03	20	Max Engine Speed	0	4000	4000	1/min	Maximum Engine Speed. Is only active with a manual transmission type (parameter 02/09 à 0=Manual without Neutral switch or 3=Manual with neutral switch), 0..32000=signal
03	22	Max Engine Torque	0	5000	5000	Nm	Maximum Engine Torque 0..25000=signal
03	27	Min Engine Speed	0	1000	496	1/min	Minimum Engine Speed 0/min N min 0..32000=signal

5.1.2.1. Speed control via PTO mode

Next is a brief description of the four PTO speed control which are explained on a detail in the following chapters:

- **Cabin PTO** (control from the driver's cabin via CC+ and CC-)(chapter 5.1.2.1.1)
- **Remote PTO** (with fixed speeds via the RemotePTO switch) (chapter 5.1.2.1.2)
- **Cruise PTO** (start with fixed speed via the RemotePTO switch, then manipulate with CC+/CC-)(chapter 5.1.2.1.3)
- **PTO while driving** (special applications) (chapter 5.1.2.1.4)

Before it is possible to activate the PTO speed control it is necessary that the transmission is set to neutral. Therefore a check of the current gear is done through the evaluation of the appropriate hardwired pin (Pin 4/16, "Transmission Neutral") or the J1939 CAN message ETC2 ("TransCurrentGear" = 0), no matter what transmission type is set.

The PTO feature is enabled with the parameter 07/01 ("Config PTO Speed Control"). Additionally this parameter determines the activation conditions of the PTO functionality:

Value	Description	Hint
0	Disabled	PTO disabled
1	Cab/Remote PTO enabled (neutral not conf.)	Cabine/Remote PTO possible to enable without neutral transmission (not recommended)
2	Cab/Remote PTO enabled if neutral	Cabine/Remote PTO possible to enable when transmission is neutral
3	Cab/Remote PTO enabled if neutral and park brake	Cabine/Remote PTO possible to enable when transmission is neutral and park brake is active
4	Cab/Remote PTO enabled if park brake	Cabine/Remote PTO possible to enable when park brake is active
5	Cab PTO while driving	Only Cabine PTO possible to enable while driving
6	Cruise PTO with park brake	Cabine PTO with Remote PTO controls and vice versa when park brake is active
7	Cab/Remote PTO while driving	Cabine/Remote PTO possible to enable while driving

The values 1 to 4 and 6 demands that the vehicle is stationary. This has to be considered when the parameterization is set.

5.1.2.1.1. Cabin PTO (control from the driver's cabin via CC+ and CC-)

In case the hardwired method is used and the activation conditions are met the PTO mode is enabled by actuating the cruise control button, pin 1/14 ("CruiseControl on/off"). The nominal value for the PTO speed can be adjusted, starting with the idle speed, by increasing it with the CC+ button (Pin 1/16, "CruiseControl res/accel") and decreasing it via the CC- button (Pin 1/12, "CruiseControl set/coast").

Before the activation of the PTO it is necessary to define the method to enter the operating commands (hardwired, SAE CAN CCVS messages or both). This is done via parameter 13/21 (“Cab PTO Switch Config”).

The starting speed, when initially toggling the switches CC+ or CC-, can be preset with the parameters 07/18 (“Resume Accel Sw PTO Set Spd”) and 07/21 (“Set Coast Switch PTO Set Speed”). The current PTO speed can be overridden via the accelerator pedal and the remote accelerator pedal, provided that they are enabled for the PTO mode with the parameters 07/15 (“PTO Remote Throt Override Mode”).
With parameter 07/08 (“PTO Dropout Serv Brk Prk Brk”) it is possible to parameterize the PTO dropout on service brake activation, park brake activation or both. Additionally it is possible to cause a dropout by means of the clutch pedal actuation (parameter 07/07, “PTO Dropout on Clutch Enabled”).
The thresholds defined by the parameters 07/03 (“Max PTO Spd Resume Accel Sw”), 07/04 (“Max Road Speed in PTO Mode”) and 07/05 (“Min PTO Spd Set Coast Sw”) limit the actual engine / road speed to these values in PTO control mode. If a higher or lower engine speed is wanted, the values have to be adjusted to proper thresholds.

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
01	04	CC1 Source Address SAE J1939	0	255	23		SAE J1939 Source Address #1 CCVS1 (PGN 65265). 0..255=signal
01	05	CC2 Source Address SAE J1939	0	255	33		SAE J1939 Source Address #2 CCVS1 (PGN 65265). 0..255=signal
01	06	CC3 Source Address SAE J1939	0	255	49		SAE J1939 Source Address #3 CCVS1 (PGN 65265). 0..255=signal
07	03	Max PTO Spd Resume Accel Sw	500	3000	1200	1/min	General Maximum PTO Speed 4000..24000=signal
07	04	Max Road Speed in PTO Mode	0	128	9,6	km/h	Maximum Road Speed in PTO Mode 0..16384=signal
07	05	Min PTO Spd Set Coast Sw	464	3000	700	1/min	General Minimum PTO Speed 3712..24000=signal
07	07	PTO Dropout on Clutch Enabled	0	1	0		PTO dropout on clutch enabled 0=No PTO drop out with clutch pedal, 1=Causes PTO to drop out if the Clutch is being depressed
07	08	PTO Dropout Serv Brk Prk Brk	0	3	0		PTO dropout on Service Brake or Park Brake Activation 0=No PTO drop out on service brake or park brake activation, 1=Causes PTO to drop out on Service Brake or Park Brake activation, 2=Drop out on Service Brake activation, 3=Drop out on Park Brake activation
07	09	PTO Ramp Rate	25	2500	250	(1/min)/s	PTO Ramp Rate 200..20000=signal
07	10	PTO Spd Governor with CC+ sw	1	11	1		PTO Speed Governor# with CC+ Switch Governor type selection, if PTO mode has been activated via CC+ 1..11=signal
07	14	PTO Speed Gov Set Coast Switch	1	11	1		PTO Speed Governor# with CC- Switch Governor type selection, if PTO mode has been activated via CC- 1..11=signal
07	15	PTO Remote Throt Override Mode	0	2	0		PTO Remote Throttle Override Mode 0=disable, 1=always On, 2=only at speed #0
07	16	Remote PTO Spd Selection Mode	0	2	0		Input selection (calculation) 0=1 pulsed input (RemPTO), 1=2 gray coded inputs (PTO), 2=2 binary coded inputs (PTO)
07	18	Resume Accel Sw PTO Set Spd	0	3000	500	1/min	PTO Set Speed with CC+ Switch 0..24000=signal
07	19	RPM Increment	0,125	500	25	1/min	Cruise PTO Increment Rate for toggling CC+ and CC- 1..4000=signal

PGR	No.	Parameter	min	max	default	unit	description
07	21	Set Coast Switch PTO Set Speed	0	3000	500	1/min	PTO Set Speed with CC- Switch 0..24000=signal
07	28	Throttle Override Max Eng Spd	0	3000	1400	1/min	Max. Engine Speed for Throttle Override 0..24000=signal
07	29	PTO Accel Pedal Override Mode	0	2	0		PTO Accelerator Pedal Override Mode 0=disable, 1=always On, 2=only at speed #0
07	30	PTO Cab Switches Mode	0	2	0		PTO Cab Switches Mode 0=always On, 1=disable, 2=only at speed #0
13	21	Cab PTO Switch Config	0	6	0		Source of the CC switches for Cab PTO mode 0=hardwired, 1=Ccvs1 from Source Address #1, 2=Ccvs1 from Source Address #2, 3=Ccvs1 from Source Address #3, 4= Ccvs1 from Source Address #1 or hardwired, 5= Ccvs1 from Source Address #2 or hardwired, 6= Ccvs1 from Source Address #3 or hardwired

Remark: Regarding parameter 07/16 (“Remote PTO Spd Selection Mode”) the mentioned value “0 = 1 pulsed input (LIM0)” refers to the pin 1/11(“DI_FLEX_08”) namend “Limiter0” in the wiring diagram.

Regarding the three CCVS1 source address parameters 01/04 (“CC1 Source Address SAE J1939”), 01/05 (“CC2 Source Address SAE J1939”) and 01/06 (“CC3 Source Address SAE J1939”): It is important that these three parameters are configured with different values!

Parameterization examples

Cabine PTO – Hardware Input Pin:

- Example description: Cabine PTO operated via the hardwired cruise control switches. PTO only enabled when transmission in neutral and park brake active. Dropout on service brake activation:
  - Set parameter 07/01 (“Configuration PTO Speed Control”) to 3 (“Cab/Remote PTO enabled if neutral and park brake”);
  - Check parameter 07/03 (“Max PTO Spd Resume Accel Sw”) if it is set to a proper value. It is not possible to achieve a PTO speed higher than the set threshold;
  - Check parameter 07/05 (“Min PTO Spd Set Coast Sw”) if it is set to a proper value. It is not possible to achieve a PTO speed of less than the set threshold;
  - Set parameter 07/08 (“PTO Dropout Serv Brk Prk Brk”) to 2 (“Drop out on Service Brake activation”);
  - Set parameter 07/10 (“PTO Spd Governor with CC+ sw”) to the PTO speed governor to use e. g. 5;
  - Set parameter 07/14 (“PTO Speed Gov Set Coast Switch”) to the PTO speed governor to use e. g. 9;
  - Actuate pin 1/14 (“CruiseControl on/off”) to activate the PTO functionality;
  - Use the CC+ (1/16) and CC- (1/12) pins to manipulate the fixed remote speed inside of the limiting bands defined by the parameters 07/03 and 07/05.

5.1.2.1.2. Remote PTO (with fixed speeds via the RemotePTO switch)

The conditions for enabling and disabling the remote PTO function correspond to the conditions for the function „cabine PTO“ (parameter 07/01, “Config PTO Speed Control”) described in chapter 5.1.2.1.1.

The remote PTO function supports up to three predetermined fixed engine speeds. These engine speeds are defined via the parameters 07/23 (“Spd 1 via Remote PTO”), 07/23 (“Spd 2 via Remote PTO”) and 07/23 (“Spd 3 via Remote PTO”). The number of the available engine speeds is also set via

a parameter (07/06, “No of Speeds via Remote PTO”). There are two methods to activate the remote PTO function:

a) Via hardwired input (pin 2/09, DI_FLEX_09)

b) Via J1939 CAN message PTO (PGN 65264, “Power Takeoff Information”)

In case of using hardwired pins of the CPC4 there are several methods (parameter 07/16, “Remote PTO Speed Selection Mode”) to activate and change between the three determined speeds (see table below):

<table>
<tr><th>Value</th><th>Meaning</th><th>Description</th></tr>
<tr><td>1</td><td>1 pulsed input</td><td>This method does only require one input pin (Pin 2/09, “RemotePTO”) to choose the desired remote PTO speed:
If the switch is closed only once à remote speed 1 (parameter 07/23) is set as long as the switch stays closed.
If the switch is then opened and closed within 2 seconds à remote speed 2 (parameter 07/25) is set.
If the switch is opened and closed (within 2 seconds) a second time à remote speed 3 (parameter 07/27) is set.
If the switch is actuated a third time like described above the remote speed is set to speed 1 again.
If the switch is opened for longer then 2 seconds, the remote PTO mode is deactivated after a delay of the said 2 seconds.</td></tr>
<tr><td>2</td><td>2 gray coded inputs</td><td><table><tr><th>Pin 1/11 (DI_FLEX_08)</th><th>Pin 2/11 (DI_FLEX_10)</th><th>Remote Speed #x</th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>1</td><td>2</td></tr><tr><td>1</td><td>0</td><td>3</td></tr></table>Additionally to the mentioned inputs pins 1/11 and 2/11 the pin 2/09 (“RemotePTO”) has to be actuated to!</td></tr>
<tr><td>3</td><td>2 binary coded inputs</td><td><table><tr><th>Pin 1/11 (DI_FLEX_08)</th><th>Pin 2/11 (DI_FLEX_10)</th><th>Remote Speed #x</th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>2</td></tr><tr><td>1</td><td>1</td><td>3</td></tr></table>Additionally to the mentioned inputs pins 1/11 and 2/11 the pin 2/09 (“RemotePTO”) has to be actuated to!</td></tr>
</table>

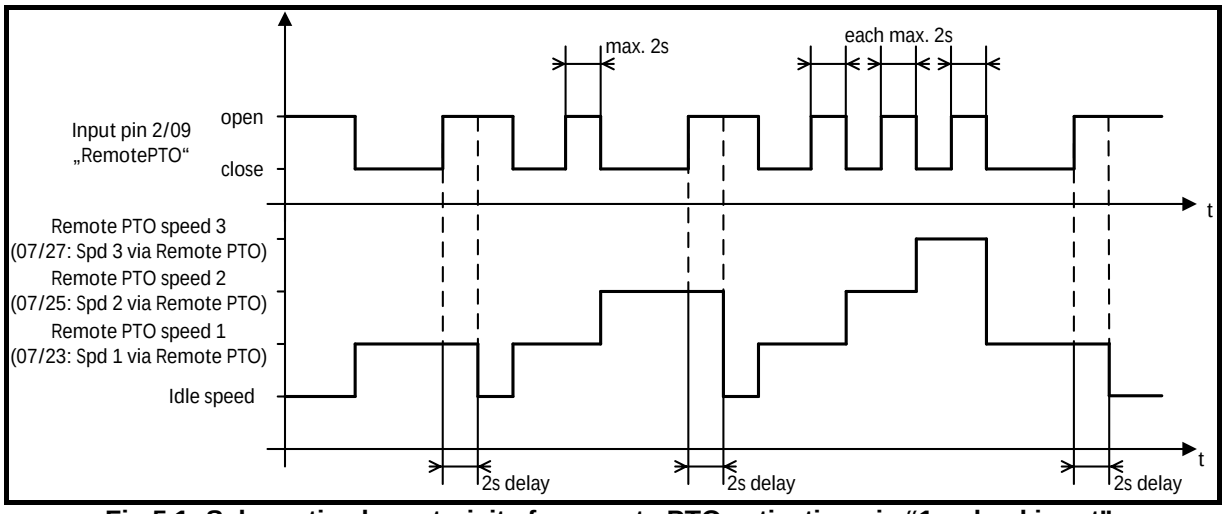


Fig 5.1: Schematic characterisitc for remote PTO activation via “1 pulsed input”

If one of the two binary coded methods is chosen the above mentioned input pins have to be configured accordingly, parameters 13/65 (“2 11 DI Selection”); 13/66 (“1 11 DI Selection”).

Dropout on park-/service brake activation and/or clutch pedal actuation is also possible as described in the previous chapter (see 5.1.2.1.1).

Since the remote PTO speeds are predetermined beforehand, the maximum engine speed limit (parameter 07/03, ”Max PTO Spd Resume Accel Sw”) used with the Cabin PTO mode (see chapter 5.1.2.1.1) don’t interfere with them even if they are exceeded by them. The minimum engine speed limit (parameter 07/05, ” Min PTO Spd Set Coast Sw”) is set as initial PTO speed when the mode is activated.

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
01	52	PTO Source Address SAE J1939	0	255	23		SAE J1939 Source Address PTO message 0..255=signal
07	01	Config PTO Speed Control	0	7	0		Configuration PTO Speed Control 0=disabled, 1=Cab/Remote PTO enabled (neutral not conf.), 2=Cab/Remote PTO enabled if neutral, 3=Cab/Remote PTO enabled if neutral and park brake, 4=Cab/Remote PTO enabled if park brake, 5=Cab PTO while driving, 6=Cruise PTO with park brake, 7=Cab/Remote PTO while driving
07	04	Max Road Speed in PTO Mode	0	128	9,6	km/h	Maximum Road Speed in PTO Mode 0..16384=signal
07	05	Min PTO Spd Set Coast Sw	464	3000	700	1/min	General Minimum PTO Speed 3712..24000=signal
07	06	No of Speeds via Remote PTO	1	3	1		Number of Speeds via Remote PTO (Pin 2/9) 1..3=signal
07	07	PTO Dropout on Clutch Enabled	0	1	0		PTO dropout on clutch enabled 0=No PTO drop out with clutch pedal, 1=Causes PTO to drop out if the Clutch is being depressed
07	08	PTO Dropout Serv Brk Prk Brk	0	3	0		PTO dropout on Service Brake or Park Brake Activation 0=No PTO drop out on service brake or park brake activation, 1=Causes PTO to drop out on Service Brake or Park Brake activation, 2=Drop out on Service Brake activation, 3=Drop out on Park Brake activation
07	11	PTO Speed 1 Governor Type	1	11	1		PTO Speed #1 Governor Type Governor type selection, if fixed speed #1 has been

							activated 1..11=signal
07	12	PTO Speed 2 Governor Type	1	11	1		PTO Speed #2 Governor Type Governor type selection, if fixed speed #2 has been activated 1..11=signal
07	13	PTO Speed 3 Governor Type	1	11	1		PTO Speed #3 Governor Type Governor selection, if fixed speed #3 has been activated 1..11=signal
07	15	PTO Remote Throt Override Mode	0	2	0		PTO Remote Throttle Override Mode 0=disable, 1=always On, 2=only at speed #0
07	16	Remote PTO Spd Selection Mode	0	2	0		Input selection (calculation) 0=1 pulsed input (RemPTO), 1=2 gray coded inputs (PTO), 2=2 binary coded inputs (PTO)
07	22	Spd 1 Max Eng Trq Remote PTO	0	5000	5000	Nm	PTO Speed #1 Maximum Engine Torque 0..25000=signal
07	23	Spd 1 via Remote PTO	464	3000	900	1/min	PTO Speed #1 3712..24000=signal
07	24	Spd 2 Max Eng Trq Remote PTO	0	5000	5000	Nm	PTO Speed #2 Maximum Engine Torque 0..25000=signal
07	25	Spd 2 via Remote PTO	500	3000	1250	1/min	PTO Speed #2 4000..24000=signal
07	26	Spd 3 Max Eng Trq Remote PTO	0	5000	5000	Nm	PTO Speed #3 Maximum Engine Torque 0..25000=signal
07	27	Spd 3 via Remote PTO	500	3000	1850	1/min	PTO Speed #3 4000..24000=signal
07	28	Throttle Override Max Eng Spd	0	3000	1400	1/min	Max. Engine Speed for Throttle Override 0..24000=signal

The operating mode PTO via the PTO switch has priority over the driver's cab PTO via the CC tip switches.

Parameterization examples

Remote PTO – Hardware Input Pin:

- Example description: Remote PTO only enabled via hardware input and when transmission is in neutral and park brake active. There are 3 different fixed remote PTO speeds available and the selection is done via two input pins. Additionaly the PTO will dropout on service brake activation:
  - Set parameter 07/01 ("Configuration PTO Speed Control") to 3 ("Cab/Remote PTO enabled if neutral and park brake");
  - Check parameter 07/05 ("Min PTO Spd Set Coast Sw") if it is set to a proper value. It is not possible to achieve a PTO speed of less than the set threshold;
  - Set parameter 07/06 ("No of Speeds via Remote PTO") to 3 ("remote PTO speed #3 available");
  - Set parameter 07/08 ("PTO Dropout Serv Brk Prk Brk") to 2 ("Drop out on Service Brake activation");
  - Set parameter 07/16 ("Remote PTO Spd Selection Mode") to 1 ("2 gray coded inputs (PTO)")
  - Set parameter 07/11 ("PTO Speed 1 Governor Type") to the value of PTO speed governor to be used e. g. 1;
  - Set parameter 07/12 ("PTO Speed 2 Governor Type") to the value of PTO speed governor to be used e. g. 5;
  - Set parameter 07/13 ("PTO Speed 3 Governor Type") to the value of PTO speed governor to be used e. g. 9;
  - Set parameter 13/07 ("2 09 DI Selection") to 1 ("hardwired PTO");
  - Configure needed Remote PTO speed #1 value in parameter 07/23 ("Spd 1 via Remote PTO") e. g. 800;
  - Configure needed Remote PTO speed #2 value in parameter 07/25 ("Spd 2 via Remote PTO") e. g. 1000;

- Configure needed Remote PTO speed #3 value in parameter 07/27 (“Spd 3 via Remote PTO”) e. g. 1200;
- Set parameter 13/65 (“2 11 DI Selection”) to 1 (“LIM1”);
- Set parameter 13/66(“1 11 DI Selection”) to 2 (“PTO part 1 (adjustable via -Remote PTO Spd Selection Mode-)”).
- Actuate pin 2/09 to activate the PTO functionality and the pins 2/11 and 1/11 according to the chosen PTO speed selection mode mentioned in the table above to select the desired remote speed.

Remote PTO – J1939 CAN message:

· Example description: Remote PTO operated via CAN message (PGN 65264, “Power Takeoff Information”) and enabled only with transmission in neutral. The remote PTO speed selection is done by pulsed input of the CAN message mentioned above. Additionaly the PTO will dropout when the service brake or the park brake is activated.

- Set parameter 07/01 (“Configuration PTO Speed Control”) to 2 (“Cab/Remote PTO enabled if neutral”);
- Set parameter 07/08 (“PTO Dropout Serv Brk Prk Brk”) to 1 (“Causes PTO to drop out on Service Brake or Park Brake activation”);
- Set parameter 07/16 (“Remote PTO Spd Selection Mode”) to 0 (“1 pulsed input(RemPTO)”)
- Set parameter 13/07 (“2 09 DI Selection”) to 2 (“J1939 PTO”);
- Configure SAE J1939 PTO Source Address in parameter 01/52 (“PTO Source Address SAE J1939”) e. g. 23/0x17;
- Configure the CAN signals in the SAE J1939 PTO message (PGN 65264) and send it via the J1939 CAN. The source address has to match the SAE J1939 PTO Source Address set in parameter 01/52 mentioned before;
- Send PTO message with SPN 979 set to “1” to activate remote PTO via CAN message.

5.1.2.1.3. Cruise PTO (start with fixed speed, manipulate with CC+/CC-)

The cruise PTO function provides the possibility to activate the PTO with one of the three predetermined engine speeds mentioned in chapter 5.1.2.1.2 (“Remote PTO”) but allows also the manipulation of these speeds via the CruiseControl switches described in chapter 5.1.2.1.1 (“Cabine PTO”).

If this function is parameterized, the driver is able to activate the Remote PTO mode (described in chapter 5.1.2.1.2) with e. g. the 2nd predetermined engine speed (defined in parameter 07/25 (“Spd 2 via Remote PTO”)) and then, by actuating the CC+ / CC- switches, to increase or decrease the actual engine speed based on this.

It is important to know that in case this feature is used, the limitations mentioned in chapter 5.1.2.1.1 (parameters 07/03 and 07/05) are indeed limiting the engine speed! This means if a predetermined remote PTO engine speed is chosen which exceeds the maximum PTO speed set in parameter 07/03 the actual engine speed will not increase higher than the set limit.

Depending on how parameter 07/30 (“PTO Cab Switches Mode”) is set, the CC Switches in the driver’s cabine are always enabled, only in Cruise PTO or only at the remote speed #0 (which is only achievable when the remote PTO speed selection is done by two input pins (binary- or gray-coeded) which both are not actuated).

Parameters:

PGR	No.	Parameter	min	max	default	unit	Description
07	01	Config PTO Speed Control	0	7	0		Configuration PTO Speed Control 0=disabled, 1=Cab/Remote PTO enabled (neutral not conf.), 2=Cab/Remote PTO enabled if neutral, 3=Cab/Remote PTO enabled if neutral and park brake, 4=Cab/Remote PTO enabled if park brake, 5=Cab PTO while driving, 6=Cruise PTO with park brake, 7=Cab/Remote PTO while driving
07	03	Max PTO Spd Resume Accel Sw	500	3000	1200	1/min	General Maximum PTO Speed 4000..24000=signal

07	04	Max Road Speed in PTO Mode	0	128	9,6	km/h	Maximum Road Speed in PTO Mode 0..16384=signal
07	05	Min PTO Spd Set Coast Sw	464	3000	700	1/min	General Minimum PTO Speed 3712..24000=signal
07	07	PTO Dropout on Clutch Enabled	0	1	0		PTO dropout on clutch enabled 0=No PTO drop out with clutch pedal, 1=Causes PTO to drop out if the Clutch is being depressed
07	11	PTO Speed 1 Governor Type	1	11	1		PTO Speed #1 Governor Type Governor type selection, if fixed speed #1 has been activated 1..11=signal
07	12	PTO Speed 2 Governor Type	1	11	1		PTO Speed #2 Governor Type Governor type selection, if fixed speed #2 has been activated 1..11=signal
07	13	PTO Speed 3 Governor Type	1	11	1		PTO Speed #3 Governor Type Governor selection, if fixed speed #3 has been activated 1..11=signal
07	14	PTO Speed Gov Set Coast Switch	1	11	1		PTO Speed Governor# with CC- Switch Governor type selection, if PTO mode has been activated via CC- 1..11=signal
07	16	Remote PTO Spd Selection Mode	0	2	0		Input selection (calculation) 0=1 pulsed input (RemPTO), 1=2 gray coded inputs (PTO), 2=2 binary coded inputs (PTO)
07	22	Spd 1 Max Eng Trq Remote PTO	0	5000	5000	Nm	PTO Speed #1 Maximum Engine Torque 0..25000=signal
07	23	Spd 1 via Remote PTO	464	3000	900	1/min	PTO Speed #1 3712..24000=signal
07	24	Spd 2 Max Eng Trq Remote PTO	0	5000	5000	Nm	PTO Speed #2 Maximum Engine Torque 0..25000=signal
07	25	Spd 2 via Remote PTO	500	3000	1250	1/min	PTO Speed #2 4000..24000=signal
07	26	Spd 3 Max Eng Trq Remote PTO	0	5000	5000	Nm	PTO Speed #3 Maximum Engine Torque 0..25000=signal
07	27	Spd 3 via Remote PTO	500	3000	1850	1/min	PTO Speed #3 4000..24000=signal
07	30	PTO Cab Switches Mode	0	2	0		PTO Cab Switches Mode 0=always On, 1=disabled, 2=only at speed #0

Parameterization examples

Cruise PTO – Hardware input pins:

- Example description: Cruise PTO operated via hardware pins, enabled only with park brake active. The number of fixed remote PTO speeds is set to one and the actual input is done via a single input pin. The CPC4 is not able to drop out of the PTO by actuation of the park or service brakes.
  - Set parameter 07/01 (“Configuration PTO Speed Control”) to 6 (“Cruise PTO with park brake”);
  - Set parameters 07/03 (“Max PTO Spd Resume Accel Sw”) and 07/05 (“Min PTO Spd Set Coast Sw”);
  - Check parameter 07/05 (“Min PTO Spd Set Coast Sw”) if it is set to a proper value. It is not possible to achieve a PTO speed of less than the set threshold;
  - Set parameter 07/06 (“No of Speeds via Remote PTO”) to 1 (“remote PTO speed #1 available”);
  - Set parameter 07/08 (“PTO Dropout Serv Brk Prk Brk”) to 0 (“No PTO dropout on service brake activation”);
  - Set parameter 07/16 (“Remote PTO Spd Selection Mode”) to 0 (“1 pulsed input (RemPTO)”);
  - Set parameter 13/07 (“2 09 DI Selection”) to 1 (“hardwired”);
  - Configure needed Remote PTO speed #1 value in parameter 07/23 (“Spd 1 via Remote PTO”) e. g. 1000;

- Actuate pin 2/09 to activate the PTO functionality and the pins 2/11 and 1/11 according to the chosen PTO speed selection mode explained in detail in chapter 5.1.2.1.2 to select the configured remote speed;
- Use the CC+ and CC- pins to manipulate the fixed remote speed inside of the limiting bands defined by the parameters 07/03 and 07/05.

5.1.2.1.4. PTO while driving (special applications)

This operating mode has to be selected, if the application has to remain permanently in the PTO mode.

The two settings “Cab PTO while driving” and “Cab/Remote PTO while driving” (setting 5 respectively 7 of parameter 07/01 (“Config PTO Speed Control”)) allow the usage of the PTO functionality even when the gear is engaged. This is needed for applications where the trucks gear is split at the rear axle to e. g. drive a pump or concrete mixer instead of the wheels.
“Cab PTO while driving“ is used for cabine PTO whereas “Cab/Remote PTO while driving” is used for the Remote PTO mode.

The generell function of this mode is the same as in the according chapters described above 5.1.2.1.1 (“Cabine PTO”) and 5.1.2.1.2 (“Remote PTO”). Additionally the limitation set by parameter 07/04 (“Max Road Speed in PTO Mode”) is taken into consideration since the transmission is engaged and the vehicle is about to move while the PTO mode is active. If the actual vehicle speed is exceeding the set threshold, the PTO mode is deactivated for safety reasons.
The function idle speed adjustment via CC+ and CC- remains active in this operating mode.

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
07	03	Max PTO Spd Resume Accel Sw	500	3000	1200	1/min	General Maximum PTO Speed 4000..24000=signal
07	04	Max Road Speed in PTO Mode	0	128	9,6	km/h	Maximum Road Speed in PTO Mode 0..16384=signal
07	05	Min PTO Spd Set Coast Sw	464	3000	700	1/min	General Minimum PTO Speed 3712..24000=signal
21	01	Configuration Droop Ctrl Mode	0	2	0		Droop Control Mode 0=disable, 1=normal droop mode, 2=limited droop mode

Parameterization examples

Cabine PTO while driving – Hardware Input Pin:

- Cabine PTO activated via hardware pin and no PTO dropout on Service Brake or Park Brake activation. The remote throttle override is always possible:
  - Set parameter 07/01 (“Configuration PTO Speed Control”) to 5 (“Cab PTO while driving”);
  - Check parameter 07/04 (“Max Road Speed in PTO Mode”) if it is set to a proper value. It is not possible to accelerate the vehicle beyond the set threshold;
  - Set parameter 07/08 (“PTO Dropout Serv Brk Prk Brk”) to 1 (“No PTO dropout on Service Brake or Park Brake activation”).

5.1.2.2. Speed control via Droop mode

The Droop mode allows to operate the vehicle in permanent speed control mode. It is then possible to set an engine speed via the accelerator pedal. As shown in the figure below (Fig 5.2) the requested engine speed is directly proportional to the accelerator pedal position. An AP position of 0% equals the engine idle speed (P1) and a position of 100% equals the maximum engine speed (P2). Both values are provided by the MCM and send via the J1939 CAN signals in SPN 188, “Engine Speed At Idle, Point 1 (Engine Configuration)” and SPN 528, “Engine Speed At Point 2 (Engine Configuration)” in CAN message PGN 65251, “Engine Configuration” (EC1).

With parameter 21/02 (“Droop Ctrl Mode Governor Type”) the used governor type for the droop mode can be preset while the parameter 21/03 (“Droop Maximum Engine Torque”) defines the maximum

engine torque allowed in droop mode. Additionally the two parameters 03/20 (“Max Engine Speed”) and 03/27 (“Min Engine Speed”) do limit the engine speed.

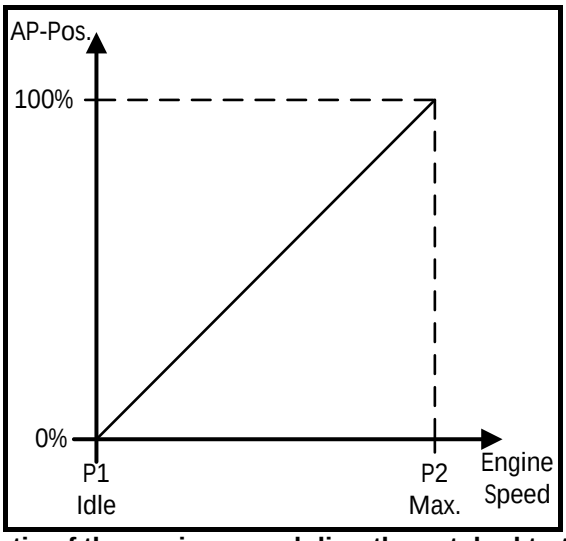


Fig 5.2: Schematic of the engine speed directly matched to the AP position

The difference between the two configuration possibilities of parameter 21/01 (“Configuration Droop Ctrl Mode”):

- **Normal droop mode:** As mentioned above, the minimum/maximum values are the two engine speeds P1/P2 provided by the MCM;
- **Limited droop mode:** The minimum and maximum values are defined by the two parameters 03/20 (“Max Engine Speed”) and 03/27 (“Min Engine Speed”). This is used to access a speed range smaller then set by the values P1/P2.

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
03	20	Max Engine Speed	0	4000	4000	1/min	Maximum Engine Speed. Is only active with a manual transmission type (parameter 02/09 à 0=Manual without Neutral switch or 3=Manual with neutral switch), 0..32000=signal
03	27	Min Engine Speed	0	1000	496	1/min	Minimum Engine Speed 0/min N min 0..32000=signal
21	01	Configuration Droop Ctrl Mode	0	2	0		Droop Control Mode 0=disable, 1=normal droop mode, 2=limited droop mode
21	02	Droop Ctrl Mode Governor Type	1	11	1		Governor Type for the Droop Control Mode 1..11=signal
21	03	Droop Maximum Engine Torque	0	5000	5000	Nm	Maximum Allowed Engine Torque in Droop Mode. 0..1000=signal

Outputs:

- SAE J1939 Signal: PGN 65251, “Engine Configuration” (EC1)
  SPN 188, “Engine Speed At Idle, Point 1 (Engine Configuration)”
- SAE J1939 Signal: PGN 65251, “Engine Configuration” (EC1)
  SPN 528, “Engine Speed At Point 2 (Engine Configuration)”

Parameterization example:

Engine speed control via Droop mode:

- Set parameter 21/01 (“Configuration Droop Ctrl Mode”) to 1 (“normal droop mode”);

5.1.2.3. Speed control via TSC1 – J1939 CAN message

In addition to the above mentioned methods it is also possible to utilize the J1939 CAN message TSC1 (“Torque/Speed Control 1”) to request a speed from the engine. For safety reasons the two J1939 signals “Message Counter” (SPN 4206) and “Message Checksum” (SPN 4207) are monitored by the CPC4 to detect missing messages and occurring errors. These have to be filled in addition to the other CAN signals.

Although it is possible to set the “Message Counter” and “Message Checksum” values to 0xF to omit fault reactions, this is only recommended temporarily for means of prototyping and/or testing.

Engine speed control

The governors for the engine speed request are chosen with the parameters 22/01 (“0 Speed Gov TSC1 Condition”), 22/01 (“1 Speed Gov TSC1 Condition”), 22/03 (“2 Speed Gov TSC1 Condition”) and 22/04 (“3 Speed Gov TSC1 Condition”), each of them corresponding to the respective speed control condition 0 to 3 of SAE J1939/71 SPN 696.

TSC1 CAN message Timeout

The period of time after which a TSC1 message will be considered missing can be configured in two different ways.

1) Via parameter 01/71 (“J1939 Tsc1 Tout Sel”). This parameter sets the TSC1 timeout period in “ticks”. One tick equals 10ms which means if the parameter is set to “10” (=default) the message will be considered missing after: 10 * 10ms = 100ms.
2) Via J1939 CAN signal “TSC1 Transmission Rate” (SPN 3349) send with J1939 CAN message TSC1 (PGN 0, “Torque/Speed Control 1”) a transmission rate for the TSC1 message can be defined. If now the parameter 01/70 (“J1939 Tsc1 Eng Var Rate Stat”) is set to “1” (“Use SPN 3349 three times for timeout detection”) the timeout period will be equal to three times the transmission rate. The “TSC1 Transmission Rate” signal consists of 3 bits which encode the possible transmission rates in fixed steps as shown in the following table:

bit setting	transmission rate
000	1000ms
001	750ms
010	500ms
011	250ms
100	100ms
101	50ms
110	20ms
111	Use standard TSC1 transmission rate of 10ms to engine

Diagnostics:

– Analog Value: Torque Speed Command Sender (chapter 6.3.1)

Inputs:

– SAE J1939 Signal: PGN 0, “Torque/Speed Control 1” (TSC1)
SPN 695, “Engine Override Control Mode”
– SAE J1939 Signal: PGN 0, “Torque/Speed Control 1” (TSC1)
SPN 898, “Engine Requested Speed/Speed Limit”
– SAE J1939 Signal: PGN 0, “Torque/Speed Control 1” (TSC1)
SPN 3349, “TSC1 Transmission Rate”
– SAE J1939 Signal: PGN 0, “Torque/Speed Control 1” (TSC1)
SPN 4206, “Message Counter”
– SAE J1939 Signal: PGN 0, “Torque/Speed Control 1” (TSC1)
SPN 4207, “Message Checksum”

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
01	16	Engine Source Address J1939	0	255	0		SAE J1939 Source Address Engine. 0..255=signal. 0..255=signal
01	48	J1939 TSC1 Source Address4	0	255	59		SAE J1939 4. Source Address TSC1 e.g.

PGR	No.	Parameter	min	max	default	unit	description
							fire truck pump ECU.
01	56	TSC1 Source Address SAE J1939	0	255	231		SAE J1939 3. Source Address TSC1 e.g. jack knife control. 0..255=signal
01	71	J1939 Tsc1 Tout Sel	0	1000	10		the interval after which an active J1939 TSC1 control message will timeout and be deactivated 0..1000=signal
01	72	Source Address OHECS	0	255	23		SAE J1939 Source Address OHECS 0..255=signal
22	01	0 Speed Gov TSC1 Condition	1	16	1		Speed Gov# TSC1 condition #0 PLD speed governor# which is used for TSC1 requested speed control condition #0. See J1939/71 4.2.3.2 1..16=signal
22	02	1 Speed Gov TSC1 Condition	1	16	1		Speed Gov# TSC1 condition #1 PLD speed governor# which is used for TSC1 requested speed control condition #1. See J1939/71 4.2.3.2 1..16=signal
22	03	2 Speed Gov TSC1 Condition	1	16	1		Speed Gov# TSC1 condition #2 PLD speed governor# which is used for TSC1 requested speed control condition #2. See J1939/71 4.2.3.2 1..16=signal
22	04	3 Speed Gov TSC1 Condition	1	16	1		Speed Gov# TSC1 condition #3 PLD speed governor# which is used for TSC1 requested speed control condition #3. See J1939/71 4.2.3.2 1..16=signal

Parameter values:
1 .. 15 MCM2 controls engine speed after receiving the requested speed from the CPC4
16 CPC4 internal speed governor

Parameterization example:

Engine speed control via J1939 CAN message TSC1:

- Set SAE J1939 TSC1 Destination Address to 0x0 (CPC4);
- Set SAE J1939 TSC1 Source Address to e.g. 0xE7 (“TSC1 Source Address SAE J1939”);
- Set SAE J1939 TSC1 signal SPN 695 (“Engine Override Control Mode”) to 1 (“SpdCtrlGvrnSpdTIncIddDsrdSpdVle”);
- Set SAE J1939 TSC1 signal SPN 898 (“Engine Requested Speed/Speed Limit”) to the desired engine speed: e. g. 1000rpm;
- Send the TSC1 message with the appropriate repetition rate: e. g. 10ms.
- Set SAE J1939 TSC1 signal SPN 4206 (“Message Counter”) to 0. The transmitting device will have to increase the message counter in every cycle. The message counter will count from 0 to 7 and then wrap.
- Calculate the message checksum as described in the SAE J1939 standard and set the SAE J1939 TSC1 signal SPN 4207 (“Message Checksum”) according to the outcome.

TSC1 Speed Control and Speed Limitation
Depending on parameters in group 22 (“Limiter Governor”) the speed governors for maximum engine speed limitation and engine speed control are selected.

5.1.3. Characteristics of Governor Types

The here mentioned governors are part of the fuelmap in the MCM2 but chosen with the appropriate CPC4 parameters mentioned below. The following table shows governor configuration for **HDEP Tier4** type engines:

Governor Type Number	Description(HDEP Tier4)
00	Transmission synchronisation governor
01	**Standard PTO speed control;** PTO governor with high dynamic characteristic;
02	PTO governor with maximum dynamic characteristic (quick response, avoiding overshoot, less stability)
03	Base-calibration only, no specific use case yet.
04	Base-calibration only, no specific use case (identical to gov. 3) , also calibratable via Xentry in MCM-E2P
05	PTO governor with less dynamic characteristic (half of gov. 1)
06	Governor for gear synchronization à not to be used for other purposes
07	Not valid, not in Software (idle with locked torque request)
08	Base-calibration only, no specific use case (identical to gov. 3)
09	Specific charactersitic for e.g. CVT drivetrains (quick response on speed-request-changes)
10	Base-calibration only, no specific use case (identical to gov. 3)
11	specific charactersitic for e.g. power take-off shaft, high engine speed accuracy
12	Not valid, not in Software(idle with locked torque request)
13	Not valid, not in Software(idle with locked torque request)
14	Additional idle governor for launch control (quick response, less stability in steady-state conditions)
15	**Standard Torque based control;** Low idle governor (also necessary for Driving mode) with idle speed control
16	CPC4 controls engine speed by calculation of an appropriate requested torque à not to be used anymore

For speed control it is <u>only</u> allowed to use governors: 01, 02, 04, 05, 09 and 11!
Governor 14 and 15 should be used for torque control <u>only</u>!

The following table shows governor configuration for **MDEG** type engines:

Governor Type Number	Description(MDEG Tier4)
00	Transmission synchronisation governor
01	**Standard PTO speed control;** PTO governor with high dynamic characteristic;
02	No calibration, do not use
03	Specific charactersitic for hydraulic loads (quick response, avoiding overshoot)
04	No calibration, do not use
05	PTO governor with less dynamic characteristic (half of gov. 1)
06	No calibration, do not use
07	Not valid, not in Software(idle with locked torque request)
08	No calibration, do not use
09	No calibration, do not use
10	No calibration, do not use
11	PTO governor with low dynamic characteristic.
12	Not valid, not in Software(idle with locked torque request)
13	Not valid, not in Software(idle with locked torque request)
14	Additional idle governor for launch control (quick response, less stability in steady-state conditions)
15	**Standard Torque based control;** Low idle governor (also necessary for Driving mode) with idle speed control
16	CPC4 controls engine speed by calculation of an appropriate requested torque à not to be used anymore

For speed control it is only allowed to use governors: 01, 03, 05 and 11!
Governor 14 and 15 should be used for torque control only!

5.2. Vehicle Identification Number (VIN)

To activate the safety feature PMC (powertrain monitoring concept, based on UDE EGAS concept) it is neccessary to set the vehicle identification number via the service routine “VIN Current Write” in Xentry. To read the current value the service routine “VIN Current Read” shall be used. The default configuration is “AAAAAAAAAAAAAAAAA”. If the VIN is set in CPC4 it will be sent via CAN message (PGN 65260, “Vehicle Identification” (VI), SPN 237) to other ECU’s on J1939 as well.

The setting of the VIN is a mandatory act. If the parameter values of the CPC4 are reset to default via service routine, it is necessary to set the VIN anew otherwise the safety feature is not available!

5.3. Transmission

5.3.1. Transmisson Type

Parameter 02/09 (“Transmission Type”) must be configured in dependence of the used transmission. The parameterization of this parameter influences a number of different features, so it is necessary to set the proper value.
Depending on this parameterization a CAN message is sent to the MCM that locks the engine starter if the neutral switch of the transmission is not actuated. Therefore, if the parameter is e. g. set to a transmission type which supports a hardwired neutral switch and none is provided by the transmission actually built-in, the engine will not start. The following table shows the different possible settings:

Value	Engine start without transmission neutral possible	Comment	Transmission neutral switch configuration (if neutral switch is used)
Manual without Neutral Switch	Yes	Manual transmission without a neutral switch	
Allison, Eaton Ultrashift/Ultrashift ASW, Autoshift, ZF ASTronic, AGS2 without ETC2	Yes	Automatic transmission without CAN message ETC2	
Manual, with Neutral Switch	No	Manual transmission with a neutral switch	Par. 13/33 (“Trans Neutral Input Config”) to 0 (“hardwired”)
Eaton Autoshift, Ultrashift, ZF ASTronic, AGS2 with ETC2	No	Automatic transmission with CAN message ETC2	Par. 13/33 (“Trans Neutral Input Config”) to 1 (“ETC2 (SPN 523 and 524)”)
Allison, Eaton Ultrashift ASW: MCM start	No	Automatic transmission; Neutral status message necessary	
Eaton Ultrashift PLUS	No	Automatic transmission	
Detroid Transmission	No	Daimler Transmission	

According to the transmission setting, it is necessary to choose the correct input mechanism for the transmission neutral switch (if the built-in transmission utilizes one).

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
02	09	Transmission type	0	9	3		Transmission Type 0=Manual, without Neutral Switch, 1=not used in NAFTA: automated, 2=Allison, Eaton Ultrashift/Ultrashift ASW, Autoshift, ZF ASTronic, AGS2 without ETC2, 3=Manual, with Neutral Switch, 4=not used in NAFTA: automated with starter lock, 5=Eaton Autoshift, Ultrashift, ZF ASTronic, AGS2 with ETC2, 6=Allison, Eaton Ultrashift ASW: MCM start,

PGR	No.	Parameter	min	max	default	unit	description
							7=reserved, 8=Eaton Ultrashift PLUS, 9=Detroit Transmission

5.3.1.1. Transmission Protection – vehicle speed based

The transmission protection works by limiting the engine torque when the actual vehicle speed ranges between two pre-parameterised (parameters 23/01, “ADM 1 Trans Prot 1 Veh Speed” and 23/02, “ADM 1 Trans Prot 2 Veh Speed”) thresholds. Therefore the torque limitation is vehicle speed dependent.

Condition	Limitation
Actual Vehicle Speed < ADM 1 Trans Prot 1 Veh Speed	Engine torque limited to ADM 1 Trans Prot Torque (23/03)
ADM 1 Trans Prot 1 Veh Speed < Actual Vehicle Speed < ADM 1 Trans Prot 2 Veh Speed	With raising vehicle speed the restriction is redeemed
Actual Vehicle Speed > ADM 1 Trans Prot 2 Veh Speed	No limitation

Additionaly it is possible to set certain parameters to reduce the maximum engine torque for gears with a gear ratio below certain values. This parameters include 23/27 (“Gear Ratio for High Gear Power”), 23/28 (“Gear Ratio Gear Down Protect”), 23/64 (“Torque Factor Gear Dwn Protect”), 23/65 (“Torque Factor High Gear Power”). To determine in which gears this feature works set parameter 23/67 (“Gear Down Protection Mode”) to the according value.

Parameters:

PGR	No.	Parameter	min	max	default	unit	Description
23	01	ADM 1 Trans Prot 1 Veh Speed	0	250	0	km/h	Torque limitation dependent on vehicle speed for Allison Transmissions without CAN connection. Reserved, 0..32000=signal
23	02	ADM 1 Trans Prot 2 Veh Speed	0	250	0	km/h	Torque limitation dependent on vehicle speed for Allison Transmissions without CAN connection. Reserved, 0..32000=signal
23	03	ADM 1 Trans Prot Torque	-5000	5000	5000	Nm	Reserved, -25000..25000=signal
23	27	Gear Ratio for High Gear Power	0	2	0,02		Gear ratio for high gear power Torque reduction occurs to gear ratios below this value. See also parameter 23/03 0..2000=signal
23	28	Gear Ratio Gear Down Protect	0	2	0,01		Gear ratio for gear down protection Torque reduction occurs to gear ratios below this value. See also parameter 23/01 0..2000=signal
23	64	Torque Factor Gear Dwn Protect	0	1	1		Torque factor gear down protection Torque reduction factor in gears below the ratio that is set in parameter 23/02 0..1000=signal
23	65	Torque Factor High Gear Power	0	1	1		Torque factor high gear power Torque reduction factor in gears below the ratio that is set in parameter 23/04 0..1000=signal
23	67	Gear Down Protection Mode	0	1	1		Operation of gear down protection and high gear power 0=in all gears (legacy), 1=not in top gear or top gear -1

Parameterization example

To reduce the output torque of the 3 highest gears parameter 23/27 (“Gear Ratio for High Gear Power”) has to be set to a value slightly higher than the highest gear ratio out of these three gears (e. g. 1,6). Furthermore the parameter 23/65 (“Torque Factor High Gear Power”) has to be set to the factor by which the torque shall be reduced (e. g. 0,55).

5.3.2. Clutch Switch

The clutch switch/switches signals the state of the clutch, whether it is closed or opened, to the CPC4. The status can be detected via different methods including one or two hardwired pins, the SAE J1939 CAN message CCVS1 or the CAN message ETC1. The decision which input is taken into consideration the parameter 13/25 (“Clutch Switch Config”) is used.

When configured to be received from ETC1, the clutch slip is used to determine if the clutch is open or closed, being open when greater than 95% slip and closed when less than 5% slip. The clutch slip between these two values is not detectable, and is therefore assumed to be invalid.

When configured for one hardwired clutch switch, the CPC4 reads the clutch-closed (pedal released) status from pin 4/08 (DI_FLEX_23, “Clutch1”); when configured for two switches, it additionally reads the clutch status from pin 4/17 (DI_FLEX_21, “Clutch2”). Note that the sense of the two switches is inverted: DI_FLEX_21 will give the clutch ‘open’ status and DI_FLEX_23 will give the clutch ‘closed’ status.
The detection via the CAN signal “Clutch Switch” (SPN 598) in message CCVS1 works like a single hardwired pin described above.

Features that take the Clutch condition into consideration:
- PTO: It is possible to let the PTO drop out because of the opening clutch. (refer e. g. chapter 5.1.2.1.1)
- EBM: Engine brake without closed clutch is not possible.
- DPF: The clutch must be closed to fulfill the activation conditions for the high idle regeneration and the manual regeneration request.

Diagnostics:
- Binary Value: 1/4, Clutch Open (chapter 6.3.2)

Inputs:
- Pin 4/08, DI_FLEX_23, “Clutch1” : Clutch Switch
- Pin 4/17, DI_FLEX_21, “Clutch2” : 2 Clutch Switch
- SAE J1939 Signal: PGN 65265, “Cruise Control/Vehicle Speed 1” (CCVS1)
  SPN 598, ”Clutch Switch”
- SAE J1939 Signal: PGN 61442, “Electronic Transmission Controller” (ETC1)
  SPN 522, ”Percent Clutch Slip”

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
01	04	CC1 Source Address SAE J1939	0	255	23		SAE J1939 Source Address #1 CCVS1 (PGN 65265). 0..255=signal
01	05	CC2 Source Address SAE J1939	0	255	33		SAE J1939 Source Address #2 CCVS1 (PGN 65265). 0..255=signal
01	06	CC3 Source Address SAE J1939	0	255	49		SAE J1939 Source Address #3 CCVS1 (PGN 65265). 0..255=signal
01	55	Trans Source Address J1939	0	255	3		SAE J1939 Source Address Transmission 0..255=signal

13	16	4 08 DI Selection	0	1	0		CPC2: Configuration input DiFlexE1 # CPC4: DI_FLEX_23
							0=disable,
							1=clutch switch

13	18	4 17 DI Selection	0	3	2		Configuration parameter for input Di_Flex21 0=disable, 1=2 Clutch Switch, 2=DPF regeneration switch, 3=PTO1stat
13	25	Clutch Switch Config	0	7	0		Source and configuration clutch switch(es) info 0=no clutch switch, 1=1 Clutch Switch, 2=2 Clutch Switch, 3=Ccvs1 from source address #1, 4=Ccvs1 from source address #2, 5=Ccvs1 from source address #3, 6=ETC1,

PGR	No.	Parameter	min	max	default	unit	description
							7=1 Clutch switch, clutch info via PTCan

Regarding the three CCVS1 source address parameters 01/04 ("CC1 Source Address SAE J1939"), 01/05 ("CC2 Source Address SAE J1939") and 01/06 ("CC3 Source Address SAE J1939"): It is important that these three parameters are configured with different values!

Parameterization example:

Clutch state via one clutch switch:
- Set parameter 13/16 ("4 08 DI Selection") to 1 ("clutch switch");
- Set parameter 13/25 ("Clutch Switch Config") to 1 ("1 Clutch Switch").

Clutch state via two clutch switches:
- Set parameter 13/16 ("4 08 DI Selection") to 1 ("clutch switch");
- Set parameter 13/18 ("4 17 DI Selection") to 1 ("2 Clutch Switch");
- Set parameter 13/25 ("Clutch Switch Config") to 2 ("2 Clutch Switch").

Clutch state via SAE CAN message CCVS1:
- Set parameter 13/25 ("Clutch Switch Config") to 4 ("CCVS1 from source address #2");
- Configure the J1939 CAN Source Address of CCVS1 message with parameter 01/05 ("CC2 Source Address SAE J1939") to 33/0x21.
- Send message CCVS1 from SA: 33/0x21, Signal "Clutch Switch" (SPN 598) set to "0" ("ClutchPedalReleased") if the clutch is closed.
- Send message CCVS1 from SA: 33/0x21, Signal "Clutch Switch" (SPN 598) set to "1" ("ClutchPedalDepressed") if the clutch is opened.

Clutch state via SAE CAN message ETC1:
- Set parameter 13/25 ("Clutch Switch Config") to 6 ("ETC1");
- Configure the J1939 CAN Source Address of ETC1 message with parameter 01/55 ("Trans Source Address J1939") to 3/0x3.
- Send message ETC1 from SA: 3/0x3, Signal "Percent Clutch Slip" (SPN 522) set to "< 5%" if the clutch is closed.
- Send message ETC1 from SA: 3/0x3, Signal "Percent Clutch Slip" (SPN 522) set to "> 95%" if the clutch is opened.

5.4. Engine Crank/Start/Stop Behaviour

Risk of accident!

The functions „starter interlock" and „engine start with automatic transmission" are not effective in engine emergency running programs without the CPC4 control unit or if the CAN connection is defective. In such cases, the engine start is controlled only by the MCM2 engine management and can no longer be influenced by the CPC4. If the drive train is closed (transmission not in neutral), the vehicle could unexpectedly start moving or set the working machine in operation, constituting a risk to life and limb.

5.4.1. Four Alternatives for the Engine Start

Four alternative starting devices are provided:

a) Start MCM2 and CPC4 in parallel (terminal 50 on both devices or J1939 message) - recommended;
b) Start MCM2 and CPC4 in series (hardwired via terminal 50 or J1939 message);
c) Start via terminal 50 on CPC4 without the participation of the MCM2, whereby a starter protection is possible via a starter cut-off relay of the CPC4;

d) Start via start-/stop-button at the engine block.

The J1939 CAN signals "EssEngStartFlag", "EssEngStopFlag" and "EngStartLockFlag" are now only available with the proprietary CAN message "PropB04"!

The respective starting device has to be configured in the MCM2 (MCM2 parameter 04/02 "Starter Type Control"). Except for the last mentioned case, the engine starter is directly actuated from an output of the MCM2.
There is also a protective function in the CPC4 which is used in every different variant:

– Starter lockout, if the transmission is not in neutral position; it can be activated via parameter 02/09 „Transmission Type" (parameter value = 2), for an automatic transmission.

Regardless which starting device is chosen, the CPC4 checks if the transmission is set to neutral status before the engine can be started at all. This can be done in two different ways:

– Via hardwired pin: Pin 4/16, DI_FLEX_17, "Transmission Neutral"; if the built in transmission is equipped with a neutral switch, it has to be connected to this input pin.
– or via SAE J1939 CAN Signal: PGN 61445, Electronic Transmission Controller 2 (ETC2)
SPN 523, Transmission Current Gear

It is always recommended to choose a starter device which is directly connected to the MCM2 which would refer to the chapters 5.4.1.1, 5.4.1.2.

5.4.1.1. Engine Start via CPC4 and MCM in Parallel (hardwired) - recommended

An engine start via the ignition lock (terminal 50) is demanded via the input terminal 50 of the CPC4 and the terminal 50 of the MCM2 engine management. The „terminal 50" inputs of the CPC4 and the MCM2 must be wired in parallel, because the redundancy of both wires is monitored. If the two signals are not coincident or one is missing at all, the engine still starts, but a fault memory entry is set, because the redundancy of the system is no longer existent. The starter device is, in this case, directly connected to the MCM2.

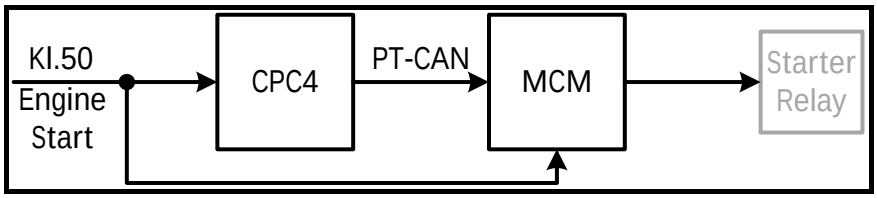


Fig 5.3: Schematic diagram of the engine start via CPC and MCM in parallel

This is also the recommended engine starter type.

The starting process is monitored by the MCM2

– Overload protection through limitation of the starting time
– Overspeed protection through limitation of the starter speed
– Mesh protection when the engine is running

Diagnostics:

– Binary Value: 6/1, Neutral Switch (chapter 6.3.2)

Inputs:

– Pin 1/18, SFP_01, "Starter (KL50)"
– Pin 4/16, DI_FLEX_17, "TransmissionNeutral" or
– SAE J1939 Signal: PGN 61445, "Electronic Transmission Controller 2" (ETC2)
SPN 523, "Transmission Current Gear"
– SAE J1939 Signal: PGN 61445, "Electronic Transmission Controller 2" (ETC2)
SPN 524, "Transmission Selected Gear"

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
02	09	Transmission Type	0	9	3		Transmission Type

PGR	No.	Parameter	min	max	default	unit	description
							0=Manual, without Neutral Switch, 1=not used in NAFTA: automated, 2=Allison, Eaton Ultrashift/Ultrashift ASW, Autoshift, ZF ASTronic, AGS2 without ETC2, 3=Manual, with Neutral Switch, 4=not used in NAFTA: automated with starter lock, 5=Eaton Autoshift, Ultrashift, ZF ASTronic, AGS2 with ETC2, 6=Allison, Eaton Ultrashift ASW: MCM start, 7=reserved, 8=Eaton Ultrashift PLUS, 9=Detroit Transmission
13	33	Trans Neutral Input Config	0	255	0		Source neutral switch (hardwired or from J1939) 0=hardwired, 1=info from J1939 (muxed), 255=not available

Outputs:

– Engine start demand to MCM2 via CAN connection

Parameterization (regarding the transmissiontype parameter 02/09):

E. g. Allison transmission <u>without</u> neutral status monitoring via SAE J1939 ETC2:

· Lower safety, because it is possible to start the engine with engaged gear and thus the risk of accident is higher.

– Set parameter 02/09 (“Transmission Type”) to 2 (“Allison, Eaton Ultrashift/Ultrashift ASW, Autoshift, ZF ASTronic, AGS2 without ETC2”)

E. g. Allison transmission <u>with</u> neutral status monitoring via SAE J1939 ETC2:

· Higher safety, because the engine start is only possible if transmission is in neutral status. Altough it is to mention that there are specific transmissions that allow engine starts with the first gear engage, by means of maneuvering. This may cause fault memory entries.

– Set parameter 02/09 (“Transmission Type”) to 5 (“Eaton Autoshift, Ultrashift, ZF ASTronic, AGS2 with ETC2”)

According to the preferred behavior, the parameterization is to be chosen. Although it is recommended to use the configuration with which the higher safety may be provided.

5.4.1.2. Engine Start via CPC4 and MCM in Series (hardwired and CAN)

If it is not possible to check the transmission status via SAE J1939 message it is mandatory to use the provided metho via input pin.

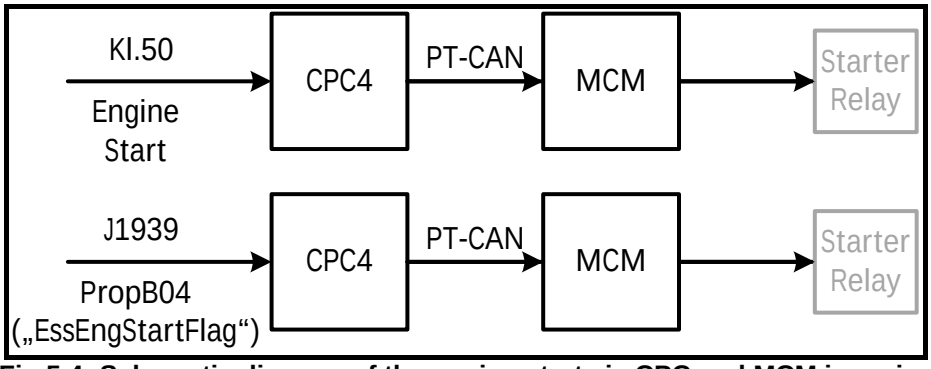


Fig 5.4: Schematic diagram of the engine start via CPC and MCM in series

In order to use the J1939 CAN message PropB04 to start the engine it is necessary to set the source address of this message via parameter 01/63 (“J1939 PropB04 Source Address”) to a valid value which is by default set to the invalid value (=254) due to safety considerations.
The message PropB04 consists of five signals and all of them have to be filled every time the message is send:

PropB04 signals	Start engine	Stop engine	Starter lock (engine start impossible)
EssEngStopFlag	0	1	0
EssEngStartFlag	1	0	0
EssStartLockFlag	0	0	1
MessageCounter	0xFF	0xFF	0xFF
MessageChecksum	0xFF	0xFF	0xFF

Although it is possible to set the “Message Counter” and “Message Checksum” values to 0xF to omit fault reactions, this is only recommended temporarily for means of prototyping and/or testing.

Remark: For further information regarding the setting of the MessageCounter/Checksum signals refer to the chapter 5.1.2.3 (“Speed control via TSC1 – J1939 CAN message”) and the SAE J1939 CAN standard.

An engine start is demanded via the input terminal 50 of the CPC4 or the J1939 CAN message PropB04. In both cases the CPC4 sends the engine start request via the Engine CAN to the MCM2. Because of a nonexistent redundancy this method is not recommended. If the engine start is demanded via J1939 CAN message, it is always checked if the transmission is set to neutral in the first place. This is done through the evaluation of the appropriate hardwired pin (Pin 4/16, “Transmission Neutral”) or the J1939 CAN message ETC2 (TransCurrentGear = 0), no matter what transmission type is set. Likewise to the method described in chapter 5.4.1.1 the starter device is connected directly to the MCM2.

Diagnostics:
- Binary Value: 6/1, Neutral Switch (chapter 6.3.2)

Inputs:
- Pin 1/18, SFP_01, “Starter (KL50)”
- Pin 4/16, DI_FLEX_17, “TransmissionNeutral”
- SAE J1939 Signal: “PropB04”,
  Byte 1, Bit 2,3, “EssEngStartFlag”
- SAE J1939 Signal: “PropB04”,
  Byte 8, Bit 1..4, “MessageCounter”
- SAE J1939 Signal: “PropB04”,
  Byte 8, Bit 5..8, “MessageChecksum”
- SAE J1939 Signal: PGN 61445, “Electronic Transmission Controller 2” (ETC2)
  SPN 523, “Transmission Current Gear”
- SAE J1939 Signal: PGN 61445, “Electronic Transmission Controller 2” (ETC2)
  SPN 524, “Transmission Selected Gear”

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
01	63	J1939 PropB04 Source Address	0	254	254		SAE J1939 Source Address PropB04 message (PropB4), 0..254=signal, 255=snv
02	09	Transmission Type	0	9	3		Transmission Type 0=Manual, without Neutral Switch, 1=not used in NAFTA: automated, 2=Allison, Eaton Ultrashift/Ultrashift ASW, Autoshift, ZF ASTronic, AGS2 without ETC2, 3=Manual, with Neutral Switch, 4=not used in NAFTA: automated with starter lock, 5=Eaton Autoshift, Ultrashift, ZF ASTronic, AGS2 with ETC2, 6=Allison, Eaton Ultrashift ASW: MCM start,

PGR	No.	Parameter	min	max	default	unit	description
							7=reserved, 8=Eaton Ultrashift PLUS, 9=Detroit Transmission
13	33	Trans Neutral Input Config	0	255	0		Source neutral switch (hardwired or from J1939) 0=hardwired, 1=info from J1939 (muxed), 255=not available

Parameterization (regarding the transmissiontype parameter 02/09):

E. g. Allison transmission without neutral status monitoring via SAE J1939 ETC2:

- Lower safety, because it is possible to start the engine with engaged gear and thus the risk of accident is higher.
  - Set parameter 02/09 (“Transmission Type”) to 2 (“Allison, Eaton Ultrashift/Ultrashift ASW, Autoshift, ZF ASTronic, AGS2 without ETC2”)

E. g. Allison transmission with neutral status monitoring via SAE J1939 ETC2:

- Higher safety, because the engine start is only possible if transmission is in neutral status. Altough it is to mention that there are specific transmissions that allow engine starts with the first gear engage, by means of maneuvering. This may cause fault memory entries.
  - Set parameter 02/09 (“Transmission Type”) to 5 (“Eaton Autoshift, Ultrashift, ZF ASTronic, AGS2 with ETC2”)

According to the preferred behavior, the parameterization is to be chosen. Although it is recommended to use the configuration with which the higher safety may be provided.

5.4.1.3. Engine Start via CPC4 without MCM (hardwired and CAN)

An engine start can only be demanded via the ignition lock (terminal 50).

Fig 5.5: Schematic diagram of the engine start via CPC without the MCM

A starter lockout relay - which deactivates the starter in reliance on the CPC4 internal protection mechanisms - is controlled via the output Pin 3/17 (“Misc(Relay 1)”). Since the MCM2 is not part of the starter chain, its protection mechanisms are not taken into consideration. Because of this, this engine starter type is not recommended.

The CPC4 internal protection mechanism results in:

- Overload protection through limitation of the starting time
- Overspeed protection through limitation of the starter speed
- Mesh protection when the engine is running

Diagnostics:

- Binary Value: 6/1, Neutral Switch (chapter 6.3.2)

Inputs:

- Pin 1/18, SFP_01, “Starter (KL50)”
- Pin 4/16, DI_FLEX_17, “TransmissionNeutral”
- SAE J1939 Signal: PGN 61445, “Electronic Transmission Controller 2” (ETC2)
  SPN 523, “Transmission Current Gear”

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
02	09	Transmission Type	0	9	3		Transmission Type 0=Manual, without Neutral Switch, 1=not used in NAFTA: automated, 2=Allison, Eaton Ultrashift/Ultrashift ASW, Autoshift, ZF ASTronic, AGS2 without ETC2, 3=Manual, with Neutral Switch, 4=not used in NAFTA: automated with starter lock, 5=Eaton Autoshift, Ultrashift, ZF ASTronic, AGS2 with ETC2, 6=Allison, Eaton Ultrashift ASW: MCM start, 7=reserved, 8=Eaton Ultrashift PLUS, 9=Detroit Transmission
13	07	2 09 DI Selection	0	2	0		Configuration input DiFlex09 0=disable, 1=hardwired, 2=J1939 PTO
13	33	Trans Neutral Input Config	0	255	0		Source neutral switch (hardwired or from J1939) 0=hardwired, 1=info from J1939 (muxed), 255=not available
35	12	3 17 DO Selection	0	10	1		usage of Output DoHpLs04 0=disabled, 1=enable starter lockout, 2=enable kick down output, 3=not used, 4=optimized idle alarm, 5=split valve 2, 6=starter lockout and AGS2 run signal / starter lockout, 7=engine brake disabled for over speed, 8=battery voltage low lamp, 9=coolant level low lamp, 10=PTO1valve2
35	31	3 17 DO Fault Detection	0	15	0		0=Fault Detection Off, 1=Diag, 2=PulseWhenOff, 3=PulseWhenOff + Diag, 4=PulseWhenOn, 5=PulseWhenOn + Diag, 6=PulseWhenOn + PulseWhenOff, 7=PulseWhenOn + PulseWhenOff + Diag, 8=SetFault, 9=SetFault + Diag, 10= SetFault + PulseWhenOff, 11=SetFault + PulseWhenOff + Diag, 12=SetFault + PulseWhenOn, 13=SetFault + PulseWhenOn + Diag, 14=SetFault + PulseWhenOn + PulseWhenOff, 15=SetFault + PulseWhenOn + PulseWhenOff + Diag
35	48	3 17 DO Configuration	0	1	0		Binary Output Configuration, hp: high power, ls: low side 0=disabled, 1=enabled

Outputs:

– Pin 3/17, DO_HP_LS_04, “Misc (Relay 1)”

Parameterization (regarding the transmissiontype parameter 02/09):

E. g. Allison transmission without neutral status monitoring via SAE J1939 ETC2:

· Lower safety, because it is possible to start the engine with engaged gear and thus the risk of accident is higher.

– Set parameter 02/09 (“Transmission Type”) to 2 (“Allison, Eaton Ultrashift/Ultrashift ASW, Autoshift, ZF ASTronic, AGS2 without ETC2”)

E. g. Allison transmission <u>with</u> neutral status monitoring via SAE J1939 ETC2:

· Higher safety, because the engine start is only possible if transmission is in neutral status. Altough it is to mention that there are specific transmissions that allow engine starts with the first gear engage, by means of maneuvering. This may cause fault memory entries.

– Set parameter 02/09 (“Transmission Type”) to 5 (“Eaton Autoshift, Ultrashift, ZF ASTronic, AGS2 with ETC2”)

According to the preferred behavior, the parameterization is to be chosen. Although it is recommended to use the configuration with which the higher safety may be provided.

5.4.1.4. Service Start- / Stop-Button at the Engine Block

Refer to the installation guidelines of the MCM2 engine management for further information on this button!

Risk of injury!

For reasons of safety a start via the service start button at the engine block is prevented by the vehicle control CPC4, if the gear is engaged. A start via the service start button is only possible in neutral position of the transmission and only if the engine-CAN is intact (in the CAN limp home mode and in case of an operation without CAN, no start is possible).

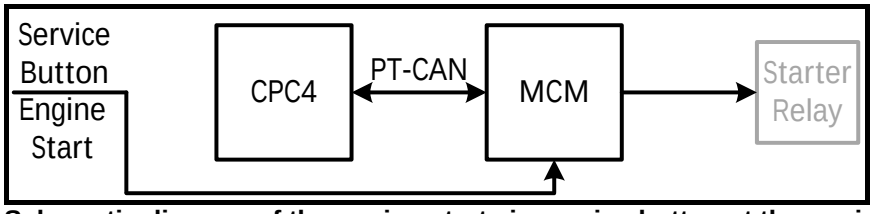


Fig 5.6: Schematic diagram of the engine start via service button at the engine block

The service start-/stop-button at the engine block allows to operate the engine without the use of terminal 50 or J1939 CAN message.
If the start button (which is connected to a MCM2 input) is actuated, the MCM2 requests an engine start at the CPC4 (via PT-CAN) which again is evaluating the request. If the conditions are met, the CPC4 sends an enable message to the MCM which starts the engine.

Diagnostics:

– Binary Value: 6/1, Neutral Switch (chapter 6.3.2)

Inputs:

– Pin 4/16, DI_FLEX_17, “TransmissionNeutral”
– SAE J1939 Signal: PGN 61445, “Electronic Transmission Controller 2” (ETC2)
SPN 523, “Transmission Current Gear”

5.4.1.5. Starter Lock

The starter lock is an optional function that prevents the engine from starting according to different input signals described below. It interrupts the starting signal via a normally closed relay connected to the output pin 3/17 (“starter lockout”) regardless which engine start method is chosen.

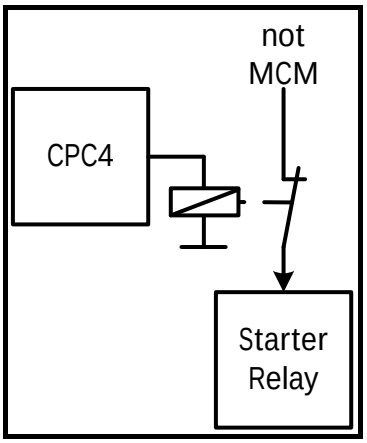


Fig 5.7: Schematic figure of the Starter Lock

The relevant signals include:

a) KL15, Ignition On;
b) Input Pin 4/18, “Crank Inhibit”: This input pin can e. g. be connected to a switch at the hood to detect if it is opened or closed (the switch have to be installed seperately);
c) J1939 CAN signal “EssStartLockFlag”: Starter Lock from the J1939 PropB04 message;
d) J1939 CAN signal “Transmission Engine Crank Enable”: Cranking not enabled by J1939 CAN message ETC7;
e) Transmission neutral status (see also chapter “Engine Start / Stop”):
   - Input Pin 4/16, “Transmission Neutral”: If the built in transmission is equipped with a neutral switch, it has to be connected to this input pin.
   - J1939 CAN signal “Transmission Current Gear”: Check if transmission is in neutral.

For further information on the PropB04 CAN message refer to chapter 5.4.1.2 (“Engine Start via CPC4 and MCM in Series (hardwired and CAN)”).

Inputs:

– Pin 2/03, KL15, “Battery Switched”
– Pin 4/18, DI_FLEX_18, “Misc (Crank Inhibit)” : Enable Crank Inhibit
– SAE J1939 Signal: “PropB04”,
  Byte 1, Bit 5, 6, “EssStartLockFlag”
– SAE J1939 Signal: “PropB04”,
  Byte 8, Bit 1..4, “MessageCounter”
– SAE J1939 Signal: “PropB04”,
  Byte 8, Bit 5..8, “MessageChecksum”
– SAE J1939 Signal: PGN 65098, “Electronic Transmission Controller 7” (ETC7)
  SPN 2900, “Transmission Engine Crank Enable”

– Transmission neutral status:
– Pin 4/16, DI_FLEX_17, “Transmission Neutral”: if the built in transmission is equipped with a neutral switch, it has to be connected to this input pin or
– SAE J1939 CAN Signal: PGN 61445, “Electronic Transmission Controller 2” (ETC2)
  SPN 523, “Transmission Current Gear”

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
01	63	J1939 PropB04 Source Address	0	254	254		SAE J1939 Source Address PropB04 message (PropB4) 0..254=signal, 255=snv
13	19	4 18 DI Selection	0	9	0		Configuration input DiFlex18 0=disable, 1=enable crank inhibit, 2=enable engine hood (Optimized Idle), 3=not used, 4=RPM Freeze,

PGR	No.	Parameter	min	max	default	unit	description
							5=Engine Brake Disable, 6=Fast Engine Heat Up Switch, 7=Service-Brace active, 8=Driver Requested Engine Brake Lockout, 9=ManeuverMode
35	12	3 17 DO Selection	0	10	0		usage of Output DoHpLs04 0=disabled, 1=enable starter lockout, 2=enable kick down output, 3=not used, 4=optimized idle alarm, 5=split valve 2, 6=starter lockout and AGS2 run signal / starter lockout, 7=engine brake disabled for over speed, 8=battery voltage low lamp, 9=coolant level low lamp, 10=PTO1valve2
35	31	3 17 DO Fault Detection	0	15	1		0=Fault Detection Off, 1=Diag, 2=PulseWhenOff, 3=PulseWhenOff + Diag, 4=PulseWhenOn, 5=PulseWhenOn + Diag, 6=PulseWhenOn + PulseWhenOff, 7=PulseWhenOn + PulseWhenOff + Diag, 8=SetFault, 9=SetFault + Diag, 10= SetFault + PulseWhenOff, 11=SetFault + PulseWhenOff + Diag, 12=SetFault + PulseWhenOn, 13=SetFault + PulseWhenOn + Diag, 14=SetFault + PulseWhenOn + PulseWhenOff, 15=SetFault + PulseWhenOn + PulseWhenOff + Diag
35	48	3 17 DO Configuration	0	1	0		Binary Output Configuration, hp: high power, ls: low side 0=disabled, 1=enabled

Outputs:
- Pin 3/17, DO_HP_LS_04, “Misc (Relay 1)” : Enable Starter Lockout

5.4.2. Four Alternatives for Engine Stop

An engine stop can be initiated in four different ways:

- Engine stop through deactivation of terminal 15
- Engine stop via “StopEngine/AuxShutdown”
- Engine stop via external engine stop button
- Engine stop via SAE J1939 CAN signal

5.4.2.1. Engine Stop through Deactivation of Terminal 15

The engine stop is initiated by the deactivation of the control inputs terminal 15 of CPC4 and MCM2.
If the CPC4 detects a deactivation of terminal 15, then the CPC4 demands zero torque quantity via CAN and the engine stops.

The instructions stated in chapter 3.2.3 for the connection of the terminal 15 to CPC4 must be applied (concerning the run-on phase, the input resistance, blocking diode, etc.).

Inputs:
- Pin 2/03, Power Supply Unit, “Battery Switched (KL15)”

Outputs:
- Engine stop demand on MCM2 (transmitting zero injection via engine CAN)

5.4.2.2. Engine stop via “StopEngine/AuxShutdown”

Via the input pin 1/10 switched to ground; an engine stop can be initiated. As long as the button is actuated, the CPC4 requests an engine stop via CAN. The button has to remain pressed until the engine stops. As long as the engine speed does not fall below the value 50 1/min, the injection is released again upon releasing the stop button and the engine continues running. In this way, the engine is not shut down by a short-term actuation of the external stop button.

Inputs:
- Pin 1/10, DI_FLEX_20, “StopEngine/AuxShutdown”

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
13	3	1 10 DI Selection	0	3	0		Configuration input DiFlex20 0=disable, 1=enable aux shutdown, 2=FUSO Accelerator switch, 3=Evobus retarder lever stage0

Outputs:
- Engine stop demand on MCM2 (transmitting zero injection via engine CAN)

5.4.2.3. Service start- / stop-button at the engine block

The service start-/stop-button at the engine block allows operating the engine without the use of terminal 50 or J1939 CAN message. Refer to chapter 5.4.1.4 for further information.

5.4.2.4. Engine stop via CAN

An engine stop can also be initiated via SAE J1939 CAN message PropB04 (“EssEngStopFlag”). CPC4 demands an engine stop via CAN as long as the signal „engine stop“ is present. The signal has to remain present until the engine stops. As long as the engine speed does not fall below the value 50 1/min, the injection is released again upon the withdrawal of the demand „engine stop“ and the engine continues running. For further information on the PropB04 CAN message refer to chapter 5.4.1.2 (“Engine Start via CPC4 and MCM in Series (hardwired and CAN)”).

Inputs:
- SAE J1939 Signal: “PropB04”,
  Byte 1, Bit 1,2, “EssEngStopFlag”
- SAE J1939 Signal: “PropB04”,
  Byte 8, Bit 1..4, “MessageCounter”
- SAE J1939 Signal: “PropB04”,
  Byte 8, Bit 5..8, “MessageChecksum”

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
01	63	J1939 PropB04 Source Address	0	254	254		SAE J1939 Source Address PropB04 message (PropB4), 0..254=signal, 255=snv

Outputs:
- Engine stop request on MCM2 (transmitting zero torque quantity via engine CAN)

5.5. Cruise Control

The cruise control is generally enabled via parameter 15/25 (“CC Function Stat”) which has to be set to “1=Cruise Control”. Now it is possible to activate the CC via the input pin 1/14 (“CruiseControl on/off”). After this step it is activated by actuating the input pins 1/16 (“CruiseControl res/accel”) or 1/12 (“CruiseControl set/coast”), provided that the current vehicle speed exceeds a minimum value. This speed can be set via parameter 15/09 (“Min Cruise Set Speed low”).

If pin 1/12 (“CruiseControl set/coast”) is used to start the cruise control the nominal value is set to the actual vehicle speed value whereas, if pin 1/16 (“CruiseControl res/accel”) is used, the cruise control resumes the cruise control function if it was formerly set to standby. If the CC wasn’t set to standby

and is started anew the input pin 1/16 (“CruiseControl res/accel”) works exactly like pin 1/12 (“CruiseControl set/coast”).

Reliable validation of input switches (toggling required)

The parameters 15/01 (“Clutch Switch Toggle Required”), 15/06 (“Master Switch Toggle Required”) and 15/10 (“Service Switch Toggle Required”) provide a few (optional) conditions that have to be met, in case they were enabled, before the cruise control can be activated:

- Driveline State (Clutch switch) must have been toggled (parameter 15/01, “Clutch Switch Toggle Required”)
- Pin 1/14 (“CruiseControl on/off”) must have been toggled (parameter 15/06, “Master Switch Toggle Required”)
- Service Brake must have been toggled (parameter 15/10, “Service Switch Toggle Required”)

When the cruise control is active, the nominal speed can be reduced or increased gradually by momentarily toggling the switch “CruiseControl res/accel“ (pin 1/16) respectively “CruiseControl set/coast” (pin 1/12). Holding instead of toggling the related switch will reduce/increase the step size via a ramp. The cruise control is deactivated if the brake or clutch pedal is actuated. Through the proper parameterization of parameter 15/04 (“Disable CC On Drive Train Open”) it is possible to drop out of the CC when an open drivetrain (“out-of-gear”) is detected.

Additionally there are different circumstances were the CPC4 deactivates the cruise control e. g. due to safety reasons for example if the CPC4 detects an excessive deceleration of the vehicle and many additional situations.

ABS System required

To operate the cruise control the CPC4 require a ABS system (receiving the J1939 CAN message EBC1 PGN 61441, SPN 563 “Anti-Lock Braking (ABS) Active” from SA Par 01/01 “ABS Source Address SAE J1939” default value “11 / 0xB”). The parameter 15/81 (“CC Deact Error ABS”) defines if an ABS error causes the cruise control to drop out. If the vehicle is not using any ABS-functionality it is necessary to set this parameter to “0=disable”.

Vehicle Set-Speed adjustment

To adjust the set speed of cruise control there are two different options to operate (parameter 15/19, “CC Set Speed Mode”):

- Step-Ramp-Mode (default)

In Step-Ramp-Mode it is necessary for the driver to use a display because if he, for example actuates the CC+ switch, the cruise control increases the CC set speed in certain increments and shows the value on said display even if the actual vehicle speed won’t keep up due to vehicle inertia. If now the CC+ switch is released, the new CC set speed will be set to the displayed value and the cruise control will continue to accelerate the vehicle till the new set speed is reached.

- Continuous-Ramp-Mode

In Continuous-Ramp-Mode if the driver actuates e. g. the CC+ switch the cruise control will begin to increase the CC set speed and thereby the vehicle speed. If the driver now releases the CC+ switch, the cruise control stops this incrementation and the acceleration of the vehicle at once and the new CC set speed equals the actual vehicle speed.

Automatic resumption of cruise control

With the „auto resume“ function enabled, the cruise control will not be deactivated when the clutch pedal is actuated. Instead it is set to standby mode and resumed after the circumstances defined in parameter 15/05 (“Enable Cruise Auto Resume”) are met. The following table shows the available options depending on the built-in transmission type:

Value	Parameter 15/05 (“Enable Cruise Auto Resume”)	Description
0	disable	
1	enable automatic cruise resume function after clutch has been released once	Manual transmission
2	release clutch twice	Manual transmission (not synchronized)
3	Resume AMT style	Automated transmission

It is communicated to the MCM2, if during the cruise control operation the accelerator pedal or the remote accelerator pedal (if present) or the SAE J1939 demands a torque which is higher than the torque currently demanded by the cruise control. As a result, the vehicle is accelerated with the current nominal speed, until the torque demanded by the cruise control becomes the determining torque again.

Automated transmission

If cruise control is used in combination with automated transmission the parameter 48/168 (“Mechanical Transmission Type”) have set to “3=automatic transmission”.

Diagnostics:
- Binary Value: 2/1, Cruise Control Set/Coast
- Binary Value: 2/2, Cruise Control Resume/Accel
- Binary Value: 2/3, Cruise Control Enable
- Binary Value: 2/4, Cruise Control Pause
- Binary Value: 4/4, Cruise Control Status
- Analog Value 48, Cruise Control Deactivate Status

Inputs (via hardwired pins):
- Pin 1/14, DI_FLEX_04, “CruiseControl on/off “
- Pin 1/12, DI_FLEX_03, “CruiseControl set/coast”
- Pin 1/16, DI_FLEX_06, “CruiseControl res/accel”
- Pin 3/18, DI_FLEX_22, “Misc (Temposet)” : Enable Tempo Set **or**
- Pin 4/13, DI_FLEX_19, “Misc (Temposet)” : Enable Tempo Set

Inputs (via CAN):
- SAE J1939 Signal: PGN 65265, “Cruise Control/Vehicle Speed 1” (CCVS1), SPN 596, “Cruise Control Enable Switch”
- SAE J1939 Signal: PGN 65265, “Cruise Control/Vehicle Speed 1” (CCVS1), SPN 599, “Cruise Control Set Switch”
- SAE J1939 Signal: PGN 65265, “Cruise Control/Vehicle Speed 1” (CCVS1), SPN 600, “Cruise Control Coast (Decelerate) Switch”
- SAE J1939 Signal: PGN 65265, “Cruise Control/Vehicle Speed 1” (CCVS1), SPN 601, “Cruise Control Resume Switch”
- SAE J1939 Signal: PGN 65265, “Cruise Control/Vehicle Speed 1” (CCVS1), SPN 602, “Cruise Control Accelerate Switch”
- SAE J1939 Signal: “PropB06”, Byte 1, Bit 3, 4, “LimIdleModeSwitch” : (“Temposet”)

With the below mentioned parameter 01/44 (“ J1939 SPN1716 Mode”) it is possible to allow the cruise control operation while a third-party retarder is active (parameter set to “0”) resulting in the cc moving the vehicle against the retarder! If at all, this function should only be used for test purposes!

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
01	44	J1939 SPN1716 Mode	0	1	1		Mode witch Retarder Request should be use (SPN1716 or 520) and allow CC operation during Transmission Retarder is active 0=allow CC operation during J1939 TransRetarder is active and use SPN 520,

PGR	No.	Parameter	min	max	default	unit	description
							1=not allow CC operation during J1939 TransRetarder is active and use SPN 1716
10	02	Cruise Control Enable Eng Brk	0	1	1		Enable Engine Brakes on Cruise Control 0=disable, 1=enable automatic engine brake operation with cruise control
13	22	CC ON OFF Switch Config	0	3	0		Source CC On/Off Switch for CruiseControl Mode 0=hardwired, 1=Ccvs1 from Source Address #1, 2=Ccvs1 from Source Address #2, 3=Ccvs1 from Source Address #3
13	23	CC Pause Switch Config	0	14	0		Source CC pause switch CC 0=hardwired, 1=Ccvs1 from Source Address #1, 2=Ccvs1 from Source Address #2, 3=Ccvs1 from Source Address #3, 4=Ccvs1 from SA1# or SA#2, 5=Ccvs1 from SA2# or SA#3, 6=Ccvs1 from SA1# or SA#3, 7=Ccvs1 from SA1# or SA#2 or SA#3, 8=Ccvs1 from SA#1 or hardwired, 9=Ccvs1 from SA#2 or hardwired, 10=Ccvs1 from SA#3 or hardwired, 11=Ccvs1 from SA1# or SA#2 or hardwired, 12=Ccvs1 from SA2# or SA#3 or hardwired, 13=Ccvs1 from SA1# or SA#3 or hardwired, 14=Ccvs1 from SA1# or SA#2 or SA#3 or hardwired
13	24	CC Set Cst Res Accel Sw Config	0	3	0		Source CC set/reset switch for CruiseControl Mode, only for Set-switch, ccminus-switch and ccplus-switch 0=hardwired, 1=Ccvs1 from Source Address #1, 2=Ccvs1 from Source Address #2, 3=Ccvs1 from Source Address #3
13	25	Clutch Switch Config	0	7	0		Source and configuration clutch switch(es) info 0=no clutch switch, 1=1 Clutch Switch, 2=2 Clutch Switch, 3=Ccvs1 from source address #1, 4=Ccvs1 from source address #2, 5=Ccvs1 from source address #3, 6=ETC1, 7=1 Clutch switch, clutch info via PTCan
13	28	Park Brake Switch Config	0	3	0		Source EBM switch (hardwired or from J1939) 0=hardwired, 1=info from J1939 (muxed), 2=Info from LIN, 255=not available
13	29	Service Brake Switch Config	0	5	0		Source service brake switch (hardwired or from J1939) 0=hardwired, 1=Ccvs1 from Source Address #1, 2=Ccvs1 from Source Address #2, 3=Ccvs1 from Source Address #3 4=Ebc1 (SPN 1121), 5=J1939 PROP6 (T4PP Cab only)
15	01	Clutch Switch Toggle Required	0	1	1		Driveline State must have toggled once before CC can be activated 0=no toggle required, 1=toggle required before CC operation possible
15	04	Disable CC On Drive Train Open	0	255	0		if enabled, Cruise Control is disabled when out of gear is detected. 0=disabled, 1=enabled, 255=SNA
15	05	Enable Cruise Auto Resume	0	3	3		Enable Cruise Auto Resume 0=disable, 1=enable automatic cruise resume function after clutch has been released once, 2=release clutch twice, 3=Resume AMT style
15	06	Master Switch Toggle Required	0	1	1		Master Switch Toggle Required 0=no toggle required,

PGR	No.	Parameter	min	max	default	unit	description
							1=toggle required before CC operation possible
15	09	Min Cruise Set Speed low	15	125	15	km/h	minimum activation speed speed for vehicles with ATC 30..250=signal, 255=snv
15	10	Service Brake Toggle Required	0	1	1		Service Brake Toggle Required 0=no toggle required, 1=toggle required before CC operation possible
15	19	CC Set Speed Mode	0	255	0		Step Ramp - driver uses a display to capture the set speed shown on a driver display.Engine-Vehicle ramps up-down to the speed. Continuous - set speed is captured when the switch is released. 0=Step-Ramp-Mode, 1=Continuous-Ramp-Mode, 255=SNA
15	23	Switch Variant	0	255	0		CC HMI-Switches, Variant A - SFTP (Set/Plus:Resume/Minus), Variant B - NAFTA (Resume/Plus:Set/Minus) 0=Variant A, 1=Variant B, 255=SNA
15	24	HMI Concept Mode	0	255	0		CC HMI-Concept-Mode, Variant A - SFTP, Variant B - NAFTA, Note: Adapt Parameter 15/23 Switch Variant (cdi_p_Cc.CcSwitchVarSel_u8) 0=Variant A, 1=Variant B, 255=SNA
15	25	CC Function Stat	0	3	0		Cruise Control CC / Adaptive Cruise Control ACC / Adaptive Cruise Control Plus / ACCP CAN available 0=not available, 1=Cruise Control, 2=adaptive CC, 3=adaptive CC+
15	26	CC Brake Mode available	0	1	1		Cruise control brake function available 0=not available, 1=available
15	54	Norm Hyst Vspeed	0	250	2		Default hysteresis if no cc band switch is installed or any hysteresis error occur 0..50000=signal, 65535=snv
15	62	CC Deact by Retarder Switch	0	2	0		Paramter to switch off Cc when Retarder Switch is activated, 0=do not switch off CC, 1=switch off CC, 2=switch off CC if lever is actuated and switched back to 0, 3=snv
15	81	CC Deact Error ABS	0	255	1		If enabled, ABS error will drop out Cruise Control 0=disable, 1=enable, 255=inactive
15	82	CC Hyst Variant	0	255	3		Hystesis concept: A = continuous and store, B = continuous wihtout store, C = CC Band Switch, D = Single hysteresis 0=Variant A, 1=Variant B, 2=Variant C, 3=Variant D, 255=inactive
48	168	Mechanical Transmission Type	0	255	0		Mechanical type of built in transmission. (Mechanical Transmission Type) 0=not used, 1=unsynchronized gearbox, 2=synchronized gearbox, 3=automatic transmission, 255=SNA

Remark: The ACC functionality is not supported!

Outputs:
- Pin 3/08, DO_HP_FLEX_02, “Misc (CcLimiterLamp)” : CC Limiter Active Lamp (with ECE-R89)
- Pin 4/02, DO_LP_LS_04, “Misc (Tier4LimiterActiveLamp)” : CC Limiter Active Lamp (with ECE-R89)
- SAE J1939 Signal: “PropB09”, Byte 3, Bit 1..4, “CruiseCtrlFunctionModeStat”
- SAE J1939 Signal: “PropB09”, Byte 3, Bit 5, 6, “CruiseCrtlLimActvnStat”
- SAE J1939 Signal: “PropB09”, Byte 1, Bit 1, 8, “DispCruiseCtrlSetSpeed”
- SAE J1939 Signal: “PropB0A”, Byte 4, Bit 7, 8, “CCLimLampReq”
- SAE J1939 Signal: “PropB09”, Byte 4, Bit 3, 4, “LimOverSpeedStat”

Parameterization examples

Example cruise control basic functions (with hardwired pins):
- Connect Pin 1/14, DI_FLEX_04, “CruiseControl on/off “
- Connect Pin 1/12, DI_FLEX_03, “CruiseControl set/coast”
- Connect Pin 1/16, DI_FLEX_06, “CruiseControl res/accel”

- Set Par 15/25 (“CC Function Stat”) to “1=Cruise Control”.
- Set Par 15/23 (“Switch Variant”) to “1=Variant B”
- Set Par 15/24 (“HMI Concept Mode”) to “1=Variant B”
- Set Par 15/61 (“CC Deact by Brake Pedal”) to “1=switch off CC”

- Precondition: Toggle Clutch Switch, CC Master Switch (on/off), Service Brake

- For diagnosis check “Binary Value: 2/3, Cruise Control Enable”
- For diagnosis check “Binary Value: 2/1, Cruise Control Set/Coast”
- For diagnosis check “Binary Value: 2/2, Cruise Control Resume/Accel”
- For diagnosis check “Binary Value: 4/4, Cruise Control Status”
- For diagnosis check “Analog Value 48, Cruise Control Deactivate Status”

Example cruise control basic functions (with CAN interface):
- Send SAE J1939 Signal: PGN 65265, “Cruise Control/Vehicle Speed 1” (CCVS1), SPN 596, “Cruise Control Enable Switch” with SA:” “23 / 0x17”
- Send SAE J1939 Signal: PGN 65265, “Cruise Control/Vehicle Speed 1” (CCVS1), SPN 599, “Cruise Control Set Switch” with SA:” “23 / 0x17”
- Send SAE J1939 Signal: PGN 65265, “Cruise Control/Vehicle Speed 1” (CCVS1), SPN 600, “Cruise Control Coast (Decelerate) Switch” with SA:” “23 / 0x17”
- Send SAE J1939 Signal: PGN 65265, “Cruise Control/Vehicle Speed 1” (CCVS1), SPN 601, “Cruise Control Resume Switch” with SA:” “23 / 0x17”
- Send SAE J1939 Signal: PGN 65265, “Cruise Control/Vehicle Speed 1” (CCVS1), SPN 602, “Cruise Control Accelerate Switch” with SA:” “23 / 0x17”

- Set Par 01/4 (“CC1 Source Address SAE J1939”) default: “23 / 0x17”
- Set Par 13/22 (“CC ON OFF Switch Config”) “1=Ccvs1 from Source Address #1”
- Set Par 13/24 (“CC Set Cst Res Accel Sw Config”) “1=Ccvs1 from Source Address #1”
- Set Par 15/25 (“CC Function Stat”) to “1=Cruise Control”.
- Set Par 15/23 (“Switch Variant”) to “1=Variant B”
- Set Par 15/24 (“HMI Concept Mode”) to “1=Variant B”
- Set Par 15/61 (“CC Deact by Brake Pedal”) to “1=switch off CC”

- Precondition: Toggle Clutch Switch, CC Master Switch (on/off), Service Brake

- For diagnosis check “Binary Value: 2/3, Cruise Control Enable”
- For diagnosis check “Binary Value: 2/1, Cruise Control Set/Coast”
- For diagnosis check “Binary Value: 2/2, Cruise Control Resume/Accel”
- For diagnosis check “Binary Value: 4/4, Cruise Control Status”
- For diagnosis check “Analog Value 48, Cruise Control Deactivate Status”

5.5.1. Cruise Control with Engine Brake

For proper functionality of this feature it is mandatory to change the below mentioned parameters to convenient values. With the set default values, the desired functions won’t work in an appropriate way!

In the driving mode a cruise control operation can be activated via switches and tip switches in the instrument panel (see chapter 5.3).

Vehicle overspeed based

The CC accelerates the vehicle till its speed reaches the preset speed. If now, the vehicle is accelerated further, due to e. g. downhill drive, and its speed exceeds certain thresholds defined in the parameters 10/22 (“Low Eng Brk Min Cruise RSL Spd”), 10/23 (“Low Eng Brk Max Cruise RSL Spd”), 10/28 (“Med Eng Brk Min Cruise RSL Spd”), 10/29 (“Med Eng Brk Max Cruise RSL Spd”), 10/34 (“Hi Eng Brk Min Cruise RSL Spd”) and 10/35 (“Hi Eng Brk Max Cruise RSL Spd”) the engine brake is activated to slow the vehicle down. The used engine brake level is chosen according to the difference between actual vehicle speed and preset CC speed. The following table shows the recommended settings for a torque interface based cruise control:

Parameter	Name	Setting
15/82	CC Hyst Variant	Variant D (= 3)
15/54	Norm Hyst Vspeed	2 km/h
10/02	Cruise Control Enable Eng Brk	1

In the cruise control operating mode the CPC4 authorizes an additional activation of the engine brake, if the set speed is exceeded during downhill driving. The cut-in and cut-off speeds (threshold values) for the engine brakes are divided into the stages low, medium and high.
The parameter 10/02 (“Cruise Control Enable Eng Brk”) enables the possibility for the cruise control to use the engine brakes to decelerate the vehicle.

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
10	02	Cruise Control Enable Eng Brk	0	1	1		Enable Engine Brakes on Cruise Control 0=disable, 1=enable automatic engine brake operation with cruise control
10	23	Low Eng Brk Max Cruise RSL Spd	0	48	1	km/h	CC / RSL vehicle-over-speed for engine brake stage 1 activation 0..6144=signal
10	28	Med Eng Brk Min Cruise RSL Spd	0	48	0	km/h	CC / RSL vehicle-over-speed for engine brake stage 2 de-activation 0..6144=signal
10	29	Med Eng Brk Max Cruise RSL Spd	0	48	1	km/h	CC / RSL vehicle-over-speed for engine brake stage 2 activation 0..6144=signal
10	34	Hi Eng Brk Min Cruise RSL Spd	0	48	0	km/h	CC / RSL vehicle-over-speed for engine brake stage 3 de-activation 0..6144=signal
10	35	Hi Eng Brk Max Cruise RSL Spd	0	48	1	km/h	CC / RSL vehicle-over-speed for engine brake stage 3 activation 0..6144=signal

Note:
1.) This RSL-EBM parameter values are differential to the EBM threshold parameters of the cruise control in the mode “overspeed based” activation of engine brakes.
2.) As mentioned at the beginning of the chapter, with the values as they are set by default, the maximum engine brake level will always be activated, if the threshold of 1 km/h is exceeded

and lead to toggling of engine brake activation. Therefore the values have to be changed for proper function.

The differential speed in parameter 10/23 has to be exceeded, so that the engine brake stage 1 is activated during the cruise control mode. It is switched off again, if the speed falls below the differential speed in parameter 10/22.
The differential speed in parameter 10/29 has to be exceeded, so that the engine brake stage 2 is activated during the cruise control mode. The engine brake is switched off again, if the speed falls below the differential speed in parameter 10/28.
The differential speed in parameter 10/35 has to be exceeded, so that the engine brake stage 3 is activated during the cruise control mode. It is switched off again, if the speed falls below the differential speed in parameter 10/34.

Value changes of the parameters 10/22, 10/23, 10/28, 10/29, 10/34, 10/35 of the engine brake must only be performed by specially trained personnel or after consultation with the engine manufacturer.

5.5.2. Cruise Control when using a Stalk Switch

It is possible to combine the CPC4 with a stalk switch for cruise control and engine brake operation. According to the number of engine brake stages different types of stalk switches are available. For more information refer to chapter 5.9.2.2. The last 4 digits of the Part-No determine the color of the stalk switch:

Stalk switch	Part-No.
cruise control, limiter, engine brake (1 stage)	A 008 545 10 24 – 5B21
cruise control, limiter, engine brake (2 stages)	A 008 545 09 24 – 5B21
cruise control, limiter, engine brake (2+3 stages)	A 008 545 16 24 – 5B21

Stalk switch color	Part-No.
grey	– 5B21
trition grey	– 5C38
deep dark grey	– 7C45

For connecting the stalk switch, Pins 1/12 (DI_FLEX_03) and 1/16 (DI_FLEX_06) are used conventionally for Cruise Control set/coast and Cruise Control res/accel respectively. Pin 1/14 (DI_FLEX_04), marked as Cruise Control on/off is used as a Cruise Control Pause Switch, compare the following figures too. For safety reasons each cruise control operation leads to an inverted signal on the Quit output of the stalk switch, which have to be connected to pin 1/01 (DI_FLEX_01).

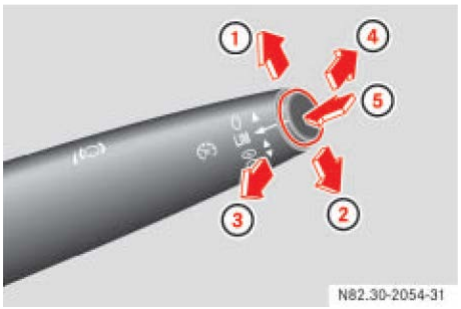


Fig 5.8: Stalk switch functions (top view)

	Nr.		Function
–	1	–	CC pause
–	2	–	Engine Brake, up to five steps
–	3	–	CC+, increase speed, resume (DI_FLEX_06)
–	4	–	CC-, decrease speed, set (DI_FLEX_03)
–	5	–	Temposet/Limiter (Di_FLEX_19 or DI_FLEX_22)

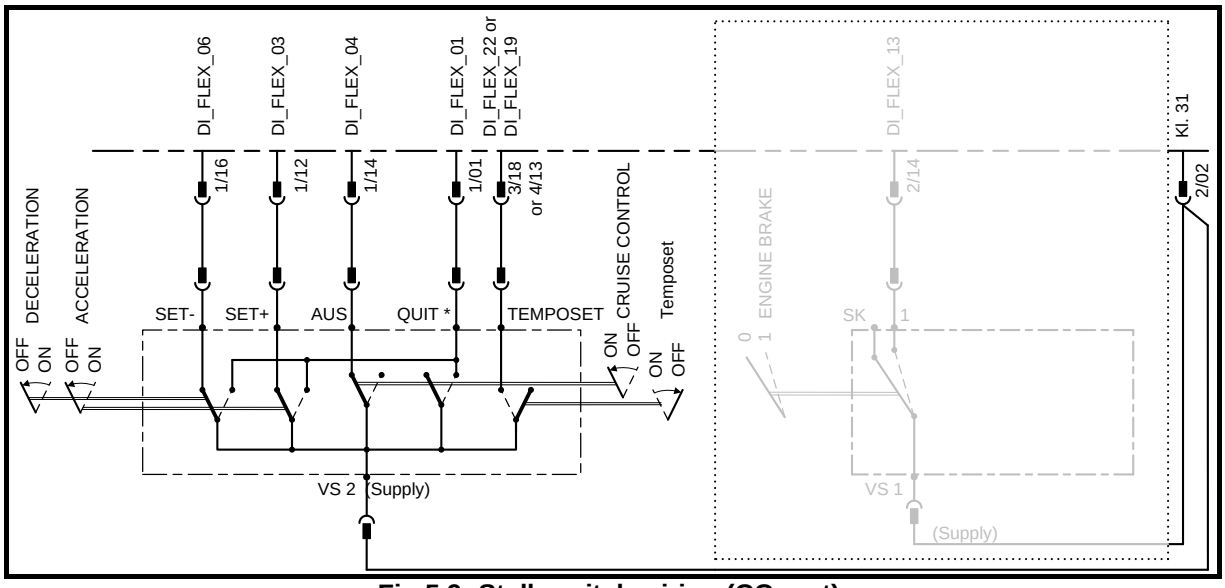


Fig 5.9: Stalk switch wiring (CC part)

If using the stalk switch it is not possible to increase the idle speed by using the CC+ and CC- switches via "Idle speed adjustment" (parameter 03/19).

The stalk switch offers also the possibility for engine brake operation with two stages EngineBrakeLow and EngineBrakeMedium, but no Limiter function. Please refer to chapter 5.9.2.2. for details.

Inputs:

- Pin 1/01, DI_FLEX_01, "Misc (Evobus Cruise Control Lever Quit signal)" : Evobus Cruise Control Lever Quit signal
- Pin 1/14, DI_FLEX_04, "CruiseControl on/off "
- Pin 1/12, DI_FLEX_03, "CruiseControl set/coast"
- Pin 1/16, DI_FLEX_06, "CruiseControl res/accel"
- Pin 2/14, DI_FLEX_13, "Misc (EngineBrakeLow)" : Evobus retarder lever stage1
- Pin 2/15, DI_FLEX_14, "Misc (EngineBrakeMedium)" : Evobus retarder lever stage2
- Pin 3/18, DI_FLEX_22, "Misc (Temposet)" : Enable Tempo Set **or**
- Pin 4/13, DI_FLEX_19, "Misc (Temposet)" : Enable Tempo Set

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
01	04	CC1 Source Address SAE J1939	0	255	23		SAE J1939 Source Address #1 CCVS1 (PGN 65265). 0..255=signal
01	05	CC2 Source Address SAE J1939	0	255	33		SAE J1939 Source Address #2 CCVS1 (PGN 65265). 0..255=signal
01	06	CC3 Source Address SAE J1939	0	255	49		SAE J1939 Source Address #3 CCVS1 (PGN 65265). 0..255=signal
13	01	1 01 DI Selection	0	4	0		Configuration input DiFlex01 0=disable, 1=enable Dual Speed Axle, 2=enable transmission retarder input, 3=clutch switch, 4=Evobus Cruise Control Lever Quit signal
13	12	3 18 DI Selection	0	12	0		CPC2: Configuration input Sfp02 DSF1 # CPC4: DIFLEX_22 0=disable, 1=enable ABS input, 2=enable transmission retarder input, 3=enable tempo set, 4=enable grid heater detection, 5=switchable torque demand, 6=drive on super structure, 7=throttle inhibit super structure, 8=split select,

PGR	No.	Parameter	min	max	default	unit	description
							9=FUSO Engine brake stage 2 cancel switch, 10=DPF Inhibit Regen Switch, 11=PTO2stat, 12=engine shutdown/Tier4 inducement override
13	17	4 13 DI Selection	0	11	0		Configuration input DiFlex19 DSF0 0=disable, 1=enable ABS input, 2=enable transmission retarder input, 3=enable tempo set, 4=enable grid heater detection, 5=switchable torque demand, 6=drive on super structure, 7=throttle inhibit super structure, 8=split select, 9=FUSO Engine brake stage 2 cancel switch, 10=DPF Inhibit Regen Switch, 11=engine shutdown/Tier4 inducement override
13	22	CC ON OFF Switch Config	0	3	0		Source CC On/Off Switch for CruiseControl Mode 0=hardwired, 1=Ccvs1 from Source Address #1, 2=Ccvs1 from Source Address #2, 3=Ccvs1 from Source Address #3
13	24	CC Set Cst Res Accel Sw Config	0	3	0		Source CC set/reset switch for CruiseControl Mode, only for Set-switch, ccminus-switch and ccplus-switch 0=hardwired, 1=Ccvs1 from Source Address #1, 2=Ccvs1 from Source Address #2, 3=Ccvs1 from Source Address #3
13	34	Evobus Cc Lever Enable	0	1	0		Evobus cruise control enable cal 0=disable, 1=enable

Attention! Regarding Parameters 13/22 (“CC ON OFF Switch Config”) and 13/24 (“CC Set Cst Res Accel Sw Config”): The “Ccvs1-3” mentioned in the parameter description are not the CAN messages of the same name, but the source addresses of these messages. They have to be set with the parameters 01/04 (“CC1 Source Address SAE J1939”), 01/05 (“CC2 Source Address SAE J1939”) and 01/06 (“CC3 Source Address SAE J1939”). It is also important that these three parameters are configured with different values.

Parameterization examples

Activation of stalk switch cruise control functionality

- Set Parameter 13/34 (“Evobus Cc Lever Enable”) to 1 (“enable”)
- Set Parameter 13/01 (“1 01 DI Selection”) to 4 (“Evobus Cruise Control Lever Quit signal”)
- Set Parameter 13/12 (“3 18 DI Selection”) to 3 (“enable temposet”) **or**
- Set Parameter 13/17 (“4 13 DI Selection”) to 3 (“enable temposet”)

5.5.3. CC–/Limiter Mode (Temposet / ECE-R89)

Attention! Regarding the ECE-R89 licensing it is mandatory that the activity of the CC Limiter as well as the exceeding of the temposet-limit-speed are signaled to the driver e.g. via a “CC limiter lamp”. Additionally the overspeed has to be shown on a display.

Temposet function means a variable, adjustable vehicle speed limitation. CPC4 provides the possibility to limit the vehicle speed to the current vehicle speed. To change between the CC - and Limiter- mode it is possible to use the temposet switch of hardwired pin or stalk switch.

A temposet function can be assigned to the digital inputs DI_FLEX_22 or DI_FLEX_19 by configuration. Caution: Since DI_FLEX_22 and DI_FLEX_19 are multiple assigned pins, only one pin can be assigned to this function! Buttons, not switches, are to be used in this case.

Speed limiting to the current value of the driving speed is activated by toggling the CC set switch when the LIMITER mode is active (selected by default parameter or via temposet switch).
The temposet function is deactivated by toggling the temposet switch once again and change back to CC mode or via kickdown of the accelerator pedal.

Pressing the accelerator pedal into the kick-down position deactivates an active temposet function, and the vehicle can be accelerated, exceeding the set temposet-limit-speed. The following figure shows the signal pattern of the CC Limiter lamp request considering the ECE-R89 functionality in combination with different events regarding the vehicle speed.

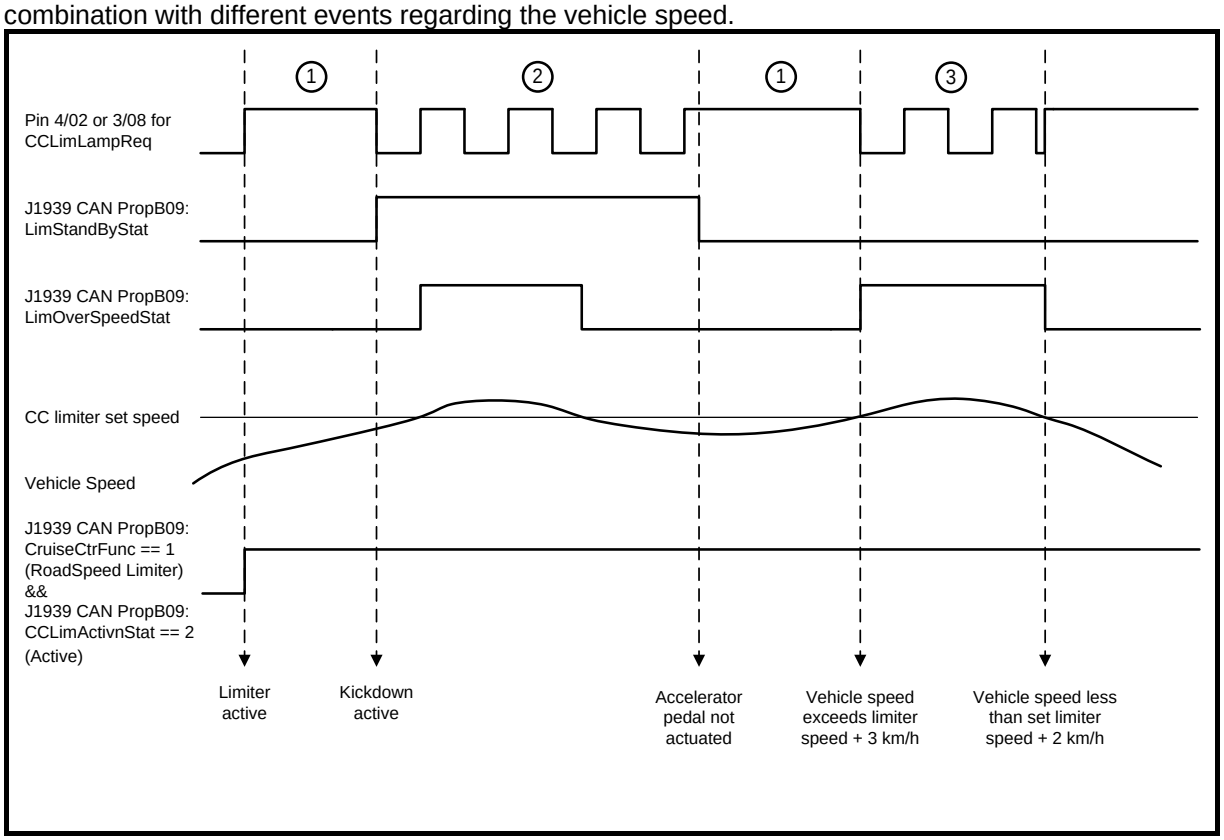


Fig 5.10: Signal pattern of the CC Limiter lamp considering the ECE-R89 functionality

The figure shows the 3 different use cases for the ECE-R89 functionality. The initial condition of every case is that the cc limiter is active:

Use case	Cc limiter	Vehicle speed	LimStandByStat	LimOverSpeedStat	Cc limiter lamp
1	active	<= cc limiter speed	0	0	Solid
2	active	> cc limiter speed (because of kickdown)	1	1	Flashing
3	active	> cc limiter speed (downhill / despite of EBR at full load)	0	1	Flashing

Remark: The above mentioned case 3 will be available in software release R33!
The Temposet (LIMITER mode) function is only allowed with an accelerator pedal with a kickdown signal and the ECE-R 89 confirmed display concept.

Explanation of the parameter options concerning the cc limiter lamp output pins (parameter 35/07, “3 08 DO Selection” and 35/14, “4 02 DO Selection”):

CC limiter active lamp	à is used without the ECE-R89 functionality, the lamp is glowing solid when the cc limiter is active
CC limiter active lamp with ECE-R89	à the cc limiter lamp is glowing solid when the limiter is active and flashing when the cc limiter speed is exceeded (regardless if this is caused by kick-down or downhill driving; this parameterization equals the functionality in figure Fig 5.10)
CC limiter active lamp ECE-R89 only	à the cc limiter lamp is glowing solid when the cc limiter speed is exceeded (regardless if this is caused by kick-down or downhill driving) otherwise the lamp is inactive

Inputs:

- Pin 3/18, DI_FLEX_22, “Misc (Temposet)” : Enable Tempo Set **or**
- Pin 4/13, DI_FLEX_19, “Misc (Temposet) : Enable Tempo Set”
- SAE J1939 Signal: “PropB06”,
  Byte 1, Bit 3, 4, “LimIdleModeSwitch” : (“Temposet”)
- SAE J1939 Signal: PGN 65265, “Cruise Control/Vehicle Speed 1” (CCVS1),
  SPN 599, “Cruise Control Set Switch”
- SAE J1939 Signal: PGN 65265, “Cruise Control/Vehicle Speed 1” (CCVS1),
  SPN 600, “Cruise Control Coast (Decelerate) Switch”
- SAE J1939 Signal: PGN 65265, “Cruise Control/Vehicle Speed 1” (CCVS1),
  SPN 601, “Cruise Control Resume Switch”
- SAE J1939 Signal: PGN 65265, “Cruise Control/Vehicle Speed 1” (CCVS1),
  SPN 602, “Cruise Control Accelerate Switch”
- SAE J1939 Signal: PGN 65265, “Cruise Control/Vehicle Speed 1” (CCVS1),
  SPN 596, “Cruise Control Enable Switch”
- SAE J1939 Signal: PGN 65265, “Cruise Control/Vehicle Speed 1” (CCVS1),
  SPN 86, “Cruise Control Set Speed”

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
13	12	3 18 DI Selection	0	12	0		CPC2: Configuration input Sfp02 DSF1 # CPC4: DIFLEX_22 0=disable, 1=enable ABS input, 2=enable transmission retarder input, 3=enable tempo set, 4=enable grid heater detection, 5=switchable torque demand, 6=drive on super structure, 7=throttle inhibit super structure, 8=split select, 9=FUSO Engine brake stage 2 cancel switch, 10=DPF Inhibit Regen Switch, 11=PTO2stat, 12=engine shutdown/Tier4 inducement override
13	17	4 13 DI Selection	0	11	0		Configuration input DiFlex19 DSF0 0=disable, 1=enable ABS input, 2=enable transmission retarder input, 3=enable tempo set, 4=enable grid heater detection, 5=switchable torque demand, 6=drive on super structure, 7=throttle inhibit super structure, 8=split select, 9=FUSO Engine brake stage 2 cancel switch, 10=DPF Inhibit Regen Switch, 11=engine shutdown/Tier4 inducement override
35	07	3 08 DO Selection	0	12	0		usage of Output DoHpFlex02 0=disabled, 1=exhaust brake only,

							2=exhaust and decompression brake via single valve, 3=not used, 4=not used, 5=not used, 6=not used, 7=expansion tank pressure control valve 2, 8=CC Limiter Active Lamp, 9=CC Limiter Active Lamp with ECE R89, 10=CC Limiter Lamp ECE R89 only, 11=Tier4 Limitation Active Lamp, 12=EU6 Limitation Active Lamp
35	14	4 02 DO Selection	0	5	4		usage of Output DoLpLs04 0=disabled, 1=CC Limiter Active Lamp, 2=CC Limiter Active Lamp with ECE R89, 3=CC Limiter Lamp ECE R89 only, 4=Tier4 Limitation Active Lamp, 5=EU6 Limitation Active Lamp
35	26	3 08 DO Fault Detection					0=Fault Detection Off, 1=Diag, 2=PulseWhenOff, 3=PulseWhenOff + Diag, 4=PulseWhenOn, 5=PulseWhenOn + Diag, 6=PulseWhenOn + PulseWhenOff, 7=PulseWhenOn + PulseWhenOff + Diag, 8=SetFault, 9=SetFault + Diag, 10= SetFault + PulseWhenOff, 11=SetFault + PulseWhenOff + Diag, 12=SetFault + PulseWhenOn, 13=SetFault + PulseWhenOn + Diag, 14=SetFault + PulseWhenOn + PulseWhenOff, 15=SetFault + PulseWhenOn + PulseWhenOff + Diag
35	33	4 02 DO Fault Detection					0=Fault Detection Off, 1=Diag, 2=PulseWhenOff, 3=PulseWhenOff + Diag, 4=PulseWhenOn, 5=PulseWhenOn + Diag, 6=PulseWhenOn + PulseWhenOff, 7=PulseWhenOn + PulseWhenOff + Diag, 8=SetFault, 9=SetFault + Diag, 10= SetFault + PulseWhenOff, 11=SetFault + PulseWhenOff + Diag, 12=SetFault + PulseWhenOn, 13=SetFault + PulseWhenOn + Diag, 14=SetFault + PulseWhenOn + PulseWhenOff, 15=SetFault + PulseWhenOn + PulseWhenOff + Diag
35	43	3 08 DO Configuration	0	2	0		Binary Output Configuration, lp: low power, ls: low side, hs: high side, flex: switching either to ls or hs 0=disabled, 1=Low side only, 2=High side only
35	50	4 02 DO Configuration	0	1	1		binary Output Configuration, lp: low power, ls: low side 0=disabled, 1=enabled

Outputs:

- Pin 3/08, DO_HP_FLEX_02, “Misc (CcLimiterLamp)” : CC Limiter Active Lamp (with ECE-R89)
- Pin 4/02, DO_LP_LS_04, “Misc (Tier4LimiterActiveLamp)” : CC Limiter Active Lamp (with ECE-R89)
- SAE J1939 Signal: “PropB09”,
  Byte 3, Bit 1..4, “CruiseCtrlFunctionModeStat”

– SAE J1939 Signal: “PropB09”,
Byte 3, Bit 5, 6, “CruiseCrtlLimActvnStat”
– SAE J1939 Signal: “PropB09”,
Byte 1, Bit 1, 8, “DispCruiseCtrlSetSpeed”
– SAE J1939 Signal: “PropB0A”,
Byte 4, Bit 7, 8, “CCLimLampReq”
– SAE J1939 Signal: “PropB09”,
Byte 4, Bit 3, 4, “LimOverSpeedStat”

Parameterization examples

Separated lamps on hardwired pins for limiter active indication and the ECE-R89 display concept:

· Example description: Two different lamps for “Limiter active” indication and the above mentioned “ECE-R89” lamp concept:
– Set Parameter 35/07 (“3 08 DO Selection”) to 8 (“CC Limiter Active Lamp”)
– Set Parameter 35/26 (“3 08 DO Fault Detection”) to 9 (“SetFault + Diag”)
– Set Parameter 35/43 (“3 08 DO Configuration”) to e. g. 1 (“Low side only”)
– Set Parameter 35/14 (“4 02 DO Selection”) to 3 (“CC Limiter Lamp ECE R89 only”)
– Set Parameter 35/33 (“4 02 DO Fault Detection”) to 9 (“SetFault + Diag”)
– Set Parameter 35/50 (“4 02 DO Configuration”) to 1 (“enabled”)

Alternative: Combined lamp on hardwired pins for limiter active indication and the ECE-R89 display concept:

· Example description: One lamp for both “Limiter active” indication and the above mentioned “ECE-R89” lamp concept:
– Set Parameter 35/07 (“3 08 DO Selection”) to 9 (“CC Limiter Active Lamp with ECE R89”)
– Set Parameter 35/26 (“3 08 DO Fault Detection”) to 9 (“SetFault + Diag”)
– Set Parameter 35/43 (“3 08 DO Configuration”) to e. g. 1 (“Low side only”)

5.6. Idle Speed Adjustment

In the CPC there is the possibility to increase temporarily the idle engine speed if the vehicle is in standstill and the transmission is in neutral (e.g. expedite to fill up the air tank). This function is operated via the Cruise-control switches.

Preconditions:
1. The transmission has to be in neutral. Therefore a check of the current gear is done through the evaluation of the appropriate hardwired pin (Pin 4/16, “Transmission Neutral”) or the J1939 CAN message ETC2 (“TransCurrentGear” = 0 and “TransSelectedGear” = 0), independent of used transmission type.
2. The cruise-control switch (Pin 1/14) has to be in the off-position.
3. Adapted parameter “Max Adjusted Idle Speed”.

Operation: The idle speed can be adjusted via the cruise-control switch CC+ and CC- (Pin 1/16 and Pin 1/12) or via J1939 CAN. Increasing with CC+ and decreasing with CC-. Further modifications of the function „idle speed adjustment“ can be realized with the parameter group 03:

Parameters:

PGR	No.	Parameter	min	max	Default	unit	description
03	19	Max Adjusted Idle Speed	0	1000	500	1/min	Maximum Adjusted Idle Speed 0..32000=signal
03	29	Ramp Rate Adjusted Idle Spd	0	8192	100	(1/min)/s	Desired Idle Speed Ramp Rate Inc./Dec. 0..65535=signal
03	31	Single Step Adjusted Idle Spd	0	100	16	1/min	Desired Idle Speed Single Step Inc./Dec. 0..800=signal

5.7. Accelerator Pedal/Remote Accelerator Pedal

Risk of accident!

The accelerator pedal is a safety-relevant function for commercial vehicles. Incorrect wiring or parameter setting can seriously affect the reactions of the accelerator pedal. This can cause the driver's requirements (e.g. throttle back) not to be implemented properly or only after a delay.

Changes to the accelerator pedal parameters must only be performed by specially trained personnel or after consultation with the engine manufacturer! Normally it is not neccesary to change the accelerator pedal parameters apart from their first application, when the pedal was installed into the vehicle!

Only use accelerator pedals approved by Daimler. The use of any other accelerator pedal could lead to malfunctions.
Due to limited availability of the VDO accelerator pedals the usage of the ABE accelerator pedal is strongly recommended (see table below).
It is very important to choose the appropriate parameter values according to the used accelerator pedal type. If the wrong values are set, the vehicle may react in a different way than expected, resulting in a heightened level of accident risk!

Part-Numbers for recommended accelerator pedals:

Accelerator pedal	Part-No.
ABE (PWM)	A 960 300 00 04
Assembly Group consists of: – ABE (PWM) AP – VDO adapter plate[1]	A 943 300 02 04 see ABE (PWM) A 943 301 00 02

[1] For a replacement of a VDO accelerator pedal with an ABE pedal in an existing vehicle. This accelerator pedal consists of an ABE pedal and an additional adapter compatible with the VDO pedal socket.

The CPC4 supports analog accelerator pedals as well as accelerator pedals with PWM interface. An analog accelerator pedal is e. g. the Williams accelerator pedal, a PWM accelerator pedal is e. g. the AB-Elektronik accelerator pedal.

In case of a PWM accelerator pedal, the driver's requirements (accelerator pedal position) are identified by two electronic modules working independently of each other and transmitted via two PWM signals with mutually opposite pulse duty cycles.
The evaluation electronics check the plausibility of the accelerator pedal signals and generate fault codes in the event of deviations.
In case of an analog accelerator pedal, the driver's requirements are transmitted in the form of an analog voltage; additional switches are for the safety check.

If the CPC4 detects a fault during the accelerator pedal evaluation, limp-home routines are activated, which enables driving only with restricted functions and reduced security routines. This is indicated to the driver by the fault lamp. Driving in such a limp-home routine is only allowed for authorized drivers and not recommended.

5.7.1. ABE Accelerator Pedal (PWM)

The table below figure Fig 5.11 shows the parameters and how they are to set to use the ABE PWM Accelerator Pedal. In addition an automatic learning process for the static minimal- /maximal-positions of the AP is done.

– Dynamic Min-Position: The dynamic minimal position used for each channel is determined as maximum learned minimal position and the smallest previously recognized value since startup.

- AP-Span: For each channel, the dynamic AP-Span is the difference between learned maximum and dynamic minimum position. In contrast the static AP-Span is the difference between learned maximum and learned minimum position. The static span always used for the normalization of raw-positions.
- Idle-Point: A calibrated range above the dynamic minimum position the idle-point is assumed. Hereby the calibration is treated as normalized value.

Diagnostics:

- Analog Value: PWM Pedal Signal GAS1 (chapter 6.3.1)
- Analog Value: PWM Pedal Signal GAS2 (chapter 6.3.1)
- Analog Value: Accelerator Pedal Position (chapter 6.3.1)
- Analog Value: Calculated Pedal Torque (chapter 6.3.1)

Inputs for ABE-PWM AP:

- Pin 1/03, SFP_05, “FFG1” : PWM FFG, path 1
- Pin 1/06, SFP_06, “FFG2” : PWM FFG, path 2
- Pin 1/07, SFP_08, “FFG2+” : PWM power supply, path 2
- Pin 1/08, SFP_07, “FFG1+” : PWM power supply, path 1
- Pin 1/04, DO_LP_LS_02, “ThrottleSensorGround” : Ground accelerator pedal

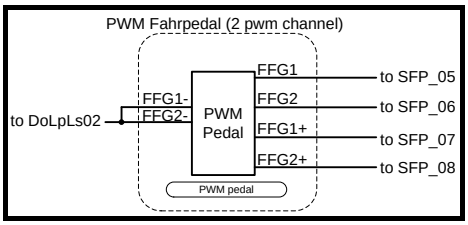


Fig 5.11: Example PWM Dual-Channel AP

The following figure (Fig 5.12) shows the position of the individual pins on the side of the AP sensor.

Pin-No.	Pin assignment (sensor)
1	FFG1-
2	FFG1
3	FFG2-
4	FFG2
5	FFG1+
6	FFG2+

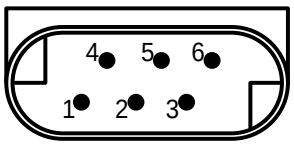


Fig 5.12: Schematic pin numeration (ABE sensor front view)

Parameterization for ABE-PWM AP:

PGR	No.	Parameter	min	max	Default (ABE-PWM AP)	unit	description
11	4	Accel Pedal Type	0	7	7		Accelerator Pedal Type, Item 1, FP 0=none, 1=PWM throttle (VDO), 4=Analog Accelerator Pedal with IVS, 6=Williams Dual-Channel Analog Pedal, 7=ABE Pedal (PWM)
11	32	Dual-Chan AP Idle Range Max Perc Chan1	0	30	20	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Idle-Range upper threshold of channel1 0..9600=signal
11	33	Dual-Chan AP Idle Range Min Perc Chan1	0	30	18	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal)

PGR	No.	Parameter	min	max	Default (ABE-PWM AP)	unit	description
							Idle-Range lower threshold of channel1 0..9600=signal
11	34	Dual-Chan AP Wide Range Max Perc Chan1	0	100	74	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Wide-Range upper threshold of channel1 0..32000=signal
11	37	Full Load range percent	0	100	2	%	AP full load range 0..32000=signal
11	39	idle range percent	0	100	0,8	%	PWM/FUSO-Analog AP: AP idle range 0..32000=signal
11	43	kick down off percent	-100	100	24	%	Dual Channel AP: Position-Threshold for Kickdown Off -32000..32000=signal
11	44	kick down on percent	-100	100	21	%	Dual Channel AP: Position-Threshold for Kickdown On -32000..32000=signal
11	62	Dual-Chan AP Wide Range Min Perc Chan1	0	100	72	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Wide-Range lower threshold of channel1 0..32000=signal
11	63	Dual-Chan AP Idle Range Min Perc Chan2	0	30	18	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Idle-Range lower threshold of channel2 0..9600=signal
11	64	Dual-Chan AP Idle Range Max Perc Chan2	0	30	20	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Idle-Range upper threshold of channel2 0..9600=signal
11	65	Dual-Chan AP Wide Range Max Perc Chan2	0	100	74	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Wide-Range upper threshold of channel2 0..32000=signal
11	66	Dual-Chan AP Wide Range Min Perc Chan2	0	100	72	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Wide-Range lower threshold of channel2 0..32000=signal
11	71	Dual Chan Span Max Perc	0	100	5	%	Dual Channel Pedals: Max allowed difference between channel1 and channel2 0..32000=signal

5.7.2. VDO Accelerator Pedal (PWM) - Discontinued

Due to limited availability of the VDO accelerator pedals the usage of the ABE (PWM) pedal is strongly recommended (check chapters 5.7.1).

In case of a PWM accelerator pedal the driver's requirements (accelerator pedal position) are identified by two electronic modules working independently of each other and transmitted via two PWM signals (FFG1, FFG2) with mutually opposite pulse duty cycles. The evaluation electronics check the plausibility of the accelerator pedal signals and generate fault codes in the event of deviations.
A diagnosis tool is required to teach-in the accelerator pedal characteristic values. Concerning the CPC4, teach-in routines for the accelerator pedal characteristic values are available in the Xentry diagnostic software.

Diagnostics:

- Analog Value: PWM Pedal Signal GAS1 (chapter 6.3.1)
- Analog Value: PWM Pedal Signal GAS2 (chapter 6.3.1)
- Analog Value: Accelerator Pedal Position (chapter 6.3.1)
- Analog Value: Calculated Pedal Torque (chapter 6.3.1)

Inputs:

- Pin 1/03, SFP_05, "FFG1" : PWM FFG, path 1

- Pin 1/06, SFP_06, “FFG2” : PWM FFG, path 2
- Pin 1/07, SFP_08, “FFG2+” : PWM power supply, path 2
- Pin 1/08, SFP_07, “FFG1+” : PWM power supply, path 1
- Pin 1/04, DO_LP_LS_02, “ThrottleSensorGround” : Ground accelerator pedal

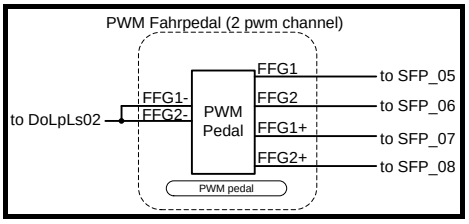


Fig 5.13: Example PWM accelerator pedal

Parameterization for VDO Accelerator Pedal (PWM):

PGR	No.	Parameter	min	max	Default (VDO-PWM AP)	unit	description
11	4	Accel Pedal Type	0	7	1		Accelerator Pedal Type, Item 1, FP 0=none, 1=PWM throttle (VDO), 4=Analog Accelerator Pedal with IVS, 6=Williams Dual-Channel Analog Pedal, 7=ABE Pedal (PWM)
11	32	Dual-Chan AP Idle Range Max Perc Chan1	0	30	22	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Idle-Range upper threshold of channel1 0..9600=signal
11	33	Dual-Chan AP Idle Range Min Perc Chan1	0	30	16	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Idle-Range lower threshold of channel1 0..9600=signal
11	34	Dual-Chan AP Wide Range Max Perc Chan1	0	100	78	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Wide-Range upper threshold of channel1 0..32000=signal
11	37	Full Load range percent	0	100	11	%	AP full load range 0..32000=signal
11	39	idle range percent	0	100	1	%	PWM/FUSO-Analog AP: AP idle range 0..32000=signal
11	43	kick down off percent	-100	100	14	%	Dual Channel AP: Position-Threshold for Kickdown Off -32000..32000=signal
11	44	kick down on percent	-100	100	4	%	Dual Channel AP: Position-Threshold for Kickdown On -32000..32000=signal
11	62	Dual-Chan AP Wide Range Min Perc Chan1	0	100	71	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Wide-Range lower threshold of channel1 0..32000=signal
11	63	Dual-Chan AP Idle Range Min Perc Chan2	0	30	16	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Idle-Range lower threshold of channel2 0..9600=signal
11	64	Dual-Chan AP Idle Range Max Perc Chan2	0	30	22	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Idle-Range upper threshold of channel2 0..9600=signal
11	65	Dual-Chan AP Wide Range Max Perc Chan2	0	100	78	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Wide-Range upper threshold of channel2 0..32000=signal
11	66	Dual-Chan AP Wide Range Min Perc Chan2	0	100	71	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Wide-Range lower threshold of channel2 0..32000=signal

PGR	No.	Parameter	min	max	Default (VDO-PWM AP)	unit	description
11	71	Dual Chan Span Max Perc	0	100	5	%	Dual Channel Pedals: Max allowed difference between channel1 and channel2 0..32000=signal

5.7.3. Dual Channel Analog Accelerator Pedal

Risk of accident!

Changes to the parameters of this group must only be performed by specially trained personnel or after consultation with the engine manufacturer. Normally it is not neccesary to change these parameters apart from their first application after the AP is installed into the vehicle!

It is very important to choose the appropriate parameter values according to the used accelerator pedal type. If the wrong values are set, the vehicle may react in a different way than expected, resulting in a heightened level of accident risk!

The figure below (Fig 5.14) shows a schematic example of a dual channel analog accelerator pedal output signal in order to clarify the meaning of the different parameters necessary to operate such an AP.

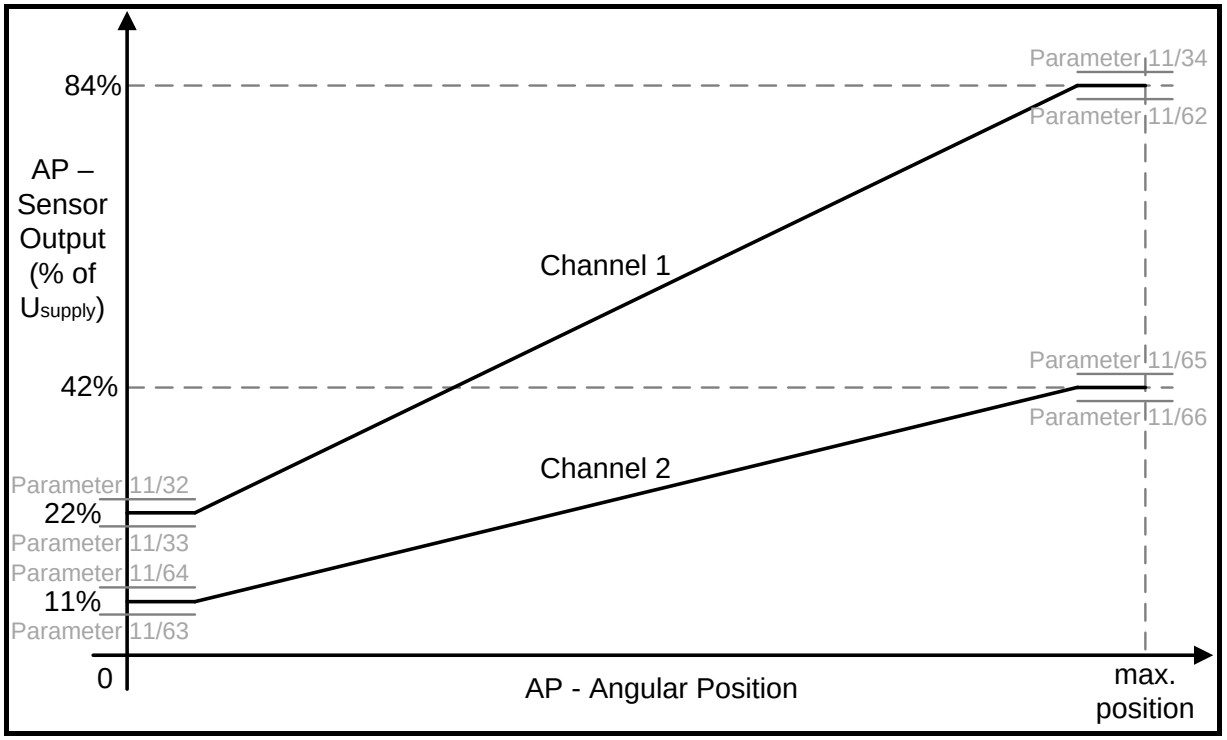


Fig 5.14: Schematic of the dual channel analog AP output signal / parameter configuration

The parameters mentioned in the figure above shall equal a signalrange within +/- 3% of the actual value. Example:
AP Sensor output at AP angular position 0 = 22% * Usupply: Parameter 11/32 (“Dual-Chan AP Idle Range Max Perc Chan1”) shall be set to 25% and parameter 11/33 (“Dual-Chan AP Idle Range Min Perc Chan1”) shall be set to 19%.

Interface description for the analog accelerator pedal
The stated voltage thresholds regarding the channel signal voltages in the following table can be configurated via the parameters 11/67 (“Dual Chan1 Sig Diag Max Volt”), 11/67 (“Dual Chan2 Sig Diag Max Volt”), 11/67 (“Dual Chan1 Sig Diag Min Volt”) and 11/67 (“Dual Chan2 Sig Diag Min Volt”).

Voltage	Analog AP
Supply voltage	$4.5V < U_{sup} < 5.4V$
Signal voltage channel 1	$0.75V < U_{sig1} < 4.55\ V$
Signal voltage channel 2	$0.35V < U_{sig2} < 2.5\ V$

Fault detection

Above and below the stated voltage thresholds different fault memory entries are set (see chapter 6.2):

Voltage	SPN	FMI	DTC	Description
$U_{sup} > 5.5V$	3510	4	B60D04	Accelerator Pedal Supply Voltage Circuit shorted to GND
$U_{sup} < 4.5V$	3510	7	B60D07	Accelerator Pedal Supply Voltage Circuit shorted to Ubat
$0.35V > U_{sig2} > 2.5V$	2623	8	3F0A08	2-Channel Accelerator Pedal Signal 2 Missing (failed high or low)
$0.75 > U_{sig1} > 4.55V$	91	8	5B0008	2-Channel Accelerator Pedal Signal 1 Missing (failed high or low)

The following figures and tables show parameterization examples (based on Williams accelerator pedals) for dual channel analog APs. These are available:

a) with kickdown and
b) without kickdown.

Diagnostics:

- Analog Value: Supply Analog Accelerator Pedal (chapter 6.3.1)
- Analog Value: Accelerator Pedal Position (chapter 6.3.1)
- Analog Value: Accelerator Pedal Raw Sensor Value (chapter 6.3.1)
- Analog Value: Supply Analog Remote Pedal (chapter 6.3.1)
- Analog Value: Analog Remote Pedal (chapter 6.3.1)
- Analog Value: Calculated Pedal Torque (chapter 6.3.1)

a) Inputs for Dual Channel Analog AP Williams with Kickdown:

- Pin 1/04, DO_LP_LS_02, “ThrottleSensorGround” : 3/B, Throttle Sensor Ground (“Channel 1”)
- Pin 1/07, SFP_08, “FFG2+” : 2/A, Throttle Sensor (“Channel 1”)
- Pin 1/08, SFP_07, “FFG1+” : 1/C, Throttle Sensor Power (“Channel 1”)
- Pin 3/02, AGND, “SensorGround” : 6/E, Sensor Ground (“Channel 2”)
- Pin 3/03, SUP_5V, “SensorSupply” : 4/D, Sensor Supply (“Channel 2”)
- Pin 4/14, AI_03 : 5/F, Throttle Sensor (“Channel 2”)

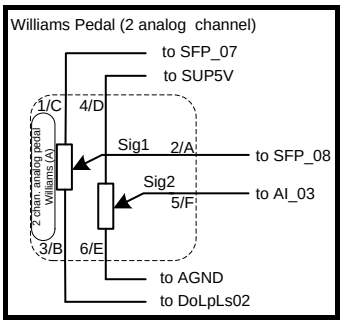


Fig 5.15: Example Dual Channel Analog (Williams) AP

Parameterization for Dual Channel Analog AP Williams with Kickdown:

PGR	No.	Parameter	min	max	Default (Williams Analog AP w/ KD)	unit	description
11	4	Accel Pedal Type	0	7	6		Accelerator Pedal Type, Item 1, FP 0=none, 1=PWM throttle (VDO), 4=Analog Accelerator Pedal with IVS, 6=Williams Dual-Channel Analog Pedal, 7=ABE Pedal (PWM)
11	32	Dual-Chan AP Idle Range Max Perc Chan1	0	30	25	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal)

PGR	No.	Parameter	min	max	Default (Williams Analog AP w/ KD)	unit	description
							Idle-Range upper threshold of channel1 0..9600=signal
11	33	Dual-Chan AP Idle Range Min Perc Chan1	0	30	19	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Idle-Range lower threshold of channel1 0..9600=signal
11	34	Dual-Chan AP Wide Range Max Perc Chan1	0	100	74,4	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Wide-Range upper threshold of channel1 0..32000=signal
11	37	Full Load range percent	0	100	2	%	AP full load range. 0..32000=signal
11	39	idle range percent	0	100	0,8	%	PWM/FUSO-Analog AP: AP idle range 0..32000=signal
11	43	kick down off percent	-100	100	22	%	Dual Channel AP: Position-Threshold for Kickdown Off. -32000..32000=signal
11	44	kick down on percent	-100	100	19	%	Dual Channel AP: Position-Threshold for Kickdown On. -32000..32000=signal
11	62	Dual-Chan AP Wide Range Min Perc Chan1	0	100	68,4	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Wide-Range lower threshold of channel1 0..32000=signal
11	63	Dual-Chan AP Idle Range Min Perc Chan2	0	30	8	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Idle-Range lower threshold of channel2 0..9600=signal
11	64	Dual-Chan AP Idle Range Max Perc Chan2	0	30	14	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Idle-Range upper threshold of channel2 0..9600=signal
11	65	Dual-Chan AP Wide Range Max Perc Chan2	0	100	38,7	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Wide-Range upper threshold of channel2 0..32000=signal
11	66	Dual-Chan AP Wide Range Min Perc Chan2	0	100	32,7	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Wide-Range lower threshold of channel2 0..32000=signal
11	67	Dual Chan1 Sig Diag Max Volt	0	250	4,55	V	Dual Channel Analog Pedal: chan1 max signal voltage (Type 6 (Williams) only) 0..50000=signal, 65535=snv
11	68	Dual Chan2 Sig Diag Max Volt	0	250	2,5	V	Dual Channel Analog Pedal: chan2 max signal voltage (Type 6 (Williams) only) 0..50000=signal, 65535=snv
11	69	Dual Chan1 Sig Diag Min Volt	0	250	0,75	V	Dual Channel Analog Pedal: chan1 min signal voltage (Type 6 (Williams) only) 0..50000=signal, 65535=snv
11	70	Dual Chan2 Sig Diag Min Volt	0	250	0,35	V	Dual Channel Analog Pedal: chan2 min signal voltage (Type 6 (Williams) only) 0..50000=signal, 65535=snv
11	71	Dual Chan Span Max Perc	0	100	5	%	Dual Channel Pedals: Max allowed difference between channel1 and channel2 0..32000=signal
13	64	4 14 AI_03 Selection	0	2	1		analog input three configuration, AI_03 0=no sensor, 1=Dual channel analog throttle, channel 2 signal, 2=Expansion tank pressure sensor

In addition to the accelerator pedal specific parameterization values the analog input pin 4/14 has to be configured to function as throttle sensor signal input:

– Set parameter 13/64 (“4 14 AI_03 Selection”) to 1 (“Dual channel analog throttle, channel 2 signal”);

b) Inputs for Dual Channel Analog AP Williams without Kickdown:

The pinout listings and the circuit diagram are equal to the accelerator pedals with kickdown. Therefore the following parameterization example only lists the parameters which are to be set deviate from the configuration mentioned under item a).

Parameterization for Dual Channel Analog AP Williams without Kickdown:

PGR	No.	Parameter	min	max	Default (Williams Analog AP w/o KD)	unit	description
11	34	Dual-Chan AP Wide Range Max Perc Chan1	0	100	87	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Wide-Range upper threshold of channel1. 0..32000=signal
11	43	kick down off percent	-100	100	0	%	Dual Channel AP: Position-Threshold for Kickdown Off. -32000..32000=signal
11	44	kick down on percent	-100	100	0	%	Dual Channel AP: Position-Threshold for Kickdown On.-32000..32000=signal
11	62	Dual-Chan AP Wide Range Min Perc Chan1	0	100	81	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Wide-Range lower threshold of channel10..32000=signal
11	65	Dual-Chan AP Wide Range Max Perc Chan2	0	100	45	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Wide-Range upper threshold of channel2 0..32000=signal
11	66	Dual-Chan AP Wide Range Min Perc Chan2	0	100	39	%	Dual Channel AP Pedal Type 5 (FUSO) Type 6 (Williams), Type 1+7 (Pwm-Pedal) Wide-Range lower threshold of channel2 0..32000=signal

5.7.4. Analog Accelerator Pedal with IVS

It is very important to choose the appropriate parameter values according to the used accelerator pedal type. If the wrong values are set, the vehicle may react in a different way than expected, resulting in a heightened level of accident risk!

Only analog accelerator pedals with two idle validation switch (IVS) are supported. Those switches are interconnected as an alteration switch, which means one of them is closed the other is open and vice versa. As shown in the figure below, when the AP is not actuated, the IVS1 is closed. The IVS1 is a break contact that is closed as long as the accelerator pedal is in idle position. The IVS2 is a make contact that is opened when the AP is in idle and closes when the AP is actuated.

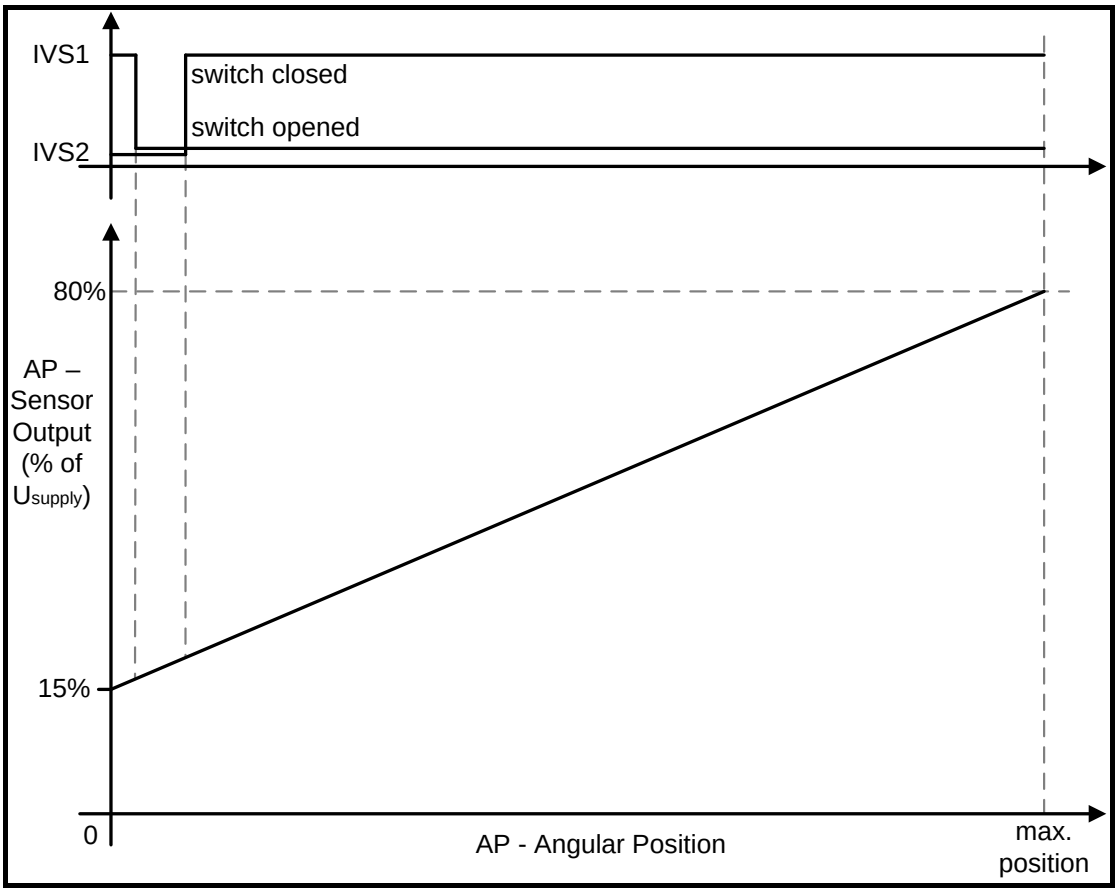


Fig 5.16: Schematic of the output signal of an Analog AP with IVS

Remark: It is recommended to place the switching thresholds of the IVSs in the front range of the analog APs output characteristic as shown in Fig 5.16 to utilize the APs pedal travel as good as possible. Valid values are e. g.: between 15% and 20% of the supply voltage.

Interface description for the analog accelerator pedal with IVS

	Analog AP with IVS
Supply voltage	$4.5V < U_{sup} < 5.4V$
Signal voltage	$0.25V < U_{sig} < 4.5\ V$
IVS voltage	GND / Pull-Up to U_{Bat}

The sensors internal resistor should have a value of 2.5k ohms (end-to-end resistance).

Fault detection

Above and below the stated voltage thresholds different fault memory entries are set (see chapter 6.2):

Voltage	SPN	FMI	DTC	Description
$U_{sup} > 5.5V$	3510	7	B60D07	Accelerator Pedal Supply Voltage Circuit Failed High
$U_{sup} < 4.5V$	3510	4	B60D04	Accelerator Pedal Supply Voltage Circuit Failed Low
$U_{sig} > 4.5\ V$	91	0	5B0000	Accelerator Pedal Circuit shorted to Ubat
$U_{sig} < 0.25\ V$	91	4	5B0004	Accelerator Pedal Circuit shorted to GND

The input pins 1/06 (SFP_06), 1/03 (SFP_05) and 3/02 (AGND) for the Idle Validation Switches are configured automatically via the parameter 11/04 (“Accel Pedal Type”). They are interconnected as an alteration switch, when one of them is closed the other is open and vice versa.

The following figures and tables show parameterization examples (based on Williams APs) for analog accelerator pedal:

Diagnostics:
- Binary Value: 6/3, Idle Validation Switch 1 (chapter 6.3.2)
- Binary Value: 6/4, Idle Validation Switch 2 (chapter 6.3.2)
- Analog Value: Supply Analog Accelerator Pedal (chapter 6.3.1)
- Analog Value: Accelerator Pedal Position (chapter 6.3.1)
- Analog Value: Accelerator Pedal Raw Sensor Value (chapter 6.3.1)
- Analog Value: Calculated Pedal Torque (chapter 6.3.1)

Inputs:
- Pin 1/03, SFP_05, “FFG1” : D, IVS2
- Pin 1/06, SFP_06, “FFG2” : E, IVS1
- Pin 1/07, SFP_08, “FFG2+” : A, Sig1
- Pin 1/08, SFP_07, “FFG1+” : C, Power
- Pin 1/04, DO_LP_LS_02, “ThrottleSensorGround”: B
- Battery Ground, “Ground” : F

Optional to pin 1/04, DO_LP_LS_02:
- Pin 1/05, DO_LP_LS_01, “Misc (AirFilterLamp)”

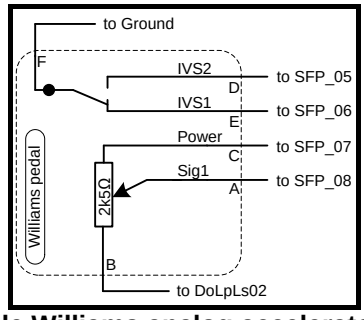


Fig 5.17: Example Williams analog accelerator pedal with IVS

Parameterization for Analog Accelerator Pedal with IVS (Williams):

PGR	No.	Parameter	min	max	Default (Williams Analog AP 1-ch w/ IVS)	unit	description
11	4	Accel Pedal Type	0	7	4		Accelerator Pedal Type, Item 1, FP 0=none, 1=PWM throttle (VDO), 4=Analog Accelerator Pedal with IVS, 6=Williams Dual-Channel Analog Pedal, 7=ABE Pedal (PWM)
11	37	Full Load range percent	0	100	2	%	AP full load range 0..32000=signal
11	39	idle range percent	0	100	1	%	PWM/FUSO-Analog AP: AP idle range 0..32000=signal

5.7.5. Remote Accelerator Pedal (hardwired pins or CAN)

Risk of accident!

Changes to the parameters of this group must only be performed by specially trained personnel or after consultation with the engine manufacturer. It is not normally necessary to change these parameters apart from their first application after the AP is installed into the vehicle!

Only analog remote accelerator pedals with at least one idle validation switch (IVS) are allowed! Therefore the use of IVS 2 is mandatory, but it is recommended to use remote APs with two idle validation switches. The remote accelerator pedal input pins are not suitable for the connection of the primary accelerator pedal.

Remote accelerator pedals can be used in two different versions. They are decribed in the following chapters:

a) Via hardwired pins **or**
b) Via J1939 CAN.

The idle validation switches work the same as described in chapter 5.7.4:
IVS1 is closed when the AP is in idle and opened when the AP is actuated;
IVS2 is opened when the AP is in idle and closed when the AP is actuated.

a) Analog Remote Accelerator Pedal via hardwired pins

To enable the analog remote accelerator pedal first the parameter 20/04 ("Remote Accelerator Enable") has to be set accordingly to the used AP (one or two IVS). Then, the input pin 2/08 must been configurated as "RemoteThrottleSelect" switch. If now this switch is actuated, the remote accelerator pedal is useable.

For information on the analog remote accelerator pedal interface and an example output characteristic of the AP refer to chapter 5.7.4.

Interface description for the analog remote accelerator pedal

	Analog Remote AP
Supply voltage	$4{,}5V < U_{sup} < 5{,}5V$
Signal voltage	$0{,}25V < U_{sig} < 4{,}5\ V$

Fault detection

Above and below the stated voltage thresholds different fault memory entries are set (see chapter 6.2):

Voltage	SPN	FMI	DTC	Description
$U_{sup} > 5{,}5V$	3511	3	B70D03	Remote Accelerator Pedal Supply Voltage circuit shorted to Ubat
$U_{sup} < 4{,}5V$	3511	4	B70D04	Remote Accelerator Pedal Supply Voltage circuit shorted to GND
$U_{sig} > 4{,}5V$	974	3	CE0303	Remote Accelerator Pedal Circuit shorted to Ubat
$U_{sig} < 0{,}25V$	974	4	CE0304	Remote Accelerator Pedal Circuit shorted to GND

According to the number of the IVSs the digital inputs DiFlex_10, DiFlex_12, DiFlex_13, DiFlex_14 and/or DiFlex_16 have to be parameterized correctly via the parameters 13/06 ("2 08 DI Selection"), 13/08 ("2 13 DI Selection"), 13/09 ("2 14 DI Selection"), 13/10 ("2 15 DI Selection") and 13/65 ("2 11 DI Selection"). If two IVSs are used, they are interconnected as an alteration switch, which means one of them is closed the other is open and vice versa. If a remote AP with only one IVS is used, only one of the above mentioned input pins is allowed to be parameterized as a Remote AP IVS.

It is necessary to consider if the remote AP IVS is connected to IVS1 or IVS2 input of the CPC4. If the IVS1-pins (2/14 or 2/11) are used, the pin must switch to ground when the pedal is actuated. For the IVS2-pins (2/13 or 2/15) the pin must switch to ground in idle position.

No external teach-in routine is needed for the remote accelerator pedal. After the switching-on, the maximum value is automatically adjusted.

Diagnostics:

- Binary Value: 4/3, Remote Accelerator Select Switch (chapter 6.3.2)
- Binary Value: 6/3, Idle Validation Switch 1 (chapter 6.3.2)
- Binary Value: 6/4, Idle Validation Switch 2 (chapter 6.3.2)
- Analog Value: Supply Analog Remote Pedal (chapter 6.3.1)
- Analog Value: Analog Remote Pedal (chapter 6.3.1)
- Analog Value: Accelerator Pedal Raw Sensor Value (chapter 6.3.1)
- Analog Value: Calculated Pedal Torque (chapter 6.3.1)

Inputs:

- Pin 2/08, DI_FLEX_16, “Remote Throttle Select”
- Pin 2/13, DI_FLEX_12, “Misc (RemAP IVS2)” : RemAP IVS2 **or**
- Pin 2/15, DI_FLEX_14, “Misc (EngineBrakeMedium)” : RemAP IVS2
- Pin 2/14, DI_FLEX_13, “Misc (EngineBrakeLow)” : RemAP IVS1 **or**
- Pin 2/11, DI_FLEX_10, Limiter1 : RemAP IVS1
- Pin 3/03, SUP_5V, “SensorSupply”: Supply of remote accelerator pedal
- Pin 3/04, AI_02, “RemoteThrottleSensor”: Signal remote accelerator pedal
- Battery Ground, “AGND” : Ground of remote accelerator pedal

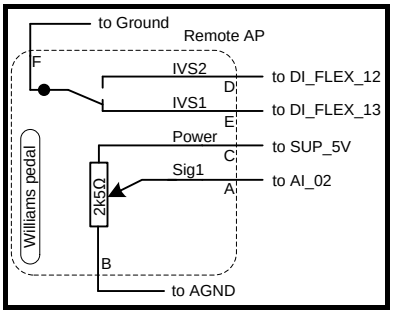


Fig 5.18: Example Remote accelerator pedal with IVS

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
13	06	2 08 DI Selection	0	3	0		Configuration input DiFlex16 0=disable, 1=Remote-Throttle enable, 2=Fast Engine Heat Up Switch, 3=Evobus retarder lever stage3
13	08	2 13 DI Selection	0	4	1		Configuration input DiFlex12 0=disable, 1=fan override switch, 2=Evobus retarder lever stage5, 3=RockOutMode, 4=RemAP IVS2
13	09	2 14 DI Selection	0	4	0		Configuration input DiFlex13 0=disable, 1=engine brake low, 2=Evobus retarder lever stage1, 3=CC hysteresis low, 4=RemAP IVS1
13	10	2 15 DI Selection	0	4	0		Configuration input DiFlex14 0=disable, 1=engine brake high, 2=Evobus retarder lever stage2, 3=CC hysteresis high, 4=RemAP IVS2
13	63	3 04 AI_02 Selection	0	2	0		analog input two configuration, AI_02 0=no sensor, 1=Remote throttle sensor, 2=Expansion tank pressure sensor
13	65	2 11 DI Selection	0	2	0		Configuration input DiFlex10 0=disable, 1=LIM1, 2=RemAP IVS1
20	04	Remote Accelerator Enable	0	3	0		Remote Accelerator Pedal Input Configuration 0=Remote AP disabled, 1=Remote AP without IVS (idle validation switches), 2=Remote AP with 1 IVS, 3=Remote AP with 2 IVS

Parameterization example:

Hardwired analog remote accelerator pedal with 2 IVS:

- Set Parameter 13/06 (“2 08 DI Selection”) to 1 (“Remote-Throttle enable”)
- Set Parameter 13/08 (“2 13 DI Selection”) to 4 (“RemAP IVS2”)
- Set Parameter 13/09 (“2 14 DI Selection”) to 4 (“RemAP IVS1”)
- Set Parameter 13/63 (“3 04 AI_02 Selection”) to 1 (“Remote throttle sensor”)
- Set Parameter 20/04 (“Remote Accelerator Enable”) to 3 (“Remote AP with 2 IVS”)
- Connect pin 3/02 + 3/03 + 3/04 with the remote throttle
- Connect pin 2/08 with ground for enable remote throttle

b) Analog Remote Accelerator Pedal via J1939 CAN

It is also possible to enable the remote AP via the CAN signal “Remote Accelerator Enable Switch” (SPN 969) in CAN message EBC1 (PGN 61441) and provide the remote accelerator pedal position via the CAN signal “Remote Accelerator Pedal Position” (SPN 974) in CAN message EBC2 (PGN 61443). It is mandatory to send the EBC1 message from the source address defined in parameter 01/42 (“J1939 Second Engine Address”), otherwise the signal will not be red.

Inputs:

- SAE J1939 Signal: PGN 61441, “Electronic Brake Controller 1” (EBC1),
  SPN 969, “Remote Accelerator Enable Switch”
- SAE J1939 Signal: PGN 61443, “Electronic Engine Controller 2” (EEC2),
  SPN 974, “Remote Accelerator Pedal Position”

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
01	42	J1939 Second Engine Address	0	255	2		ENG2 -RX (for special off highway function) 0..255=signal

Parameterization example:

Remote accelerator via J1939 CAN messages:

- Configure SAE J1939 EBC1 Source Address in parameter 01/42 (“J1939 Second Engine Address”) to 2 / 0x02 (default).
- Send EBC1 message with SPN 969 set to 1 to activate remote accelerator pedal from source 2/0x02.
- Send EEC2 message with SPN 974 set the remote accelerator pedal position to a value between 0-100%.

5.7.6. Throttle inhibit

The throttle inhibit function hinders the vehicle to accelerate any further through actuating the accelerator pedal and sets the maximum speed possible to idle speed. The digital input pin 01/17 (DI_FLEX_07) “Throttle inhibit switch” is used to activate the throttle inhibit function. It is for example possible to connect a door switch of a bus door to this input to prevent the bus from accelerating while the bus door is still open.

Additionally through the optional use of either input pin 3/18 (parameter 13/12, “3 18 DI Selection”) or input pin 4/13 (parameter 13/17, “4 13 DI Selection”) it is also possible to provide the throttle inhibit function for a super structure, e. g. a crane. In any case, the parameter 11/53 (“Throttle Inhibit Selection”) defines if the cabin, remote or both accelerator pedals are degraded.

Diagnostics:

- Analog Value: Analog Remote Pedal (chapter 6.3.1)
- Analog Value: Accelerator Pedal Position (chapter 6.3.1)
- Binary Value: 7/4, Throttle Inhibit (chapter 6.3.2)

Inputs:

– Pin 01/17, DI_FLEX_07, ”ThrottleInhibit” : Throttle Inhibit

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
11	53	Throttle Inhibit Selection	0	2	0		Accelerator Pedal inhibit mode 0=Cab and Remote Throttle, 1=Cab Throttle, 2=Remote Throttle
13	05	1 17 DI Selection	0	2	1		Configuration input DiFlex07 0=disable, 1=throttle inhibit, 2=Evobus retarder lever stage4
13	12	3 18 DI Selection	0	12	0		CPC2: Configuration input Sfp02 DSF1 # CPC4: DIFLEX_22 0=disable, 1=enable ABS input, 2=enable transmission retarder input, 3=enable tempo set, 4=enable grid heater detection, 5=switchable torque demand, 6=drive on super structure, 7=throttle inhibit super structure, 8=split select, 9=FUSO Engine brake stage 2 cancel switch, 10=DPF Inhibit Regen Switch, 11=PTO2stat, 12=engine shutdown/Tier4 inducement override
13	17	4 13 DI Selection	0	11	0		Configuration input DiFlex19 DSF0 0=disable, 1=enable ABS input, 2=enable transmission retarder input, 3=enable tempo set, 4=enable grid heater detection, 5=switchable torque demand, 6=drive on super structure, 7=throttle inhibit super structure, 8=split select, 9=FUSO Engine brake stage 2 cancel switch, 10=DPF Inhibit Regen Switch, 11=engine shutdown/Tier4 inducement override

5.8. Emission Related Functions

5.8.1. DAI System Overview (TIER4 / EURO VI)

Due to the emission regulations and the according certifications there are two different technologies used for the exhaust aftertreatment.

a) In case of the TIER4 variant an SCR-system
b) And in case of the EURO6 variant an SCR- with an additional DPF system.

The basic functionality of these systems is managed generally by the MCM2 and the ACM. The DAI System provides several kinds of DEF-tanks and liquid-sensors. In order to provide a liquid level in liters, the ACM must be parameterized with the relations between resistor values and liquid levels depending on the sensor type and on the actual shape of the tank.

Detailed information on this topic, a more precise description of the functionality and the used components are to be found in the installation guidelines.

5.8.2. HW Input-/Output - Parameter

Several indication lamps are provided to monitor the functionality of the DEF system and can be parameterized by the parameters shown in the tables below. This chapter shows a summary of the parameters necessary for these purposes.

Diagnostics:

- Binary Value: 8/2, DPF Regen Switch Status (chapter 6.3.2)
- Binary Value: 8/3, DPF Inhibit Switch Status (chapter 6.3.2)
- Binary Value: 9/1, Amber Warning Lamp (chapter 6.3.2)
- Binary Value: 9/2, Red Stop Lamp (chapter 6.3.2)
- Binary Value: 9/3, Malfunction Indicator Lamp (chapter 6.3.2)
- Binary Value: 9/4, DEF Level Low Lamp (chapter 6.3.2)
- Binary Value: 11/1, DPF Regeneration Lamp (chapter 6.3.2)
- Binary Value: 11/3, High Exhaust System Temperature Lamp (chapter 6.3.2)

Inputs:

- Pin 1/15, DI_FLEX_05, ”Tier4InducementOverride” : Shutdown Override

Used by TIER4 and EURO6

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
01	07	CM1 DPF Source Addr SAE J1939	0	255	49		SAE J1939 Source Address Cm1 for cyclic Dpf message, 0..255=signal
09	7	4 15 FPO_03 Selection	0	10	0		Configuration FPO_03 0=disabled, 1=throttle torque 10%..90%, 2=difference torque (extern load control), 3=throttle torque 90%..10%, 4=actual torque, 5=load torque (no idle torque for automatic transmission), 6=road speed, 7=demand speed, 8=demand speed CC+, 9=Urea Tank Level 10..90%, 10=FUSO Accelerator PWM output
09	13	4 15 FPO_03 Fault Detection	0	15	1		0=Fault Detection Off, 1=Diag, 2=PulseWhenOff, 3=PulseWhenOff + Diag, 4=PulseWhenOn, 5=PulseWhenOn + Diag, 6=PulseWhenOn + PulseWhenOff, 7=PulseWhenOn + PulseWhenOff + Diag, 8=SetFault, 9=SetFault + Diag, 10= SetFault + PulseWhenOff, 11=SetFault + PulseWhenOff + Diag, 12=SetFault + PulseWhenOn, 13=SetFault + PulseWhenOn + Diag, 14=SetFault + PulseWhenOn + PulseWhenOff, 15=SetFault + PulseWhenOn + PulseWhenOff + Diag
09	17	4 15 FPO_03 Output Configuration	0	2	0		FPO_03 output configuration 0=switched off, 1=switched to low side, 2=switched to high side
13	4	1 15 DI Selection	0	2	0		Configuration input DiFlex05 0=disable, 1=Shutdown override, 2=FUSO CC-Cancel
35	04	2 10 DO Selection	0	1	1		usage of Output Dolpflex03 0=disabled, 1=check engine lamp yellow
35	06	3 07 DO Selection	0	8	0		usage of Output DoHpFlex01 0=disabled, 1=decompression valve, 2=grid heater, 3=not used, 4=expansion tank pressure control valve 1, 5=Service Brake Request Lamp, 6=Urea Low Lamp, 7=TIER4 DEF Lamp,

PGR	No.	Parameter	min	max	default	unit	description
							8=EU6 Inducement Lamp
35	07	3 08 DO Selection	0	12	0		usage of Output DoHpFlex02 0=disabled, 1=exhaust brake only, 2=exhaust and decompression brake via single valve, 3=not used, 4=not used, 5=not used, 6=not used, 7=expansion tank pressure control valve 2, 8=CC Limiter Active Lamp, 9=CC Limiter Active Lamp with ECE R89, 10=CC Limiter Lamp ECE R89 only, 11=Tier4 Limitation Active Lamp, 12=EU6 Limitation Active Lamp
35	09	3 10 DO Selection	0	8	7		usage of Output DoLpFlex02 0=disabled, 1=air filter lamp, 2=not used, 3=not used, 4=not used, 5=Fuso retarder control 1, 6=Urea Low Lamp, 7=TIER4 DEF Lamp, 8=EU6 Inducement Lamp
35	11	3 16 DO Selection	0	2	1		usage of Output DoLpFlex05 0=disabled, 1=stop engine lamp red, 2=Buzzer
35	14	4 02 DO Selection	0	5	4		usage of Output DoLpLs04 0=disabled, 1=CC Limiter Active Lamp, 2=CC Limiter Active Lamp with ECE R89, 3=CC Limiter Lamp ECE R89 only, 4=Tier4 Limitation Active Lamp, 5=EU6 Limitation Active Lamp
35 35 35 35 35 35	23 25 26 28 30 33	2 10 DO Fault Detection 3 07 DO Fault Detection 3 08 DO Fault Detection 3 10 DO Fault Detection 3 16 DO Fault Detection 4 02 DO Fault Detection	0 0 0 0 0 0	15 15 15 15 15 15	9 1 1 9 9 9		0=Fault Detection Off, 1=Diag, 2=PulseWhenOff, 3=PulseWhenOff + Diag, 4=PulseWhenOn, 5=PulseWhenOn + Diag, 6=PulseWhenOn + PulseWhenOff, 7=PulseWhenOn + PulseWhenOff + Diag, 8=SetFault, 9=SetFault + Diag, 10= SetFault + PulseWhenOff, 11=SetFault + PulseWhenOff + Diag, 12=SetFault + PulseWhenOn, 13=SetFault + PulseWhenOn + Diag, 14=SetFault + PulseWhenOn + PulseWhenOff, 15=SetFault + PulseWhenOn + PulseWhenOff + Diag
35 35 35 35 35	41 42 43 45 47	2 10 DO Configuration 3 07 DO Configuration 3 08 DO Configuration 3 10 DO Configuration 3 16 DO Configuration	0 0 0 0 0	2 2 2 2 2	0 0 0 1 1		Binary Output Configuration, lp: low power, ls: low side, hs: high side, flex: switching either to ls or hs 0=disabled, 1=Low side only, 2=High side only
35	50	4 02 DO Configuration	0	1	1		binary Output Configuration, lp: low power, ls: low side 0=disabled, 1=enabled

TIER4 only

PGR	No.	Parameter	min	max	default	unit	description
35	13	4 01 DO Selection	0	1	1		usage of Output DoLpLs03 0=disabled,

							1=Buzzer
35	32	4 01 DO Fault Detection	0	15	9		0=Fault Detection Off, 1=Diag, 2=PulseWhenOff, 3=PulseWhenOff + Diag, 4=PulseWhenOn, 5=PulseWhenOn + Diag, 6=PulseWhenOn + PulseWhenOff, 7=PulseWhenOn + PulseWhenOff + Diag, 8=SetFault, 9=SetFault + Diag, 10= SetFault + PulseWhenOff, 11=SetFault + PulseWhenOff + Diag, 12=SetFault + PulseWhenOn, 13=SetFault + PulseWhenOn + Diag, 14=SetFault + PulseWhenOn + PulseWhenOff, 15=SetFault + PulseWhenOn + PulseWhenOff + Diag
35	49	4 01 DO Configuration	0	1	1		binary Output Configuration, lp: low power, ls: low side 0=disabled, 1=enabled

EURO6 only

PGR	No.	Parameter	min	max	default	unit	description
35	03	1 13 DO Selection	0	3	0		usage of Output DoLpFlex01 0=disabled, 1=MIL lamp, 2=Urea Low Lamp, 3=coolant temperature lamp
35	22	1 13 DO Fault Detection	0	15	1		0=Fault Detection Off, 1=Diag, 2=PulseWhenOff, 3=PulseWhenOff + Diag, 4=PulseWhenOn, 5=PulseWhenOn + Diag, 6=PulseWhenOn + PulseWhenOff, 7=PulseWhenOn + PulseWhenOff + Diag, 8=SetFault, 9=SetFault + Diag, 10= SetFault + PulseWhenOff, 11=SetFault + PulseWhenOff + Diag, 12=SetFault + PulseWhenOn, 13=SetFault + PulseWhenOn + Diag, 14=SetFault + PulseWhenOn + PulseWhenOff, 15=SetFault + PulseWhenOn + PulseWhenOff + Diag
35	40	1 13 DO Configuration	0	2	0		Binary Output Configuration, lp: low power, ls: low side, hs: high side, flex: switching either to ls or hs 0=disabled, 1=Low side only, 2=High side only

5.8.3. Inducement Strategy and DEF - Inducement (TIER4)

Due to limitations of NOx emissions as defined in the TIER4 proposal an inducement strategy has been developed for the combination of the control units ACM and MCM2. Emission related warnings and failures lead to indicator signals and torque reduction of the engine.
Inducement is a mandatory process required if NOx emissions exceed a certain threshold.
Since the CPC4 will be used by two different markets, Europe (Stage IV) as well as in the USA (TIER4), it is favored in terms of a better maintainability that there will be only one common dataset for both variants.

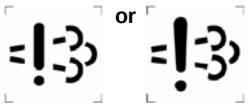
Events which effect NOx emissions and therefor are primary factors for an inducement strategy:
- DEF Tank Level
- DEF Quality

– NOx Monitoring System
– Dosing Interruption

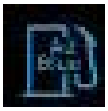
Certain values are monitored by the ACM and the MCM and if the appointed thresholds are violated, the inducement takes place. These results in a reduced maximum engine torque/speed and besides this, several different indicator lamps are activated to inform the driver about the changed vehicle status.

In addition to the indicator lamps explained below, a buzzer shall be activated to highlight every state transition with an audible signal.

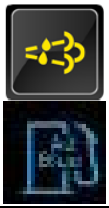
The different indication lamps are provided as followed:

Indicator	Indication	e. g. Symbol	e. g. AEM-Icon
Diesel Exhaust Fluid (DEF)	**Inducement Warning**		 **or** **(ref. to ISO 7000-2596)**
Torque Limiter Active (LIM)	**Active with torque reduction:** **100% < Torque > 50% à solid** **Torque ≤ 50% à blinking**		
Amber Warning Light (AWL)	**Failures & tampering**		
Stop Engine Lamp	**Inducement level:** **Ultra Severe Inducement à solid** **Final Inducement à blinking**		
Buzzer	With each transition of inducement state the buzzer will be activated for 5s (-> warning -> low -> severe -> ultra severe -> final) If inducement is active, buzzer active for 5s with each engine start **In case of an override, the buzzer will sound continuously!**		

Optional:

Indicator	Indication	e. g. Symbol	e. g. AEM-Icon
DEF Reserve Lamp	**DEF level below the before in ACM parameterized value**		 **(ref. to ISO 7000-2946)**

The following table shows the possible indicator lamp reactions and their cause:

Cause	Indicator	System reaction
DEF Level		
DEF level **---** **DEF level ≤10%**		– **DEF Lamp solid** – **DEF Reserve Lamp solid à warning** **---** **ACM-DM1 à SPN 3517 / FMI 17**

DEF level --- 7,5% ≥ DEF level > 5%		– DEF Lamp flashing 1Hz, – LIM Lamp solid, – DEF Reserve Lamp solid maximum available engine torque is reduced to 75% of peak torque across the speed range à low inducement --- ACM-DM1 à SPN 3517 / FMI 14
DEF level --- 5% ≥ DEF level > 2,5%		– DEF Lamp flashing 1Hz, – LIM Lamp flashing 1Hz, – DEF Reserve Lamp solid, maximum available engine torque is reduced to 50% of peak torque and maximum speed is reduced to 60% à severe inducement --- ACM-DM1 à SPN 3517 / FMI 18
DEF level --- 2,5% ≥ DEF level > 0%		– DEF Lamp flashing 1Hz, – LIM Lamp flashing 1Hz, – Stop Engine Lamp solid, – DEF Reserve Lamp solid, maximum available engine torque is reduced to 20% of peak torque and maximum speed is reduced idle speed à ultra severe inducement --- ACM-DM1 à SPN 3517 / FMI 1
DEF level --- DEF level = 0%		– DEF Lamp flashing 1Hz, – LIM Lamp flashing 1Hz, – Stop Engine Lamp flashing 1Hz, – DEF Reserve Lamp flashing 1Hz, maximum available engine torque is reduced to 20% of peak torque and engine speed is reduced to idle à final inducement --- ACM-DM1 à SPN 3517 / FMI 31

Cause	Indicator	System reaction
DEF quality		
DEF quality --- After detection of incorrect quality in the 2nd Driving Cycle		– DEF Lamp solid à warning
DEF quality --- 60 min of engine operation after detection of incorrect quality		– DEF Lamp flashing 1Hz, – LIM Lamp solid, maximum available engine torque is reduced to 75% of peak torque across the speed range à low inducement

DEF quality --- 180 min of engine operation after detection of incorrect quality		– **DEF Lamp flashing 1Hz,** – **LIM Lamp flashing 1Hz,** **maximum available engine torque is reduced to 50% of peak torque and maximum speed is reduced to 60%** **à severe inducement**
DEF quality --- 230 min of engine operation after detection of incorrect quality		– **DEF Lamp flashing 1Hz,** – **LIM Lamp flashing 1Hz,** – **Stop Engine Lamp solid,** **maximum available engine torque is reduced to 20% of peak torque and maximum speed is reduced idle speed** **à ultra severe inducement**
DEF quality --- 240 min of engine operation after detection of incorrect quality		– **DEF Lamp flashing 1Hz,** – **LIM Lamp flashing 1Hz,** – **Stop Engine Lamp flashing 1Hz,** **maximum available engine torque is reduced to 20% of peak torque and engine speed is reduced to idle** **à final inducement**
<u>Trigger: Detection of</u> – **DEF Tank Level Sensor Circuit Failed Low** – **DEF Tank Level Sensor Circuit Failed High** – **DEF pump is blocked** – **Tank Level Curve not selected** – **Dosing Valve Signal Failed Low** – **Dosing Valve Signal Failed High** – **Dosing Valve Signal Failed Open** – **High side switch 1 -pump and heater shortcut to ground** – **High side switch 2 -pump and heater- shortcut to ground** – **Battery signal range low** – **Battery signal range high** – **ECU internal fault** – **DEF dosing system is not cooled** – **Dosing unit defect**		– **DEF Lamp solid** – **AWL solid**
60min after trigger		– **DEF Lamp flashing 1Hz,** – **LIM Lamp solid,** – **AWL solid,** **maximum available engine torque is reduced to 75% of peak torque across the speed range** **à low inducement**

180min after trigger		– **DEF Lamp flashing 1Hz,** – **LIM Lamp flashing 1Hz,** – **AWL solid,** **maximum available engine torque is reduced to 50% of peak torque and maximum speed is reduced to 60%** **à severe inducement**
230min after trigger		– **DEF Lamp flashing 1Hz,** – **LIM Lamp flashing 1Hz,** – **AWL solid,** – **Stop Engine Lamp solid,** **maximum available engine torque is reduced to 20% of peak torque and maximum speed is reduced idle speed** **à ultra severe inducement**
240min after trigger		– **DEF Lamp flashing 1Hz,** – **LIM Lamp flashing 1Hz,** – **AWL solid,** – **Stop Engine Lamp flashing 1Hz,** **maximum available engine torque is reduced to 20% of peak torque and engine speed is reduced to idle** **à final inducement**

Outputs / TIER4

This chapter contains different connecting options for each output signal / indicator lamp described in the former TIER4 chapters. The according output pins have to be configured with the parameters mentioned before (see chapter 5.8.2).

Tier4DEF Lamp:
- Pin 3/07, DO_HP_FLEX_01, “Misc (UreaLowLamp)” : TIER4 DEF Lamp **or**
- Pin 3/10, DO_LP_FLEX_02, “Misc (TIER4 DEF Lamp)” : TIER4 DEF Lamp **or**
- SAE J1939 Signal: PGN 65290, “PropB0A”
  Byte 2, Bits 5..8: “Tier4DefLampReq”

Buzzer:
- Pin 4/01, DO_LP_LS_03, “Buzzer” : Buzzer **or**
- SAE J1939 Signal: PGN 65290, “PropB0A”
  Byte 2, Bits 1..4: “BuzzReq”

LIM Lamp:
- Pin 3/08, DO_HP_FLEX_02, “Misc (CCLimiterLamp)” : Tier4 Limitation Active Lamp **or**
- Pin 4/02, DO_LP_LS_04, “Misc (TIER4LimiterActiveLamp)” : Tier4 Limitation Active Lamp **or**
- J1939 Signal: PGN 65290, “PropB0A”
  Byte 3, Bits 1..4: “LimLampReq”

CEL Lamp:
- Pin 2/10, DO_LP_FLEX_03, “CEL (CheckEngineLamp)” : Check Engine Lamp Yellow **or**

– SAE J1939 Signal: PGN 64775, “Direct Lamp Control Command” (DLCC1)
SPN 5078, ”Engine Amber Warning Lamp Command”

SEL Lamp:
– Pin 3/16, DO_LP_FLEX_05, “SEL (StopEngineLamp)” : Stop Engine Lamp Red **or**
– SAE J1939 Signal: PGN 64775, “Direct Lamp Control Command” (DLCC1)
SPN 5079, “Engine Red Stop Lamp Command”

DEF Reserve Lamp:
– Pin 3/10, DO_LP_FLEX_02, “Misc (TIER4 DEF Lamp)” : Urea Low Lamp **or**
– SAE J1939 Signal: PGN 65110, “Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Information” (AT1T1I),
SPN 5245, “Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Low Level Indicator”

SAE J1939 Signals:
– SAE J1939 Signal: PGN 57344, “Cab Message 1” (CM1),
SPN 3696, “Diesel Particulate Filter Regeneration Force Switch”
– SAE J1939 Signal: PropB0A,
Byte 4, Bit 7, 8, “CCLimLampReq”
– SAE J1939 Signal: PGN 65110, “Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Information” (AT1T1I),
SPN 1761, “Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Level”
– Diagnostic Message 1 (DM1) à Active Diagnostic Trouble Codes

Parameterization example:

Example parameterization for TIER4 DEF Lamp, Buzzer, Tier4 Limitation Active Lamp, check engine lamp yellow, stop engine lamp red and Urea Low Lamp:
– Set Parameter 35/06 (“3 07 DO Selection”) to 7 (“TIER4 DEF Lamp”)
– Set Parameter 35/25 (“3 07 DO Fault Detection”) to 9 (“SetFault + Diag”)
– Set Parameter 35/42 (“3 07 DO Configuration”) to 2 (“High side only”)
– Set Parameter 35/13 (“4 01 DO Selection”) to 1 (“Buzzer”)
– Set Parameter 35/32 (“4 01 DO Fault Detection”) to 9 (“SetFault + Diag”)
– Set Parameter 35/49 (“4 01 DO Configuration”) to 1 (“enabled”)
– Set Parameter 35/14 (“4 02 DO Selection”) to 4 (“Tier4 Limitation Active Lamp”)
– Set Parameter 35/33 (“4 02 DO Fault Detection”) to 9 (“SetFault + Diag”)
– Set Parameter 35/50 (“4 02 DO Configuration”) to 1 (“enabled”)
– Set Parameter 35/04 (“2 10 DO Selection”) to 1 (“check engine lamp yellow”)
– Set Parameter 35/23 (“2 10 DO Fault Detection”) to 9 (“SetFault + Diag”)
– Set Parameter 35/41 (“2 10 DO Configuration”) to 2 (“High side only”)
– Set Parameter 35/11 (“3 16 DO Selection”) to 1 (“stop engine lamp red”)
– Set Parameter 35/30 (“3 16 DO Fault Detection”) to 9 (“SetFault + Diag”)
– Set Parameter 35/47 (“3 16 DO Configuration”) to 2 (“High side only”)
– Set Parameter 35/09 (“3 10 DO Selection”) to 6 (“Urea Low Lamp”)
– Set Parameter 35/28 (“3 10 DO Fault Detection”) to 9 (“SetFault + Diag”)
– Set Parameter 35/45 (“3 10 DO Configuration”) to 2 (“High side only”)

5.8.3.1. Impact of the Inducement System

The Driver Inducement System consists of four escalation levels:

“Low inducement”
Maximum available torque is reduced to 75% of peak torque across the speed range within 15 minutes.

“Severe inducement”
Maximum available torque will be reduced from 75% to 50% in 25min. Engine speed will be reduced to 60% rated speed in 25min.

“Ultra Severe inducement”

Maximum available torque will be reduced from 50% to 20%, and simultaneously engine speed will be reduced to idle, in 8 min respectively.

“Final Inducement”
Engine in idle at 20% torque. Due to the different applications the engines are installed in the idle speed cannot be defined as a fixed value. (Daimler ensures the maximum idle speed cannot exceed 1200rpm)

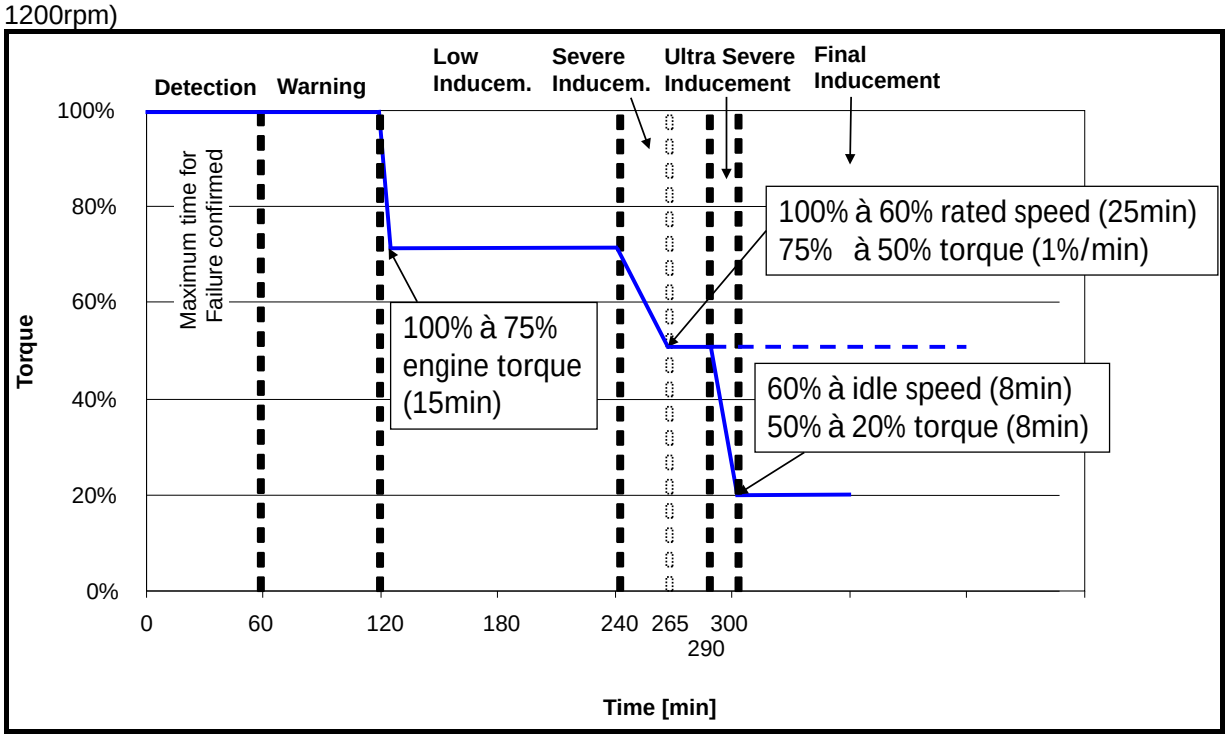


Fig 5.20: Impact of the inducement strategy

5.8.3.2. Inducement Override

In case of emergency an inducement override button is implemented that can be used to release the full engine power for **up to** 30 minutes regardless of the inducement level, **as long as the final level isn’t reached yet**. The following list shows the certain conditions for the use of override mode:

- Override is not allowed in final inducement,
- the maximum time for the final inducement (240min) can’t be prolonged via the override function,
- the override can be used to a maximum of 3 times,
- the inducement escalation will take place in the background even if override is used, with the result that after the override mode comes to an end, the proper inducement state is activated.

The two parameters 13/04 (“1 15 DI Selection”) and 13/30 (“CC Pause Switch Config”) define whether the source of the override is hardwired or Ccvs and which source address is used.

5.8.3.3. Reoccurring Failures – only valid for urea quality and tampering

In case of reoccurring failures the time for the final inducement will be reduced from 240 to 30 minutes.

If all inducement relevant failures are healed (e.g. a defective plug is repaired or reconnected) the inducement will be reset and the normal engine operation will be achieved again.

From now on, if an inducement related failure occurs again within the next 40h of engine operation, the inducement activated again as described in the previous chapter but with the above mentioned inducement time of 30 minutes.

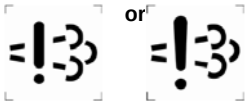
An active inducement failure cannot be erased by clearing of the fault code memory by a diagnosis tool.

5.8.4. Inducement Strategy and AdBlue - Inducement (EURO VI)

Due to limitations of NOx emissions as defined in the EURO VI standard an inducement strategy has been developed for the combination of the control units CPC4, MCM2 and ACM. As stated above emission related warnings and failures will lead to indicator signals, torque reduction of the engine and vehicle speed reduction.

The CPC4 is informed about an active torque and vehicle speed limitation and a Urea Tank level warning by the ACM/MCM2 control unit. This information is used to drive an Inducement Lamp (DEF), an AdBlue Reserve Lamp and a Torque Limiter Active Lamp (LIM) in the vehicle using the output relays. The status information is also offered in the SAE J1939 CAN message (see Output).

Following indicators are provided for the system:

Indicator	Indication	e. g. Symbol	e. g. AEM-Icon
Inducement Lamp (DEF)	**Inducement Warning**		 **or** **(ref. to ISO 7000-2596)**
Torque Limiter Active (LIM)	**Inducement Level** **Solid light for the case of low inducement (75% Torque),** **flashing light for the case of severe inducement (20 km/h)**		
Malfunction Indicator Lamp (MIL)	**Failures (only exhaust – OBD relevant)**	 **This symbol is no suggestion!**	

Optional:

Indicator	Indication	e. g. Symbol	e. g. AEM-Icon
AdBlue Reserve Lamp	**AdBlue level below 10%**		 **(ref. to ISO 7000-2946)**

Low AdBlue level or quality as well as failures of the emission reduction system lead to combinations of indicators as shown in following table. The respective system reactions are presented as well.

Cause	Indicator	System reaction
AdBlue Level		
AdBlue level **---** **AdBlue level less than 10%**	 	– **Inducement Lamp solid,** – **AdBlue Reserve Lamp solid**

AdBlue level **---** **AdBlue level less than 2,5%**		– **Inducement Lamp solid** – **LIM Lamp solid** – **AdBlue Reserve Lamp solid** **maximum available engine torque is reduced to 75% of peak torque across the speed range** **à low inducement**
AdBlue level **---** **AdBlue level = 0%** **---** **Diesel fuel sensor installed:** **a) Detected diesel fuel refilling and AdBlue *not* refilled or** **b) Engine operated for more than 8 hours after low inducement and vehicle standstill** **---** **Diesel fuel sensor not installed:** **Upon the next engine start**		– **Inducement Lamp solid,** – **LIM Lamp flashing 1Hz,** – **AdBlue Reserve Lamp flashing 1Hz,** **the vehicle speed is limited to 20km/h** **à severe inducement**

Cause	Indicator	System reaction
AdBlue Quality		
AdBlue quality **---** **After detection of incorrect quality in the 2nd Driving Cycle**		– **Inducement Lamp solid** **à warning**
AdBlue quality **---** **10h of engine operation after detection of incorrect quality**		– **Inducement Lamp solid,** – **LIM Lamp solid,** **maximum available engine torque is reduced to 75% of peak torque across the speed range** **à low inducement**
AdBlue quality **---** **20h of engine operation after detection of incorrect quality**		– **Inducement Lamp solid,** – **LIM Lamp flashing 1Hz,** **the vehicle speed is limited to 20km/h** **à severe inducement**

Cause	Indicator	System reaction
Low Reagent Consumption		
Low Reagent Consumption **---** **After detection of low reagent consumption in the 2nd Driving Cycle**		– **Inducement Lamp solid** – **MIL solid**

Cause	Indicator	System reaction
Low Reagent Consumption		
Low Reagent Consumption --- 10h of engine operation after detection of low reagent consumption		**– Inducement Lamp solid, – LIM Lamp solid, – MIL solid maximum available engine torque is reduced to 75% of peak torque across the speed range à low inducement**
Low Reagent Consumption --- 20h of engine operation after detection of low reagent consumption		**– Inducement Lamp solid, – LIM Lamp flashing 1Hz, – MIL solid, the vehicle speed is limited to 20km/h à severe inducement**

Cause	Indicator	System reaction
Interruption of Reagent Dosing		
Interruption of Reagent Dosing --- After detection of interruption of reagent dosing in the 2nd Driving Cycle		**– Inducement Lamp solid**
Interruption of Reagent Dosing --- 10h of engine operation after detection of interruption of reagent dosing		**– Inducement Lamp solid, – LIM Lamp solid, – maximum available engine torque is reduced to 75% of peak torque across the speed range à low inducement**
Interruption of Reagent Dosing --- 20h of engine operation after detection of interruption of reagent dosing		**– Inducement Lamp solid, – LIM Lamp flashing 1Hz, maximum the vehicle speed is limited to 20km/h à severe inducement**

Cause	Indicator	System reaction
Failures of Components of the Monitoring System or EGR		
Failures of Components of the Monitoring System or EGR --- After detection of interruption of reagent dosing in the 2nd Driving Cycle		**– Inducement Lamp solid**
Failures of Components of the Monitoring System or EGR --- 36h of engine operation after detection of failures of components of the monitoring system		**– Inducement Lamp solid, – LIM Lamp solid, maximum available engine torque is reduced to 75% of peak torque across the speed range à low inducement**

Cause	Indicator	System reaction
Failures of Components of the Monitoring System or EGR		
Failures of Components of the Monitoring System or EGR **---** **100h of engine operation after detection of failures of components of the monitoring system**		– **Inducement Lamp solid,** – **LIM Lamp flashing 1Hz,** **the vehicle speed is limited to 20km/h** **à severe inducement**

Outputs / EURO6:

This chapter contains different connecting options for each output signal / indicator lamp described in the former EURO6 chapters. The according output pins have to be configured with the parameters mentioned before (see chapter 5.8.2).

Inducement Lamp (DEF):
- Pin 3/07, DO_HP_FLEX_01, “Misc (UreaLowLamp)” : EU6 Inducement Lamp **or**
- Pin 3/10, DO_LP_FLEX_02, “Misc (TIER4 DEF Lamp)” : EU6 Inducement Lamp **or**
- SAE J1939 Signal: PGN 65290, “PropB0A”
  Byte 3, Bits 5..8: ”EU6 Inducement Lamp Request”

Torque Limiter Active (LIM):
- Pin 3/08, DO_HP_FLEX_02, “Misc (CcLimiterLamp)” : EU6 Limitation Active Lamp **or**
- Pin 4/02, DO_LP_LS_04, “Misc (TIER4LimiterActiveLamp)” : EU6 Limitation Active Lamp **or**
- J1939 Signal: PGN 65290, “PropB0A”
  Byte 3, Bits 1..4: “LimLampReq”

Malfunction Indicator Lamp (MIL):
- Pin 1/13, DO_LP_FELX_01, “Misc(CoolantTempLamp)” : MIL Lamp **or**
- SAE J1939 Signal: PGN 64775, “Direct Lamp Control Command” (DLCC1)
  SPN 5080, “OBD Malfunction Indicator Lamp Command”

DEF Reserve Lamp:
- Pin 3/10, DO_LP_FLEX_02, “Misc(TIER4 DEF Lamp)” **or**
- SAE J1939 Signal: PGN 65110, “Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Information” (AT1T1I),
  SPN 5245, “Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Low Level Indicator”

Parameterization example:

Example parameterization for EU6 Inducement Lamp, Buzzer, EU6 Limitation Active Lamp and Urea Low Lamp:
- Set Parameter 35/06 (“3 07 DO Selection”) to 8 (“EU6 Inducement Lamp”)
- Set Parameter 35/25 (“3 07 DO Fault Detection”) to 9 (“SetFault + Diag”)
- Set Parameter 35/42 (“3 07 DO Configuration”) to 2 (“High side only”)
- Set Parameter 35/14 (“4 02 DO Selection”) to 5 (“EU6 Limitation Active Lamp”)
- Set Parameter 35/33 (“4 02 DO Fault Detection”) to 9 (“SetFault + Diag”)
- Set Parameter 35/50 (“4 02 DO Configuration”) to 1 (“enabled”)
- Set Parameter 35/09 (“3 10 DO Selection”) to 6 (“Urea Low Lamp”)
- Set Parameter 35/28 (“3 10 DO Fault Detection”) to 9 (“SetFault + Diag”)
- Set Parameter 35/45 (“3 10 DO Configuration”) to 2 (“High side only”)

5.8.4.1. Impact of the Inducement System

The Driver Inducement System consists of three levels:

1.) Warning:
Warning level indicates the imminent torque reduction.

2.) Low inducement:
The low inducement reduces the maximum available engine torque by 25 percent. If the inducement system requested, the activation takes place after the standstill condition is given.

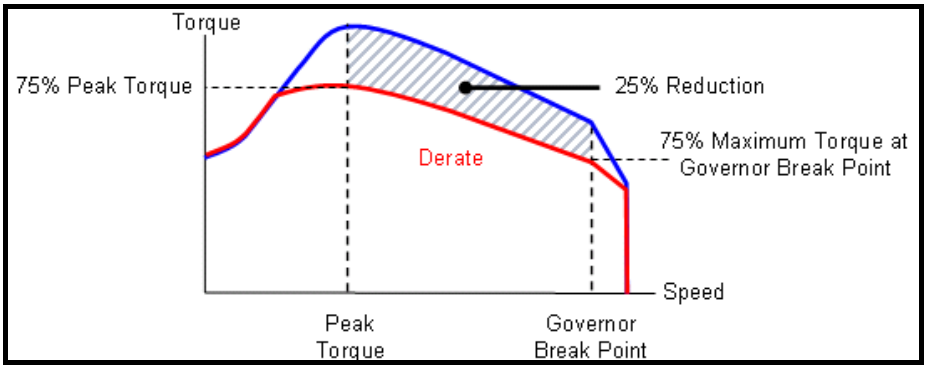


Fig 5.21: Example for the inducement system

3.) Severe inducement:
The Severe inducement limits the vehicle speed to 20km/h. The activation takes place after the standstill condition is given and one of the above mentioned pre-conditions are given.

In EU6 system there **is no possibility** to postpone the inducement levels via override function like in Tier4 inducement.

5.8.4.2. Reoccurring Failures

In case of reoccurring failures the following steps will be accomplished:

If a failure appears again within 40h of recovery or deletion and
a) the escalation from “warning” to “low inducement” has taken place on the last occurrence OR
b) severe inducement was active on the last occurrence:

The Low Level inducement (75% of maximum torque) will be immediately active after stand still condition is given and after additional 2h the maximum vehicle speed will be reduced again to 20km/h (Severe inducement).

5.8.5. DPF - Diesel Particulate Filter (EURO VI)

The principal functions of the DPF system with charging model and regeneration strategy are implemented in the ACM.

The principal tasks of the DPF module in the CPC4 control unit are:

- Manual regeneration request à High Idle mode (increased engine speed)
  If several conditions are fulfilled, the CPC4 changes into the High-Idle-Mode by pressing the regeneration switch or receiving a diagnostic routine. Therefore the CPC4 is requesting a stationary regeneration (High-Idle) from ACM and MCM2 by PTCAN. Additionally the remaining regeneration duration is shown in the display.

- Inhibit mode
  The CPC4 changes to this status when the Inhibit switch is pressed or when a diagnostic request is received. In this state all forms of regenerations are inhibited. This mode is mandatory implemented e. g. for critical areas like refineries.

Inputs:
Regeneration Inhibit Switch:
– Pin 4/13, DI_FLEX_19, “Misc (TempoSet)” : Engine Shutdown/Tier4 Inducement Override
– SAE J1939 Signal: PGN 57344, “Cab Message 1” (CM1),
SPN 3695, “Diesel Particulate Filter Regeneration Inhibit Switch”
Manual Regeneration Push Button:
– Pin 4/17, DI_FLEX_21, “DPF regeneration switch”
– SAE J1939 Signal: PGN 57344, “Cab Message 1” (CM1),
SPN 3696, “Diesel Particulate Filter Regeneration Force Switch”

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
01	07	CM1 DPF Source Addr SAE J1939	0	255	49		SAE J1939 Source Address Cm1 for cyclic Dpf message, 0..255=signal
13	17	4 13 DI Selection	0	11	0		Configuration input DiFlex19 DSF0 0=disable, 1=enable ABS input, 2=enable transmission retarder input, 3=enable tempo set, 4=enable grid heater detection, 5=switchable torque demand, 6=drive on super structure, 7=throttle inhibit super structure, 8=split select, 9=FUSO Engine brake stage 2 cancel switch, 10=DPF Inhibit Regen Switch, 11=engine shutdown/Tier4 inducement override
13	18	4 17 DI Selection	0	3	2		Configuration parameter for input Di_Flex21 0=disable, 1=2 Clutch Switch, 2=DPF regeneration switch, 3=PTO1stat
35	2	1 05 DO Selection	0	3	0		usage of Output DoLpLs01 0=disabled, 1=ground, analog accelerator pedal, 2=DPF Lamp, 3=air filter lamp
35	16	4 07 DO Selection	0	15	0		usage of Output DoHpLs02,[2..6]:Compares the actual value against a configured threshold.,[8..13] PTCAN [1+10] digital state 0=disabled, 1=accelerator pedal kick down, 2=actual torque, 3=road speed, 4=engine speed, 5=coolant temperature, 6=pedal torque, 7=boost temperature, 8=oil pressure (threshold), 9=coolant temperature (Eng.Controller threshold), 10=vehicle power shutdown / ignition relay, 11=optimized idle ACC bus (ignition relay), 12=split valve 1, 13=High Exhaust Temperature Lamp, 14=AUX-Relay, 15=PTO2valve2
35 35	21 35	1 05 DO Fault Detection 4 07 DO Fault Detection	0 0	15 15	1 1		0=Fault Detection Off, 1=Diag, 2=PulseWhenOff, 3=PulseWhenOff + Diag, 4=PulseWhenOn, 5=PulseWhenOn + Diag, 6=PulseWhenOn + PulseWhenOff, 7=PulseWhenOn + PulseWhenOff + Diag, 8=SetFault, 9=SetFault + Diag, 10= SetFault + PulseWhenOff, 11=SetFault + PulseWhenOff + Diag, 12=SetFault + PulseWhenOn, 13=SetFault + PulseWhenOn + Diag, 14=SetFault + PulseWhenOn + PulseWhenOff, 15=SetFault + PulseWhenOn + PulseWhenOff + Diag
35	39	1 05 DO Configuration	0	1	0		binary Output Configuration, lp: low power, ls: low side 0=disabled, 1=enabled
35	52	4 07 DO Configuration	0	1	0		Binary Output Configuration, hp: high power, ls: low side 0=disabled,

PGR	No.	Parameter	min	max	default	unit	description
							1=enabled

Outputs:
Particulate Trap Lamp (DPF)
- Pin 1/05, DO_LP_LS_01, “Misc (AirFilterLamp)” : DPF Regeneration Lamp **or**
- J1939 Signal: PGN 64892, “Diesel Particulate Filter Control 1” (DPFC1),
  SPN 3697, “Diesel Particulate Filter Lamp Command”

Check Engine Lamp (CEL)
- Pin 2/10, DO_LP_FLEX_03, “CEL (CheckEngineLamp)” : Check Engine Lamp Yellow **or**
- J1939 Signal: PGN 64775, “Direct Lamp Control Command 1” (DLCC1)
  SPN 5078, “Engine Amber Warning Lamp Command”

Stop Engine Lamp (SEL)
- Pin 3/16, DO_LP_FLEX_05, “SEL (StopEngineLamp)” : Stop Engine Lamp Red **or**
- J1939 Signal: PGN 64775, “Direct Lamp Control Command 1” (DLCC1)
  SPN 5079, “Engine Red Stop Lamp Command”

High Exhaust Temperature Lamp
- Pin 4/07, DO_HP_LS_02, “Misc (Relay 4)” : High Exhaust Temperature Lamp **or**
- J1939 Signal: PGN 64892, “Diesel Particulate Filter Control 1” (DPFC1)
  SPN 3698, “Exhaust System High Temperature Lamp Command”

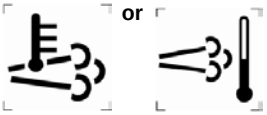
Parameterization example:

Hardwired on CPC4 pins: EU6 relevant DPF lamps and switches.

DPF Inhibit Regeneration Switch, DPF Regeneration Switch, DPF Lamp, Check Engine Lamp (yellow), Stop Engine Lamp (red) and High Exhaust Temperature Lamp:
- Set Parameter 13/17 (“4 13 DI Selection”) to 10 (“DPF Inhibit Regen Switch”)
- Set Parameter 13/18 (“4 17 DI Selection”) to 2 (“DPF regeneration switch”)
- Set Parameter 35/02 (“1 05 DO Selection”) to 2 (“DPF Lamp”)
- Set Parameter 35/21 (“1 05 DO Fault Detection”) to 9 (“SetFault + Diag”)
- Set Parameter 35/39 (“1 05 DO Configuration”) to 1 (“enabled”)
- Set Parameter 35/04 (“2 10 DO Selection”) to 1 (“check engine lamp yellow”)
- Set Parameter 35/23 (“2 10 DO Fault Detection”) to 9 (“SetFault + Diag”)
- Set Parameter 35/41 (“2 10 DO Configuration”) to 2 (“High side only”)
- Set Parameter 35/11 (“3 16 DO Selection”) to 1 (“stop engine lamp red”)
- Set Parameter 35/30 (“3 16 DO Fault Detection”) to 9 (“SetFault + Diag”)
- Set Parameter 35/47 (“3 16 DO Configuration”) to 2 (“High side only”)
- Set Parameter 35/16 (“4 07 DO Selection”) to 13 (“High Exhaust Temperature Lamp”)
- Set Parameter 35/35 (“4 07 DO Fault Detection”) to 9 (“SetFault + Diag”)
- Set Parameter 35/52 (“4 07 DO Configuration”) to 1 (“enabled”)

Following indicators are provided for the system:

Indicator	Indication	e. g. Symbol	e. g. AEM-Icon
Particulate Trap Lamp (DPF)	**Diesel particulate filter: fill level increased**		 **(ref. ISO7000-2433)**
Stop Engine Lamp (SEL)	**Failures & tampering**		
Check Engine Lamp (CEL)	**Failures & tampering**		

Indicator	Indication	e. g. Symbol	e. g. AEM-Icon
High Exhaust Temp Lamp (i.e. Active regeneration)	**High exhaust gas temperature**		 **or** **(ref. ISO7000-2844A/B)**
DPF Inhibit switch	**Switch to inhibit the regeneration (possible in DPF Zone 1 – 4)**		
DPF regeneration switch	**Activate Manual Regeneration (pressing t >= 3s) – tentatively (possible in DPF Zone 2 – 4)**		

The respective system reactions are presented as well:

Cause	Indicator	System reaction
DPF soot level increased		– **Particulate Trap Lamp solid,** – **Check Engine Lamp solid**
DPF soot level very high		– **Particulate Trap Lamp flashing 1Hz,** – **Check Engine Lamp solid**
DPF soot level too high		– **Particulate Trap Lamp flashing 1Hz,** – **Stop Engine Lamp solid** – **<u>No</u> regeneration <u>possibly!</u>**
Manual Regeneration is active (High Exhaust Temp)		– **Lamp for Regeneration State flashing 1Hz**

The High Exhaust Temperature Lamp utilizes the following operation mode:

Lamp operation mode	Situation
Symmetric Blinking (1Hz)	- Manual Regeneration of DPF is active
Asymmetric Blinking (1 sec. ON, 10 sec. OFF)	- Exhaust gas temperature is high
Continuous	- Vehicle speed is low or vehicle standstill (VSpeed < 8 km/h) AND Exhaust gas temperature is very high (Temp > 525°C) - If vehicle speed not applicable or not valid AND Exhaust gas temperature is very high (Temp > 525°C) - Exhaust gas temperature is very high

Detailed information of DPF-HMI : Overview of the display logic in case of increased DPF soot level, shared in different zones of escalation level. Additional information regarding the DPF-Zone concept.

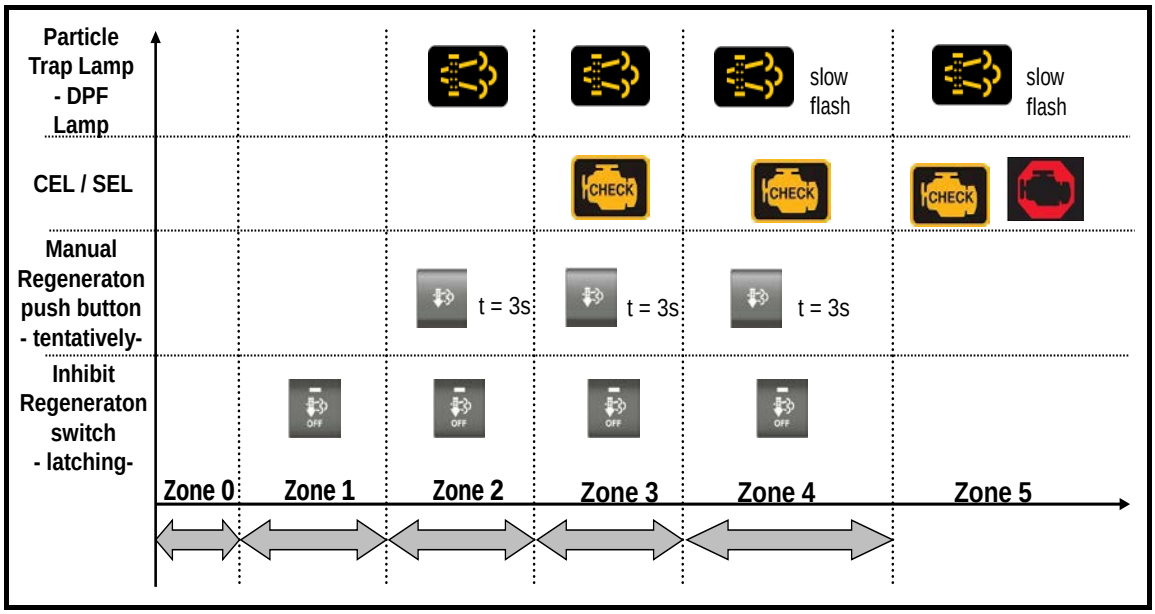


Fig 5.22: Chart of the different DPF soot load (zones)

5.8.6. Malfunction Indicator Lamp (EURO VI)

The malfunction indicator lamp is used due to OBD regulations in EU6 vehicles. Three different methods for connecting the MIL are possible:

a) Hardwired via output pin;
b) via J1939 CAN message DLCC1 (“Direct Lamp Control Command 1”);
c) DM1 J1939 CAN message to e. g. attach a dashboard with a MIL via J1939 CAN.

In the last case it is mandatory that this dashboard sends a cyclic ICUC_DM1 Message from the source address defined in parameter 01/73 (“J1939 Source Addr Instrument Cluster”) with the Fault Code “0x2EF0FF”.

Inputs:

– PT-CAN message containing MIL status

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
01	73	J1939 Source Addr Instrument Cluster	0	255	23		SAE J1939 Source Address Instrument (Cascadia) 0..255=signal
35	03	1 13 DO Selection	0	3	0		usage of Output DoLpFlex01 0=disabled, 1=MIL lamp, 2=Urea Low Lamp, 3=coolant temperature lamp
35	22	1 13 DO Fault Detection	0	15	1		0=Fault Detection Off, 1=Diag, 2=PulseWhenOff, 3=PulseWhenOff + Diag, 4=PulseWhenOn, 5=PulseWhenOn + Diag, 6=PulseWhenOn + PulseWhenOff, 7=PulseWhenOn + PulseWhenOff + Diag, 8=SetFault, 9=SetFault + Diag, 10= SetFault + PulseWhenOff, 11=SetFault + PulseWhenOff + Diag, 12=SetFault + PulseWhenOn, 13=SetFault + PulseWhenOn + Diag, 14=SetFault + PulseWhenOn + PulseWhenOff, 15=SetFault + PulseWhenOn + PulseWhenOff + Diag
35	40	1 13 DO Configuration	0	2	0		Binary Output Configuration, lp: low power,

PGR	No.	Parameter	min	max	default	unit	description
							ls: low side, hs: high side, flex: switching either to ls or hs 0=disabled, 1=Low side only, 2=High side only

Outputs:
- MIL status in J1939 CAN messages DM1 and DM2

Parameterization example:

Malfunction Indicator Lamp via output pin:
- Set parameter 35/03 (“1 13 DO Selection”) to 1 (“MIL lamp”)
- Set parameter 35/22 (“1 13 DO Fault Detection”) to 9 (“SetFault + Diag”)
- Set parameter 35/40 (“1 13 DO Configuration”) to e. g. 2 (“High side only “)

Malfunction Indicator Lamp via J1939 CAN message:
- Send DLCC1 (PGN 64775, “Direct Lamp Control Command 1”) message with SPN 5080 set to 1 to activate the MIL via CAN message.

5.9. Engine Brake

Risk of injury!

The engine brake is a safety-relevant function for commercial vehicles.
Incorrect wiring or unsuitable parameter programming can make it impossible to actuate the engine brake. The lack of, or reduction in, engine braking power could lead to the vehicle brake being overloaded.

Changes to the parameters in this group must only be performed by specially trained personnel or after consultation with the engine manufacturer. It is not normally necessary to change these parameters.

The Engine brake can be activated if the following conditions are given:

- Driving mode, no PTO speed control;
- No ABS intervention;
- Engine speed higher than parameter 10/13 (“Min Eng Spd for Engine Brakes”), minimum engine speed for engine brakes;
- Accelerator pedal not further pushed down than maximum throttle position for engine brake, parameter 10/12
- , parameter 10/12 (“Max Throttle Pos for Eng Ret”);
- Vehicle speed higher than minimum road speed for engine brake operation, parameter 10/14 (“Min Road Spd Eng Brk Operation”);
- Coolant temperature must have reached the value of 65°C;
- Drive train closed.

Remark: The parameter 10/12 (“Max Throttle Pos for Eng Ret”) has an internal hysteresis of 4% which has to be taken into consideration. So with the default value of 4% the engine brake would be deactivated at 8% throttle position and activated at 4%.

For engine brake activation refer to chapter 5.9.2 and for engine brake deactivation refer to chapter 5.9.4.

Diagnostics:
- Binary Value: 3/1, Engine Brake Disable (chapter 6.3.2)
- Binary Value: 3/2, Engine Brake Low (chapter 6.3.2)
- Binary Value: 3/3, Engine Brake Medium (chapter 6.3.2)

– Binary Value: 11/2, Engine Brake Active (chapter 6.3.2)

Inputs:

– Pin 2/14, DI_FLEX_13, “Misc (EngineBrakeLow)” : Engine Brake Low
– Pin 2/15, DI_FLEX_14, “Misc (EngineBrakeMedium)” : Engine Brake High
– SAE J1939 Signal: PGN 61441, “Electronic Brake Controller 1” (EBC1), SPN 973, “Engine Retarder Selection”
– SAE J1939 Signal: PGN 61442, “Electronic Transmission Controller 1“ (ETC1), SPN 560, “Transmission Driveline Engaged”
– SAE J1939 Signal: PGN 61445, “Electronic Transmission Controller 2” (ETC2), SPN 523, “Transmission Current Gear”

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
01	10	EBC1 Source Address SAE J1939	0	255	33		SAE J1939 Source Address EBC1, 0..255=signal
10	12	Max Throttle Pos for Eng Ret	0	100	4	%	Maximum Throttle Position for Engine Brakes 0..32000=signal
10	13	Min Eng Spd for Engine Brakes	1000	4000	1100	1/min	Minimum Engine Speed for Engine Brakes for open driveline 8000..32000=signal
10	14	Min Road Spd Eng Brk Operation	0	200	0	km/h	Minimum Road Speed for Engine Brake Operation. 0..25600=signal

5.9.1. Application of the Engine Brake

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
10	8	Engine Brake Configuration	0	3	3		Engine Brake Configuration 0=no engine brake, 1=Decompression Valve Only or Exhaust Flap Only, 2=Decompression Valve + Exhaust Flap or Fuso 2-stage Jake, 3=Jake Compression Brake or Decompression Valve + Brake Gate
10	19	Stage 1 Factor Engine Brake	0	100	100	%	Engine Brake Stage 1 Factor 0..32000=signal
10	20	Stage 1 Mask Engine Brake	0	81	81		Engine Brake Stage 1 Mask 0=no engine brake activation, 16=Exhaust Flap only or Fuso Jake Brake stage 2, 17=Jake Brake 2nd stage, 64=decompression valve only or Jake Brake 1st stage, 80=decompression valve and exhaust flap, 81=decompression valve and turbo brake or Jake Brake 3rd stage
10	25	Stage 2 Factor Engine Brake	0	100	100	%	Engine Brake Stage 2 Factor 0..32000=signal
10	26	Stage 2 Mask Engine Brake	0	81	81		Engine Brake Stage 2 Mask 0=no engine brake activation, 16=Exhaust Flap only or Fuso Jake Brake stage 2, 17=Jake Brake 2nd stage, 64=decompression valve only or Jake Brake 1st stage, 80=decompression valve and exhaust flap, 81=decompression valve and turbo brake or Jake Brake 3rd stage
10	30	Stage 3 Factor Engine Brake	0	100	100	%	Engine Brake Stage 3 Factor 0..32000=signal
10	32	Stage 3 Mask Engine Brake	0	81	81		Engine Brake Stage 3 Mask 0=no engine brake activation, 16=Exhaust Flap only or Fuso Jake Brake stage 2,

PGR	No.	Parameter	min	max	default	unit	description
							17=Jake Brake 2nd stage, 64=decompression valve only or Jake Brake 1st stage, 80=decompression valve and exhaust flap, 81=decompression valve and turbo brake or Jake Brake 3rd stage

Parameterization example:

Engine Brake:

· Example of engine brake parameterization on an “OM470 TIER4” engine (see table below):
  – Set parameter 10/08 (“Engine Brake Configuration”) to 3 (“Jake Compression Brake or Decompression Valve + BrakeGate”)
  – Set parameter 10/19 (“Stage 1 Factor Engine Brake”) to 20%
  – Set parameter 10/20 (“Stage 1 Mask Engine Brake”) to 64 (“decompression valve only or Jake Brake 1st stage”)
  – Set parameter 10/25 (“Stage 2 Factor Engine Brake”) to 100%
  – Set parameter 10/26 (“Stage 2 Mask Engine Brake”) to 64 (“decompression valve only or Jake Brake 1st stage”)
  – Set parameter 10/30 (“Stage 3 Factor Engine Brake”) to 100%
  – Set parameter 10/32 (“Stage 3 Mask Engine Brake”) to 81 (“decompression valve and turbo brake or Jake Brake 3rd stage”)

Depending on the Engine, the engine brakes have to be adjusted to the follow values:

Engine	Stage X	Stage Mask	Stage Factor
OM470 TIER4	1	64	20%
	2	64	100%
	3	81	100%
OM470 EU6 HP	1	17	75%
	2	81	55%
	3	81	100%
OM471 TIER4	1	64	45%
	2	64	100%
	3	81	100%
OM471 EU6 HP	1	17	50%
	2	81	55%
	3	81	100%
OM473 TIER4	1	64	40%
	2	81	50%
	3	81	100%
OM473 EU6 HP	1	17	60%
	2	81	60%
	3	81	100%
OM934-STC TIER4	1	81	33%
	2	81	66%
	3	81	100%
OM934-STC EU6 HP	1	81	33%
	2	81	66%
	3	81	100%
OM934-DTC TIER4	1	81	33%
	2	81	66%
	3	81	100%

OM934-DTC EU6 HP	1	81	33%
	2	81	66%
	3	81	100%
OM936-STC TIER4	1	81	45%
	2	81	75%
	3	81	100%
OM936-STC EU6 HP	1	81	33%
	2	81	66%
	3	81	100%
OM936-DTC TIER4	1	81	45%
	2	81	70%
	3	81	100%
OM936-DTC EU6 HP	1	81	33%
	2	81	66%
	3	81	100%

5.9.2. Activation of the engine brake systems

There are three different methods to activate the engine brake systems:

a) Engine brake activation via EngineBrakeLow (pin 2/14, DI_FLEX_13) and EngineBrakeMedium (pin 2/15, DI_FLEX_14) switches at CPC4 (normally open switches; active, if closed to ground);
b) Engine brake operation with stalk switch (refer to chapter 5.9.2.2);
c) Engine brake via J1939 CAN message.

5.9.2.1. Engine Brake Activation via Input Pins

As mentioned in the chapter before, the engine brake can be controlled via input pins if configured correctly.

Inputs:
- Pin 2/14, DI_FLEX_13, “Misc (EngineBrakeLow)” : Engine Brake Low
- Pin 2/15, DI_FLEX_14, “Misc (EngineBrakeMedium)” : Engine Brake High

Medium	Low	Brake Step
0	0	No Engine Brake
0	1	Engine Brake step 1
1	0	Engine Brake step 2
1	1	Engine Brake step 3

Parameter

PGR	No.	Parameter	min	max	default	unit	description
13	9	2 14 DI Selection	0	4	0		Configuration input DiFlex13 0=disable, 1=engine brake low, 2=Evobus retarder lever stage1, 3=CC hysteresis low, 4=RemAP IVS1
13	10	2 15 DI Selection	0	4	0		Configuration input DiFlex14 0=disable, 1=engine brake high, 2=Evobus retarder lever stage2, 3=CC hysteresis high, 4=RemAP IVS2
13	26	Engine Brake Switch Config	0	255	0		Source EBM switch (hardwired or from J1939) 0=hardwired, 1=info from J1939 (muxed), 2=Info from LIN, 255=not available

Parameterization example:

Engine Brake - hardwired:

- Example of engine brake parameterization for activation via hardwired pin:
  - Set parameter 13/09 (“2 14 DI Selection”) to 1 (“engine brake low”)
  - Set parameter 13/10 (“2 15 DI Selection”) to 1 (“engine brake high”)
  - Set parameter 13/26 (“Engine Brake Switch Config”) to 0 (“hardwired“)

5.9.2.2. Engine Brake Operation with a Stalk Switch

As already mentioned in chapter 5.5.2., the described stalk switch offers several possibilities for an engine brake operation with up to 5 stages depending on the type of the used stalk switch (see the figures below). The engine brake configuration is set by parameter 10/08 (“Engine Brake Configuration”). For the color coding refer to the table in chapter 5.5.2.

Medium	Low	Brake Step
0	0	No Engine Brake
0	1	Engine Brake step 1
1	0	Engine Brake step 2
1	1	Engine Brake step 3

Diagnostics:

- Binary Value: 18/1, Retarder Lever Input 0
- Binary Value: 18/2, Retarder Lever Input 1
- Binary Value: 18/3, Retarder Lever Input 2
- Binary Value: 18/4, Retarder Lever Input 3
- Binary Value: 19/1, Retarder Lever Input 4
- Binary Value: 19/2, Retarder Lever Input 5
- Analog Value: Engine Brake Lever Position

Inputs:

- Pin 1/10, DI_FLEX_20, “StopEngine/AuxShutdown” : Evobus Retarder Lever Stage0
- Pin 2/14, DI_FLEX_13, “Misc (EngineBrakeLow)” : Evobus Retarder Lever Stage1
- Pin 2/15, DI_FLEX_14, “Misc (EngineBrakeMedium)” : Evobus Retarder Lever Stage2
- Pin 2/08, DI_FLEX_16, “RemoteThrottleSelect” : Evobus Retarder Lever Stage3
- Pin 1/17, DI_FLEX_07, “ThrottleInhibit” : Evobus Retarder Lever Stage4
- Pin 2/13, DI_FELX_12, “Misc (RemAPIVS2)” : Evobus Retarder Lever Stage5

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
13	3	1 10 DI Selection	0	3	0		Configuration input DiFlex20 0=disable, 1=enable aux shutdown, 2=FUSO Accelerator switch, 3=Evobus retarder lever stage0
13	5	1 17 DI Selection	0	2	1		Configuration input DiFlex07 0=disable, 1=throttle inhibit, 2=Evobus retarder lever stage4
13	6	2 08 DI Selection	0	3	0		Configuration input DiFlex16 0=disable, 1=Remote-Throttle enable, 2=Fast Engine Heat Up Switch, 3=Evobus retarder lever stage3
13	8	2 13 DI Selection	0	4	1		Configuration input DiFlex12 0=disable, 1=fan override switch, 2=Evobus retarder lever stage5, 3=RockOutMode, 4=RemAP IVS2
13	9	2 14 DI Selection	0	4	0		Configuration input DiFlex13 0=disable, 1=engine brake low, 2=Evobus retarder lever stage1,

PGR	No.	Parameter	min	max	default	unit	description
							3=CC hysteresis low, 4=RemAP IVS1
13	10	2 15 DI Selection	0	4	0		Configuration input DiFlex14 0=disable, 1=engine brake high, 2=Evobus retarder lever stage2, 3=CC hysteresis high, 4=RemAP IVS2
13	26	Engine Brake Switch Config	0	255	0		Source EBM switch (hardwired or from J1939) 0=hardwired, 1=info from J1939 (muxed), 2=Info from LIN, 255=not available
13	27	Evobus Retarder Lever Enable	0	3	0		Evobus 5 stage retarder switch enable cal 0=disabled, 1=enabled via ERC1, 2=enabled via TSC1, 3=enabled for EBM only

Parameterization example:

Engine Brake – hardwired – 2 stages:

- Example of engine brake parameterization for activation via hardwired pin:
  - Set parameter 13/27 (“Evobus Retarder Lever Enable”) to 3 (“enabled for EBM only”)
  - Set parameter 13/03 (“1 10 DI Selection”) to 3 (“Evobus retarder lever stage0”)
  - Set parameter 13/09 (“2 14 DI Selection”) to 2 (“Evobus retarder lever stage1”)
  - Set parameter 13/10 (“2 15 DI Selection”) to 2 (“Evobus retarder lever stage2”)
  - Set parameter 13/26 (“Engine Brake Switch Config”) to 0 (“hardwired“)

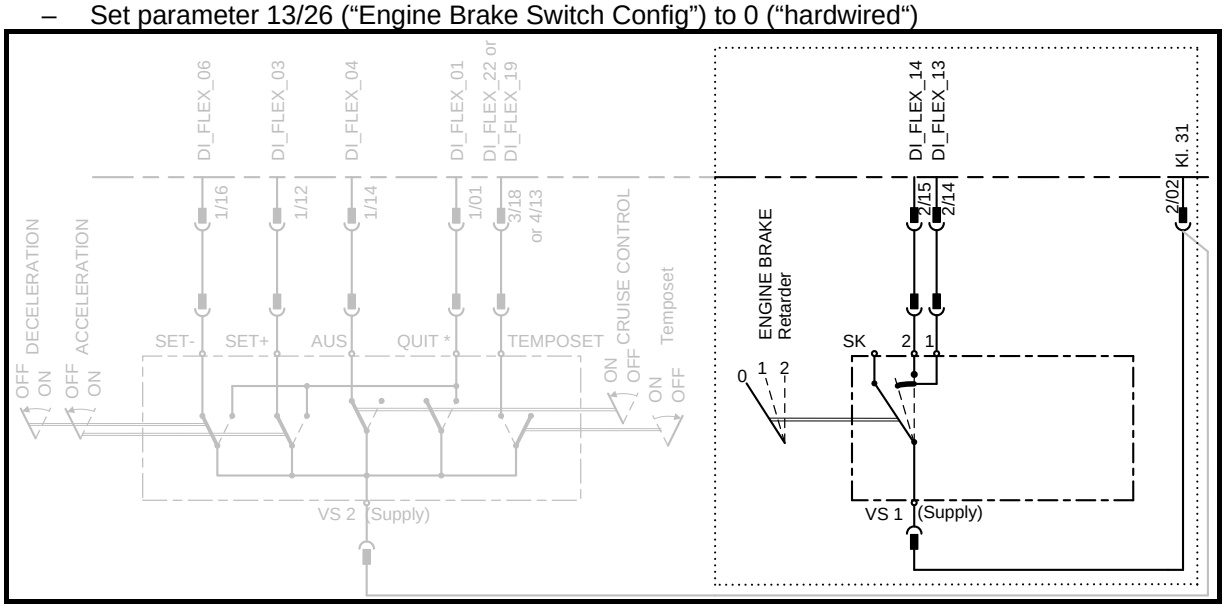


Fig 5.23: Stalk switch wiring (engine brake 2 stage) (Part-No. A 008 545 09 24 – 5B21)

Engine Brake – hardwired – 5 stages:

- Example of engine brake parameterization for activation via hardwired pin:
  - Set parameter 13/27 (“Evobus Retarder Lever Enable”) to 3 (“enabled for EBM only”)
  - Set parameter 13/03 (“1 10 DI Selection”) to 3 (“Evobus retarder lever stage0”)
  - Set parameter 13/09 (“2 14 DI Selection”) to 2 (“Evobus retarder lever stage1”)
  - Set parameter 13/10 (“2 15 DI Selection”) to 2 (“Evobus retarder lever stage2”)
  - Set parameter 13/06 (“2 08 DI Selection”) to 3 (“Evobus retarder lever stage3”)
  - Set parameter 13/05 (“1 17 DI Selection”) to 2 (“Evobus retarder lever stage4”)
  - Set parameter 13/08 (“2 13 DI Selection”) to 2 (“Evobus retarder lever stage5”)
  - Set parameter 13/26 (“Engine Brake Switch Config”) to 0 (“hardwired“)

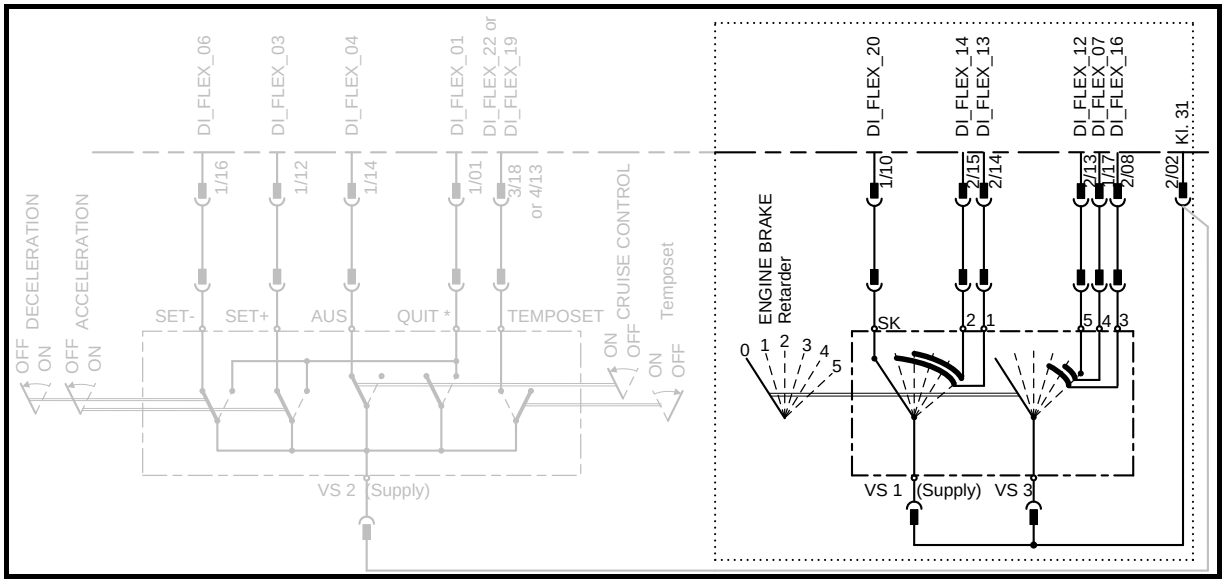


Fig 5.24: Stalk switch wiring (engine brake 5 stage) (Part-No. A 008 545 16 24 – 5B21)

Engine Brake – hardwired – 1 stage:

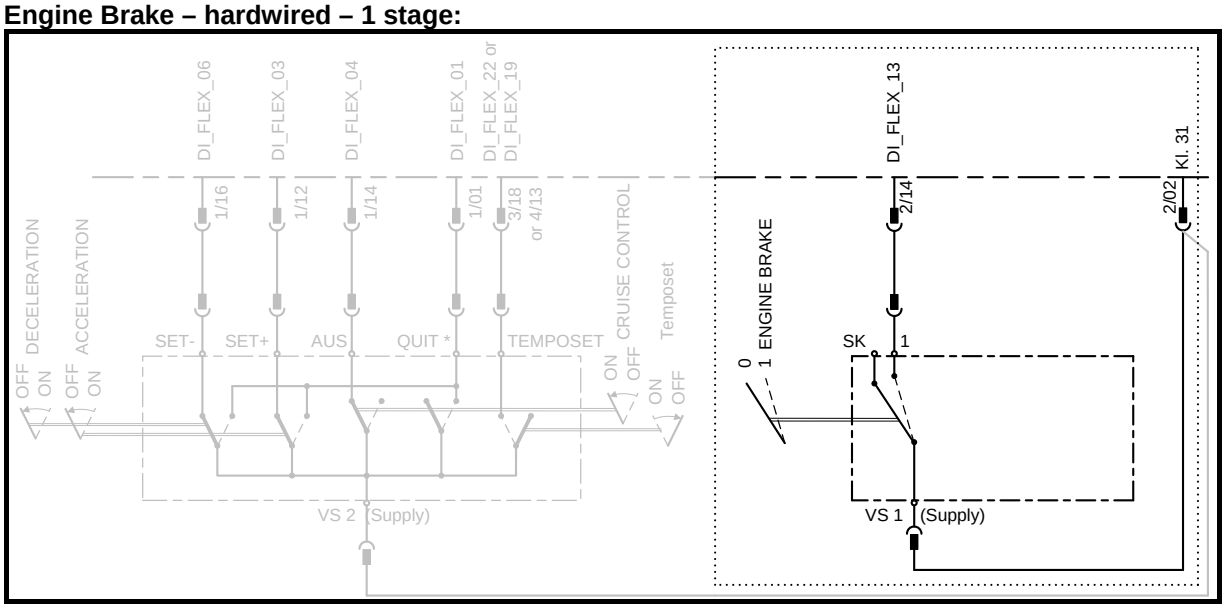


Fig 5.25: Stalk switch wiring (engine brake 1 stage) (Part-No. A 008 545 10 24 – 5B21)

Engine Brake – hardwired – possible use of third party retarder control:

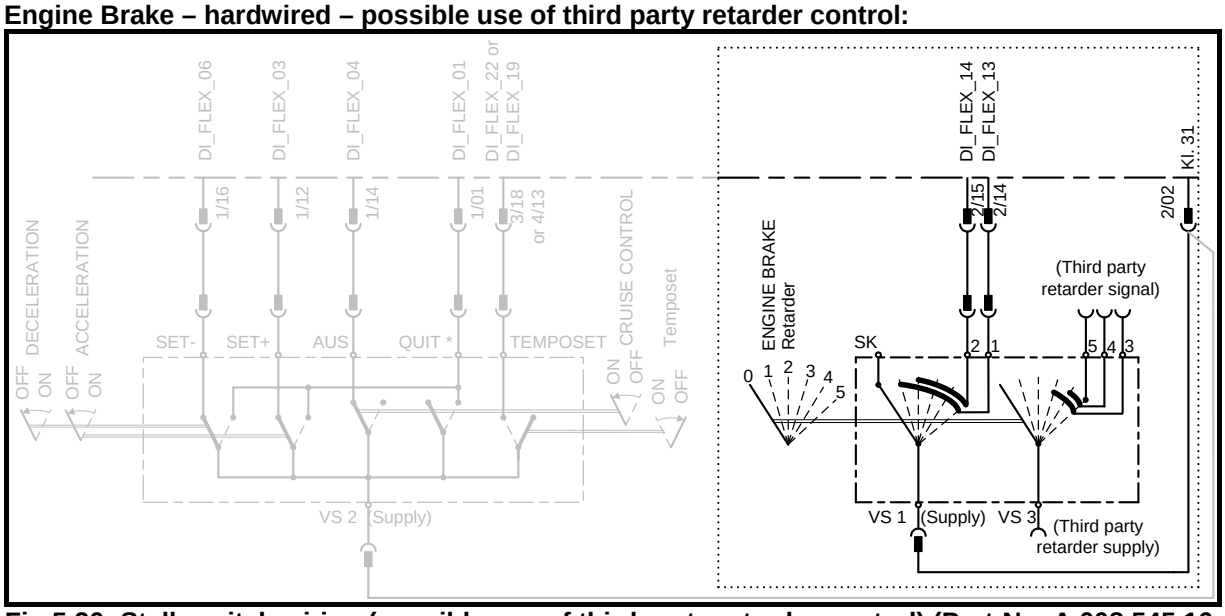


Fig 5.26: Stalk switch wiring (possible use of third party retarder control) (Part-No. A 008 545 16 24 – 5B21)

5.9.2.3. Engine Brake Operation via J1939 CAN Message EBC1

It is possible to request the engine brake via J1939 CAN message, if configurated in the proper way, shown in this chapter.

Inputs:

– SAE J1939 Signal: PGN 61441, “Electronic Brake Controller 1” (EBC1),
SPN 973, “Engine Retarder Selection”

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
01	10	EBC1 Source Address SAE J1939	0	255	33		SAE J1939 Source Address EBC1, 0..255=signal
13	26	Engine Brake Switch Config	0	255	0		Source EBM switch (hardwired or from J1939) 0=hardwired, 1=info from J1939 (muxed), 2=Info from LIN, 255=not available

Parameterization example:

Engine Brake – J1939 CAN message:

· Example of engine brake parameterization for activation via J1939 CAN message EBC1:
– Set parameter 13/26 (“Engine Brake Switch Config”) to 1 (“info from J1939 (muxed)”);
– Configure parameter 01/10 (“EBC1 Source Address SAE J1939”) to 33/0x21;
– Send EBC1 message with SPN 973 set to the requested braking torque in percent.

5.9.3. Automatic Activation of the Engine Brake

There are also three different methods to activate the engine brake systems automatically:

a) Engine brake on service brake
b) Engine brake on CC
c) Engine brake on road speed limit

5.9.3.1. Engine Brake on Service Brake

The parameter 10/18 (“Service Brk Enable Eng Brakes”) allows to configure the engine brake if it will or won’t be activated with the activation of the service brake. It provides several possibilities as shown in the table below.

Value	Description
0	Disabled
1	The engine brake is applied automatically by activation of the service brake and **hold** even if the service brake is deactivated. The actuation of the accelerator pedal deactivates the engine brake.
2	The engine brake is only applied after the operator sets the engine brake level with the according input pins or lever and additionally actuates the service brakes. After the release of the service brake pedal or the engine brake input pins, said are deactivated.
3	Like value 1 but without the hold functionality. If the service brake is released the engine brake is also.

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
10	18	Service Brk Enable Eng Brakes	0	3	0		Enable Engine Brakes on Service Brake 0=disable, 1=enable automatic engine brake and hold when applied service brake, 2=operator selection and service brake for engine brake activation, 3=enable automatic engine brake when applied service brake

5.9.3.2. Engine Brake on CC

Refer to chapter 5.5.1 for further information

5.9.3.3. Engine Brake on Road Speed Limit

The engine brake will be activated automatically, if the vehicle speed exceeds the maximum road speed (parameter 03/23, “Max Road Speed”) limit. To activate this function and to also set the engine brake intensity the parameter 10/17 (“Road Spd Limit Max Stage Num”) is to be set to a value < 0.

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
03	23	Max Road Speed	10	152	90	km/h	Maximum Road Speed (legal) 1280..19456=signal
10	14	Min Road Spd Eng Brk Operation	0	200	0	km/h	Minimum Road Speed for Engine Brake Operation. 0..25600=signal
10	17	Road Spd Limit Max Stage Num	0	5	0		Enable Engine Brake on Road Speed Limiter Engine brakes will come on automatically if value. >0 0=off, 1=low, 2=medium, 3=high, 4=stage #4, 5=stage #5

5.9.4. Deactivation of the Engine Brake

The engine brake is deactivated if one of the following circumstances is occurring:

If driveline is open

- Engine speed below threshold, parameter 10/13 (“Min Eng Spd for Engine Brakes”);

If driveline is closed

- Engine speed below value, parameter 10/05 (“Eng Brk Drvline Clsd Min Spd”);

- Accelerator pedal pushed down further than maximum throttle position for engine brake;
- parameter 10/12 (“Max Throttle Pos for Eng Ret”);
- Vehicle speed below minimum road speed for engine brake operation, parameter 10/14 (“Min Road Spd Eng Brk Operation”)

If cruise control is active
- Refer to chapter 5.5.1

If PTO speed control is active
- Refer to chapter 5.1.2

- Engine brake lock out via SAE J1939;
- Engine brake lock out via Pin DI_FLEX_18;
- (Driver requested)Engine brake disable via pin DI_FLEX_18;
- Engine brake deactivation on release of service brake with parameter 10/18 (“Service Brk Enable Eng Brakes”)

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
10	05	Eng Brk Drvline Clsd Min Spd	800	4000	800	1/min	Minimum Engine Speed for Engine Brakes for closed driveline 0/min, 6400..32000=signal
10	12	Max Throttle Pos for Eng Ret	0	100	4	%	Maximum Throttle Position for Engine Brakes 0..32000=signal
10	13	Min Eng Spd for Engine Brakes	1000	4000	1100	1/min	Minimum Engine Speed for Engine Brakes for open driveline 8000..32000=signal
10	14	Min Road Spd Eng Brk Operation	0	200	0	km/h	Minimum Road Speed for Engine Brake Operation. 0..25600=signal
10	18	Service Brk Enable Eng Brakes	0	3	0		Enable Engine Brakes on Service Brake 0=disable, 1=enable automatic engine brake and hold when applied service brake, 2=operator selection and service brake for engine brake activation, 3=enable automatic engine brake when applied service brake

5.9.4.1. Anti-Lock Brake (ABS) Intervention and the Engine Brake

The ABS intervention is deactivating the engine brake and can be initialized over the configurable input pin 3/18 or 4/13, if the function is enabled by appropriate parameters, 13/12 (“3 18 DI Selection ”) or 13/17 (“4 13 DI Selection”).

An ABS intervention can also be initialized via SAE J1939. The ABS is deactivating the engine brake via TSC1 by sending a torque limitation. The SAE J1939 CAN message EBC1 (“Electronic Brake Controller 1”) contains different signals to monitor the ABS activity and state of operation including the signal SPN 563 (“Anti-Lock Braking (ABS) Active”) that shows if the ABS is active or not.

Diagnostics:
- Analog Value: Torque Speed Command Sender (chapter 6.3.1)
- Analog Value: ERC1 Controlling Device SA (chapter 6.3.1)
- Analog Value: Torque Path State (chapter 6.3.1)
- Binary Value: 7/1, ABS System Active (chapter 6.3.2)

Inputs:
- Pin 3/18, DI_FLEX_22, “Misc (SwitchableTorque)” : Switchable Torque Demand
- Pin 4/13, DI_FLEX_19, “Misc (TempoSet)” : Switchable Torque Demand
- SAE J1939 Signal: PGN 61441, “Electronic Brake Controller 1” (EBC1),
  SPN 563, “Anti-Lock Braking (ABS) Active”

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
01	01	ABS Source Address SAE J1939	0	255	33		SAE J1939 Source Address ABS, 0..255=signal
13	12	3 18 DI Selection	0	12	0		CPC2: Configuration input Sfp02 DSF1 # CPC4: DIFLEX_22 0=disable, 1=enable ABS input, 2=enable transmission retarder input, 3=enable tempo set, 4=enable grid heater detection, 5=switchable torque demand, 6=drive on super structure, 7=throttle inhibit super structure, 8=split select, 9=FUSO Engine brake stage 2 cancel switch, 10=DPF Inhibit Regen Switch, 11=PTO2stat, 12=engine shutdown/Tier4 inducement override
13	17	4 13 DI Selection	0	11	0		Configuration input DiFlex19 DSF0 0=disable, 1=enable ABS input, 2=enable transmission retarder input, 3=enable tempo set, 4=enable grid heater detection, 5=switchable torque demand, 6=drive on super structure, 7=throttle inhibit super structure, 8=split select, 9=FUSO Engine brake stage 2 cancel switch, 10=DPF Inhibit Regen Switch, 11=engine shutdown/Tier4 inducement override

Parameterization example:

ABS intervention – hardwired:

- Example of the parameterization of an input pin (3/18 or 4/13) for deactivating the engine brake because of an ABS intervention
  - Set parameter 13/12 (“3 18 DI Selection”) to 1 (“enable ABS input”);

ABS intervention – J1939 CAN message:

- Example of the parameterization of an input pin for deactivating the engine brake because of an ABS intervention
  - Configure parameter 01/01 (“SAE J1939 Source Address ABS”) to 11/0xB(default) for the source address of the EBC1 message;
  - Evaluate EBC1 message with SPN 563 to check whether the Anti-Lock Braking is active or not.

5.10. Instruments / Displays

The following chapters show an overview of the possibilities to configure the different outputs provided by the CPC4 including the low/high side configuration, fault detection and general use of the pins.

5.10.1. Vehicle Speed

To provide the CPC4 with the appropriate vehicle speed information, different approaches are possible. If a tachograph is used, its C3/B7 speed signal (see chapter 5.10.1.1) has to be connected to input 3/13 (“VehicleSpeedSensor”) of the CPC4.
Otherwise, if the tachograph is equipped with a J1939 CAN interface, it is also possible to provide the actual vehicle speed via J1939 TCO1 CAN message (see chapter 5.10.1.2). The appropriate vehicle speed information source has to be set in parameter 08/13 (“Vehicle Speed Sensor”) or even disabled if none vehicle speed signal is available for the application (not recommended).

Parameter programming of the maximum speed (legal maximum speed) and the deactivation of the speed measurement is only possible with special authorization. Such authorization can be issued to vehicle manufacturers upon application to Daimler.

Due to European legal regulations the Speed Sensor type in parameter 08/13 ("Vehicle Speed Sensor") can only be set to J1939 TCO1 source or C3 signal which are approved as calibrated systems for on-highway applications in Europe. "No sensor" is only permitted for use in off-highway applications.
In every application with vehicle speed sensing via CPC4 the following parameters have to be set. In case of using J1939 ETC1 message those parameters will be used for vehicle speed calculation.
Additionally the parameters will be used in case of a vehicle speed sensor error for calculation of the maximum engine speed to limit the current vehicle speed to the maximum road speed (Parameter 03/23).

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
03	23	Max Road Speed	10	152	90	km/h	Maximum Road Speed (legal) 1280..19456=signal
08	04	Axle Ratio	1	20	4,3		Axle Ratio 1024..20480=signal
08	09	Tire Revs per Unit Distance	160	1599	313	1/km	Tire Revolutions per Distance 160..1599=signal
08	10	Top Gear Ratio	0,1	2,5	0,7		Top Gear Ratio 102..2612=signal
08	11	Two Spd Axle Second Axle Ratio	1	20	1		Two Speed Axle - Second Axle Ratio 1024..20480=signal
08	13	Vehicle Speed Sensor	0	11	1		Vehicle Speed Sensor Configuration 0=no sensor, 1=C3 sensor, 3=J1939 ETC1, 5=J1939 TCO,
08	24	Wheel Revs Front Axle Nr	160	1599	313	1/km	Tire Revolutions per Distance 160..1599=signal

Output:
- Maximum Speed via required torque to MCM2 via CAN connection

Axle Ratio (Dual Speed Axle)

If a dual speed axle or a shiftable transfer case gearbox with two different gear ratios is in use, it is mandatory to set the second axle ratio in parameter 08/11 ("Two Spd Axle Second Axle Ratio") in order to get the correct vehicle speed if the speed sensor is placed in a way that the gear ratios have to be taken into account.
To indicate the switching in axle ratios to the CPC4 there are two possibilities:
- Input pin 1/01 (DI_FLEX_01, "2ndAxleSpeed") can be configured to do just that;
- And SAE J1939 CAN signal "Two Speed Axle Switch" (SPN 69) in PGN 65265 (CCVS1) can be used.

Diagnostics:
- Binary Value: 6/2, Two Speed Axle Switch (chapter 6.3.2)

Inputs:
- Pin 1/01, DI_FLEX_01, "2ndAxleSpeed" : Enable Dual Speed Axle
- SAE J1939 Signal: PGN 65265, "Cruise Control/Vehicle Speed 1" (CCVS1)
  SPN 69, "Two Speed Axle Switch"

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
01	04	CC1 Source Address SAE J1939	0	255	23		SAE J1939 Source Address #1 CCVS1 (PGN 65265). 0..255=signal
01	05	CC2 Source Address SAE J1939	0	255	33		SAE J1939 Source Address #2 CCVS1 (PGN 65265). 0..255=signal

PGR	No.	Parameter	min	max	default	unit	description
01	06	CC3 Source Address SAE J1939	0	255	49		SAE J1939 Source Address #3 CCVS1 (PGN 65265). 0..255=signal
13	01	1 01 DI Selection	0	4	0		Configuration input DiFlex01 0=disable, 1=enable Dual Speed Axle, 2=enable transmission retarder input, 3=clutch switch, 4=Evobus Cruise Control Lever Quit signal
13	20	2nd Axle Speed Switch Config	0	3	0		Source Dual Speed Axle Switch (hardwired or from J1939) 0=hardwired, 1=Ccvs1 from Source Address #1, 2=Ccvs1 from Source Address #2, 3=Ccvs1 from Source Address #3

Regarding the three CCVS1 source address parameters 01/04 ("CC1 Source Address SAE J1939"), 01/05 ("CC2 Source Address SAE J1939") and 01/06 ("CC3 Source Address SAE J1939"): It is important that these three parameters are configured with different values!

Parameterization example

2nd Speed Axle Switch via hardwired input pin:

- Set parameter 13/01 ("1 01 DI Selection") to 1 ("enable Dual Speed Axle");
- Set parameter 13/20 ("2nd Axle Speed Switch Config") to 0 ("hardwired");

2nd Speed Axle Switch via SAE CAN message CCVS1:

- Set parameter 13/20 ("2nd Axle Speed Switch Config") to 1 ("CCVS1 from source address #1");
- Configure the J1939 CAN Source Address of CCVS1 message with parameter 01/04 ("CC1 Source Address SAE J1939") to 23/0x17.
- Send message CCVS1 from SA: 23/0x17, Signal "Two Speed Axle Switch" (SPN 69) set according to the dual axle configuration.

5.10.1.1. Tachograph (C3, B7)

As mentioned above, if a Tachograph with C3/B7 speed signal output is available it is necessary to connect it to input pin 3/13 ("VehicleSpeedSensor") of the CPC4. The input C3 is monitored for a shorted or open circuit. The configuration of the C3 signal has to meet the modulation of the speed signal (described by ISO 16844-2):

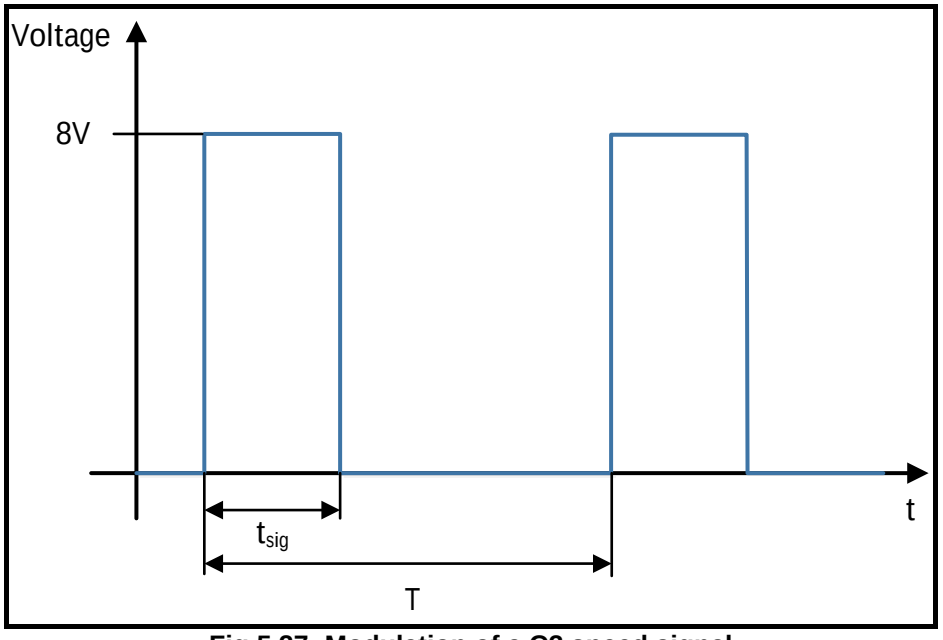


Fig 5.27: Modulation of a C3 speed signal

Inputs:

– Pin 3/13, SFP_09, “C3/B7 VehicleSpeedSensor”

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
03	23	Max Road Speed	10	152	90	km/h	Maximum Road Speed (legal) 1280..19456=signal
08	13	Vehicle Speed Sensor	0	11	1		Vehicle Speed Sensor Configuration 0=no sensor, 1=C3 sensor, 3=J1939 ETC1, 5=J1939 TCO,

Outputs:

– Maximum Speed via required torque to MCM2 via CAN connection

Parameterization example

C3 – Vehicle Speed Signal:

· Tachograph connected to input pin 3/13 with C3 speed signal:

– Set parameter 08/13 (“Vehicle Speed Sensor”) to 1 (“C3 Sensor”)

5.10.1.2. J1939 TCO1 – Message

If the speed signal C3/B7 is not available, the transmission output shaft speed and vehicle speed may be provided by the tachograph via the SAE J1939 message TCO1. If the parameter 08/13 (“Vehicle Speed Sensor”) is set to 5, then the transmission output shaft speed and the vehicle speed are derived from the TCO1 message. It is mandatory that the output shaft speed is provided through this!

Inputs:

– SAE J1939 Signal: PGN 65132, “Tachograph” (TCO1)
SPN 1623, “Tachograph Output Shaft Speed”

– SAE J1939 Signal: PGN 65132, “Tachograph” (TCO1)
SPN 1624, “Tachograph Vehicle Speed”

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
01	62	J1939 Source Addr Tachograph	0	255	238		SAE J1939 Source Address Tachograph 0..255=signal
03	23	Max Road Speed	10	152	90	km/h	Maximum Road Speed (legal) 1280..19456=signal
08	13	Vehicle Speed Sensor	0	11	1		Vehicle Speed Sensor Configuration 0=no sensor, 1=C3 sensor, 3=J1939 ETC1, 5=J1939 TCO

Outputs:

– Maximum Speed via required torque to MCM2 via CAN connection

Parameterization example

SAE J1939 TCO1 – Tachograph Vehicle Speed:

- Tachograph connected via SAE J1939 CAN:
  - Set parameter 08/13 (“Vehicle Speed Sensor”) to 5 (“J1939 TCO”)
  - Leave parameter 01/62 (“J1939 Source Addr Tachograph”) at default value 238/0xEE;
  - Send the CAN message (PGN 65132) “Tachograph” with “Tachograph Output Shaft Speed” (SPN 1623) and “Tachgraph Vehicle Speed” (SPN 1624) set to their according values.

5.10.1.3. Vehicle Speed PWM Output

The PWM vehicle speed output is provided in the form of PWM signal at the output "IWA"(actual value output) to incorporate customer-specific electronic systems. The physical value output at IWA can be selected. The figure below (Fig 5.28) shows the generell signal pattern provided by the said output. The formula used to calculate the signal is provided after the picture.

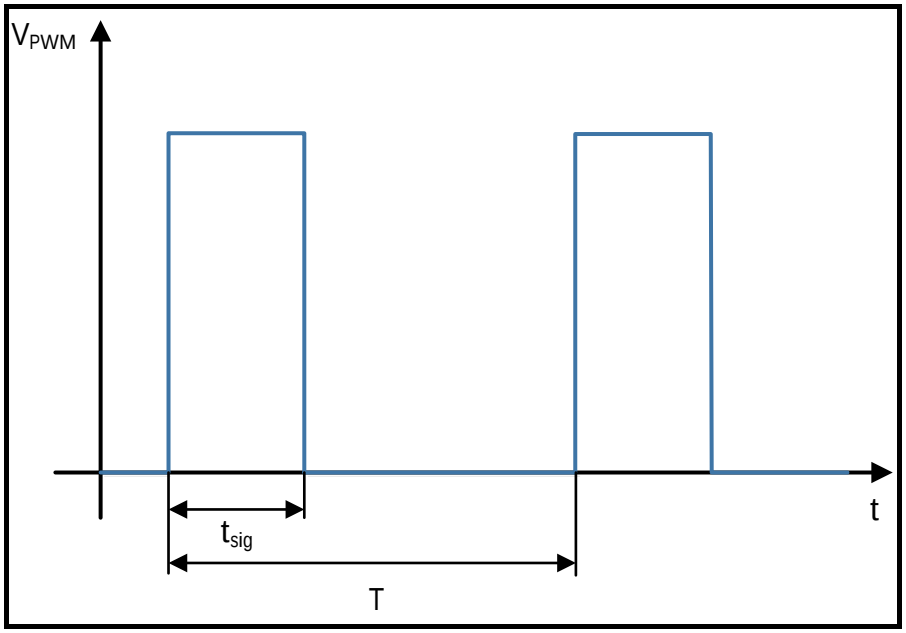


Fig 5.28: Signal pattern of the IWA PWM speed signal

$$\text{Vehicle Speed} = \frac{450}{T\ \ [ms]}\ [\frac{km}{s}] \quad \text{with T = 3 to 150ms}$$

$$t_{sig} = 2\text{ms (static high time)}$$

The speed signal range which can be covered with the above mentioned method results in 3km/h < Vehicle Speed < 150km/h. The following table shows the PWM signal pattern according to the vehicle speed:

Vehicle Speed	PWM Signal pattern
0 km/h	standstill; no pulses are generated; output holds 0V
0 km/h < vehicle speed ≤ 3 km/h	maximum cycle duration T = 150ms (equals 3km/h)
3 km/h < vehicle speed ≤ 150 km/h	maximum cycle duration T = 150ms (equals 3km/h) to minmum cycle duration T = 3ms (equals 150km/h)

Attention! In case the C3 signal is erratic the same signal condition for the PWM (IWA) signal as in 0km/h (standstill) will be present at the outputs FPO_01/FPO_02. In the future a parameter will be available where it can be adjusted if PWM vehicle speed signal on FPO_01/02 pin should hold U_{Batt} to indicate a speed signal error. Therefore a error can be detected.

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
09	06	4 12 FPO_01 Selection	0	10	0		Configuration FPO_01 0=disabled, 1=throttle torque 10%..90%, 2=difference torque (extern load control), 3=throttle torque 90%..10%, 4=actual torque, 5=load torque (no idle torque for automatic transmission), 6=road speed, 7=demand speed, 8=demand speed CC+, 9=Urea Tank Level 10..90%, 10=FUSO Accelerator PWM output
09	12	4 12 FPO_01 Fault Detection	0	15	1		0=Fault Detection Off, 1=Diag, 2=PulseWhenOff, 3=PulseWhenOff + Diag, 4=PulseWhenOn, 5=PulseWhenOn + Diag, 6=PulseWhenOn + PulseWhenOff, 7=PulseWhenOn + PulseWhenOff + Diag, 8=SetFault, 9=SetFault + Diag, 10= SetFault + PulseWhenOff, 11=SetFault + PulseWhenOff + Diag, 12=SetFault + PulseWhenOn, 13=SetFault + PulseWhenOn + Diag, 14=SetFault + PulseWhenOn + PulseWhenOff, 15=SetFault + PulseWhenOn + PulseWhenOff + Diag
09	16	4 12 FPO_01 Resistor Enable	0	1	0		FPO resistance 0=switched off, 1=switched on

Outputs:

– Pin 4/12, FPO_01, “IWA1 (Vehicle Speed PWM Output)” : Road Speed

Parameterization example

Vehicle Speed Output – PWM (IWA):

· Vehicle Speed Output with fault memory entries in case of occouring errors:
  – Set parameter 09/06 (“4 12 FPO_01 Selection”) to 6 (“road speed”)
  – Set parameter 09/12 (“4 12 FPO_01 Fault Detection”) to 9 (“SetFault + Diag”)
  – Set parameter 09/16 (“4 12 FPO_01 Resistor Enable”) to 1 (“switched on”)

5.10.2. Engine Speed

With this a signal for actuating a revolution counter is provided at the output "Engine Speed PWM Output”. Its source depends on whether the CAN connection is available or not:

– if the PT-CAN connection between CPC4 and MCM2 is active, the engine speed is derived from the appropriate CAN message,
– if the PT-CAN connection not available or broken, the engine speed is provided via terminal W (pin 4/04, SFP_11, “Misc(AlternatorTerminalW)”). Only available if the beforementioned input pin is parameterized via parameter 56/01 (“Trans Inshaft Sens Sel” set to 1) and connected correctly.

Inputs:
- Engine speed information from MCM2 via PT-CAN connection

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
09	01	1 9 FPO_02 Selection	0	1	0		Configuration FPO_02 0=disabled, 1=engine speed
09	02	1 9 FPO_02 Engine Speed Display N Mot	200	30000	1604	counts/ rev	Engine Speed Display N Mot Scaling: Pulses per 100 rpm 200..30000=signal
09	08	1 9 FPO_02 Fault Detection	0	15	1		0=Fault Detection Off, 1=Diag, 2=PulseWhenOff, 3=PulseWhenOff + Diag, 4=PulseWhenOn, 5=PulseWhenOn + Diag, 6=PulseWhenOn + PulseWhenOff, 7=PulseWhenOn + PulseWhenOff + Diag, 8=SetFault, 9=SetFault + Diag, 10= SetFault + PulseWhenOff, 11=SetFault + PulseWhenOff + Diag, 12=SetFault + PulseWhenOn, 13=SetFault + PulseWhenOn + Diag, 14=SetFault + PulseWhenOn + PulseWhenOff, 15=SetFault + PulseWhenOn + PulseWhenOff + Diag
09	14	1 9 FPO_02 Resistor Enable	0	1	0		FPO resistance 0=switched off, 1=switched on
56	01	Trans Inshaft Sens Sel	0	2	0		Transmission Input Speed Sensor Configuration 0=no sensor, 1=magnetic pickup transmission speed sensor, 2=Klemme W

Outputs:
- Pin 1/9, FPO_02, “Engine speed PWM output” : Engine Speed

Parameterization example

Engine speed revolution counter:
- Set parameter 09/01 (“1 9 FPO_02 Selection”) to 1 (“engine speed”)
- Set parameter 09/08 (“1 9 FPO_02 Fault Detection”) to 9 (“SetFault + Diag”)
- Set parameter 09/14 (“1 9 FPO_02 Resistor Enable”) to 1 (“switched on”)

5.10.3. Coolant Temperature Gauge

A signal which is compatible with temperature sensors is provided at the output “MISC (Coolant Temperature Gauge)” for connecting up a conventional analogue indicator instrument.

Inputs:
- The associated coolant temperature sensor is connected to the MCM2

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
09	4	3 06 AO_02 Selection	0	2	0		Configuration of Analog Output/Input Pin AO_02 0=disabled, 1=coolant temperature lamp, 2=coolant temperature gauge

PGR	No.	Parameter	min	max	default	unit	description
09	10	3 06 AO_02 Fault Detection	0	15	1		0=Fault Detection Off, 1=Diag, 2=PulseWhenOff, 3=PulseWhenOff + Diag, 4=PulseWhenOn, 5=PulseWhenOn + Diag, 6=PulseWhenOn + PulseWhenOff, 7=PulseWhenOn + PulseWhenOff + Diag, 8=SetFault, 9=SetFault + Diag, 10= SetFault + PulseWhenOff, 11=SetFault + PulseWhenOff + Diag, 12=SetFault + PulseWhenOn, 13=SetFault + PulseWhenOn + Diag, 14=SetFault + PulseWhenOn + PulseWhenOff, 15=SetFault + PulseWhenOn + PulseWhenOff + Diag

Outputs:

– Pin 3/06, AO_02, “Misc (CoolantTemperatureGauge)” : Coolant Temperature Gauge

5.10.4. Coolant Temperature Lamp

Beside an analog gauge, the output AO_02 is additionally capable of driving a temperature indicator lamp, depending on parameter 09/04. The output "AO_02" (coolant indicator lamp) reports impermissibly high coolant temperatures. Here, the output "MIL/CEL/SEL" (warning lamp) is actuated. The temperature limit is stored in the engine data records. The coolant temperature lamp can also be configured to either one of the MISC (Relay3 / Relay4) Pins (4/07 and 4/09).

Inputs:

– CAN information "Coolant temperature too high" from MCM2

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
09	04	3 06 AO_02 Selection	0	2	0		Configuration of Analog Output/Input Pin AO_02 0=disabled, 1=coolant temperature lamp, 2=coolant temperature gauge
14	03	Comparator 3 Temperature	-50	200	200	°C	reserved, Item 8 -1600..6400=signal
14	04	Comparator 3 Temp Hysteresis	-50	200	5	°C	reserved, Item 9 -1600..6400=signal
14	11	Comparator 4 Temperature	-50	200	200	°C	reserved, Item 17 -1600..6400=signal
14	12	Comparator 4 Temp Hysteresis	-50	200	5	°C	reserved, Item 18 -1600..6400=signal
35	16	4 07 DO Selection	0	15	0		usage of Output DoHpLs02 (Relay 4/Comparator 4) [2..6]:Compares the actual value against a configured threshold., [8..13] PTCAN [1+10] digital state 0=disabled, 1=accelerator pedal kick down, 2=actual torque, 3=road speed, 4=engine speed, 5=coolant temperature, 6=pedal torque, 7=boost temperature, 8=oil pressure (threshold), 9=coolant temperature (Eng.Controller threshold), 10=vehicle power shutdown / ignition relay, 11=optimized idle ACC bus (ignition relay), 12=split valve 1, 13=High Exhaust Temperature Lamp, 14=AUX-Relay, 15=PTO2valve2

PGR	No.	Parameter	min	max	default	unit	description
35	17	4 09 DO Selection	0	17	0		usage of Output DoHpLs03 (Relay 3/Comparator 3) 0=disabled, 1=accelerator pedal idle position, 2=actual torque, 3=road speed, 4=engine speed, 5=coolant temperature, 6=pedal torque, 7=boost temperature, 8=oil pressure (threshold), 9=coolant temperature (Eng.Controller threshold), 10=optimized idle active lamp, 11=deceleration lamp, 12=not used, 13=WIF-Lamp, 14=cruise / PTO active lamp, 15=Check Transmission Lamp, 16=Battery Charge Indicator, 17=PTO1valve1
35	35 36	4 07 DO Fault Detection 4 09 DO Fault Detection	0 0	15 15	1 1		0=Fault Detection Off, 1=Diag, 2=PulseWhenOff, 3=PulseWhenOff + Diag, 4=PulseWhenOn, 5=PulseWhenOn + Diag, 6=PulseWhenOn + PulseWhenOff, 7=PulseWhenOn + PulseWhenOff + Diag, 8=SetFault, 9=SetFault + Diag, 10= SetFault + PulseWhenOff, 11=SetFault + PulseWhenOff + Diag, 12=SetFault + PulseWhenOn, 13=SetFault + PulseWhenOn + Diag, 14=SetFault + PulseWhenOn + PulseWhenOff, 15=SetFault + PulseWhenOn + PulseWhenOff + Diag
35	52 53	4 07 DO Configuration 4 09 DO Configuration	0 0	1 1	0 0		Binary Output Configuration, hp: high power, ls: low side 0=disabled, 1=enabled

Outputs:

- Pin 3/06, AO_02, “Misc (CoolantTemperatureGauge)” : Coolant Temperature Lamp
- Pin 4/07, DO_HP_LS_02, “Misc (Relay4)” : Coolant Temperature
- Pin 4/09, DO_HP_LS_03, “Misc (Relay3)” : Coolant Temperature

5.10.5. Coolant Level Low Lamp

To signal a low coolant level (detected by the coolant level sensor, see chapter 5.10.6) it is possible to connect a coolant level low lamp to the hardwired output pin 3/17 (“Misc(Relay 1)”). The following parameters are necessary to configure the CPC4 to make proper use of said coolant level low lamp.

Diagnostics:

- Binary Value: 12/2, Low Coolant Level Lamp (chapter 6.3.2)

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
35	12	3 17 DO Selection	0	10	0		usage of Output DoHpLs04 0=disabled, 1=enable starter lockout, 2=enable kick down output, 3=not used, 4=optimized idle alarm, 5=split valve 2, 6=starter lockout and AGS2 run signal / starter lockout, 7=engine brake disabled for over speed, 8=battery voltage low lamp,

PGR	No.	Parameter	min	max	default	unit	description
							9=coolant level low lamp, 10=PTO1valve2
35	31	3 17 DO Fault Detection	1	15	1		0=Fault Detection Off, 1=Diag, 2=PulseWhenOff, 3=PulseWhenOff + Diag, 4=PulseWhenOn, 5=PulseWhenOn + Diag, 6=PulseWhenOn + PulseWhenOff, 7=PulseWhenOn + PulseWhenOff + Diag, 8=SetFault, 9=SetFault + Diag, 10= SetFault + PulseWhenOff, 11=SetFault + PulseWhenOff + Diag, 12=SetFault + PulseWhenOn, 13=SetFault + PulseWhenOn + Diag, 14=SetFault + PulseWhenOn + PulseWhenOff, 15=SetFault + PulseWhenOn + PulseWhenOff + Diag
35	48	3 17 DO Configuration	0	1	0		Binary Output Configuration, hp: high power, ls: low side 0=disabled, 1=enabled

Outputs:
Coolant Level Low Lamp:
- Pin 3/17, DO_HP_LS_04, “Misc (Relay 1)” : Coolant Level Low Lamp or
- J1939 Signal: PGN 64775, “Direct Lamp Control Command 1” (DLCC1)
  SPN 5084, “Engine Coolant Level Low Lamp Command”

Parameterization examples for fault detection

Coolant Level Low Lamp:
· For the use of a digital output as low side switch it is recommended to set the fault detection mask to:
- Set parameter 35/12 (“3 17 DO Selection”) to 9 (“coolant level low lamp”);
- Set parameter 35/31 (“3 17 DO Fault Detection”) to 9 (“SetFault + Diag”);
- Set parameter 35/48 (“3 17 DO Configuration”) to 1 (“enabled”)

5.10.6. Coolant Level Sensor

The use of a coolant level sensor is strictly recommended!

Remark: The CPC4 support an engine protection shutdown in combination with parameter 18/01 (“Cool Level Eng Protect Shtdn”) (see chapter 5.12.1 for further information).

Inputs
- Pin 03/11, SFP_14, “CoolLevSensor”
- Pin 03/02, AGND, “SensorGround”

Parameter

PGR	No.	Parameter	min	max	default	unit	description
32	02	Cool Level Sensor Input Enable	0	5	3		Coolant Level Sensor Type Input (KW_SE) 0=disable, 1=dual level probe sensor (IMO_ACTROS), fix threshold evaluation, 2=single level probe sensor (Rusty Nail), temperature dependent evaluation, 3=dual level float sensor (FTL), fix threshold evaluation, 4=single level probe sensor (Rusty Nail), fix

PGR	No.	Parameter	min	max	default	unit	description
							threshold evaluation, 5=dual level probe sensor (IMO_SFTP), fix threshold evaluation

To monitor the coolant level a sensor is connected via the input pins 3/11 (“CoolLevSensor”) and 3/02 (“SensorGround”), with the later one used as ground. According to which type of sensor is used, the corresponding parameter 32/02 (“Cool Level Sensor Input Enable”) has to be set correctly to allow a proper supervision of the coolant level.
The two recommended examples in this chapter show a “make contact” sensor type and a “break contact” sensor type with their slightly different resistor/reed-contact construction and the according “resistor/coolant level” tables. To indicate an empty coolant fluid tank it is possible to connect a lamp to the output pin 3/17 (“Misc(Relay 1)”) (see chapter 5.10.5 for further information regarding the signalisation of the collant level).

5.10.6.1. Coolant level sensor: IMO classic

List of coolant level warnings in case of parameter 32/02 (“Cool Level Sensor Input Enable”) set to 1 (“dual level probe sensor (IMO_ACTROS), fix threshold evaluation”) when using a dual level sensor:

Remark: The below figure of the sensor chematic shows the (reed-) switch position of the sensor for the correct coolant level (state “Full”).

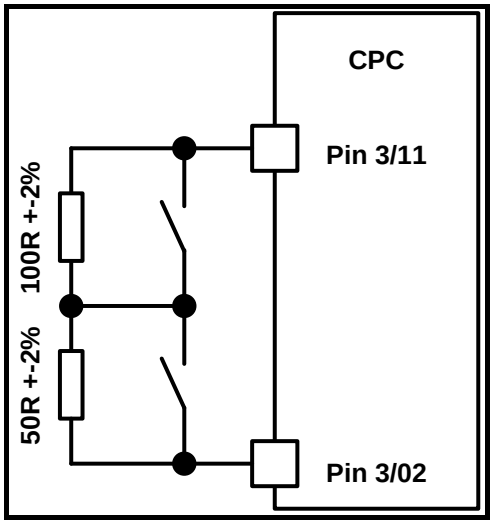


Fig 5.29: Dual level probe sensor (IMO classic)

Coolant Level	Resistor	Output: Coolant Level Low Lamp (Pin 3/17)
Full	150 Ohm	No warning
Partly	100 Ohm	Warning
Empty	0 Ohm	Warning
Error	50 Ohm	Hardware error; check fault memory
Error	> 300 Ohm	Hardware error; check fault memory

List of coolant level warnings in case of parameter 32/02 (“Cool Level Sensor Input Enable”) set to 1 (“dual level probe sensor (IMO_ACTROS), fix threshold evaluation”) when using a single level sensor (Part-No. A970 545 01 24):

Remark: The below figure of the sensor chematic shows the (reed-) switch position of the sensor for the correct coolant level (state “Full”).

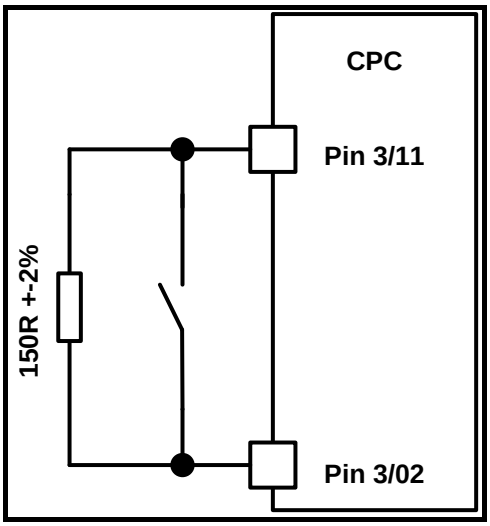


Fig 5.30: Single level probe sensor (IMO classic)

Coolant Level	Resistor	Output: Coolant Level Low Lamp (Pin 3/17)
Full	150 Ohm	no warning
Empty	0 Ohm	warning (red)
Error	> 300 Ohm	SNA

5.10.6.2. Coolant level sensor: IMO

List of coolant level warnings in case of parameter 32/02 (“Cool Level Sensor Input Enable”) set to 5 (“dual level probe sensor (IMO_SFTP), fix threshold evaluation”) and using the according dual level sensor (Part-No. A960 542 06 17):

Remark: The below figure of the sensor chematic shows the (reed-) switch position of the sensor for the correct coolant level (state “Full”).

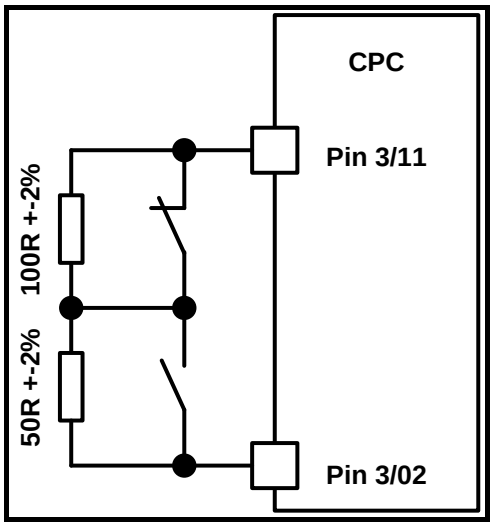


Fig 5.31: Dual level probe sensor (IMO)

Coolant Level	Resistor	Output: Coolant Level Low Lamp (Pin 3/17)
Full	50 Ohm	No warning
Partly	150 Ohm	No warning (if engine warm)
		Warning (if engine cold)
Empty	100 Ohm	Warning
Error	0 Ohm, > 300 Ohm	Hardware error; check fault memory

5.10.7. Oil Pressure Gauge

With MDEG engines (OM 63x) an oil pressure switch is delivered instead of an oil pressure sensor!

A signal which is compatible with oil pressure sensors is provided at the output pin 3/05 (“Misc (OilPressureGauge)”) for connecting up a conventional analogue indicator instrument.

Diagnostics:
- Binary Value: 12/3, Low Oil Pressure Lamp (chapter 6.3.2)

Inputs:
- The associated oil pressure sensor is connected to the MCM2

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
09	03	3 05 AO_01 Selection	0	4	0		Configuration of Analog Ouput/Input Pin AO_01 0=disabled, 1=oil pressure lamp, 2=5 bar oil pressure gauge, 3=10 bar oil pressure gauge, 4=fuel filter sensor
09	09	3 05 AO_01 Fault Detection	0	15	1		0=Fault Detection Off, 1=Diag, 2=PulseWhenOff, 3=PulseWhenOff + Diag, 4=PulseWhenOn, 5=PulseWhenOn + Diag, 6=PulseWhenOn + PulseWhenOff, 7=PulseWhenOn + PulseWhenOff + Diag, 8=SetFault, 9=SetFault + Diag, 10= SetFault + PulseWhenOff, 11=SetFault + PulseWhenOff + Diag, 12=SetFault + PulseWhenOn, 13=SetFault + PulseWhenOn + Diag, 14=SetFault + PulseWhenOn + PulseWhenOff, 15=SetFault + PulseWhenOn + PulseWhenOff + Diag

Outputs:
- Pin 3/05, AO_01, “Misc (OilPressureGauge)” : 5 bar oil pressure gauge / 10 bar oil pressure gauge

5.10.8. Oil Pressure Lamp

Beside an analog gauge, the output pin 3/05 (“Misc (OilPressureGauge)”) is additionally capable of driving an oil pressure indicator lamp, depending on parameter 09/03. The oil pressure limit is stored in the engine data records. The oil pressure indicator lamp can also be configured to either one of the Pins 4/07 (“Misc (Relay 4)”) and 4/09 (“Misc (Relay 3)”) or digital output Pin 3/12 (“Misc (OilPressureLowLamp)”).

Diagnostics:
- Binary Value: 12/3, Low Oil Pressure Lamp (chapter 6.3.2)

Inputs:
- The associated oil pressure sensor is connected to the MCM2

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
09	03	3 05 AO_01 Selection	0	4	0		Configuration of Analog Ouput/Input Pin AO_01 0=disabled,

PGR	No.	Parameter	min	max	default	unit	description
							1=oil pressure lamp, 2=5 bar oil pressure gauge, 3=10 bar oil pressure gauge, 4=fuel filter sensor
09	09	3 05 AO_01 Fault Detection	0	15	1		0=Fault Detection Off, 1=Diag, 2=PulseWhenOff, 3=PulseWhenOff + Diag, 4=PulseWhenOn, 5=PulseWhenOn + Diag, 6=PulseWhenOn + PulseWhenOff, 7=PulseWhenOn + PulseWhenOff + Diag, 8=SetFault, 9=SetFault + Diag, 10= SetFault + PulseWhenOff, 11=SetFault + PulseWhenOff + Diag, 12=SetFault + PulseWhenOn, 13=SetFault + PulseWhenOn + Diag, 14=SetFault + PulseWhenOn + PulseWhenOff, 15=SetFault + PulseWhenOn + PulseWhenOff + Diag
35	10	3 12 DO Selection	0	8	0		usage of Output DoLpFlex04 0=disabled, 1=oil level lamp, 2=not used, 3=oil pressure low lamp, 4=cruise / PTO active lamp, 5=Fuso retarder control 2, 6=battery voltage low lamp, 7=Fuel Filter Restriction Lamp, 8=RockOutMode
35	16	4 07 DO Selection	0	15	0		usage of Output DoHpLs02,[2..6]:Compares the actual value against a configured threshold.,[8..13] PTCAN [1+10] digital state 0=disabled, 1=accelerator pedal kick down, 2=actual torque, 3=road speed, 4=engine speed, 5=coolant temperature, 6=pedal torque, 7=boost temperature, 8=oil pressure (threshold), 9=coolant temperature (Eng.Controller threshold), 10=vehicle power shutdown / ignition relay, 11=optimized idle ACC bus (ignition relay), 12=split valve 1, 13=High Exhaust Temperature Lamp, 14=AUX-Relay, 15=PTO2valve2
35	17	4 09 DO Selection	0	17	0		usage of Output DoHpLs03 0=disabled, 1=accelerator pedal idle position, 2=actual torque, 3=road speed, 4=engine speed, 5=coolant temperature, 6=pedal torque, 7=boost temperature, 8=oil pressure (threshold), 9=coolant temperature (Eng.Controller threshold), 10=optimized idle active lamp, 11=deceleration lamp, 12=not used, 13=WIF-Lamp, 14=cruise / PTO active lamp, 15=Check Transmission Lamp, 16=Battery Charge Indicator, 3517=PTO1valve1
35 35	29 35	3 12 DO Fault Detection 4 07 DO Fault Detection	0 0	15 15	1 1		0=Fault Detection Off, 1=Diag,

PGR	No.	Parameter	min	max	default	unit	description
35	36	4 09 DO Fault Detection	0	15	1		2=PulseWhenOff, 3=PulseWhenOff + Diag, 4=PulseWhenOn, 5=PulseWhenOn + Diag, 6=PulseWhenOn + PulseWhenOff, 7=PulseWhenOn + PulseWhenOff + Diag, 8=SetFault, 9=SetFault + Diag, 10= SetFault + PulseWhenOff, 11=SetFault + PulseWhenOff + Diag, 12=SetFault + PulseWhenOn, 13=SetFault + PulseWhenOn + Diag, 14=SetFault + PulseWhenOn + PulseWhenOff, 15=SetFault + PulseWhenOn + PulseWhenOff + Diag
35	46	3 12 DO Configuration	0	2	0		Binary Output Configuration, lp: low power, ls: low side, hs: high side, flex: switching either to ls or hs 0=disabled, 1=Low side only, 2=High side only
35 35	52 53	4 07 DO Configuration 4 09 DO Configuration	0 0	1 1	0 0		Binary Output Configuration, hp: high power, ls: low side 0=disabled, 1=enabled

Outputs:

- Pin 3/05, AO_01, “Misc (OilPressureGauge)” : Oil Pressure Lamp
- Pin 3/12, DO_LP_FLEX_04, “Misc (OilPressureLowLamp)” : Oil Pressure Low Lamp
- Pin 4/07, DO_HP_LS_02, “Misc (Relay4)” : Oil Pressure (Threshold)
- Pin 4/09, DO_HP_LS_03, “Misc (Relay3)” : Oil Pressure (Threshold)

5.10.9. Oil Level Lamp

The output pin 3/12 (“Misc (OilPressureLowLamp)”) can be configured to report impermissibly low oil levels. The function "Oil level warning" is only available on engines with oil level sensor. The oil level limit is stored in the engine data records. If the oil level is too low, the lamp will be illuminated solid, if the oil level is very low, the lamp will be flashing.

Inputs:

- The associated oil level sensor is connected to the MCM2

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
35	10	3 12 DO Selection	0	8	0		usage of Output DoLpFlex04 0=disabled, 1=oil level lamp, 2=not used, 3=oil pressure low lamp, 4=cruise / PTO active lamp, 5=Fuso retarder control 2, 6=battery voltage low lamp, 7=Fuel Filter Restriction Lamp, 8=RockOutMode
35	29	3 12 DO Fault Detection	0	15	1		0=Fault Detection Off, 1=Diag, 2=PulseWhenOff, 3=PulseWhenOff + Diag, 4=PulseWhenOn, 5=PulseWhenOn + Diag, 6=PulseWhenOn + PulseWhenOff, 7=PulseWhenOn + PulseWhenOff + Diag, 8=SetFault, 9=SetFault + Diag, 10= SetFault + PulseWhenOff, 11=SetFault + PulseWhenOff + Diag, 12=SetFault + PulseWhenOn,

PGR	No.	Parameter	min	max	default	unit	description
							13=SetFault + PulseWhenOn + Diag, 14=SetFault + PulseWhenOn + PulseWhenOff, 15=SetFault + PulseWhenOn + PulseWhenOff + Diag
35	46	3 12 DO Configuration	0	2	0		Binary Output Configuration, lp: low power, ls: low side, hs: high side, flex: switching either to ls or hs 0=disabled, 1=Low side only, 2=High side only

Outputs:

– Pin 3/12, DO_LP_FLEX_04, “Misc (OilPressureLowLamp)” : Oil Level Lamp

5.10.10. Signal Buzzer

In every Tier4 application a signal buzzer is needed!

The CPC4 support a signal buzzer to give the engine operator an acoustically warning or information signal. Depending of vehicle configuration it is nessasary to cange a parameter to influence the trigger condition of the buzzer request.

The parameter 31/13 (“Buzzer Selection-bit coded-”) allows to configure the different triggers sources via a bit coding scheme, shown in the table below.

Bit	Trigger	Duration	Info
0	Non silent mode		
1	Fault Code Management (FCM)	Continuous	Needed
2	MCM	Continuous	Needed
3	AG / (Reserved)	Short	Only DAI Transmission
4	AG / TCM / (Reserved)	Long	Only DAI Transmission
5	MCM	Continuous	Tier4
6	CCM	Continuous	Only DAI Transmission
7	Overspeed	Continuous	Needed

Remark: For DAI Tranmission it is possible to adjust the duration of the buzzer signal via the parameters 31/11 (“Buzzer Short Time”), 31/12 (“Buzzer Long Time”) and 31/19 (“Buzzer Creep Abort Time”) for the Creep-Mode.

Parameters

PGR	No.	Parameter	min	max	default	unit	description
31	11	Buzzer Short Time	0	25	1	s	Time for a short Buzzer activation 0..250=signal
31	12	Buzzer Long Time	0	25	3	s	Time for a long Buzzer activation 0..250=signal
31	13	Buzzer Selection -bit coded-	0	255	167		to activate some buzzer activation, bit coded. Bit0:non silent mode, Bit1:buzzer from FCM, Bit2:buzzer from MCM, Bit3:all short buzzers, Bit4: all long buzzers, Bit5: buzzer from Tier4 #1 MCM, Bit6: buzzer from TIER4 #2 CCM request (VIAB), Bit7: buzzer from TIER4 #3 OverSpeedRequest 0..255=signal
31	19	Buzzer Creep Abort Time	0	25	0,2	s	Time for a long Buzzer activation 0..250=signal

Outputs

– Pin 4/01, DO_LP_LS_03, “Buzzer”

5.10.11. Coolant Temperature Lamp and Gauge

It is possible to use Output pin 4/09 (“Misc (Relay 3)”) and/or 4/07 (“Misc (Relay 4)”) to drive the Coolant temperature indicator lamp. Output 4/09 (“Misc (Relay 3)”) is configured via parameter 35/17 (“4 09 DO Selection”) and output 4/07 (Misc (Relay 4)”) is configured via parameter 35/16 (“4 07 DO Selection”). In this configuration the output pin AO_02 (“Misc (CoolantTemperatureGauge)”) are still available for use with an analog gauge.

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
35	10	3 12 DO Selection	0	8	0		usage of Output DoLpFlex04 0=disabled, 1=oil level lamp, 2=not used, 3=oil pressure low lamp, 4=cruise / PTO active lamp, 5=Fuso retarder control 2, 6=battery voltage low lamp, 7=Fuel Filter Restriction Lamp, 8=RockOutMode
35	16	4 07 DO Selection	0	15	0		usage of Output DoHpLs02,[2..6]:Compares the actual value against a configured threshold.,[8..13] PTCAN [1+10] digital state 0=disabled, 1=accelerator pedal kick down, 2=actual torque, 3=road speed, 4=engine speed, 5=coolant temperature, 6=pedal torque, 7=boost temperature, 8=oil pressure (threshold), 9=coolant temperature (Eng.Controller threshold), 10=vehicle power shutdown / ignition relay, 11=optimized idle ACC bus (ignition relay), 12=split valve 1, 13=High Exhaust Temperature Lamp, 14=AUX-Relay, 15=PTO2valve2
35	17	4 09 DO Selection	0	17	0		usage of Output DoHpLs03 0=disabled, 1=accelerator pedal idle position, 2=actual torque, 3=road speed, 4=engine speed, 5=coolant temperature, 6=pedal torque, 7=boost temperature, 8=oil pressure (threshold), 9=coolant temperature (Eng.Controller threshold), 10=optimized idle active lamp, 11=deceleration lamp, 12=not used, 13=WIF-Lamp, 14=cruise / PTO active lamp, 15=Check Transmission Lamp, 16=Battery Charge Indicator, 17=PTO1valve1

Outputs:

– Pin 3/06, AO_02, “Misc (CoolantTemperatureGauge)” : Coolant Temperature Lamp / Coolant Temperature Gauge
– Pin 4/09, DO_HP_LS_03, “Misc (Relay3)” : Coolant Temperature
– Pin 4/07, DO_HP_LS_02, “Misc (Relay4)” : Coolant Temperature

5.10.12. Check Engine Lamp

The output "CEL"(check engine lamp) reports impermissible engine operating states (e. g. oil pressure too low) and active faults which are recognized by the control unit due to the permanent monitoring of the inputs and outputs.

The output "CEL" must be connected to a suitable warning lamp. If the warning lamp lights up while the engine is in operation, both the engine and the electronics must be examined.
Stop the engine immediately if the coolant temperature is too high, the oil pressure too low or the oil level too low. The operating safety of the engine is endangered (risk of engine damage).

The output "CEL" is actuated if the following faults are detected:

- No PT-CAN connection to engine electronics MCM2 or CAN data implausible
- Active faults in MCM2 engine management fault memory
- Active faults in CPC4 fault memory

Inputs:
- PT-CAN information "Coolant temperature too high“ from MCM2
- PT-CAN information "Oil pressure too low“ from MCM2
- PT-CAN information "Oil level too low“ from MCM2
- PT-CAN information "Buzzer instruction"

Outputs:
- Pin 2/10, DO_LP_FLEX_03, “CEL (Check Engine Lamp)”

5.10.13. Stop Engine Lamp

The output "SEL" (Stop Engine Lamp) reports serious faults which require the engine to be switched off immediately. Failure to switch the engine off could result in major damage to the engine, possibly even its destruction. The output "SEL" has to be connected to a warning lamp as well as to a warning buzzer.

Inputs:
CAN instruction “Buzzer” from MCM2 in the event of:

- Oil level impermissibly low
- Oil pressure impermissibly low
- Coolant temperature impermissibly high

The limits for the values listed above are stored in the engine data records.
The sensors for Oil level, Oil pressure and Coolant temperature are connected to the MCM2.
Instruction "Buzzer“ from CPC4 in the event of:

- Coolant level impermissibly low

The sensor for Coolant level is connected to the CPC4.

Outputs:
- Pin 3/16, DO_LP_FLEX_05, “SEL (Stop Engine Lamp)”

5.11. Limitations

5.11.1. Common Limits

Common limitations are active in both driving mode and PTO speed control mode. The maximum values effective in parameter group 3 (“Common Limiters”) or in the engine electronics can only be superseded by lower values, the minimum values only by higher values.

Parameters:

PGR	No.	Parameter	min	max	default	Unit	description
03	20	Max Engine Speed	0	4000	4000	1/min	Maximum Engine Speed. Is only active with a manual transmission type (parameter 02/09 à 0=Manual without Neutral switch or 3=Manual with neutral switch), 0..32000=signal
03	22	Max Engine Torque	0	5000	5000	Nm	Maximum Engine Torque 0..25000=signal
03	23	Max Road Speed	10	152	90	km/h	Maximum Road Speed (legal) 1280..19456=signal
03	27	Min Engine Speed	0	1000	496	1/min	Minimum Engine Speed 0/min N min 0..32000=signal

Remark: Due to legislation it is <u>forbidden</u> to set the minimum engine speed (parameter 03/27, "Min Engine Speed") to a value <u>greater than 1000 1/min</u>!

The CPC4 fulfilled with the Software R32 the criteria for a certification of ECE-R89 norm part 3.

The parameter 03/23 ("Max Road Speed"), which determines the allowed road speed maximum is set to value 90km/h and can only be changed with the appropriate authorization. The set value is valid unless for a few exceptions (for example the inducement, see chapter 0) and can only be superseded by lower vehicle speeds using the switchable limitations (see chapter 5.11.2).

5.11.2. Switchable Limits

The inputs "Limiter0", "Limiter1" or "Limiter2" can be used to realize several different switchable limitations:

- Idle speed boost, e. g.: In case an air conditioner is built-in and activated, it is possible to limit the minimum engine speed to compensate for the decreasing idle speed caused by the additional load of the AC (parameters 05/08 ("Limiter0 Min Eng Speed Enabled"), 05/13 ("Limiter1 Min Eng Speed Enabled") and/or 06/07 ("Limiter2 Min Eng Speed Enabled")).
- Maximum engine speed limitation e.g. for pumps or other power take-off(parameters 05/03 ("Limiter0 Max Eng Speed Enabled"), 05/09 ("Limiter1 Max Eng Speed Enabled") and/or 06/03 ("Limiter2 Max Eng Speed Enabled")).

Remark: To enable the idle speed increase / decrease via "Limiter0", "Limiter1" or "Limiter2" it is necessary to configure the parameter 03/01 ("Idle Configuration for Limiter Inputs") to determine whether it should be available if e. g. transmission is neutral or park brake is enabled, etc.

- Vehicle speed limitation e. g. for road sweepers or refuse collection trucks in working mode (parameters 05/05 ("Limiter0 Max Road Speed Enabled"), 05/11 ("Limiter1 Max Road Speed Enabled") and/or 06/06 ("Limiter2 Max VSpeed")).
- Maximum torque limitation e. g. as overload protection for power take-off, transmission etc. (parameters 05/04 ("Limiter0 Max Eng Trq Enabled"), 05/10 ("Limiter1 Max Eng Trq Enabled") and/or 06/04 ("Limiter2 Max Eng Torque"))

Switchable limitations are active in both driving mode and working speed governor mode. The "maximum" values effective in parameter group 3, Common Limiters, or in the engine electronics can only be superseded by lower values, the "minimum" values only by higher.

Diagnostics:

- Binary Value: 4/1, Limiter 0 Set Switch (chapter 6.3.2)
- Binary Value: 4/2, Limiter 1 Set Switch (chapter 6.3.2)

Inputs:

- Pin 1/11, DI_FLEX_08, "Limiter0" : LIM0
- Pin 2/11, DI_FLEX_10, "Limiter1" : LIM1
- Pin 2/12, DI_FLEX_11, "Limiter2"

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
03	01	Idle Configuration for Limiter Inputs	0	4	0		Idle Configuration for Limiter Inputs 0=disabled, 1=enabled, 2=enabled if neutral, 3=enabled if neutral and park brake, 4=enabled if park brake
05	03	Limiter0 Max Eng Speed Enabled	0	4000	4000	1/min	Maximum Engine Speed when Limiter0 is enabled 0..32000=signal
05	04	Limiter0 Max Eng Trq Enabled	0	5000	5000	Nm	Maximum Engine Torque when Limiter0 is enabled 0..25000=signal
05	05	Limiter0 Max Road Spd Enabled	0	152	152	km/h	Maximum Road Speed when Limiter0 is enabled 0..19456=signal
05	08	Limiter0 Min Eng Speed Enabled	0	1000	496	1/min	Minimum Engine Speed when Limiter0 is enabled 0..32000=signal
05	09	Limiter1 Max Eng Speed Enabled	0	4000	4000	1/min	Maximum Engine Speed when Limiter1 is enabled 0..32000=signal
05	10	Limiter1 Max Eng Trq Enabled	0	5000	5000	Nm	Maximum Engine Torque when Limiter1 is enabled 0..25000=signal
05	11	Limiter1 Max Road Spd Enabled	0	152	152	km/h	Maximum Road Speed when Limiter1 is enabled 0..19456=signal
05	13	Limiter1 Min Eng Speed Enabled	0	1000	496	1/min	Minimum Engine Speed when Limiter1 is enabled 0..32000=signal
06	03	Limiter2 Max Eng Speed Enabled	0	4000	4000	1/min	Maximum Engine Speed LIM2 Enabled 0..32000=signal
06	04	Limiter2 Max Eng Torque	0	5000	5000	Nm	Maximum Engine Torque LIM2 Enabled 0..25000=signal
06	06	Limiter2 Max VSpeed	0	152	152	km/h	Maximum Road Speed LIM2 Enabled 0..19456=signal
06	07	Limiter2 Min Eng Speed Enabled	0	1000	496	1/min	Minimum Engine Speed LIM2 Enabled 0..32000=signal

Remark: Due to legislation it is <u>forbidden</u> to set the minimum engine speed for the switchable limitations (parameters 05/08, "Limiter0 Min Eng Speed Enabled", 05/13 " Limiter1 Min Eng Speed Enabled" and 06/07 "Limiter2 Min Eng Speed Enabled") to a value <u>greater than 1000 1/min</u>!

5.11.3. Power Rating Curves

Powerrating is a function to reduce the torque of the engine. The torque reduction of the engine characteristics can be adjusted via three curves. These power rating curves consist of a set of factors which are multiplied with the actual engine torque curve to limit the CPC torque request to the MCM.

Then the chosen curve is multiplied with the torque curve map send by the MCM to form the modified torque curve. To allow a smooth transition between the modified and the unmodified torque curve the selected power rating curve is superimposed with a ramp.
With parameter 24/20 it is possible to allow the power rating only in specific modes of operation like e. g. torque control mode or PTO mode.

To activate power rating in combination with cruise control the parameter 24/01 ("CC Power Rating Selection") has to be set to value " 1=use the curve selected by PGR024 / 69"

The actual state of the power rating functionality is provided by the J1939 CAN Message OHCSS ("Off-Highway Engine Control Selection States").

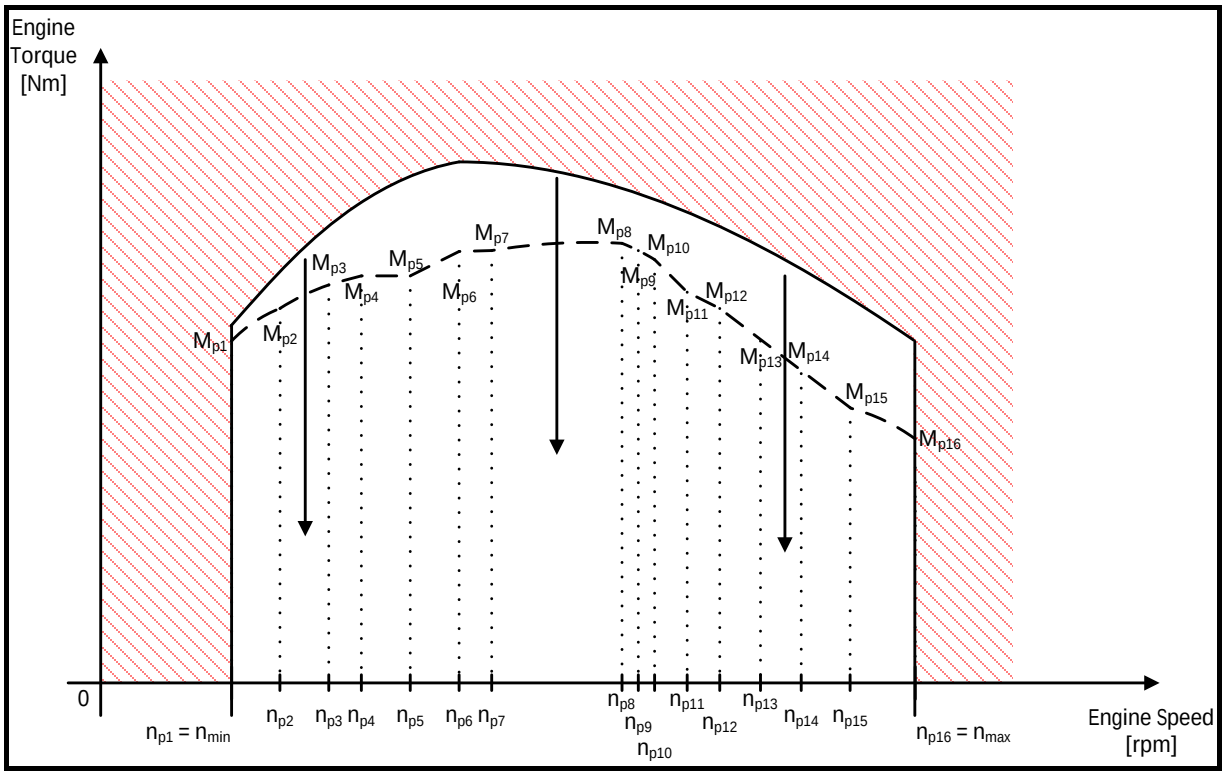


Fig 5.32: Scope of application for the power rating function

It is prohibited to set the parameter values for the power rating curves inside the red highlighted area of the engine characteristic. Otherwise this function won't work in a proper way!

In accordance to the above mentioned remark the minimum and maximum engine speeds depending on the engine type are as follows:

Engine type	Minimum engine speed / n_{min}	Maximum engine speed / n_{max}
MDEG	600 1/min	2600 1/min
HDEP	500 1/min	1965 1/min

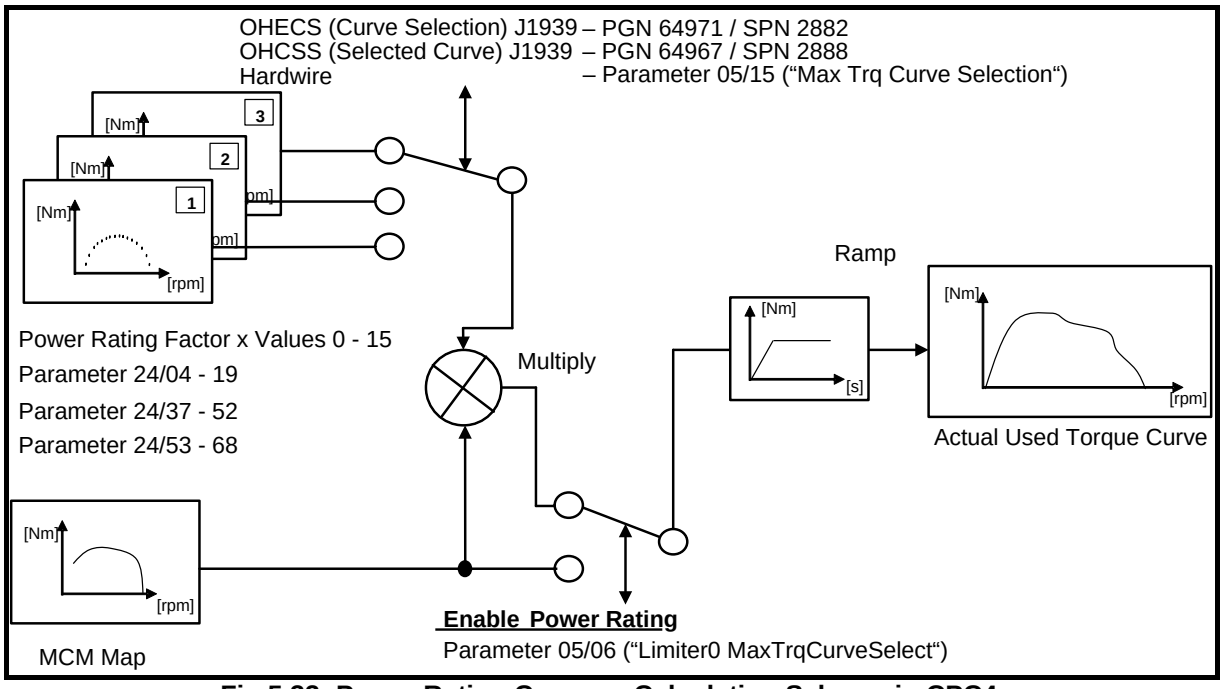


Fig 5.33: Power Rating Curves – Calculation Scheme in CPC4

Diagnostics:

- Analog Value: Torque Speed Command Sender (chapter 6.3.1)
- Analog Value: Torque Path State (chapter 6.3.1)

Inputs:

- Pin 1/11, DI_FLEX_08, "Limiter0" : LIM0
- SAE J1939 Signal: PGN 64971, "Off-Highway Engine Control Selection" (OHECS)
  SPN 2882, "Engine Alternate Rating Select"

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
01	56	TSC1 Source Address SAE J1939	0	255	231		SAE J1939 3. Source Address TSC1 e.g. jack knife control 0..255=signal
01	72	Source Address OHECS	0	255	23		SAE J1939 Source Address OHECS 0..255=signal
05	06	Limiter0 Max Trq Curve Select	0	2	0		input selection for enable limited full load torque curve PowerRatingCurve) selected on LIM0 or J1939 0=disable, 1=hardwired, 2=J1939 OHECS
05	15	Max Trq Curve Selection	1	3	1		If cdi_p_Lim01.Lim0MaxTrqCurvSel_u2 is set to rating #1, #2 or #3, then that rating is used when LIM0 is active. 1=Curve #1, 2=Curve #2, 3=Curve #3, 4..255=snv
13	66	1 11 DI Selection	0	2	0		Configuration input DiFlex08 0=disable, 1=LIM0, 2=PTO part 1 (adjustable via -Remote PTO Spd Selection Mode-), 3=Torque Curve Selection, Bit 0
24	01	CC Power Rating Selection	0	1	0		Power Rating with Cruise Control 0=no dedicated CC curve rating, 1=use the curve selected by PGR005/15 or OHECS
24	20	power rating selection	0	5	0		Power Rating Enable 0=off, 1=enable in TrqCntrlMode, 2=enable in SpdCntrlMode PTO, 3=enable in SpdCntrlMode Sa3TSC1,

PGR	No.	Parameter	min	max	default	unit	description
							4=enable in SpdCntrlMode Sa3TCS1 and PTO, 5=enable in Trq/SpdCntrlMode Sa3TSC1 and PTO
24	04 – 19	Power Rating Factor 1 Values 0-15	0	1	0,9		Power Rating Factor Curve 1 0..1024=signal
24	21 - 36	Power Rating Speed 0-15	0	4000	2400	1/min	speed characteristic that corresponds to torque limitation factor characteristic (see. Cdi_p_Veh2.PowerRatingFactXNr_s16) 0..32000=signal
24	37 – 52	Power Rating Factor 2 Values 0-15	0	1	0,8		Power Rating Factor Curve 2 0..1024=signal
24	53 – 68	Power Rating Factor 3 Values 0-15	0	1	0,7		Power Rating Factor Curve 3 0..1024=signal

Outputs:

– SAE J1939 Signal: PGN 64967, “Off-Highway Engine Control Selection States” (OHCSS)
SPN 2888 “Engine Alternate Rating Select State”

With the main switch parameter 05/06 (“Limiter 0 Max Trq Curve Select”) it is possible to activate the Power Rating functionality as well as configuring it:

– If the parameter is set to 1 (hardwired) one of the power rating curves stored inside the CPC4 will be used. Through the setting of parameter 05/15 (“Max Trq Selection”) it is determined which one of the three possible curves is taken into account.
– If the parameter is set to 2 (J1939 OHECS) the Power rating curve can be chosen via OHECS J1939 SPN 2882.

Only the TSC1 J1939 CAN message send from the source address defined by parameter 01/56 (“TSC1 Source Address SAE J1939”) is limit through the power rating curves.

Concerning software releases through R32: The combination using TSC1 in speed control mode and hardwired pin for activation of power rating function is not provided. It is recommended to use CAN network or hardwired pins for the complete function, but not in combination.

The power rating function uses the actual engine characteristics from MCM, also in case of other torque limitation, e.g. inducement limitations.

Parameterization examples for different function modes:

The activation status of power rating function is shown in the J1939 message:
OHCCS (PGN 64967) - **EngAltRatingSelectState** (SPN 2888)

Hardwired:

· Limit the Engine only in Torque Control Mode (via Hardware pin 1/11) with Power Rating Curve 2:
  – Set parameter 05/06 (“Limiter 0 Max Trq Curve Select”) to 1 (“hardwired”);
  – Set parameter 05/15 (“Max Trq Curve Selection”) to 2 (“Curve #2”);
  – Set parameter 13/66 (“1 11 DI Selection”) to 1 (“LIM0”);
  – Set parameter 24/20 (“Power Rating Selection”) to 1 (“enable in TrqCntrlMode”)

CAN - J1939 OHECS:

· Limit the Engine in Torque and Speed Control Mode (via J1939 CAN message TSC1 and PTO) with Power Rating Torque Curve 1:
  – Set parameter 05/06 (“Limiter 0 Max Trq Curve Select”) to 2 (“J1939 OHECS”);

- Set parameter 24/20 (“Power Rating Selection”) to 5 (“enable in Trq/SpdCntrlMode Sa3TSC1 and PTO”)
- Configure the J1939 CAN Source Address of OHECS message with parameter 01/72 (“Source Address OHECS”) to 23/0x17
- Configure the J1939 CAN Source Address of PTO message with parameter 01/52 (“PTO Source Address SAE J1939”) to 23/0x17
- Configure the J1939 CAN Source Address of TSC1 message (limited by Power Rating Torque Curve) with parameter 01/56 (“TSC1 Source Address SAE J1939”) to 231/0xE7
- Set parameter 13/07 (“2 09 DI Selection”) to 2 (“J1939 PTO”);
- Send message OHECS (from SA: 23/0x17); Signal “EngAltRatingSelect” (SPN 2882)
- Send message PTO (from SA: 23/0x17)
- Send message TSC1 (from SA: 231/0xE7)

5.12. Engine Protection

5.12.1. Engine Protection Shutdown

The engine protection shutdown is intended to protect non monitored engines, e.g. emergency power units, pumps, compressor or other stationary engine applications.

Risk of accident!

Attention! If the engine is shut down because of one of the below mentioned circumstances (e. g. “Oil level to low” or “Collant temperature to high”), several systems depending on a running engine (like steering boost or a retarder) don’t work properly!

This function can be used to shut down the engine if at least one of the following states emerges.
Engine protection shutdown on:

- CAN information "Coolant temperature too high " from MCM2
- CAN information "Oil pressure to low " from MCM2
- CAN information "Oil level to low " from MCM2
- "Coolant level very low " from CPC4

The limits for the values listed above are stored in the engine data records.
The sensors for Oil level, Oil pressure and Coolant temperature are connected to the MCM2. "Coolant level impermissibly low" is realized in CPC4 because the Coolant Level Sensor is connected to the CPC4.

There is a parameter for each of those states to activate or deactivate the engine protection shutdown.

If an engine protection shutdown is performed, the engine protection shutdown time is running down. After this time, the engine will be shutdown. There are different engine protection shutdown times (parameters 18/10 to 18/13). For each of the above mentioned shutdowns it is therefore possible to set another timer but the CEL and SEL shutdown times are always the same.

The indicator lamps CEL, warning lamp, and SEL, stop engine lamp, are active. The indication time, before engine shutdown, for the warning lamps are programmable. For more information about CEL and SEL, please refer to chapter 5.10.12 and 5.10.13.

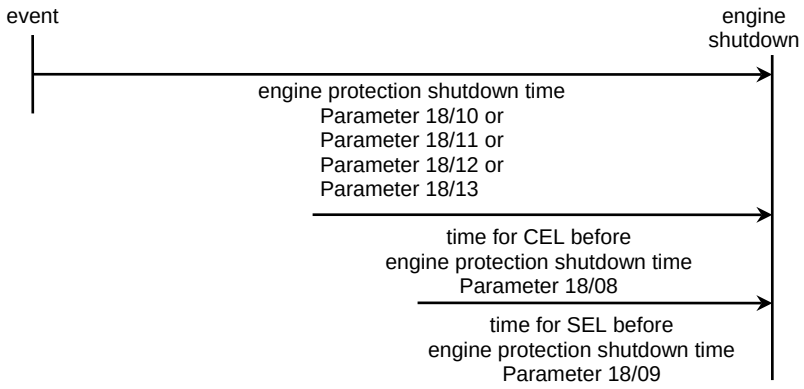


Fig 5.34: Engine protection shutdown time (example)

It is possible to overwrite an engine protection shutdown in state of emergency. The shutdown overwrite is active when input pin 1/15 (“Shutdown/Tier4 Inducement override”) is paramterized correctly and than switched to ground.

Inputs:

- Pin 1/15, DI_FLEX_05, “Tier4 Inducement override” : Shutdown Override
- CAN information "Coolant temperature too high" from MCM2
- CAN information "Oil pressure too low" from MCM2
- CAN information "Oil level too low" from MCM2
- "Coolant level very low" from CPC4

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
13	04	1 15 DI Selection	0	2	0		Configuration input DiFlex05 0=disable, 1=Shutdown override, 2=FUSO CC-Cancel
18	01	Cool Level Eng Protect Shtdn	0	1	0		Engine Protection Shutdown on Coolant Level 0=warning, 1=engine shutdown
18	02	Coolant Temp Eng Protect Shtdn	0	1	0		Engine Protection Shutdown on Coolant Temperature 0=warning, 1=engine shutdown
18	03	Oil Level Eng Protect Shtdn	0	1	0		Engine Protection Shutdown on Oil Level 0=warning, 1=engine shutdown
18	04	Oil Press Eng Protect Shtdn	0	1	0		Engine Protection Shutdown on Oil Pressure 0=warning 1=engine shutdown
18	08	CEL Time Engine Prot Shutdown	3	120	20	s	Time for CEL before Engine Protection Shutdown 150..6000=signal
18	09	SEL Time Engine Prot Shutdown	3	120	10	s	Time for SEL before Engine Protection Shutdown 150..6000=signal
18	10	Engine Prot Shutdown Time	1	120	60	s	Engine Protection Shutdown Time 50..6000=signal
18	11	Eng Prot ext Stop Shutdwn Time	1	120			Engine Protection Shutdown Time for external engine stop requests. 0..6000=signal
18	12	Oil Pressure Shtdn Time	30	60	30	s	Engine Protection Shutdown Time on Oil Pressure 00..3000=signal
18	13	Oil Level Shutdown Time	0,02	100	5	s	Oil Level Shutdown Time 1..5000=signal

Outputs:
- Engine stop demand on MCM2, transmitting zero torque quantity via CAN

5.13. Transmission Retarder (without CAN J1939 connection)

The programmable inputs 1/01 (“Misc (2SpeedAxle)”), 3/18 (“Misc (SwitchableTorque)”) or 4/13 (“Misc (TempoSet)”) are available for coupling a conventional retarder without a CAN interface. When the inputs are proper parameterized, the information „Retarder intervention“ is used for deactivation of an active cruise control. If Automatic Cruise Resume is enabled by parameter 15/05 (“Enable Cruise Auto Resume”), a retarder intervention causes an active Cruise Control function to switch over to a standby mode.

It is also possible through evaluation of the input to activate the fan together with the retarder. To achieve this, the parameter 19/27(“Trans Retarder Fan Percent”) has to be set to a value greater than the default of 0%.

Additionally different circumstances have to be met to allow the automatic activation of the fan on the retarder intervention. 19/23 (“Trans Retard Fan Min Cool Temp”), 19/24 (“Trans Retard Fan Min Oil Temp”) und 19/25 (“Trans Retard Fan Min Vspeed”) are the parameters which are taken into consideration.

Inputs:
- Pin 1/01, DI_FLEX_01, “Misc (2SpeedAxle)” : Enable Transmission Retarder Input
- Pin 4/13, DI_FLEX_19, “Misc (TempoSet)” : Enable Transmission Retarder Input
- Pin 3/18, DI_FLEX_22, “Misc (SwitchableTorque)” : Enable Transmission Retarder Input

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
13	01	1 01 DI Selection	0	4	0		Configuration input DiFlex01 0=disable, 1=enable Dual Speed Axle, 2=enable transmission retarder input, 3=clutch switch, 4=Evobus Cruise Control Lever Quit signal
13	12	3 18 DI Selection	0	12	0		CPC2: Configuration input Sfp02 DSF1 # CPC4: DIFLEX_22 0=disable, 1=enable ABS input, 2=enable transmission retarder input, 3=enable tempo set, 4=enable grid heater detection, 5=switchable torque demand, 6=drive on super structure, 7=throttle inhibit super structure, 8=split select, 9=FUSO Engine brake stage 2 cancel switch, 10=DPF Inhibit Regen Switch, 11=PTO2stat, 12=engine shutdown/Tier4 inducement override
13	17	4 13 DI Selection	0	11	0		Configuration input DiFlex19 DSF0 0=disable, 1=enable ABS input, 2=enable transmission retarder input, 3=enable tempo set, 4=enable grid heater detection, 5=switchable torque demand, 6=drive on super structure, 7=throttle inhibit super structure, 8=split select, 9=FUSO Engine brake stage 2 cancel switch, 10=DPF Inhibit Regen Switch, 11=engine shutdown/Tier4 inducement override
15	05	Enable Cruise Auto Resume	0	3	3		Enable Cruise Auto Resume 0=disable,

PGR	No.	Parameter	min	max	default	unit	description
							1=enable automatic cruise resume function after clutch has been released once, 2=release clutch twice, 3=Resume AMT style
19	14	Fan Speed Perc for Eng Ret	0	100	100	%	fan speed when engine brake is active 0..32000=signal
19	17	Hold Time Fan	0	600	0	s	hold time Fan – minimum fan on time 0..30000=signal
19	21	Ramp Fan	1	100	100	%/s	ramp Fan 320..32000=signal
19	23	Trans Retard Fan Min Cool Temp	-50	200	-50	°C	Coolant temperature threshold below which the transmission retarder fan request will be ignored, -1600..6400=signal
19	24	Trans Retard Fan Min Oil Temp	-40	210	-40	°C	Hydraulic oil temperature threshold below which the transmission retarder fan request will be ignored, -1280..6720=signal
19	25	Trans Retard Fan Min Vspeed	0	250	32	km/h	Vehicle speed temperature threshold below which the transmission retarder fan request will be ignored, 0..32000=signal
19	27	Trans Retarder Fan Percent	0	100	0	%	fan speed when retarder active 0..32000=signal

Outputs:

– Information "Retarder intervention" transmitting to the engine control MCM2 via PT-CAN

5.14. P-Grade Adjustment

The P-Grade Adjustment is a load dependent engine speed setpoint selection which works with every selectable governor in PTO speed control (see chapter 0), but without direct connection to the overspeed governor. The chosen governor works as a maximum load governor and allows a more precise and stable control strategy because an engine speed decrease is simpler to govern since the engine workload is easier to foresee. Furthermore it is possible for the maximum load control to utilize a resolution of 1 rpm. The result of using ths feature is a increased idle speed by the percentage of the p-grade chosen.

Remark: The p-grade adjustment can't be used to operate the engine above the maximum load characteristic.

The first steps to use the P-Grade Adjustment is the activation of the Engine-CAN Interface in the MCM2, with a diagnostic tool e.g. Xentry:
"PGR56_PAR_2", "e2p_pto_can_ratio_p_en" à Set to "1"
(Note: Depending on the CPC4 and MCM2 release this may already be set by default)

Next the desired P-grade can be adjusted with the CPC4 parameter 31/16 ("Activate PGrade"). If it shall be possible to adjust the P-grade during operation, the before mentioned parameter has to be set to 251. Then the desired value can be send via the J1939 CAN message PropB50 ("EngSpeedGovernorDroop", SPN 5568). The signal ranges from 0 to 10%. The parameter 01/100 ("PropB50 SA SAE J1939 – SPN5568") is used to define the appropriate source address for this message.

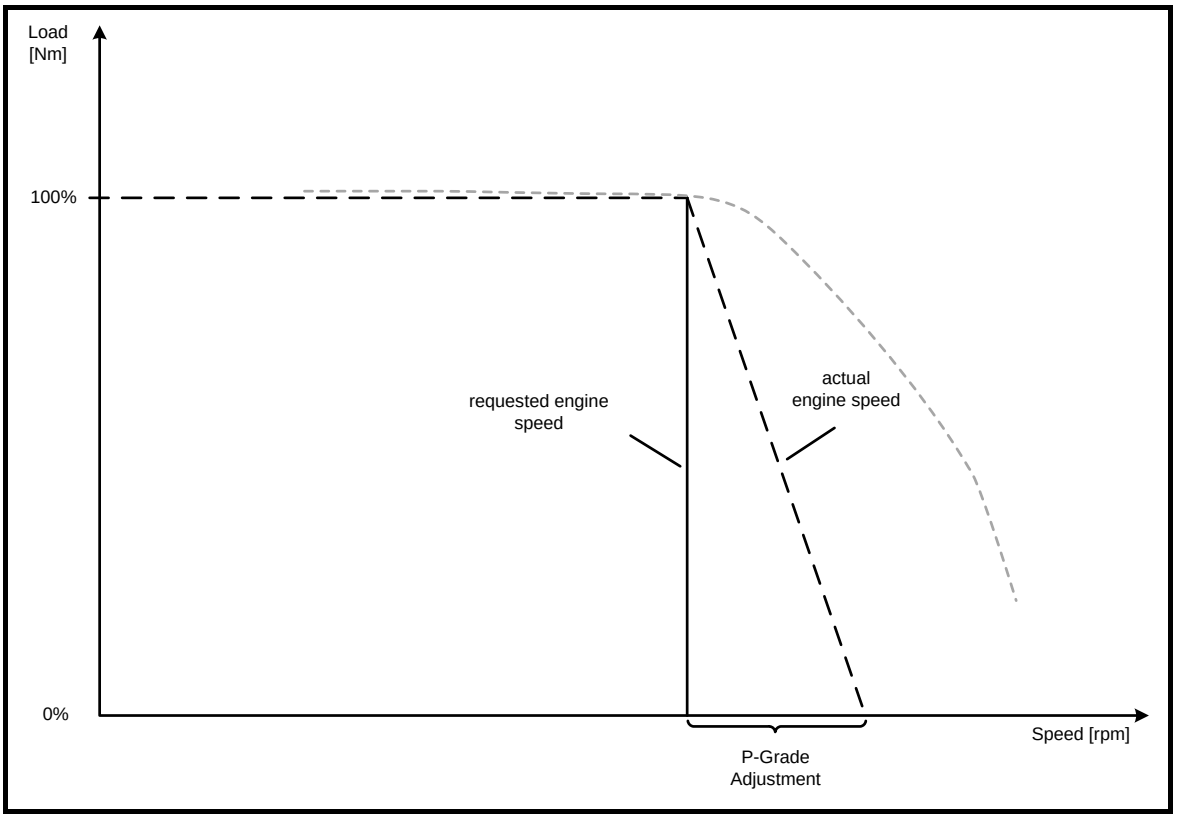


Fig 5.35: Schematic for P-Grade Adjustment

Inputs:

– SAE J1939 Signal: “PropB50”,
SPN 5568, “Engine Speed Governor Droop”

Parameters

PGR	No.	Parameter	min	max	default	unit	description
01	100	PropB50 Source Address SAE J1939	0	255	5		SAE J1939 Source Address PROP B50 0..255=signal
31	16	Activate PGrade	0	25,1	0	%	to activate P-Grade 0=disabled, 10=1 %, 20=2 %, 30=3 %, 40=4 %, 50=5 %, 60=6 %, 70=7 %, 80=8 %, 90=9 %, 100=10 %, 110=11 %, 120=12 %, 130=13 %, 140=14 %, 150=15 %, 251=use SPN 5568

Parameterization example:

Set the parameter 31/16 (“Activate PGrade”) to the value which represents the wished P-Grade, e. g. 100 for 10% adjustment. As mentioned above this results in an increased idle speed which decreases linearly while raising engine load:

Example with 10% P-Grade Adjustment, idle speed 1000 1/min without P-Grade Adjustment

Engine load 0% à Engine speed 1000 1/min x 110% = 1100 1/min
Engine load 50% à Engine speed 1000 1/min x 105% = 1050 1/min
Engine load 100% à Engine speed 1000 1/min x 100% = 1000 1/min

5.15. Automatic Fan activation

Under certain circumstances the CPC4 is qualified to request the MCM2 controlled fan. These circumstances include, e. g. active engine brakes (enabled by parameter 19/07, “Eng Brake Enable Auto Fan”), active air conditioner (enabled by parameter 19/04, “Air Condition Enable Auto Fan”), active PTO (enabled by parameter 19/19, “PTO Enable Auto Fan Activation“) and/or an impermissibly high coolant temperature (enabled by parameters 19/05, “Cool Temp at 0 Pct Fan” and 19/06, “Cool Temp at 100 Pct Fan”).

There are two methods for the automatic fan activation, hardwired via input pin 02/12 (DI_FLEX_11) and via J1939 CAN message CM1 (PGN 57344, “Cab Message 1”).

Inputs:
- Pin 2/12, DI_FLEX_11, “Limiter2”
- fan activation on engine brake from CPC4
- fan activation on air conditioner from CPC4
- fan activation on PTO from CPC4
- CAN information Coolant temperature

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
01	08	CM1 Fan Source Addr1 SAE J1939	0	255	25		SAE J1939 Source Address Cm1,for A/C fan requests, 0..255=signal
01	09	CM1 Fan Source Addr2 SAE J1939	0	255	49		SAE J1939 Source Address Cm1,for hardwired switch fan requests 0..255=signal
06	08	Mode of AC Status Input	0	4	0		Mode of Air Conditioner Status Input for Fast Idle and Fan Activation (Pin 2/12) 0=disabled, 1=AC active closed, 2=AC active open, 3=LIM active closed, 4=LIM active open
19	18	J1939 Fan Request Enable	0	3	0		Fan request from J1939 (PGN 57344) 0=disable, 1=CM1 from SA1 (see 01/08) and SA2 (see 01/09), 2=CM1 from SA1 (see 01/08) only, 3=CM1 from SA2 (see 01/09) only

Outputs:
- Information "Fan power consumption in percent" transmitting to the engine control MCM2 via CAN

Parameterization example:

Hardwired:
- Set parameter 01/09 (“Mode of AC Status Input”) to e. g. 1 (“AC active closed”) to activate the AC when the switch is closed

J1939 CAN message:
- Set parameter 19/18 (“J1939 Fan Request Enable”) to e. g. 1 (“CM1 from SA1 (see 01/08) and SA2 (see 01/09)”) to activate the AC when the CAN message CM1 is send from either Source Address #1 or Source Address #2.
- Configure the J1939 CAN Source Address 1 of CM1 message with parameter 01/08 (“CM1 Fan Source Addr1 SAE J1939”) to 25/0x19
- Configure the J1939 CAN Source Address 2 of CM1 message with parameter 01/08 (“CM1 Fan Source Addr2 SAE J1939”) to 49/0x31

– Send message CM1 e. g.(from SA1: 25/0x19); Signal “Requested Percent Fan Speed” (SPN 986) with the fan speed in percent (0% to 100% signal range)

5.16. Overspeed Governor

The following table shows the engine speed ranges in which the Overspeed governor adjusts the engine torque to 0 Nm by means of engine protection, depending on used engine variant (HDEP or MDEG).

Engine variant	Engine speed [rpm]
HDEP	1965-2140
MDEG	2600-2750

6. Diagnostics

The following figure (Fig 6.1) shows a schematic illustration of the Xentry UDS communication via J1939 CAN.

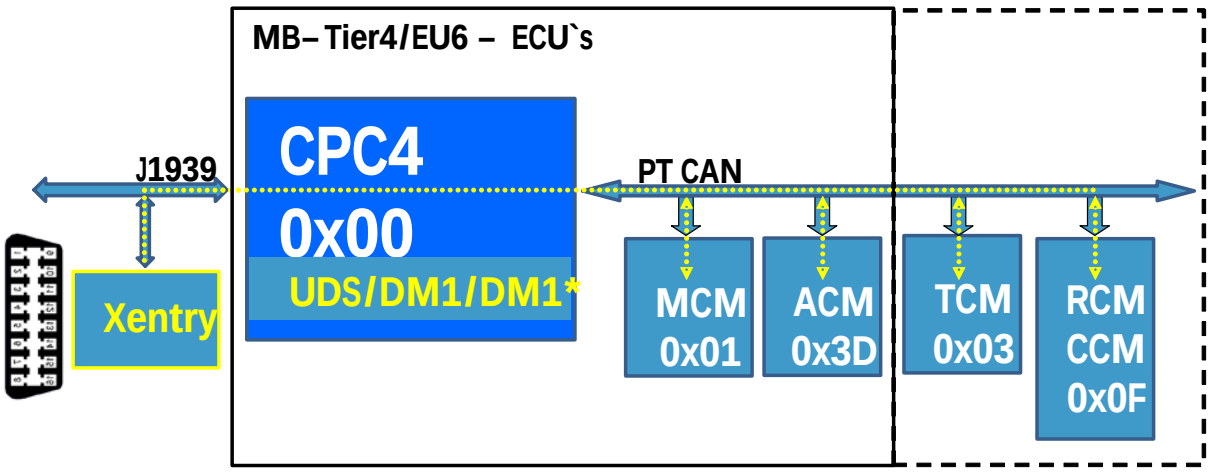


Fig 6.1: Schematic illustration of the Tier 4 Xentry DS communication

6.1. J1939 Diagnostic Messages

The CPC4 supplies several CAN messages according to the standard SAE-J1939/73.
For detailed information about the following messages please refer to chapter 7. (CAN message details of diagnostic messages).

DM1 – Active Diagnostic Trouble Codes:

Usage: This message broadcasts the currently active fault codes, each fault described by SPN and FMI according to chapter 6.2 (Fault Codes).
In contrast to reading out fault codes with Xentry the fault codes from the CPC4 and the MCM2 are sent together.
The CPC4 provides a DM1 receive message, too, which is used to receive an amber warning lamp status from the TCM.

Update rate: The broadcast message is sent whenever an error occurs and at a normal update rate of 1s thereafter and on request using PGN 59904, too. If necessary (that means in case of more than one error) the message is sent in multi package format.

Contents: The message contains the active fault codes (SPN, FMI, occurrence count) and lamp information (malfunction indicator lamp, red stop lamp, amber warning lamp, protect lamp).

DM2 – Previously Active Diagnostic Trouble Codes:

Usage: This message broadcasts the previously active fault codes from the CPC4 and the MCM2, each fault described by SPN and FMI according to chapter 6.1. (Fault Codes).

Update rate: The broadcast message is sent on request using PGN 59904. If necessary (that means in case of more than one error) the message is sent in multi package format.

Contents: The message contains the previously active fault codes (SPN, FMI, occurrence count) and lamp information (malfunction indicator lamp, red stop lamp, amber warning lamp, protect lamp).

DM4 – Freeze Frame Parameters:

Usage: This message broadcasts freeze frame data for up to 16 active or previously active fault codes. The DM4 message is a multi package message, each fault code derives in 13 Bytes length as part of the message. A freeze frame is specific to one diagnostic trouble code and one diagnostic trouble code only has one freeze frame.
As for the messages DM1 and DM2 fault codes from the CPC4 and the MCM2 are sent together.

Update rate: The message is sent on request using PGN 59904. Requests which are received within a 2s active J1939 bus are answered with a NACK.

Contents: The message contains the SPNs and FMIs and occurrence counts of the fault codes as for the DM1 and DM2 message and the freeze frame data which are Engine Torque Mode, Boost, Engine Speed, Engine Percent Load, Engine Coolant Temperature and Vehicle Speed.

DM11 – Diagnostic Clear/Reset For Active DTCs:

Usage: On request using PGN 59904 and containing the PGN 65235 for DM11, requests to the Engine / CPC4 and the Engine Brake / Retarder are answered with a NACK causing no clearing of fault codes. In order to clear fault codes please use the DM3 message.

Update rate: On request

Contents: The DM11 message contains no signals, the PGN is part of the request message.

DM13 – Stop Start Broadcast:

Usage: The signals of this receive message cause a stop or start of broadcasting over the bus types J1939 and J1587. On reception of a Stop Broadcast signal the CPC4 stops sending its messages at the addressed bus.
The current implementation does not make use of a sequence of receive messages to stop broadcasts as described in SAE-J1939/73, a suspend message is not sent by the CPC4as well.

Update rate: The DM13 message has to be sent every 5s, after a timeout of 6s the CPC4leaves the status of stopped broadcast and begins to send messages again.

Contents: The message contains Stop/Start signals for various bus types – J1939, J1587 and Current Data Link (interpreted as J1939) are used by the CPC4– and the Hold Signal.

6.2. Fault Codes

6.2.1. Conversion Method

Attention: If CPC4 Fault Codes SPN 168 / FMI 0/14/18 (all concerned with battery voltage) are occuring, troubleshoot these first and recheck the system again.

The Diagnostic Trouble Code which is displayed by diagnostic software is converted from the SPN/FMI by means of the SPN Conversion Method 4 mentioned in SAE J1939 – 73. A Diagnostic Trouble Code (DTC) is made up of four (4) independent fields:

- Suspect Parameter Number (SPN) 19 bits
- Failure Mode Identifier (FMI) 5 bits
- Occurrence Count (OC) 7 bits
- SPN Conversion Method (CM) 1 bit

OC and CM are shown greyed out because in the following fault code table these two parameters are not present. In case of an SPN value smaller than 65536 the DTC can be formed as shown in the diagram below.

Example for the computation of the DTC of the following fault:

3870	4		Digital Input 4/02 Circuit shorted to GND	Check wiring of associated pin Check parameter 13/54 (Fault Detect Ena) for correct configuration of Fault Detection of pin 4/02	Pin 4/02

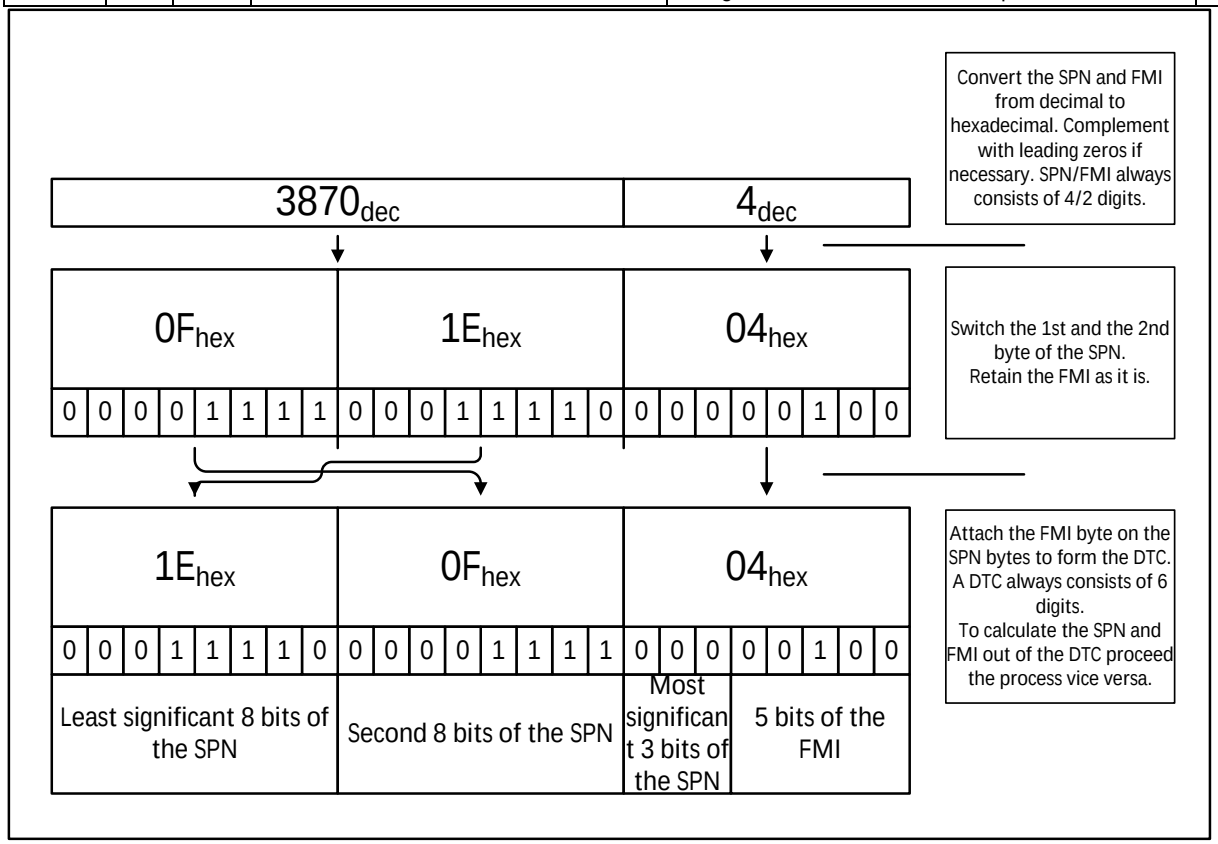


Fig 6.2: Simplified method of SPN/FMI to DTC conversion

This simplified method can be used to convert SPN with values up to 65535_{dec} or $FFFF_{hex}$. If the SPN exceeds this value, the more detailed approach on the next page is to be used.
Example for the conversion of the SPN/FMI in the according DTC of the following fault:

524283	14		Generator (Charging System) terminal W – allocation error (pulse / rev signal)	Check wiring of Generator Terminal W or check Generator functionality	

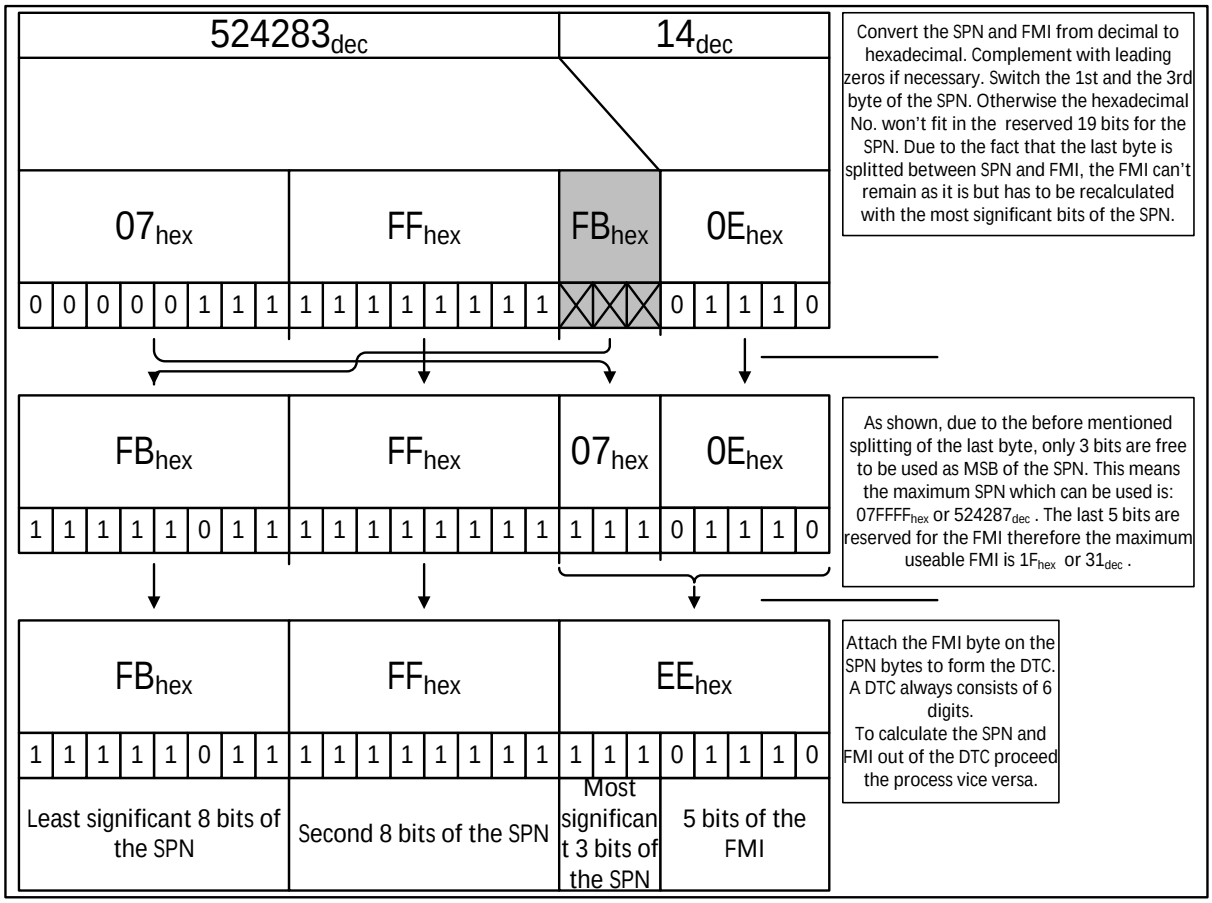


Fig 6.3: Regular method of SPN/FMI to DTC conversion

As mentioned above through the restrictions of the number of bits the maximum SPN value which can be used is 524287_{dec}.

6.2.2. Fault Codes

SPN	FMI	DTC	Fault description	Recommended Action	CEL	SEL	MIL	Fault location
70	2	460002	Park Brake Status Not Plausible (Vehicle Moving)	Check J1939 link connection to Park Brake Switch Check Parameter 13/28 (Park Brake Switch Config) for correct source Check Parameter 01/04 (CC1 Source Adress SAE J1939), 01/05 (CC2 Source Adress SAE J1939) and 01/06 (CC3 Source Adress SAE J1939) for correct Source Adress	OFF	OFF	OFF	
70	13	46000D	J1939 Park Brake Switch Signal from Source CCVS1, CCVS2 or CCVS3 is missing or not available = SNA (signal not available)	Check J1939 link connection to Park Brake Switch Check Parameter 13/28 (Park Brake Switch Config) for correct source Check Parameter 01/04 (CC1 Source Adress SAE J1939), 01/05 (CC2 Source Adress SAE J1939) and 01/06 (CC3 Source Adress SAE J1939) for correct Source Adress	ON	OFF	OFF	
70	19	460013	J1939 Park Brake Switch Signal from Source CCVS1, CCVS2 or CCVS3 is erractic = undefined value but not SNA	Check J1939 link connection to Park Brake Switch Check Parameter 13/28 (Park Brake Switch Config) for correct source Check Parameter 01/04 (CC1 Source Adress SAE J1939), 01/05 (CC2 Source Adress SAE J1939) and 01/06 (CC3 Source Adress SAE J1939) for correct Source Adress	ON	OFF	OFF	
84	0	540000	Vehicle Speed above programmable Threshold #1. This is not a system failure/fault.	This is an information-only fault. It indicates the vehicle is above a programmable threshold. Check Parameter 08/23 (vss driving diagnostrtic limit).	ON	OFF	OFF	
84	3	540003	Vehicle Speed Sensor Circuit shorted to Ubat	Check wiring of associated pin	ON	OFF	OFF	Pin 3/13

SPN	FMI	DTC	Fault description	Recommended Action	CEL	SEL	MIL	Fault location
84	4	540004	Vehicle Speed Sensor Circuit shorted to GND	Check wiring of associated pin	ON	OFF	OFF	Pin 3/13
84	5	540005	Vehicle Speed Sensor open Circuit (broken wire, terminal floating)	Check wiring of associated pins	ON	OFF	OFF	Pin 3/13 (Supply) Pin 3/02 (GND)
84	6	540006	Vehicle Speed Sensor Anti-Tamper Detection via ABS Vehicle Speed Comparison (ABS speed and Vehicle Speed Sensor are not consistent)	Check wiring of ABS Module and VSS(Pin 3/13) . Check max. Parameter 40/01(ABS Diff Thresh Veh Speed).	ON	OFF	OFF	Pin 3/13
84	7	540007	Hall effect Vehicle Speed Sensor wiring mismatch, rationality fault	Check wiring of hall effect Vehicle Speed Sensor	ON	OFF	OFF	
84	11	54000B	Vehicle Speed above programmable Threshold #2. This is not a system failure/fault.	This is an information-only fault. It indicates the vehicle is above a programmable threshold. Check Parameter 08/15 (vss absolute diagnostic limit).	ON	OFF	OFF	
84	13	54000D	J1939 Wheel-Based Vehicle Speed Signal from Source CCVS1, CCVS2 or CCVS3 is missing or not available = SNA (signal not available)	Check J1939 link connection to Wheel-Based Vehicle Speed Sensor Check Parameter 08/13 (Vehicle Speed Sensor) for correct source Check Parameter 01/04 (CC1 Source Adress SAE J1939), 01/05 (CC2 Source Adress SAE J1939) and 01/06 (CC3 Source Adress SAE J1939) for correct Source Adress	OFF	OFF	OFF	
84	14	54000E	Hall effect Vehicle Speed Sensor supply voltage out of range	Check wiring of hall effect Vehicle Speed Sensor	ON	OFF	OFF	
84	19	540013	J1939 Wheel-Based Vehicle Speed Signal from Source CCVS1, CCVS2 or CCVS3 is erractic = undefined value but not SNA	Check J1939 link connection to Wheel-Based Vehicle Speed Sensor Check Parameter 08/13 (Vehicle Speed Sensor) for correct source Check Parameter 01/04 (CC1 Source Adress SAE J1939), 01/05 (CC2 Source Adress SAE J1939) and 01/06 (CC3 Source Adress SAE J1939) for correct Source Adress	OFF	OFF	OFF	
84	20	540014	Vehicle Speed Sensor Drifted High Error (VSS signal not plausible)	Check wiring of associated pin	ON	OFF	OFF	Pin 3/13
84	21	540015	Vehicle Speed failure (VSS Signal Not Plausible)	Check wiring of associated pin	ON	OFF	OFF	Pin 3/13
91	0	5B0000	Accelerator Pedal Circuit shorted to Ubat	Check wiring of associated pins	ON	OFF	OFF	Pin 1/07 (Supply) Pin 1/04 (GND)
91	2	5B0002	Accelerator Pedal out of adjustment (Learn error)	Check wiring and calibration; Restart learning routine (chapter 6.4, routines 1 to 3)	ON	OFF	OFF	Pin 1/07
91	4	5B0004	Accelerator Pedal Circuit shorted to GND	Check wiring of associated pins	ON	OFF	OFF	Pin 1/07 (Supply) Pin 1/04 (GND)
91	7	5B0007	2-Channel Accelerator Pedal Idle Not Recognized (idle area not evaluated)	Check wiring of associated pins. Check Idle Position	ON	OFF	OFF	Pin 1/03 Pin 1/04 Pin 1/06 Pin 1/07
91	8	5B0008	2-Channel Accelerator Pedal Signal 1 missing	Check wiring of associated pins	ON	OFF	OFF	Pin 1/03
91	10	5B000A	Throttle pedal rationality check failed	Rationality check routine for throttle pedal position: If current throttle pedal value is above a certain calibratable value (i.e. 10%) while service brake is actuated in conjunction with a real strong vehicle deceleration, throttle pedal position is recognized as erroneous and a fault will be logged. The position furthermore is ramped down to 0%. As soon as original pedal position is back again to 0% the fault is deactivated.	OFF	OFF	OFF	
91	13	5B000D	J1939 EEC2 message is	Check J1939 link connection and devices:	ON	OFF	OFF	

SPN	FMI	DTC	Fault description	Recommended Action	CEL	SEL	MIL	Fault location
			missing or not available	Turbocharger				
91	14	5B000E	2-Channel Accelerator Pedal Not Learned	Start learning routine (chapter 6.4, routines 1 to 3): – Accelerator Pedal Learning: Start – Accelerator Pedal Learning: Stop – Accelerator Pedal Learning: Request Results Status	ON	OFF	OFF	Pin 1/03 Pin 1/04 Pin 1/06 Pin 1/07
91	31	5B001F	2-Channel Accelerator Pedal Learned Range to Large	Check wiring and calibration; Restart learning routine (chapter 6.4, routines 1 to 3): – Accelerator Pedal Learning: Start – Accelerator Pedal Learning: Stop – Accelerator Pedal Learning: Request Results Status	ON	OFF	OFF	Pin 1/03 Pin 1/04 Pin 1/06 Pin 1/07
98	0	620000	Oil Level is above warning level	Check oil level. If engine oil level is low, refill to proper level. Check oil gauge readings. If oil gauge is erroneous, replace oil gauge as required.	ON	OFF	OFF	MCM2
98	1	620001	Oil Level is below safe operating level – (SEL Conditions)	Check oil level. If engine oil level is low, refill to proper level. Check oil gauge readings. If oil gauge is erroneous, replace oil gauge as required.	ON	ON	OFF	MCM2
98	18	620012	Oil Level is below pre-warning level	Check oil level. If engine oil level is low, refill to proper level. Check oil gauge readings. If oil gauge is erroneous, replace oil gauge as required.	ON	OFF	OFF	MCM2
100	1	640001	Oil Pressure is below safe operating level – (SEL Conditions)	Check oil level, oil gauge, oil pump suction pipe, oil pump drive and driven gears and faulty oil pressure relief valve. If any part is erroneous, replace and retest.	ON	ON	OFF	MCM2
100	18	640012	Oil Pressure is below pre-warning level	Stop engine and allow sufficient time for the oil to drain into the oil pan. Check oil level, oil gauge, oil pump suction pipe, oil pump drive and driven gears and faulty oil pressure relief valve. If any part is erroneous, replace and recheck.	ON	OFF	OFF	MCM2
107	0	6B0000	Air Filter Restriction High	Check air cleaner for restriction. Perform pressure check/visual inspection of plugged inlet air filters, charge air cooler leaks or restriction, leaking or plugged intake manifold, exhaust leaks/plugging. Replace Air filter and delete fault code memory via service tool or instrument cluster if supported.	ON	OFF	OFF	
110	0	6E0000	Coolant Temperature exceeds a safe operating level – (SEL Conditions)	With engine cold, compare coolant inlet/coolant outlet temperatures. Check coolant loss, thermostat operation, for blockage in radiator and charge air cooler, fan belt condition, proper location of fan shroud, proper radiator hose condition, proper viscous fan operation.	ON	ON	OFF	MCM2
110	16	6E0010	Coolant Temperature exceeds a pre-warning limit	With engine cold, compare coolant inlet/coolant outlet temperatures. Check coolant loss, thermostat operation, for blockage in radiator and charge air cooler, fan belt condition, proper location of fan shroud, proper radiator hose condition and proper viscous fan operation.	ON	OFF	OFF	MCM2
111	1	6F0001	Coolant Level below safe operating level – (SEL Condition)	Check coolant level in reservoir. If coolant level is not within limit, refill coolant to proper level. If it is within proper level, change collant level sensor. Check coolant leak at cylinder head gasket, coolant leak at air compressor head gasket, external coolant leak at hose connections, coolant in oil, loose or faulty radiator cap, heating system for leaks.	ON	ON	OFF	
111	3	6F0003	Coolant Level Circuit shorted to Ubat	Check wiring of associated pins	ON	OFF	OFF	Pin 3/02 (GND) Pin 3/11 (Supply)
111	4	6F0004	Coolant Level Sensor Circuit Failed Low	Check wiring of associated pins	ON	OFF	OFF	Pin 3/02 (GND) Pin 3/11 (Supply)
111	6	6F0006	Coolant Level Sensor Circuit shorted to GND	Check wiring of associated pins	ON	OFF	OFF	Pin 3/02 (GND) Pin 3/11

SPN	FMI	DTC	Fault description	Recommended Action	CEL	SEL	MIL	Fault location
								(Supply)
111	18	6F0012	Coolant Level below operating level (pre-warning condition)	Check coolant level in reservoir. If coolant level is not within limit, refill coolant to proper level. If it is within proper level, change coolant level sensor. Check coolant leak at cylinder head gasket, coolant leak at air compressor head gasket, external coolant leak at hose connections, coolant in oil, loose or faulty radiator cap, heating system for leaks.	ON	OFF	OFF	
120	13	78000D	J1939 Retarder Fluid Message is missing or not available (J1939 Cabin Message is missing or not available?)	Check J1939 link connection to transmission retarder	OFF	OFF	OFF	
158	2	9E0002	KL15 ignition switch status of CPC and MCM do not match.	Check KL15 wiring at Pin 2/03	ON	OFF	OFF	Pin 2/03
168	0	A80000	Battery Voltage High	Check Voltage KL15 and KL30 (Fault Condition Battery Voltage > 35V) Check wiring of associated pins	ON	OFF	OFF	Pin 2/01 Pin 2/03
168	1	A80001	Battery Voltage Very Low	Check Voltage KL15 and Kl30 (Fault Condition Battery Voltage < 9.8V) Check wiring of associated pins If vehicle Is equipped with a battery disconnect switch, it must be inspected	ON	OFF	OFF	Pin 2/01 Pin 2/03
168	7	A80007	Opt Idle Detected Charging System or Battery Failure	Check battery main switch and battery wiring (KL30)	ON	OFF	OFF	Pin 2/01 Pin 2/03
168	9	A80009	Main battery connection lost	Check battery main switch and battery wiring (KL30)	ON	OFF	OFF	Pin 2/01 Pin 2/03
168	14	A8000E	ECU powerdown not completed (Main Battery Terminal Possibly Floating)	Check wiring of associated pins If vehicle Is equipped with a battery disconnect switch, it must be inspected	OFF	OFF	OFF	Pin 2/01 Pin 2/03
168	18	A80012	Battery Voltage Low	Check Voltage KL15 and KL30 (Fault Condition Battery Voltage < 19.2V) Check wiring of associated pins	ON	OFF	OFF	Pin 2/01 Pin 2/03
171	2	AB0002	Ambient Temperature Sensor Data Erratic	Check ambient temperature sensor (wiring and associated pin)	ON	OFF	OFF	Pin 3/15
171	9	AB0009	J1587 Ambient Air Temp Sensor Data Message Stopped Arriving	Check J1939 link connection to ambient Air Temp Sensor and wiring. Check Parameter 31/01 (Ambient Air Temp Sensor Enable) for proper configuration.	ON	OFF	OFF	Pin 3/15
171	14	AB000E	J1587 Ambient Air Temp Sensor Data Not Received This Ign Cycle	Check J1939 link connection to ambient Air Temp Sensor and wiring. Check Parameter 31/01 (Ambient Air Temp Sensor Enable) for proper configuration.	ON	OFF	OFF	Pin 3/15
191	9	BF0009	J1939 ETC1 Message is missing or not available	Check J1939 link connection to Transmission Controller / Check if Electronic Transmission Controller is CAN capable	ON	OFF	OFF	
191	13	BF000D	J1939 Transmission Output Shaft Speed Signal is missing or not available = SNA (signal not available)	Check J1939 link connection to Transmission Controller / Check if electronic Transmission Controller is CAN capable	OFF	OFF	OFF	
191	19	BF0013	J1939 Transmission Output Shaft Speed Signal erractic = undefined value but not SNA	Check J1939 link connection to Transmission Controller	OFF	OFF	OFF	
247	0	F70000	MCM Engine Hours Data higher than expected	Check MCM.	OFF	OFF	OFF	
247	1	F70001	MCM Engine Hours Data lower than expected	CPC or MCM. The internal clocks of the CPC or MCM do not match. Check MCM.	OFF	OFF	OFF	
247	9	F70009	MCM Engine Hours Data not received or stopped arriving	Check MCM.	OFF	OFF	OFF	
247	10	F7000A	MCM Engine Hours Data increasing at an implausible rate	CPC or MCM. The internal clocks of the CPC or MCM do not match. Check MCM.	OFF	OFF	OFF	
247	14	F7000E	ACM Reported Ash Mileage is Lower then the CPC Stored Value	Use diagnostic service to clear the ash content value.	ON	OFF	OFF	

SPN	FMI	DTC	Fault description	Recommended Action	CEL	SEL	MIL	Fault location
523	13	0B020D	J1939 Transmission Current Gear Signal is missing or not available	Check J1939 link connection to Transmission	ON	OFF	OFF	
523	19	0B0213	J1939 Transmission Current Gear Signal is erractic = undefined value but not SNA	Check J1939 link connection to Transmission	OFF	OFF	OFF	
524	9	0C0209	J1939 ETC2 message is missing or not available	Check J1939 link connection to Transmission Controller / Check if Electronic Transmission Controller os CAN capable	ON	OFF	OFF	
525	7	0D0207	Transmission gear selection switch reports internal error.	Check J1939 link connection to Transmission Controller / Check if Electronic Transmission Controller is CAN capable. Check LIN wiring / stalk switch.	ON	OFF	OFF	
525	9	0D0209	J1939 Powertrain Message (transfer case / PTO) is missing	Check wiring of OEM ICU and related J1939 link connection	ON	OFF	OFF	
525	19	0D0213	Transmission gear selection switch reports unplausible engine brake stage requests.	Check J1939 link connection to Transmission Controller / Check if Electronic Transmission Controller is CAN capable. Check LIN wiring / stalk switch.	ON	OFF	OFF	
527	9	0F0209	J1939 CCVS is missing or not available	Check J1939 link connection to Cruise Control Check Parameter 13/22 (CC ON OFF Switch Config) for correct source Check Parameter 01/04 (CC1 Source Adress SAE J1939), 01/05 (CC2 Source Adress SAE J1939) and 01/06 (CC3 Source Adress SAE J1939) for correct Source Adress	OFF	OFF	OFF	
556	9	2C0209	J1939 RC Message from Transmission Retarder is missing	Check J1939 link connection to Transmission Retarder. Check if Transmission Retarder is enabled and correct configured, Parameter 55/01. (Trans Ret Number of Stages)	ON	OFF	OFF	
558	2	2E0202	Idle Validation Switch Inputs Reversed.	Check Idle Validation switch wiring	ON	OFF	OFF	Pin 1/03 Pin 1/06
558	3	2E0203	Idle Validation Switch 1 Circuit shorted to Ubat. The two idle switches are not synchron (check AP)	Check wiring of associated pin Check parameters 35/01 (Selection), 35/20 (Fault Detection) and 35/38 (Configuration) for correct configuration of output pin 1/04 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 13	ON	OFF	OFF	Pin 1/04
558	4	2E0204	Idle Validation Switch 1 Circuit shorted to GND. The two idle switches are not synchron (check AP)	Check wiring of associated pin Check parameters 35/01 (Selection), 35/20 (Fault Detection) and 35/38 (Configuration) for correct configuration of output pin 1/04 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 13	ON	OFF	OFF	Pin 1/04
558	5	2E0205	Idle Validation Switch 2 Circuit shorted to GND. The two idle switches are not synchron (check AP)	Check wiring of associated pin Check parameters 35/01 (Selection), 35/20 (Fault Detection) and 35/38 (Configuration) for correct configuration of output pin 1/04 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 13	ON	OFF	OFF	Pin 1/04
558	6	2E0206	Idle Validation Switch 2 Circuit shorted to Ubat. The two idle switches are not synchron (check AP)	Check wiring of associated pin Check parameters 35/01 (Selection), 35/20 (Fault Detection) and 35/38 (Configuration) for correct configuration of output pin 1/04 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 13	ON	OFF	OFF	Pin 1/04
569	9	390209	J1939 EAC1 Message is missing or not available	Check J1939 link connection to Electronic Axle Control	ON	OFF	OFF	
571	4	3B0204	Engine Brake Disable push-button shorted to Ground or pressed too long	Check wiring of associated pin Check parameters 13/19 (Selection), 13/62 (Fault Detect Ena) for correct configuration of input pin 4/18	ON	OFF	OFF	Pin 4/18

SPN	FMI	DTC	Fault description	Recommended Action	CEL	SEL	MIL	Fault location
596	13	54020D	J1939 Cruise Control Enable Switch Signal from Source CCVS1, CCVS2 or CCVS3 missing or not available = SNA (signal not available)	Check J1939 link connection to Cruise Control Check Parameter 13/22 (CC ON OFF Switch Config) for correct source Check Parameter 01/04 (CC1 Source Adress SAE J1939), 01/05 (CC2 Source Adress SAE J1939) and 01/06 (CC3 Source Adress SAE J1939) for correct Source Adress	OFF	OFF	OFF	
596	19	540213	J1939 Cruise Control Enable Switch Signal from Source CCVS1, CCVS2 or CCVS3 erractic = undefined value but not SNA	Check J1939 link connection to Cruise Control Check Parameter 13/22 (CC ON OFF Switch Config) for correct source Check Parameter 01/04 (CC1 Source Adress SAE J1939), 01/05 (CC2 Source Adress SAE J1939) and 01/06 (CC3 Source Adress SAE J1939) for correct Source Adress	OFF	OFF	OFF	
597	13	55020D	J1939 Service Brake Switch Signal from Source CCVS1, CCVS2 or CCVS3 missing or not available = SNA (signal not available)	Check J1939 link connection to Cruise Control Check Parameter 13/29 (Service Brake Switch Config) for correct source Check Parameter 01/04 (CC1 Source Adress SAE J1939), 01/05 (CC2 Source Adress SAE J1939) and 01/06 (CC3 Source Adress SAE J1939) for correct Source Adress	OFF	OFF	OFF	
597	19	550213	J1939 Service Brake Switch Signal from Source CCVS1, CCVS2 or CCVS3 erractic = undefined value but not SNA	Check J1939 link connection to Cruise Control Check Parameter 13/29 (Service Brake Switch Config) for correct source Check Parameter 01/04 (CC1 Source Adress SAE J1939), 01/05 (CC2 Source Adress SAE J1939) and 01/06 (CC3 Source Adress SAE J1939) for correct Source Adress	OFF	OFF	OFF	
598	2	560202	Clutch switch status not plausible	Check wiring of Clutch Switch and Driveline Open Status	ON	OFF	OFF	
599	4	570204	Cruise Control SET and RESUME Circuits shorted to GND (SET and RESUME applied at the same time)	Check wiring of associated pins	ON	OFF	OFF	Pin 1/12 Pin 1/16
600	13	58020D	J1939 Cruise Control Coast Switch Signal from Source CCVS1, CCVS2 or CCVS3 missing or not available = SNA (signal not available)	Check J1939 link connection to Cruise Control Check Parameter 13/24 (CC Set Cst Res Accel Sw Config) for correct source Check Parameter 01/04 (CC1 Source Adress SAE J1939), 01/05 (CC2 Source Adress SAE J1939) and 01/06 (CC3 Source Adress SAE J1939) for correct Source Adress	OFF	OFF	OFF	
600	19	580213	J1939 Cruise Control Coast Switch Signal from Source CCVS1, CCVS2 or CCVS3 erractic = undefined value but not SNA	Check J1939 link connection to Cruise Control Check Parameter 13/24 (CC Set Cst Res Accel Sw Config) for correct source Check Parameter 01/04 (CC1 Source Adress SAE J1939), 01/05 (CC2 Source Adress SAE J1939) and 01/06 (CC3 Source Adress SAE J1939) for correct Source Adress	OFF	OFF	OFF	
602	13	5A020D	J1939 Cruise Control Accelerator Switch Signal from Source CCVS1, CCVS2 or CCVS3 = SNA (signal not available)	Check J1939 link connection to Cruise Control Check Parameter 13/24 (CC Set Cst Res Accel Sw Config) for correct source Check Parameter 01/04 (CC1 Source Adress SAE J1939), 01/05 (CC2 Source Adress SAE J1939) and 01/06 (CC3 Source Adress SAE J1939) for correct Source Adress	OFF	OFF	OFF	
602	19	5A0213	J1939 Cruise Control Accelerator Switch from Source CCVS1, CCVS2 or CCVS3 erractic = undefined value but not SNA	Check J1939 link connection to Cruise Control Check Parameter 13/24 (CC Set Cst Res Accel Sw Config) for correct source Check Parameter 01/04 (CC1 Source Adress SAE J1939), 01/05 (CC2 Source Adress SAE J1939) and 01/06 (CC3 Source Adress SAE J1939) for correct Source Adress	OFF	OFF	OFF	
609	12	61020C	CPC electronics are defect (EEPROM, CPU…)	Try reprogramming the CPC with the new software release. Replace CPC4 and reprogram with the latest software.	OFF	OFF	OFF	
609	13	61020D	the CPC SW is corrupt (CPC Software Diagnostics)	Source address setting conflict. Messages with more than one source address (e.g. “CM1 Fan Source Addr1” and ”CM1 Fan Source	OFF	OFF	OFF	

SPN	FMI	DTC	Fault description	Recommended Action	CEL	SEL	MIL	Fault location
				Addr2") have to be parameterized with different addresses. Check calibration for these addresses (PGR 01 "Communication")				
609	16	610210	Internal temperature of CPC4 too high.	Check CPC4 case and cooling measurements. Turn off vehicle.	ON	OFF	OFF	
625	2	710202	PTCAN Incorrect MCM System ID received	MCM Sys ID not valid (MCM initialization not finished). Check MCM.	ON	OFF	ON	
625	8	710208	MCM PT-CAN DM1 Message Not Received or has Stopped Arriving	Check CPC4 PT-CAN link connection. Check MCM functionality / PT-CAN link connection	ON	OFF	ON	
625	9	710209	ACM PT-CAN DM1 Message Not Received or has Stopped Arriving	Check CPC4 PT-CAN link connection. Check ACM functionality / PT-CAN link connection	ON	OFF	ON	
625	13	71020D	TCM System ID Not Received or Stopped Arriving (TCM Outage -> Check Translamp)	Check CPC4 PT-CAN link connection. Check TCM functionality / PT-CAN link connection	OFF	OFF	OFF	
625	14	71020E	PTCAN: MCM Sytem ID Not Received or Stopped Arriving (ECAN ID_596/7 not received or it has stopped arriving)	Check PT-CAN link connection. Check MCM functionality / PT-CAN link connection	ON	OFF	ON	
628	2	740202	EEPROM Checksum Failure	Try reprogramming the CPC with the new software release. Reset EEPROM values to default. Redownload CPC parameter set. Replace CPC4 and reprogram with the latest software.	ON	OFF	OFF	
628	14	74020E	XFLASH Static Fault Code Memory Page Read Write Failure (XFLASH Failure.)	Replace CPC4 box due to XFLASH failure and reprogram with the latest software.	OFF	OFF	OFF	
628	17	740211	1000ms ECU OS Task Timed out Prior to Completion. (Indication of a critical resource allocation issue. Task restructuring required.)	Try reprogramming the CPC with the new software release. Replace CPC4 and reprogram with the latest software.	OFF	OFF	OFF	
629	2	750202	CPC Hardware / Software Mismatch (Incorrect Hardware Configuration - NAFTA Vs. EUROPE)	Try reprogramming the CPC with the new software release. Reset EEPROM values to default. Redownload CPC parameter set. Replace CPC4 and reprogram with the latest software.	ON	OFF	OFF	
629	12	75020C	DDEC Data Xflash Write Error. Replace CPC. (XFLASH Failure.)	Try reprogramming the CPC with the new software release. Replace CPC4 and reprogram with the latest software.	OFF	OFF	OFF	
639	13	7F020D	HDMS Fan is configured and the J1939 message was not received or has stopped arriving.	Check J1939 link connection to the air conditioner transducer. Check if CPC4 parameters correct for the vehicle configuration.	OFF	OFF	OFF	
639	14	7F020E	J1939 Data Link Failure (CPC is no longer sending or receiving data from the J1939 link.)	Check J1939 data link connection	ON	OFF	OFF	Pin 2/16 Pin 2/17 Pin 2/18
667	3	9B0203	Starter Pin 1/18 Circuit shorted to Ubat (KL50)	Check KL50 wiring at Pin 1/18	ON	OFF	OFF	Pin 1/18
701	3	BD0203	Digital Output 3/07 Circuit shorted to Ubat	Check wiring of associated pin Check parameters 35/06 (Selection), 35/25 (Fault Detection) and 35/42 (Configuration) for correct configuration of output pin 3/07 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 9	ON	OFF	OFF	Pin 3/07
701	4	BD0204	Digital Output 3/07 Circuit shorted to GND	Check wiring of associated pin Check parameters 35/06 (Selection), 35/25 (Fault Detection) and 35/42 (Configuration) for correct configuration of output pin 3/07 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 9	ON	OFF	OFF	Pin 3/07

SPN	FMI	DTC	Fault description	Recommended Action	CEL	SEL	MIL	Fault location
701	5	BD0205	Digital Output 3/07 Open Circuit (broken wire, terminal floating)	Check wiring of associated pin Check parameters 35/06 (Selection), 35/25 (Fault Detection) and 35/42 (Configuration) for correct configuration of output pin 3/07 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 9	ON	OFF	OFF	Pin 3/07
702	3	BE0203	Digital Output 3/08 Circuit shorted to Ubat	Check wiring of associated pin Check parameters 35/07 (Selection), 35/26 (Fault Detection) and 35/43 (Configuration) for correct configuration of output pin 3/08 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 10	ON	OFF	OFF	Pin 3/08
702	4	BE0204	Digital Output 3/08 Circuit shorted to GND	Check wiring of associated pin Check parameters 35/07 (Selection), 35/26 (Fault Detection) and 35/43 (Configuration) for correct configuration of output pin 3/08 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 10	ON	OFF	OFF	Pin 3/08
702	5	BE0205	Digital Output 3/08 Open Circuit (broken wire, terminal floating)	Check wiring of associated pin Check parameters 35/07 (Selection), 35/26 (Fault Detection) and 35/43 (Configuration) for correct configuration of output pin 3/08 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 10	ON	OFF	OFF	Pin 3/08
703	3	BF0203	Digital Output 3/09 Circuit shorted to Ubat	Check wiring of associated pin Check parameters 35/08 (Selection), 35/27 (Fault Detection) and 35/44 (Configuration) for correct configuration of output pin 3/09 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 14	ON	OFF	OFF	Pin 3/09
703	4	BF0204	Digital Output 3/09 Circuit shorted to GND	Check wiring of associated pin Check parameters 35/08 (Selection), 35/27 (Fault Detection) and 35/44 (Configuration) for correct configuration of output pin 3/09 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 14	ON	OFF	OFF	Pin 3/09
703	5	BF0205	Digital Output 3/09 Open Circuit (broken wire, terminal floating)	Check wiring of associated pin Check parameters 35/08 (Selection), 35/27 (Fault Detection) and 35/44 (Configuration) for correct configuration of output pin 3/09 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 14	ON	OFF	OFF	Pin 3/09
704	3	C00203	Digital Output 4/07 Circuit shorted to Ubat	Check wiring of associated pin Check parameters 35/16 (Selection), 35/35 (Fault Detection) and 35/52 (Configuration) for correct configuration of output pin 4/07 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 15	ON	OFF	OFF	Pin 4/07
704	4	C00204	Digital Output 4/07 Circuit shorted to GND	Check wiring of associated pin Check parameters 35/16 (Selection), 35/35 (Fault Detection) and 35/52 (Configuration) for correct configuration of output pin 4/07 Run Service Routine (chapter 6.4, routines 15 to 17): – Dvigital Output Pin Under Software Control: Start Response with Signal Parameter 15	ON	OFF	OFF	Pin 4/07
704	5	C00205	Digital Output 4/07 Open Circuit (broken wire, terminal floating)	Check wiring of associated pin Check parameters 35/16 (Selection), 35/35 (Fault Detection) and 35/52 (Configuration) for correct configuration of output pin 4/07 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 15	ON	OFF	OFF	Pin 4/07
705	3	C10203	Digital Output 1/13 Circuit	Check wiring of associated pin	ON	OFF	OFF	Pin 1/13

SPN	FMI	DTC	Fault description	Recommended Action	CEL	SEL	MIL	Fault location
			shorted to Ubat	Check parameters 35/03 (Selection), 35/22 (Fault Detection) and 35/40 (Configuration) for correct configuration of output pin 1/13 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 1				
705	4	C10204	Digital Output 1/13 Circuit shorted to GND	Check wiring of associated pin Check parameters 35/03 (Selection), 35/22 (Fault Detection) and 35/40 (Configuration) for correct configuration of output pin 1/13 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 1	ON	OFF	OFF	Pin 1/13
705	5	C10205	Digital Output 1/13 Open Circuit (broken wire, terminal floating)	Check wiring of associated pin Check parameters 35/03 (Selection), 35/22 (Fault Detection) and 35/40 (Configuration) for correct configuration of output pin 1/13 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 1	ON	OFF	OFF	Pin 1/13
706	3	C20203	Digital Output 3/10 Circuit shorted to Ubat	Check wiring of associated pin Check parameters 35/09 (Selection), 35/28 (Fault Detection) and 35/45 (Configuration) for correct configuration of output pin 3/10 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 2	ON	OFF	OFF	Pin 3/10
706	4	C20204	Digital Output 3/10 Circuit shorted to GND	Check wiring of associated pin Check parameters 35/09 (Selection), 35/28 (Fault Detection) and 35/45 (Configuration) for correct configuration of output pin 3/10 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 2	ON	OFF	OFF	Pin 3/10
706	5	C20205	Digital Output 3/10 Open Circuit (broken wire, terminal floating)	Check wiring of associated pin Check parameters 35/09 (Selection), 35/28 (Fault Detection) and 35/45 (Configuration) for correct configuration of output pin 3/10 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 2	ON	OFF	OFF	Pin 3/10
707	3	C30203	Digital Output 2/10 Circuit shorted to Ubat (CEL / AWL Lamp)	Check wiring of associated pin Check parameters 35/04 (Selection), 35/23 (Fault Detection) and 35/41 (Configuration) for correct configuration of output pin 2/10 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 3	OFF	OFF	OFF	Pin 2/10
707	4	C30204	Digital Output 2/10 Circuit shorted to GND (CEL / AWL Lamp)	Check wiring of associated pin Check parameters 35/04 (Selection), 35/23 (Fault Detection) and 35/41 (Configuration) for correct configuration of output pin 2/10 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 3	OFF	OFF	OFF	Pin 2/10
707	5	C30205	Digital Output 2/10 Open Circuit (broken wire, terminal floating / CEL / AWL Lamp)	Check wiring of associated pin Check parameters 35/04 (Selection), 35/23 (Fault Detection) and 35/41 (Configuration) for correct configuration of output pin 2/10 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 3	OFF	OFF	OFF	Pin 2/10
708	3	C40203	Digital Output 3/12 Circuit shorted to Ubat	Check wiring of associated pin Check parameters 35/10 (Selection), 35/29 (Fault Detection) and 35/46 (Configuration) for correct configuration of output pin 3/12 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 4	ON	OFF	OFF	Pin 3/12
708	4	C40204	Digital Output 3/12 Circuit shorted to GND	Check wiring of associated pin Check parameters 35/10 (Selection), 35/29 (Fault	ON	OFF	OFF	Pin 3/12

SPN	FMI	DTC	Fault description	Recommended Action	CEL	SEL	MIL	Fault location
				Detection) and 35/46 (Configuration) for correct configuration of output pin 3/12 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 4				
708	5	C40205	Digital Output 3/12 Open Circuit (broken wire, terminal floating)	Check wiring of associated pin Check parameters 35/10 (Selection), 35/29 (Fault Detection) and 35/46 (Configuration) for correct configuration of output pin 3/12 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 4	ON	OFF	OFF	Pin 3/12
709	3	C50203	Digital Output 3/16 Circuit shorted to Ubat	Check wiring of associated pin Check parameters 35/11 (Selection), 35/30 (Fault Detection) and 35/47 (Configuration) for correct configuration of output pin 3/16 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 5	ON	OFF	OFF	Pin 3/16
709	4	C50204	Digital Output 3/16 Circuit shorted to GND	Check wiring of associated pin Check parameters 35/11 (Selection), 35/30 (Fault Detection) and 35/47 (Configuration) for correct configuration of output pin 3/16 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 5	ON	OFF	OFF	Pin 3/16
709	5	C50205	Digital Output 3/16 Open Circuit (broken wire, terminal floating)	Check wiring of associated pin Check parameters 35/11 (Selection), 35/30 (Fault Detection) and 35/47 (Configuration) for correct configuration of output pin 3/16 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 5	ON	OFF	OFF	Pin 3/16
710	3	C60203	Digital Output 4/06 Circuit shorted to Ubat	Check wiring of associated pin Check parameters 35/15 (Selection), 35/34 (Fault Detection) and 35/51 (Configuration) for correct configuration of output pin 4/06 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 6	ON	OFF	OFF	Pin 4/06
710	4	C60204	Digital Output 4/06 Circuit shorted to GND	Check wiring of associated pin Check parameters 35/15 (Selection), 35/34 (Fault Detection) and 35/51 (Configuration) for correct configuration of output pin 4/06 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 6	ON	OFF	OFF	Pin 4/06
710	5	C60205	Digital Output 4/06 Open Circuit (broken wire, terminal floating)	Check wiring of associated pin Check parameters 35/15 (Selection), 35/34 (Fault Detection) and 35/51 (Configuration) for correct configuration of output pin 4/06 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 6	ON	OFF	OFF	Pin 4/06
711	3	C70203	Digital Output 1/05 Circuit shorted to Ubat	Check wiring of associated pin Check parameters 35/02 (Selection), 35/21 (Fault Detection) and 35/39 (Configuration) for correct configuration of output pin 1/05 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 12	ON	OFF	OFF	Pin 1/05
711	4	C70204	Digital Output 1/05 Circuit shorted to GND	Check wiring of associated pin Check parameters 35/02 (Selection), 35/21 (Fault Detection) and 35/39 (Configuration) for correct configuration of output pin 1/05 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 12	ON	OFF	OFF	Pin 1/05
711	5	C70205	Digital Output 1/05 Open Circuit (broken wire, terminal floating)	Check wiring of associated pin Check parameters 35/02 (Selection), 35/21 (Fault Detection) and 35/39 (Configuration) for correct	ON	OFF	OFF	Pin 1/05

SPN	FMI	DTC	Fault description	Recommended Action	CEL	SEL	MIL	Fault location
				configuration of output pin 1/05 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 12				
712	3	C80203	Digital Output 1/04 Circuit shorted to Ubat	Check wiring of associated pin Check parameters 35/01 (Selection), 35/20 (Fault Detection) and 35/38 (Configuration) for correct configuration of output pin 1/04 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 13	ON	OFF	OFF	Pin 1/04
712	4	C80204	Digital Output 1/04 Circuit shorted to GND	Check wiring of associated pin Check parameters 35/01 (Selection), 35/20 (Fault Detection) and 35/38 (Configuration) for correct configuration of output pin 1/04 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 13	ON	OFF	OFF	Pin 1/04
712	5	C80205	Digital Output 1/04 Open Circuit (broken wire, terminal floating)	Check wiring of associated pin Check parameters 35/01 (Selection), 35/20 (Fault Detection) and 35/38 (Configuration) for correct configuration of output pin 1/04 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 13	ON	OFF	OFF	Pin 1/04
714	3	CA0203	Digital Output 4/10 Circuit shorted to Ubat	Check wiring of associated pin Check parameters 35/18 (Selection), 35/37 (Fault Detection) and 35/54 (Configuration) for correct configuration of output pin 4/10 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 11	ON	OFF	OFF	Pin 4/10
714	4	CA0204	Digital Output 4/10 Circuit shorted to GND	Check wiring of associated pin Check parameters 35/18 (Selection), 35/37 (Fault Detection) and 35/54 (Configuration) for correct configuration of output pin 4/10 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 11	ON	OFF	OFF	Pin 4/10
714	5	CA0205	Digital Output 4/10 Open Circuit (broken wire, terminal floating)	Check wiring of associated pin Check parameters 35/18 (Selection), 35/37 (Fault Detection) and 35/54 (Configuration) for correct configuration of output pin 4/10 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 11	ON	OFF	OFF	Pin 4/10
715	3	CB0203	Frequency Output 4/12 Circuit shorted to Ubat	Check wiring of associated pin Run Service Routine (chapter 6.4, routines 8 to 10): – Analog Output Pin Under Software: Start with Signal Parameter 1, Frequency in Hz, Width in %	ON	OFF	OFF	Pin 4/12
715	4	CB0204	Frequency Output 4/12 Circuit shorted to GND	Check wiring of associated pin Run Service Routine (chapter 6.4, routines 8 to 10): – Analog Output Pin Under Software: Start with Signal Parameter 1, Frequency in Hz, Width in %	ON	OFF	OFF	Pin 4/12
715	5	CB0205	Frequency Output 4/12 Open Circuit (broken wire, terminal floating)	Check wiring of associated pin Run Service Routine (chapter 6.4, routines 8 to 10): – Analog Output Pin Under Software: Start with Signal Parameter 1, Frequency in Hz, Width in %	OFF	OFF	OFF	Pin 4/12
716	3	CC0203	Frequency Output 1/09 Circuit shorted to Ubat	Check wiring of associated pin Run Service Routine (chapter 6.4, routines 8 to 10): – Analog Output Pin Under Software: Start with Signal Parameter 2, Frequency in Hz, Width in %	ON	OFF	OFF	Pin 1/09
716	4	CC0204	Frequency Output 1/09 Circuit shorted to GND	Check wiring of associated pin Run Service Routine (chapter 6.4, routines 8 to 10): – Analog Output Pin Under Software: Start with Signal Parameter 2, Frequency in Hz, Width in %	ON	OFF	OFF	Pin 1/09
716	5	CC0205	Frequency Output 1/09 Open Circuit (broken wire, terminal floating)	Check wiring of associated pin Run Service Routine (chapter 6.4, routines 8 to 10): – Analog Output Pin Under Software: Start with Signal Parameter 2, Frequency in Hz, Width in %	ON	OFF	OFF	Pin 1/09

SPN	FMI	DTC	Fault description	Recommended Action	CEL	SEL	MIL	Fault location
904	9	880309	J1939 EBC2 Message from ABS is missing or not available = SNA (signal not available)	Check J1939 link connection to the ABS and Devices Brake System Controller	OFF	OFF	OFF	
904	13	88030D	J1939 Front Axle Speed Signal is missing or not available = SNA (signal not available)	Check J1939 link connection to Front Axle Speed Sensor	OFF	OFF	OFF	
904	19	880313	J1939 Front Axle Speed Signal is erratic = undefined value but not SNA	Check J1939 link connection to Front Axle Speed Sensor	OFF	OFF	OFF	
924	3	9C0303	Digital Output 4/09 Circuit shorted to Ubat	Check wiring of associated pin Check parameters 35/17 (Selection), 35/36 (Fault Detection) and 35/53 (Configuration) for correct configuration of output pin 4/09 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 7	ON	OFF	OFF	Pin 4/09
924	4	9C0304	Digital Output 4/09 Circuit shorted to GND	Check wiring of associated pin Check parameters 35/17 (Selection), 35/36 (Fault Detection) and 35/53 (Configuration) for correct configuration of output pin 4/09 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 7	ON	OFF	OFF	Pin 4/09
924	5	9C0305	Digital Output 4/09 Open Circuit (broken wire, terminal floating)	Check wiring of associated pin Check parameters 35/17 (Selection), 35/36 (Fault Detection) and 35/53 (Configuration) for correct configuration of output pin 4/09 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 7	ON	OFF	OFF	Pin 4/09
925	3	9D0303	Digital Output 3/17 Circuit shorted to Ubat	Check wiring of associated pin Check parameters 35/12 (Selection), 35/31 (Fault Detection) and 35/48 (Configuration) for correct configuration of output pin 3/17 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 8	ON	OFF	OFF	Pin 3/17
925	4	9D0304	Digital Output 3/17 Circuit shorted to GND	Check wiring of associated pin Check parameters 35/12 (Selection), 35/31 (Fault Detection) and 35/48 (Configuration) for correct configuration of output pin 3/17 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 8	ON	OFF	OFF	Pin 3/17
925	5	9D0305	Digital Output 3/17 Open Circuit (broken wire, terminal floating)	Check wiring of associated pin Check parameters 35/12 (Selection), 35/31 (Fault Detection) and 35/48 (Configuration) for correct configuration of output pin 3/17 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 8	ON	OFF	OFF	Pin 3/17
926	3	9E0303	Digital Output 4/01 Circuit shorted to Ubat	Check wiring of associated pin Check parameters 35/13 (Selection), 35/32 (Fault Detection) and 35/49 (Configuration) for correct configuration of output pin 4/01 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 16	ON	OFF	OFF	Pin 4/01
926	4	9E0304	Digital Output 4/01 Circuit shorted to GND	Check wiring of associated pin Check parameters 35/13 (Selection), 35/32 (Fault Detection) and 35/49 (Configuration) for correct configuration of output pin 4/01 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 16	ON	OFF	OFF	Pin 4/01
926	5	9E0305	Digital Output 4/01 Open Circuit (broken wire,	Check wiring of associated pin Check parameters 35/13 (Selection), 35/32 (Fault	ON	OFF	OFF	Pin 4/01

SPN	FMI	DTC	Fault description	Recommended Action	CEL	SEL	MIL	Fault location
			terminal floating)	Detection) and 35/49 (Configuration) for correct configuration of output pin 4/01 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 16				
972	2	CC0302	Throttle inhibit switch signal not plausible due to excess vehicle speed	Check wiring of associated pin. Check parameters 13/05 (Selection) and 13/43 (Fault Detection) for correct configuration of input pin 1/17.	ON	OFF	OFF	Pin 1/17
973	2	CD0302	Evobus 5stage retarder level position not plausible	Check wiring of associated pin. Check parameters 13/08 (Selection) and 13/49 (Fault Detection) for correct configuration of input pin 2/13.	ON	OFF	OFF	Pin 2/13
973	9	CD0309	J1939 EBC1 Message is missing or not available	Check J1939 link connection and Devices Turbocharger. Check Parameter 01/10 (EBC1 Source Adress SAE J1939)	ON	OFF	OFF	
973	13	CD030D	J1939 Engine Retarder Selection Signal Missing or not available = SNA (signal not available)	Check J1939 link connection to Engine Retarder	ON	OFF	OFF	
973	19	CD0313	J1939 Engine Retarder Selection Signal erractic = undefined value but not SNA	Check J1939 link connection to Engine Retarder	ON	OFF	OFF	
974	2	CE0302	Remote Accelerator Pedal Supply Voltage Out of Range	Check wiring of associated pins	ON	OFF	OFF	Pin 3/03 Pin 3/04
974	3	CE0303	Remote Accelerator Pedal Circuit shorted to Ubat	Check wiring of associated pins	ON	OFF	OFF	Pin 3/02 Pin 3/03 Pin 3/04
974	4	CE0304	Remote Accelerator Pedal Circuit shorted to GND	Check wiring of associated pins	ON	OFF	OFF	Pin 3/02 Pin 3/03 Pin 3/04
979	9	D30309	J1939 PTO Message Not Received This Ignition Cycle	Check J1939 link connection. Check Parameter 01/52 (PTO Source Adress SAE J1939) for proper configuration.	ON	OFF	OFF	
986	9	DA0309	J1939 CM1 DPF Message is missing or not available	Check J1939 link connection and Devices Cab Controller 1 and Climate Control. Check Parameter 01/07 (CM1 DPF Source Adress SAE J1939) for proper configuration.	OFF	OFF	OFF	
986	13	DA030D	J1939 CM1 Fan SPN986 Signal from source address #1 or #2 is missing or not available = SNA (signal not available)	Check J1939 link connection. Check Parameter 01/08 (CM1 Fan Source Adress #1 SAE J1939) and Parameter 01/09 (CM1 Fan Source Adress #2 SAE J1939) for proper configuration.	OFF	OFF	OFF	
986	19	DA0313	J1939 CM1 Fan SPN986 Signal from source address #1 or #2 is erractic = undefined value but not SNA	Check J1939 link connection. Check Parameter 01/08 (CM1 Fan Source Adress #1 SAE J1939) and Parameter 01/09 (CM1 Fan Source Adress #2 SAE J1939) for proper configuration.	OFF	OFF	OFF	
1089	9	410409	J1939 AIR1 Message (Air Supply Pressure) is missing from first source address	Check J1939 link connection Check Parameter 01/96 (AIR1 Source Address 1 SAE J1939)	ON	OFF	OFF	
1089	13	41040D	J1939 AIR1 Message (Air Supply Pressure) is missing from second source address	Check J1939 link connection Check Parameter 01/102 (AIR1 Source Address 2 SAE J1939)	ON	OFF	OFF	
1121	2	610402	J1939 Powertrain Message (AMT – Detroit transmission) is missing	Check wiring of J2CC and related J1939 link connection	ON	OFF	OFF	
1121	13	61040D	J1939 Service Brake Switch Signal from EBC1 is missing or not available = SNA (signal not available)	Check J1939 link connection to Service Brake. Check Parameter 01/10 (EBC1 Source Adress SAE J1939)	OFF	OFF	OFF	
1121	19	610413	J1939 Service Brake Switch Signal from EBC1 is erractic = undefined	Check J1939 link connection to Service Brake. Check Parameter 01/10 (EBC1 Source Adress SAE J1939)	OFF	OFF	OFF	

SPN	FMI	DTC	Fault description	Recommended Action	CEL	SEL	MIL	Fault location
			value but not SNA					
1237	4	D50404	Stop Engine Override Switch shorted to Ground (if applied more than 5 sec this error flags)	Check wiring of associated pin. Check parameters 13/04 (Selection) and 13/41 (Fault Detect Enable) for correct configuration of input pin 1/15.	ON	OFF	OFF	Pin 1/15
1243	14	DB040E	ABS fault restricts automatic gear selection functionality.	Check ABS for proper function. Combination of ABS and ASC error. ABS error = v > 1km/h and req-gear < current gear and ABS in stat “not fully operable”	OFF	OFF	OFF	
1482	9	CA0509	J1939 TC1 Message (Transmission Mode) is missing	Check J1939 link connection to Transmission Control	ON	OFF	OFF	
1484	9	CC0509	J1939 Message was lost (Message Counter Error)	Check J1939 link connection	OFF	OFF	OFF	
1484	13	CC050D	J1939 Message was lost (CRC Error)	Check J1939 link connection	OFF	OFF	OFF	
1592	9	380609	J1939 HRW Message from ABS is missing (HRW not received in case newAMT Transmission used)	Check J1939 link connection to ABS. Check correct configuration (parameter 02/09 (Transmission Type)) if newAMT Transmission is used	ON	OFF	OFF	
1592	13	38060D	J1939 HRW Wheel Speed Signal Missing (HRW received but at least one signal not available)	Check J1939 link connection to ABS. Check correct configuration (parameter 02/09 (Transmission Type)) if newAMT Transmission is used	OFF	OFF	OFF	
1592	19	380613	J1939 HRW Wheel Speed Signal Erroneous (HRW received but at least one signal erroneous)	Check J1939 link connection to ABS. Check correct configuration (parameter 02/09 (Transmission Type)) if newAMT Transmission is used	OFF	OFF	OFF	
1623	9	570609	J1939 Tachograph Output Shaft Speed Signal is erratic = undefined value but not SNA	Check wiring of associated pin	OFF	OFF	OFF	
1623	13	57060D	J1939 Tachograph Output Shaft Speed Signal is missing or not available = SNA (signal not available)	Check wiring of associated pin	OFF	OFF	OFF	
1624	9	580609	J1939 TCO1 Message is missing or not available	Check J1939 link connection to Vehicle Speed Sensor. Check Parameter 08/13 (Vehicle Speed Sensor Configuration) for proper configuration	OFF	OFF	OFF	
1624	13	58060D	J1939 Tachograph Vehicle Speed Signal is missing or not available = SNA (signal not available) + J1939 TCO1 speed sensor selected	Check J1939 link connection to Vehicle Speed Sensor. Check Parameter 08/13 (Vehicle Speed Sensor Configuration) for proper configuration	OFF	OFF	OFF	
1624	19	580613	J1939 Tachograph Vehicle Speed Signal is erractic = undefined value but not SNA + J1939 TCO1 speed sensor selected	Check J1939 link connection to Vehicle Speed Sensor. Check Parameter 08/13 (Vehicle Speed Sensor Configuration) for proper configuration	OFF	OFF	OFF	
1663	7	7F0607	Optimized idle prevented from resuming (Safety Loop Faulted)	Check if Park brake is applied, Engine Hood is Closed and Transmission is in Neural Position. Check the wiring of the involved switches and sensors.	ON	OFF	OFF	
1681	9	910609	J1939 BM Message (Battery Main Switch) is missing	Check J1939 link connection	ON	OFF	OFF	
1716	9	B40609	J1939 ERC1 Message is missing or not available	Check J1939 link connection to Retarder	OFF	OFF	OFF	
1716	13	B4060D	Evobus 5stage retarder level calibration not plausible	Check wiring of associated pin. Check parameters 13/08 (Selection) and 13/49 (Fault Detect Enable) for correct configuration of input pin 2/13.	ON	OFF	OFF	Pin 2/13
1814	9	160709	J1939 VDC1 Message was not received or has stopped arriving.	Check J1939 link connection. Check Parameter 01/57 (VDC1 Source Adress SAE J1939)	OFF	OFF	OFF	
1845	9	350709	J1939 TCFG2 Message is missing or not available	Check J1939 link connection to Transmission Control	OFF	OFF	OFF	

SPN	FMI	DTC	Fault description	Recommended Action	CEL	SEL	MIL	Fault location
2003	9	D30709	J1939 Message is missing from source adress 3 (3dec = Transmission #1 ECU missing)	Check J1939 link connection to Cruise Control ECU	ON	OFF	OFF	
2011	9	DB0709	J1939 Message is missing from source address 11 (dec).		OFF	OFF	OFF	
2017	9	E10709	J1939 Message is missing from source address 17 (17dec = Cruise Control ECU missing)	Check J1939 link connection to Cruise Control ECU	OFF	OFF	OFF	
2023	9	E70709	J1939 Message is missing from source 23 (23dec = Instrument Cluster ECU missing)	Check J1939 link connection to Instrument Cluster ECU	OFF	OFF	OFF	
2025	9	E90709	J1939 Message is missing from source 25 (25dec = Passenger-Operator Climate Control ECU missing)	Check J1939 link connection to Passenger Operator Climate Control ECU	OFF	OFF	OFF	
2033	9	F10709	J1939 Message is missing from source 33 (33dec = Body Controller ECU missing)	Check J1939 link connection to body Controller ECU	ON	OFF	OFF	
2042	9	FA0709	J1939 Message is missing from source 42 (42dec = Headway Controller (forward-looking collision warning, collision avoidance, speed Controller, or speed matching) ECU is missing)	Check J1939 link connection to Headway Controller ECU	ON	OFF	OFF	
2049	9	010809	J1939 Message is missing from source 49 (49dec = Gab Controller - Primary ECU missing)	Check J1939 link connection to Gab Controller – Primary ECU	ON	OFF	OFF	
2596	9	240A09	J1939 CM1 Message (Maximum Vehicle Speed Limit) is Missing or Not Available	Check J1939 link connection	ON	OFF	OFF	
2623	2	3F0A02	2-Channel Accelerator Pedal “in-range” fault (AP Ch1 and Ch2 values differ to much)	Check wiring of associated pins and calibration; Restart learning routine. (chapter 6.4, routines 1 to 3): Check Accelerator Pedal for proper behavier regarding voltage of the 2 channels.	ON	OFF	OFF	
2623	8	3F0A08	2-Channel Accelerator Pedal Signal 2 Missing	Check wiring of associated pin.	ON	OFF	OFF	Pin 1/06
2623	14	3F0A0E	2-Channel Accelerator pedal GAS1 and GAS2 Signal Missing	Check wiring of associated pins.	ON	OFF	OFF	
2646	3	560A03	Digital Output 4/02 Circuit shorted to Ubat	Check wiring of associated pin Check parameters 35/14 (Selection), 35/33 (Fault Detection) and 35/50 (Configuration) for correct configuration of output pin 4/02 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 9	ON	OFF	OFF	Pin 4/02
2646	4	560A04	Digital Output 4/02 Circuit shorted to GND	Check wiring of associated pin Check parameters 35/14 (Selection), 35/33 (Fault Detection) and 35/50 (Configuration) for correct configuration of output pin 4/02 Run Service Routine (chapter 6.4, routines 15 to 17): – Digital Output Pin Under Software Control: Start Response with Signal Parameter 9	ON	OFF	OFF	Pin 4/02
2646	5	560A05	Digital Output 4/02 Open Circuit (broken wire, terminal floating)	Check wiring of associated pin Check parameters 35/14 (Selection), 35/33 (Fault Detection) and 35/50 (Configuration) for correct configuration of output pin 4/02 Run Service Routine (chapter 6.4, routines 15 to 17):	ON	OFF	OFF	Pin 4/02

SPN	FMI	DTC	Fault description	Recommended Action	CEL	SEL	MIL	Fault location
				– Digital Output Pin Under Software Control: Start Response with Signal Parameter 9				
2882	13	420B0D	Off-Highway Engine Configuration Selection message on J1939 was not received or has stopped arriving.	Check the J1939 link connection Check parameter 01/72 for configuration of OHECS source address Check parameter 05/06 for proper configuration	ON	OFF	OFF	
2900	9	540B09	J1939 ETC7 Message is missing or not available	Check J1939 link connection to Transmission Controller / Check if Electronic Transmission Controller is CAN capable	ON	OFF	OFF	
3187	9	730C09	Transmission Shift Console Datalink (LIN)	Check LIN wiring / stalk switch	ON	OFF	OFF	
3353	2	190D02	Generator (Charging System) D+ terminal failure	Check wiring of Generator Terminal D+ or check Generator functionality	OFF	OFF	OFF	
3510	4	B60D04	Accelerator Pedal Supply Voltage Circuit shorted to GND	Check wiring of associated pins	ON	OFF	OFF	Pin 1/04 Pin 1/08 Pin 3/02 Pin 3/03
3510	7	B60D07	Accelerator Pedal Supply Voltage Circuit shorted to Ubat	Check wiring of associated pins	ON	OFF	OFF	Pin 1/04 Pin 1/08 Pin 3/02 Pin 3/03
3510	8	B60D08	2-Channel Accelerator Pedal Supply Voltage Missing (supply of either channel is to high or to low)	Check wiring of associated pins	ON	OFF	OFF	Pin 1/04 Pin 1/08 Pin 3/02 Pin 3/03
3511	3	B70D03	Remote Accelerator Pedal Supply Voltage circuit shorted to Ubat	Check wiring of associated pins	ON	OFF	OFF	Pin 3/02 (Supply) Pin 3/03 (GND)
3511	4	B70D04	Remote Accelerator Pedal Supply Voltage circuit shorted to GND	Check wiring of associated pins	ON	OFF	OFF	Pin 3/02 (Supply) Pin 3/03 (GND)
3606	9	160E09	J1939 PROP04 Message is missing or not available	Check J1939 link connection to Diesel Particulate Filter	ON	OFF	OFF	
3645	9	3D0E09	J1939 TCI Message (Transfer Case Information) is missing	Check J1939 link connection	ON	OFF	OFF	
3695	9	6F0E09	J1939 DPF Regen Inhibit MUX Switch Message Stopped Arriving	Check J1939 link connection to Diesel Particulate Filter. Check Parameter 46/10 (DPF J1939 Inhibt Sw Enable) and 46/11 (DPF J1939 Regen Sw Enable).	ON	OFF	OFF	
3695	13	6F0E0D	J1939 DPF Regen Inhibit MUX Switch Message Contains SNV(SNA) Indicator	Check J1939 link connection to Diesel Particulate Filter. Check Parameter 46/10 (DPF J1939 Inhibt Sw Enable) and 46/11 (DPF J1939 Regen Sw Enable).	ON	OFF	OFF	
3695	14	6F0E0E	J1939 DPF Regen Inhibit MUX Switch Message Not Received this Ignition Cycle	Check J1939 link connection to Diesel Particulate Filter. Check Parameter 46/10 (DPF J1939 Inhibt Sw Enable) and 46/11 (DPF J1939 Regen Sw Enable).	ON	OFF	OFF	
3695	19	6F0E13	J1939 DPF Regen Inhibit MUX Switch Message Contains Data Error(erractic) Indicator	Check J1939 link connection to Diesel Particulate Filter. Check Parameter 46/10 (DPF J1939 Inhibt Sw Enable) and 46/11 (DPF J1939 Regen Sw Enable).	ON	OFF	OFF	
3696	4	700E04	J1939 DPF Regeneration Switch Circuit shorted to GND (if applied more than 5 sec this error flags)	Check J1939 link connection to Diesel Particulate Filter. Check Parameter 46/10 (DPF J1939 Inhibt Sw Enable) and 46/11 (DPF J1939 Regen Sw Enable).	ON	OFF	OFF	
3696	9	700E09	J1939 DPF Regen Force MUX Switch Message Stopped Arriving	Check J1939 link connection to Diesel Particulate Filter. Check Parameter 46/10 (DPF J1939 Inhibt Sw Enable) and 46/11 (DPF J1939 Regen Sw Enable).	ON	OFF	OFF	
3696	13	700E0D	J1939 DPF Regen Force MUX Switch Message Contains SNV(SNA) Indicator	Check J1939 link connection to Diesel Particulate Filter. Check Parameter 46/10 (DPF J1939 Inhibt Sw Enable) and 46/11 (DPF J1939 Regen Sw Enable).	ON	OFF	OFF	

SPN	FMI	DTC	Fault description	Recommended Action	CEL	SEL	MIL	Fault location
3696	14	700E0E	J1939 DPF Regen Force MUX Switch Message Not Received this Ignition Cycle	Check J1939 link connection to Diesel Particulate Filter. Check Parameter 46/10 (DPF J1939 Inhibt Sw Enable) and 46/11 (DPF J1939 Regen Sw Enable).	ON	OFF	OFF	
3696	19	700E13	J1939 DPF Regen Force MUX Switch Message Contains Data Error(erractic) Indicator	Check J1939 link connection to Diesel Particulate Filter. Check Parameter 46/10 (DPF J1939 Inhibt Sw Enable) and 46/11 (DPF J1939 Regen Sw Enable).	ON	OFF	OFF	
3840	3	000F03	Frequency Output 4/15 Circuit shorted to Ubat	Check wiring of associated pin. Check Parameters 09/07 (Selection), 09/13 (Fault Detection) and 09/17 (Output Configuration) for correct configuration.	ON	OFF	OFF	Pin 4/15
3840	4	000F04	Frequency Output 4/15 Circuit shorted to GND	Check wiring of associated pin. Check Parameters 09/07 (Selection), 09/13 (Fault Detection) and 09/17 (Output Configuration) for correct configuration.	ON	OFF	OFF	Pin 4/15
3840	5	000F05	Frequency Output 4/15 Open Circuit (broken wire, terminal floating)	Check wiring of associated pin. Check Parameters 09/07 (Selection), 09/13 (Fault Detection) and 09/17 (Output Configuration) for correct configuration.	ON	OFF	OFF	Pin 4/15
3841	3	010F03	Frequency Output 4/11 Circuit shorted to Ubat	Check wiring of associated pin. Check Parameters 09/07 (Selection), 09/13 (Fault Detection) and 09/17 (Output Configuration) for correct configuration.	ON	OFF	OFF	Pin 4/11
3841	4	010F04	Frequency Output 4/11 Circuit shorted to GND	Check wiring of associated pin. Check Parameters 09/07 (Selection), 09/13 (Fault Detection) and 09/17 (Output Configuration) for correct configuration.	ON	OFF	OFF	Pin 4/11
3841	5	010F05	Frequency Output 4/11 Open Circuit (broken wire, terminal floating)	Check wiring of associated pin. Check Parameters 09/07 (Selection), 09/13 (Fault Detection) and 09/17 (Output Configuration) for correct configuration.	ON	OFF	OFF	Pin 4/11
3842	3	020F03	Analog Ground 3/02 Circuit shorted to Ubat	Check wiring of associated pin Check Parameters 35/05 (Selection) and 35/24 (Fault Detection) for correct configuration.	ON	OFF	OFF	Pin 3/02
3842	4	020F04	Analog Ground 3/02 Circuit shorted to GND	Check wiring of associated pin Check Parameters 35/05 (Selection) and 35/24 (Fault Detection) for correct configuration.	ON	OFF	OFF	Pin 3/02
3842	5	020F05	Analog Ground 3/02 Open Circuit (broken wire, terminal floating)	Check wiring of associated pin Check Parameters 35/05 (Selection) and 35/24 (Fault Detection) for correct configuration.	ON	OFF	OFF	Pin 3/02
3843	3	030F03	Digital Input 1/01 Circuit shorted to Ubat	Check wiring of associated pin Check parameters 13/01 (Selection), 13/35 (Fault Detect Ena) for correct configuration of input pin 1/01	ON	OFF	OFF	Pin 1/01
3843	4	030F04	Digital Input 1/01 Circuit shorted to GND	Check wiring of associated pin Check parameters 13/01 (Selection), 13/35 (Fault Detect Ena) for correct configuration of input pin 1/01	ON	OFF	OFF	Pin 1/01
3844	3	040F03	Digital Input 1/02 Circuit shorted to Ubat	Check wiring of associated pin Check parameters 13/01 (Selection), 13/35 (Fault Detect Ena) for correct configuration of input pin 1/02	ON	OFF	OFF	Pin 1/02
3844	4	040F04	Digital Input 1/02 Circuit shorted to GND	Check wiring of associated pin Check parameters 13/02 (Selection), 13/36 (Fault Detect Ena) for correct configuration of input pin 1/02	ON	OFF	OFF	Pin 1/02
3845	3	050F03	Digital Input 1/12 Circuit shorted to Ubat	Check wiring of associated pin Check parameter 13/39 (Fault Detect Ena) for correct configuration of Fault Detection of pin 1/12	ON	OFF	OFF	Pin 1/12
3845	4	050F04	Digital Input 1/12 Circuit shorted to GND	Check wiring of associated pin Check parameter 13/39 (Fault Detect Ena) for correct configuration of Fault Detection of pin 1/12	ON	OFF	OFF	Pin 1/12
3846	3	060F03	Digital Input 1/14 Circuit shorted to Ubat	Check wiring of associated pin Check parameter 13/40 (Fault Detect Ena) for correct configuration of Fault Detection of pin 1/12	ON	OFF	OFF	Pin 1/14
3846	4	060F04	Digital Input 1/14 Circuit shorted to GND	Check wiring of associated pin Check parameter 13/40 (Fault Detect Ena) for correct configuration of Fault Detection of pin 1/12	ON	OFF	OFF	Pin 1/14
3847	3	070F03	Digital Input 1/15 Circuit shorted to Ubat	Check wiring of associated pin Check parameters 13/04 (Selection), 13/41 (Fault	ON	OFF	OFF	Pin 1/15

SPN	FMI	DTC	Fault description	Recommended Action	CEL	SEL	MIL	Fault location
				Detect Ena) for correct configuration of input pin 1/15				
3847	4	070F04	Digital Input 1/15 Circuit shorted to GND	Check wiring of associated pin Check parameters 13/04 (Selection), 13/41 (Fault Detect Ena) for correct configuration of input pin 1/15	ON	OFF	OFF	Pin 1/15
3848	3	080F03	Digital Input 1/16 Circuit shorted to Ubat	Check wiring of associated pin Check parameter 13/42 (Fault Detect Ena) for correct configuration of Fault Detection of pin 1/16	ON	OFF	OFF	Pin 1/16
3848	4	080F04	Digital Input 1/16 Circuit shorted to GND	Check wiring of associated pin Check parameter 13/42 (Fault Detect Ena) for correct configuration of Fault Detection of pin 1/16	ON	OFF	OFF	Pin 1/16
3849	3	090F03	Digital Input 1/17 Circuit shorted to Ubat	Check wiring of associated pin Check parameters 13/05 (Selection), 13/43 (Fault Detect Ena) for correct configuration of input pin 1/17	ON	OFF	OFF	Pin 1/17
3849	4	090F04	Digital Input 1/17 Circuit shorted to GND	Check wiring of associated pin Check parameters 13/05 (Selection), 13/43 (Fault Detect Ena) for correct configuration of input pin 1/17	ON	OFF	OFF	Pin 1/17
3850	3	0A0F03	Digital Input 1/11 Circuit shorted to Ubat	Check wiring of associated pin Check parameter 13/38 (Fault Detect Ena) for correct configuration of Fault Detection of pin 1/11	ON	OFF	OFF	Pin 1/11
3850	4	0A0F04	Digital Input 1/11 Circuit shorted to GND	Check wiring of associated pin Check parameter 13/38 (Fault Detect Ena) for correct configuration of Fault Detection of pin 1/11	ON	OFF	OFF	Pin 1/11
3851	3	0B0F03	Digital Input 2/09 Circuit shorted to Ubat	Check wiring of associated pin Check parameters 13/07 (Selection), 13/46 (Fault Detect Ena) for correct configuration of input pin 2/09	ON	OFF	OFF	Pin 2/09
3851	4	0B0F04	Digital Input 2/09 Circuit shorted to GND	Check wiring of associated pin Check parameters 13/07 (Selection), 13/46 (Fault Detect Ena) for correct configuration of input pin 2/09	ON	OFF	OFF	Pin 2/09
3852	3	0C0F03	Digital Input 2/11 Circuit shorted to Ubat	Check wiring of associated pin Check parameter 13/47 (Fault Detect Ena) for correct configuration of Fault Detection of pin 2/11	ON	OFF	OFF	Pin 2/11
3852	4	0C0F04	Digital Input 2/11 Circuit shorted to GND	Check wiring of associated pin Check parameter 13/47 (Fault Detect Ena) for correct configuration of Fault Detection of pin 2/11	ON	OFF	OFF	Pin 2/11
3853	3	0D0F03	Digital Input 2/12 Circuit shorted to Ubat	Check wiring of associated pin Check parameter 13/48 (Fault Detect Ena) for correct configuration of Fault Detection of pin 2/12	ON	OFF	OFF	Pin 2/12
3853	4	0D0F04	Digital Input 2/12 Circuit shorted to GND	Check wiring of associated pin Check parameter 13/48 (Fault Detect Ena) for correct configuration of Fault Detection of pin 2/12	ON	OFF	OFF	Pin 2/12
3854	3	0E0F03	Digital Input 2/13 Circuit shorted to Ubat	Check wiring of associated pin Check parameters 13/08 (Selection), 13/49 (Fault Detect Ena) for correct configuration of input pin 2/13	ON	OFF	OFF	Pin 2/13
3854	4	0E0F04	Digital Input 2/13 Circuit shorted to GND	Check wiring of associated pin Check parameters 13/08 (Selection), 13/49 (Fault Detect Ena) for correct configuration of input pin 2/13	ON	OFF	OFF	Pin 2/13
3855	3	0F0F03	Digital Input 2/14 Circuit shorted to Ubat	Check wiring of associated pin Check parameters 13/09 (Selection), 13/50 (Fault Detect Ena) for correct configuration of input pin 2/14	ON	OFF	OFF	Pin 2/14
3855	4	0F0F04	Digital Input 2/14 Circuit shorted to GND	Check wiring of associated pin Check parameters 13/09 (Selection), 13/50 (Fault Detect Ena) for correct configuration of input pin 2/14	ON	OFF	OFF	Pin 2/14
3856	3	100F03	Digital Input 2/15 Circuit shorted to Ubat	Check wiring of associated pin Check parameters 13/10 (Selection), 13/51 (Fault Detect Ena) for correct configuration of input pin 2/15	ON	OFF	OFF	Pin 2/15
3856	4	100F04	Digital Input 2/15 Circuit shorted to GND	Check wiring of associated pin Check parameters 13/10 (Selection), 13/51 (Fault Detect Ena) for correct configuration of input pin 2/15	ON	OFF	OFF	Pin 2/15
3857	3	110F03	Digital Input 2/07 Circuit shorted to Ubat	Check wiring of associated pin Check parameter 13/44 (Fault Detect Ena) for correct configuration of Fault Detection of pin 2/07	ON	OFF	OFF	Pin 2/07
3857	4	110F04	Digital Input 2/07 Circuit shorted to GND	Check wiring of associated pin Check parameter 13/44 (Fault Detect Ena) for correct configuration of Fault Detection of pin 2/07	ON	OFF	OFF	Pin 2/07
3858	3	120F03	Digital Input 2/08 Circuit shorted to Ubat	Check wiring of associated pin Check parameters 13/06 (Selection), 13/45 (Fault	ON	OFF	OFF	Pin 2/08

SPN	FMI	DTC	Fault description	Recommended Action	CEL	SEL	MIL	Fault location
				Detect Ena) for correct configuration of input pin 2/08				
3858	4	120F04	Digital Input 2/08 Circuit shorted to GND	Check wiring of associated pin Check parameters 13/06 (Selection), 13/45 (Fault Detect Ena) for correct configuration of input pin 2/08	ON	OFF	OFF	Pin 2/08
3859	3	130F03	Digital Input 4/16 Circuit shorted to Ubat	Check wiring of associated pin Check parameter 13/60 (Fault Detect Ena) for correct configuration of Fault Detection of pin 4/16	ON	OFF	OFF	Pin 4/16
3859	4	130F04	Digital Input 4/16 Circuit shorted to GND	Check wiring of associated pin Check parameter 13/60 (Fault Detect Ena) for correct configuration of Fault Detection of pin 4/16	ON	OFF	OFF	Pin 4/16
3860	3	140F03	Digital Input 4/18 Circuit shorted to Ubat	Check wiring of associated pin Check parameters 13/19 (Selection), 13/62 (Fault Detect Ena) for correct configuration of input pin 4/18	ON	OFF	OFF	Pin 4/18
3860	4	140F04	Digital Input 4/18 Circuit shorted to GND	Check wiring of associated pin Check parameters 13/19 (Selection), 13/62 (Fault Detect Ena) for correct configuration of input pin 4/18	ON	OFF	OFF	Pin 4/18
3861	3	150F03	Digital Input 4/13 Circuit shorted to Ubat	Check wiring of associated pin Check parameters 13/17 (Selection), 13/59 (Fault Detect Ena) for correct configuration of input pin 4/13	ON	OFF	OFF	Pin 4/13
3861	4	150F04	Digital Input 4/13 Circuit shorted to GND	Check wiring of associated pin Check parameters 13/17 (Selection), 13/59 (Fault Detect Ena) for correct configuration of input pin 4/13	ON	OFF	OFF	Pin 4/13
3862	3	160F03	Digital Input 1/10 Circuit shorted to Ubat	Check wiring of associated pin Check parameters 13/03 (Selection), 13/37 (Fault Detect Ena) for correct configuration of input pin 1/10	ON	OFF	OFF	Pin 1/10
3862	4	160F04	Digital Input 1/10 Circuit shorted to GND	Check wiring of associated pin Check parameters 13/03 (Selection), 13/37 (Fault Detect Ena) for correct configuration of input pin 1/10	ON	OFF	OFF	Pin 1/10
3863	3	170F03	Digital Input 4/17 Circuit shorted to Ubat	Check wiring of associated pin Check parameters 13/18 (Selection), 13/61 (Fault Detect Ena) for correct configuration of input pin 4/17	ON	OFF	OFF	Pin 4/17
3863	4	170F04	Digital Input 4/17 Circuit shorted to GND	Check wiring of associated pin Check parameters 13/18 (Selection), 13/61 (Fault Detect Ena) for correct configuration of input pin 4/17	ON	OFF	OFF	Pin 4/17
3864	3	180F03	Digital Input 3/18 Circuit shorted to Ubat	Check wiring of associated pin Check parameters 13/12 (Selection), 13/52 (Fault Detect Ena) for correct configuration of input pin 3/18	ON	OFF	OFF	Pin 3/18
3864	4	180F04	Digital Input 3/18 Circuit shorted to GND	Check wiring of associated pin Check parameters 13/12 (Selection), 13/52 (Fault Detect Ena) for correct configuration of input pin 3/18	ON	OFF	OFF	Pin 3/18
3865	3	190F03	Digital Input 4/08 Circuit shorted to Ubat	Check wiring of associated pin Check parameters 13/16 (Selection), 13/58 (Fault Detect Ena) for correct configuration of input pin 4/08	ON	OFF	OFF	Pin 4/08
3865	4	190F04	Digital Input 4/08 Circuit shorted to GND	Check wiring of associated pin Check parameters 13/16 (Selection), 13/58 (Fault Detect Ena) for correct configuration of input pin 4/08	ON	OFF	OFF	Pin 4/08
3866	3	1A0F03	Digital Input 4/04 Circuit shorted to Ubat	Check wiring of associated pin Check parameters 13/14 (Selection), 13/56 (Fault Detect Ena) for correct configuration of input pin 4/04	ON	OFF	OFF	Pin 4/04
3866	4	1A0F04	Digital Input 4/04 Circuit shorted to GND	Check wiring of associated pin Check parameters 13/14 (Selection), 13/56 (Fault Detect Ena) for correct configuration of input pin 4/04	ON	OFF	OFF	Pin 4/04
3867	3	1B0F03	Digital Input 4/05 Circuit shorted to Ubat	Check wiring of associated pin Check parameters 13/15 (Selection), 13/57 (Fault Detect Ena) for correct configuration of input pin 4/05	ON	OFF	OFF	Pin 4/05
3867	4	1B0F04	Digital Input 4/05 Circuit shorted to GND	Check wiring of associated pin Check parameters 13/15 (Selection), 13/57 (Fault Detect Ena) for correct configuration of input pin 4/05	ON	OFF	OFF	Pin 4/05
3868	3	1C0F03	Digital Input 4/03 Circuit shorted to Ubat	Check wiring of associated pin Check parameters 13/13 (Selection), 13/55 (Fault Detect Ena) for correct configuration of input pin 4/03	ON	OFF	OFF	Pin 4/03
3868	4	1C0F04	Digital Input 4/03 Circuit shorted to GND	Check wiring of associated pin Check parameters 13/13 (Selection), 13/55 (Fault Detect Ena) for correct configuration of input pin 4/03	ON	OFF	OFF	Pin 4/03
3869	3	1D0F03	Digital Input 4/01 Circuit shorted to Ubat	Check wiring of associated pin Check parameter 13/53 (Fault Detect Ena) for	ON	OFF	OFF	Pin 4/01

SPN	FMI	DTC	Fault description	Recommended Action	CEL	SEL	MIL	Fault location
				correct configuration of Fault Detection of pin 4/01				
3869	4	1D0F04	Digital Input 4/01 Circuit shorted to GND	Check wiring of associated pin Check parameter 13/53 (Fault Detect Ena) for correct configuration of Fault Detection of pin 4/01	ON	OFF	OFF	Pin 4/01
3870	3	1E0F03	Digital Input 4/02 Circuit shorted to Ubat	Check wiring of associated pin Check parameter 13/54 (Fault Detect Ena) for correct configuration of Fault Detection of pin 4/02	ON	OFF	OFF	Pin 4/02
3870	4	1E0F04	Digital Input 4/02 Circuit shorted to GND	Check wiring of associated pin Check parameter 13/54 (Fault Detect Ena) for correct configuration of Fault Detection of pin 4/02	ON	OFF	OFF	Pin 4/02
3871	2	1F0F02	Transmission Speed Failure(Vehicle Speed Signal Not Plausible)		ON	OFF	OFF	
3871	3	1F0F03	Transmission Speed Sensor 4/04 or 3/13 Circuit shorted to Ubat	Check wiring of associated pin	ON	OFF	OFF	Pin 4/04 or 3/13
3871	4	1F0F04	Transmission Speed Sensor 4/04 or 3/13 Circuit shorted to GND	Check wiring of associated pin	ON	OFF	OFF	Pin 4/04 or 3/13
3871	5	1F0F05	Transmission Speed Sensor Circuit Open (broken wire, terminal floating)	Check wiring of associated pin	ON	OFF	OFF	Pin 4/04 or 3/13
3872	3	200F03	Analog Output 01 shorted to Ubat	Check wiring of associated pin. Check parameters 09/03 (Selection) and 09/09 (Fault Detection) for correct configuration of output pin 3/05. Run Service Routine (chapter 6.4, routines 8 to 10): – Analog Output Pin Under Software Control: Start with Signal Parameter 5, Frequency in Hz, Width in %	ON	OFF	OFF	Pin 3/05
3872	4	200F04	Analog Output 01 shorted to GND or Circuit Open (broken wire, terminal floating)	Check wiring of associated pin. Check parameters 09/03 (Selection) and 09/09 (Fault Detection) for correct configuration of output pin 3/05. Run Service Routine (chapter 6.4, routines 8 to 10): – Analog Output Pin Under Software Control: Start with Signal Parameter 5, Frequency in Hz, Width in %	ON	OFF	OFF	Pin 3/05
3873	3	210F03	Analog Output 02 shorted to Ubat	Check wiring of associated pin. Check parameters 09/04 (Selection) and 09/10 (Fault Detection) for correct configuration of output pin 3/06. Run Service Routine (chapter 6.4, routines 8 to 10): – Analog Output Pin Under Software Control: Start with Signal Parameter 6, Frequency in Hz, Width in %	ON	OFF	OFF	Pin 3/06
3873	4	210F04	Analog Output 02 shorted to GND or Circuit Open (broken wire, terminal floating)	Check wiring of associated pin. Check parameters 09/04 (Selection) and 09/10 (Fault Detection) for correct configuration of output pin 3/06. Run Service Routine (chapter 6.4, routines 8 to 10): – Analog Output Pin Under Software Control: Start with Signal Parameter 6, Frequency in Hz, Width in %	ON	OFF	OFF	Pin 3/06
3948	9	6C0F09	J1939 PTODE Message (PTO Drive Engagement) is missing or not available	Check J1939 link connection Check Parameter 01/108 (PTODE Source Address SAE J1939)	ON	OFF	OFF	
4041	0	C90F00	Indication of a critical software (logic) failure. (20ms ECU OS Task Locked in an Endless Loop)	Try reprogramming the CPC with the new software release. Replace CPC4 and reprogram with the latest software.	OFF	OFF	OFF	
4041	9	C90F09	Indication of a critical resource allocation issue. Task restructuring required. (20ms ECU OS Task Timed out Prior to Completion)	Try reprogramming the CPC with the new software release. Replace CPC4 and reprogram with the latest software.	OFF	OFF	OFF	

SPN	FMI	DTC	Fault description	Recommended Action	CEL	SEL	MIL	Fault location
4041	16	C90F10	Indication of a critical software (logic) failure. (1000ms ECU OS Task Locked in an Endless Loop)	Try reprogramming the CPC with the new software release. Replace CPC4 and reprogram with the latest software.	OFF	OFF	OFF	
4206	2	6E1002	TSC1 Message Counter indicates lost Messages	Try reprogramming the CPC with the new software release. Replace CPC4 and reprogram with the latest software.	ON	OFF	OFF	
4207	2	6F1002	TSC1 Message Checksum wrong	Try reprogramming the CPC with the new software release. Replace CPC4 and reprogram with the latest software.	ON	OFF	OFF	
524280	2	F8FFE2	Remote Accelerator Pedal Idle Validation Switch inputs reversed	Check wiring of associated pins. Check Parameters 13/08, 13/09, 13/10 and 13/65	ON	OFF	OFF	Pin 2/11 Pin 2/14 Pin 2/13 Pin 2/15
524280	3	F8FFE3	Remote Accelerator Pedal Idle Validation Switch 1 circuit shorted to Ubat	Check wiring of associated pins. Check parameter 13/09 (2 14 DI Selection) and parameter 13/65 (2 11 DI Selection) Check parameter 13/47 (2 11 Diflex10 Fault Detect Enable) for correct configuration of Fault Detection of pin 2/11 and parameter 13/50 (2 14 Diflex13 Fault Detect Enable) for correct configuration of Fault Detection of pin 2/14	ON	OFF	OFF	Pin 2/11 or Pin 2/14
524280	4	F8FFE4	Remote Accelerator Pedal Idle Validation Switch 1 circuit shorted to GND	Check wiring of associated pins. Check parameter 13/09 (2 14 DI Selection) and parameter 13/65 (2 11 DI Selection) Check parameter 13/47 (2 11 Diflex10 Fault Detect Enable) for correct configuration of Fault Detection of pin 2/11 and parameter 13/50 (2 14 Diflex13 Fault Detect Enable) for correct configuration of Fault Detection of pin 2/14	ON	OFF	OFF	Pin 2/11 or Pin 2/14
524280	5	F8FFE5	Remote Accelerator Pedal Idle Validation Switch 2 circuit shorted to Ubat	Check wiring of associated pins. Check parameter 13/08 (2 13 DI Selection) and parameter 13/10 (2 15 DI Selection) Check parameter 13/49 (2 13 Diflex12 Fault Detect Enable) for correct configuration of Fault Detection of pin 2/13 and parameter 13/51 (2 15 Diflex14 Fault Detect Enable) for correct configuration of Fault Detection of pin 2/15	ON	OFF	OFF	Pin 2/13 or Pin 2/15
524280	6	F8FFE6	Remote Accelerator Pedal Idle Validation Switch 2 circuit shorted to GND	Check wiring of associated pins. Check parameter 13/08 (2 13 DI Selection) and parameter 13/10 (2 15 DI Selection) Check parameter 13/49 (2 13 Diflex12 Fault Detect Enable) for correct configuration of Fault Detection of pin 2/13 and parameter 13/51 (2 15 Diflex14 Fault Detect Enable) for correct configuration of Fault Detection of pin 2/15	ON	OFF	OFF	Pin 2/13 or Pin 2/15
524281	9	F9FFE9	J1939 Powertrain Message (Engine Droop Control) is missing	Check J1939 link connection	ON	OFF	OFF	
524283	2	FBFFE2	Generator (Charging System) terminal W – Low Voltage	Check wiring of Generator Terminal W or check Generator functionality	OFF	OFF	OFF	
524283	14	FBFFEE	Generator (Charging System) terminal W – allocation error (pulse / rev signal)	Check wiring of Generator Terminal W or check Generator functionality	ON	OFF	OFF	
524284	14	FCFFE E	PMC Level 2 fault (limitation occured)	Change CPC4	OFF	OFF	OFF	
524285	4	FDFFE4	CM1 DPF Regeneration Switch shorted to GND (if applied more than 5 sec this error flags)	Check parameter 01/07 (CM1 DPF Source Addr SAE J1939) for correct configuration	ON	OFF	OFF	
524286	1	FEFFE1	Automatic gear selection: automatic mode is not available (multiple causes for error: AT is in manual mode, no automatic mode	Check MCM, ACM, TCM and CPC Failure (calibration wrong)	OFF	OFF	OFF	

SPN	FMI	DTC	Fault description	Recommended Action	CEL	SEL	MIL	Fault location
			possible)					
524286	2	FEFFE2	Automatic gear selection: incompatible or missing dataset (calibration error, wrong calibration data set for this vehicle)	Check if CAL-Dataset version fits to the software version, engine and transmission type	OFF	OFF	OFF	
524286	3	FEFFE3	Automatic gear selection: EcoRoll is not available (multiple errors, no EcoRoll available)	Check MCM, ACM, TCM and CPC Failure	OFF	OFF	OFF	
524286	4	FEFFE4	Automatic gear selection: Gear shift not plausible (multiple errors, no optimal gear shift possible)	Check MCM, ACM, TCM and CPC Failure	OFF	OFF	OFF	
524286	5	FEFFE5	Automativ gear selection: No gear shiftable.	Check TCM for proper function and fault codes. Possible gearbox error.	OFF	OFF	OFF	
524286	6	FEFFE6	ITPM error: vehicle calibration is inconsistent	Check parameterization of PTCONF (PGR 048)	OFF	OFF	OFF	
524286	7	FEFFE7	ITPM error: drivetrain speed signal is inconsistent. (One or more speed signals incorrect)	Check parameterization of PTCONF (PGR 048) Check signals as follows: - engine speed - transmission input speed - transmission output speed - TCO vehicle speed - ABS/EBS vehicle speed	OFF	OFF	OFF	
524287	1	FFFFE1	Evobus cruise control lever position not plausible	Evobus only. Check associated Pins.	ON	OFF	OFF	
524287	9	FFFFE9	Predictive Cruise Control Message Not Received	Predictive Cruise Control Message not received. Check Link to PCC Device.	ON	OFF	OFF	
524287	19	FFFFF3	Predictive Cruise Control Device Reporting Error	Predictive Cruise Control Device Reporting Error.	OFF	OFF	OFF	

6.3. Actual Values

The following chapters list the current values of the CPC4 which can be read by means of a diagnostic tool e. g. Xentry.
The analog values are to be used primarily to check the diagnostic status of different functions (e. g. cruise control active, engine brake active, etc.) or the cause of deactivation (e. g. cruise control activation attempt during ABS intervention). The binary values are to be used primarily for commissionings since they map e. g. internal signals and different switch status.

6.3.1. Analog Values

No.	Name	Range min	Range max	Unit	Description	Pin
01	Accelerator Pedal Raw Sensor Value	0	100	%		Pin 1/07
02	Supply Analog Accelerator Pedal	0	5,44	V		Pin 1/08
03	Analog Remote Pedal	0	100	%		Pin 3/04
04	Supply Analog Remote Pedal	0	6,6	V		Pin 3/03
05	Accelerator Pedal Position	0	100	%		-
06	Calculated Pedal Torque	-5000	5000	Nm		-
07	PWM Pedal Signal GAS1	0	100	%		Pin 1/03
08	PWM Pedal Signal GAS2	0	100	%		Pin 1/06
09	Air Intake Temperature	-50	200	°C		-
10	Coolant Temperature	-50	200	°C		-
11	Oil Temperature	-50	200	°C		-
12	Oil Pressure	0	10000	mbar		-
13	Coolant Level Sensor Voltage	0	5,47	V		-
14	Coolant Level	0	100	%		Pin 3/11
15	Air Filter Sensor Voltage	0	5,44	V		Pin 3/03
16	Air Filter Pressure	0	100	mbar		-
17	Diesel Fuel Pressure	0	10	bar		-
18	Ignition Switch Voltage	0	36,33	V		Pin 2/03
19	Main Battery Voltage	0	36,33	V		Pin 2/01
20	PWM Output	0	100	%		-
21	Governor Type	0	16	-		-
22	Actual Torque	-5000	5000	Nm		-
23	Friction Torque	-800	0	Nm		-
24	Corrected Actual Torque	-5000	5000	Nm		-
25	Reference Torque	0	5000	Nm		-
26	Absolute Max Torque	0	5000	Nm		-
27	Max Retarder Torque	-5000	0	Nm		-
28	Demand Engine Torque	-5000	5000	Nm		-
29	Actual Engine Speed	0	4000	rpm		-
30	Demanded Engine Speed	0	4000	rpm		-
31	Minimum Engine Speed	0	4000	rpm		-
32	Maximum Engine Speed	0	4000	rpm		-
33	Road Speed	0	250	km/h		-
34	Set Speed Cruise Control	0	250	km/h		Pin 1/12
35	Torque Speed Command Sender	-	-	-	0 = Engine #1 1 = Engine #2 2 = Turbocharger 3 = Transmission #1	-

No.	Name	Range min	Range max	Unit	Description	Pin
					4 = Transmission #2 5 = Shift Console - Primary 6 = Shift Console - Secondary 7 = Power Take Off - (Main or Rear) 8 = Axle - Steering 9 = Axle – Drive # 1 10 = Axle – Drive #2 11 = Brakes – System Controller 12 = Brakes – Steer Angle 13 = Brakes – Drive Axle #1 14 = Brakes – Drive Axle #2 15 = Retarder – Engine 16 = Retarder – Driveline 17 = Cruise Control 18 = Fuel System 19 = Steering Controller 20 = Suspension – Steer Axle 21 = Suspension – Drive Axle #1 22 = Suspension – Drive Axle #2 23 = Instrument Cluster 24 = Trip Recorder 25 = Passenger – Operator Climate Control 26 = Electrical Charging System 27 = Aerodynamic Control 28 = Vehicle Navigation 29 = Vehicle Security 30 = Electrical System 31 = Starter System 32 = Tractor – Trailer Bridge #1 33 = Body Controller 34 = Auxiliary Valve Control 35 = Hitch Control 36 = Power Take Off (Front or Secondary) 37 = Off vehicle Gateway 38 = Virtual Terminal (in cab) 39 = Management Computer #1 40 = Gab Display 41 = Retarder, Exhaust, Engine #1 42 = Headway Controller 43 = On – Board Diagnostic Unit 44 = Retarder, Exhaust, Engine #2 45 = Endurance Braking System 46 = Hydraulik Pump Controller 47 = Suspension – System Controller #1 48 = Pneumatic – System Controller 49 = Gab Controller - Primary 50 = Gab Controller - Secondary 51 = Tire Pressure Controller 52 = Ignition Control Module #1 53 = Ignition Control Module #2 54 = Seat Controls 55 = Lighting – Operator Controls 56 = Rear Axle Steering Controller #1 57 = Water Pump Controller 58 = Passenger – Operator Climate Control #2 59 = Transmission Display - Primary 60 = Transmission Display – Secondary 61 = Exhaust Emission Controller 62 = Vehicle Dynamic Stability Controller 63 = Oil Sensor 64 = Suspension – System Controller #2 65 = Information System Controller #1	

No.	Name	Range min	Range max	Unit	Description	Pin
					66 = Ramp Control 67 = Clutch / Converter Controller 68 = Auxiliary Heater #1 69 = Auxiliary Heater #2 70 = Electronic Engine Valve Controller 248 = Reserved for future use 249 = Off Board Diagnostic – Service Tool #1 250 = Off Board Diagnostic – Service Tool #2 251 = On – Board Data Logger 252 = Reserved for Experimental Use 253 = Reserved for OEM 254 = Null Adress 255 = GLOBAL (All – Any Node)	
36	Torque Speed Command Engine Speed Request	0	4000	rpm		-
37	Torque Speed Command Engine Torque Request	-125	125	%		-
38	Torque Speed Command Engine Speed Limit	0	4000	rpm		-
39	Torque Speed Command Engine Torque Limit	-125	125	%		-
40	EEC1 Controlling Device SA	-	-	-	0 = Engine #1 1 = Engine #2 2 = Turbocharger 3 = Transmission #1 4 = Transmission #2 5 = Shift Console - Primary 6 = Shift Console - Secondary 7 = Power Take Off - (Main or Rear) 8 = Axle - Steering 9 = Axle – Drive # 1 10 = Axle – Drive #2 11 = Brakes – System Controller 12 = Brakes – Steer Angle 13 = Brakes – Drive Axle #1 14 = Brakes – Drive Axle #2 15 = Retarder – Engine 16 = Retarder – Driveline 17 = Cruise Control 18 = Fuel System 19 = Steering Controller 20 = Suspension – Steer Axle 21 = Suspension – Drive Axle #1 22 = Suspension – Drive Axle #2 23 = Instrument Cluster 24 = Trip Recorder 25 = Passenger – Operator Climate Control 26 = Electrical Charging System 27 = Aerodynamic Control 28 = Vehicle Navigation 29 = Vehicle Security 30 = Electrical System 31 = Starter System 32 = Tractor – Trailer Bridge #1 33 = Body Controller 34 = Auxiliary Valve Control 35 = Hitch Control 36 = Power Take Off (Front or Secondary) 37 = Off vehicle Gateway 38 = Virtual Terminal (in cab) 39 = Management Computer #1 40 = Gab Display 41 = Retarder, Exhaust, Engine #1 42 = Headway Controller 43 = On – Board Diagnostic Unit	-

No.	Name	Range min	Range max	Unit	Description	Pin
					44 = Retarder, Exhaust, Engine #2 45 = Endurance Braking System 46 = Hydraulik Pump Controller 47 = Suspension – System Controller #1 48 = Pneumatic – System Controller 49 = Gab Controller - Primary 50 = Gab Controller - Secondary 51 = Tire Pressure Controller 52 = Ignition Control Module #1 53 = Ignition Control Module #2 54 = Seat Controls 55 = Lighting – Operator Controls 56 = Rear Axle Steering Controller #1 57 = Water Pump Controller 58 = Passenger – Operator Climate Control #2 59 = Transmission Display - Primary 60 = Transmission Display – Secondary 61 = Exhaust Emission Controller 62 = Vehicle Dynamic Stability Controller 63 = Oil Sensor 64 = Suspension – System Controller #2 65 = Information System Controller #1 66 = Ramp Control 67 = Clutch / Converter Controller 68 = Auxiliary Heater #1 69 = Auxiliary Heater #2 70 = Electronic Engine Valve Controller 248 = Reserved for future use 249 = Off Board Diagnostic – Service Tool #1 250 = Off Board Diagnostic – Service Tool #2 251 = On – Board Data Logger 252 = Reserved for Experimental Use 253 = Reserved for OEM 254 = Null Adress 255 = GLOBAL (All – Any Node)	
41	ERC1 Controlling Device SA	-	-	-	0 = Engine #1 1 = Engine #2 2 = Turbocharger 3 = Transmission #1 4 = Transmission #2 5 = Shift Console - Primary 6 = Shift Console - Secondary 7 = Power Take Off - (Main or Rear) 8 = Axle - Steering 9 = Axle – Drive # 1 10 = Axle – Drive #2 11 = Brakes – System Controller 12 = Brakes – Steer Angle 13 = Brakes – Drive Axle #1 14 = Brakes – Drive Axle #2 15 = Retarder – Engine 16 = Retarder – Driveline 17 = Cruise Control 18 = Fuel System 19 = Steering Controller 20 = Suspension – Steer Axle 21 = Suspension – Drive Axle #1 22 = Suspension – Drive Axle #2 23 = Instrument Cluster 24 = Trip Recorder	-

No.	Name	Range min	Range max	Unit	Description	Pin
					25 = Passenger – Operator Climate Control 26 = Electrical Charging System 27 = Aerodynamic Control 28 = Vehicle Navigation 29 = Vehicle Security 30 = Electrical System 31 = Starter System 32 = Tractor – Trailer Bridge #1 33 = Body Controller 34 = Auxiliary Valve Control 35 = Hitch Control 36 = Power Take Off (Front or Secondary) 37 = Off vehicle Gateway 38 = Virtual Terminal (in cab) 39 = Management Computer #1 40 = Gab Display 41 = Retarder, Exhaust, Engine #1 42 = Headway Controller 43 = On – Board Diagnostic Unit 44 = Retarder, Exhaust, Engine #2 45 = Endurance Braking System 46 = Hydraulik Pump Controller 47 = Suspension – System Controller #1 48 = Pneumatic – System Controller 49 = Gab Controller - Primary 50 = Gab Controller - Secondary 51 = Tire Pressure Controller 52 = Ignition Control Module #1 53 = Ignition Control Module #2 54 = Seat Controls 55 = Lighting – Operator Controls 56 = Rear Axle Steering Controller #1 57 = Water Pump Controller 58 = Passenger – Operator Climate Control #2 59 = Transmission Display - Primary 60 = Transmission Display – Secondary 61 = Exhaust Emission Controller 62 = Vehicle Dynamic Stability Controller 63 = Oil Sensor 64 = Suspension – System Controller #2 65 = Information System Controller #1 66 = Ramp Control 67 = Clutch / Converter Controller 68 = Auxiliary Heater #1 69 = Auxiliary Heater #2 70 = Electronic Engine Valve Controller 248 = Reserved for future use 249 = Off Board Diagnostic – Service Tool #1 250 = Off Board Diagnostic – Service Tool #2 251 = On – Board Data Logger 252 = Reserved for Experimental Use 253 = Reserved for OEM 254 = Null Adress 255 = GLOBAL (All – Any Node)	
42	Power Rating Requested Engine Map	0	1	-		-
43	J1939 Moment of Inertia	0	10	kgm^2		
44	Power Rating Actual Engine	0	1	-		-

No.	Name	Range min	Range max	Unit	Description	Pin
	Map					
45	Nmax Gov0 rpm	0	4000	rpm		-
46	Nmax Gov4 rpm	0	4000	rpm		-
47	Nmax Gov5 rpm	0	4000	rpm		-
48	Cruise Control Deactivate Status	-	-	-	0 = Pause switch 1 = Current speed < Vmin -5 km/h 2 = Cruise control mode change => Limiter or Limiter mode Change => Cruise control 4 = Shutdown via retarder (parameter) 5 = Main switch cc enable / disable 6 = J1939 CCVS2 message 7 = FCM request active 10 = CC is deactivated by parameter setting (EEPROM) 11 = Activation attempt under CC minimum speed 12 = Activation attempt when service brake actuated 13 = Activation attempt during ASR intervention 14 = Activation attempt during ABS intervention 16 = Activation attempt during ESP intervention 17 = CC is deactivated during roll out 18 = not assigned 21 = ITPM is not initialized and is not Operating => All ITPM variables set to SNA 22 = ITPM powertrain gear ratio OOR or SNV (signal not present) 23 = Standby timeout 24 = Reverse gear engaged 25 = Gear information is invalid (SNA) 26 = Clutch-/Drivetrain status is invalid (SNA) 27 = Engine is off 28 = Clutch overload (parameter) 31 = Service brake actuated when cruise control active in drive mode 32 = Service brake operated while the cruise control is active, in brake mode without actuation of the retarder lamp 33 = Service brake failure or not plausible 34 = Parking brake operated while vehicle moving 35 = ABS error 36 = ASR failure while cruise control active 37 = ASR active or ESP is active 38 = ASR failure in ACCP mode 41 = Display error (ICUC) 42 = not assigned 43 = Engine diagnosis error 44 = Transmission diagnosis error 45 = Diagnosed engine data error 46 = Accelerator error 47 = Failure of chassis CAN 48 = Failure of powertrain CAN 51 = Shutdown request to CC by emergency brake system (NBS) 52 = No ACC response 53 = ACC shutdown request by VRDU 54 = Conditions for activating the	-

No.	Name	Range min	Range max	Unit	Description	Pin
					DTR+ not fulfilled 55 = No DTR+ activation enable 56 = No ACCP reaction 57 = ACCP shutdown request by VRDU 58 = Acceleration request validity test 61 = Powertrain disengaged by PSM 62 = Working speed request active 63 = Accelerator blocked by PSM 64 = Articulation angle protection active 65 = Ignition off or undervoltage 66 = PSM retarder active 67 = Max. vehicle speed < min. cc speed 68 = CC PMC limitation 71 = Button error (KeyPadError) 72 = Button jammed 73 = Gradient sensor failed 74 = Change in speed signal 75 = large deceleration (>4m/s^2) 76 = Accident detected by crash sensor 77 = Transmission model signal error 78 = Change in the standstill signal 81 = Out of gear state 82 = Engine speed is below parameter 83 = ACC state disable CC 84 = Optimized Idle is controlling engine speed 85 = Shutdown state disable CC 86 = Shutdown via open driveline 87 = VIAB creep mode active 255 =SNA	
49	MCM UDS Synch Status	-	-	-	MC MSYNC_READY_FOR_MCM_TOOL_CONNECT	-
50	Shutdown Engine Override Count	0	65535	-		-
51	Total Engine Shutdown Time	0	65000	S		
52	DPF Ash Volume	0	100	%		-
53	Optimized Idle System Status	-	-	-	0 = Ready to Arm 1 = Armed 2 = Wait for Shutdown 3 = Armed Not Running 4 = Armed Reqs Disabled 5 = Cranking Eng 6 = Running Eng 7 = Ramp Down to Idle 8 = Not Armed for Cycle 9 = Wait for Enable	-
54	Optimized Idle Lamp Status	-	-	-	0 = not active 1 = activce 2 = snv	-
55	Optimized Idle Alarm Status	-	-	-	0 = not active 1 = activce 2 = snv	-
56	Vehicle Power Shutdown Status	-	-	-	0 = not active 1 = activce 2 = snv	-
57	Ambient Air Temperature	-40	75	°C		Pin 3/15
58	OI Thermostat Status	-	-	-	0 = not active 1 = activce 2 = snv	-
59	Optimized Idle Run Reason	-	-	-	0 = No Run Required	-

No.	Name	Range min	Range max	Unit	Description	Pin
	Status				1 = Thermostat Regular 2 = Thermostat Extended Idle 3 = Thermostat Continuous Run 4 = Battery Voltage 5 = Engine Oil Lamp	
60	PTO Status	-	-	-	0 = ok 1 = CC Switches shortcut 2 = Clutch Open 3 = DPF Lockput 4 = Engine Off 5 = Gear Not in Neutral 6 = Idle Conditions are not true 7 = OI System is Requesting Control 8 = Park Brake Engaged 9 = Park Brake not Engaged 10 = Service Brake Active 11 = Vehicle Speed Sensor Fault 12 = PTO is not configured 13 = Vehicle Speed to High 14 = Conflicting Brake Calibration 15 = Conflicting VSpeed Calibration 16 = Remote PTO Lockout	-
61	Optimized Idle Time	0	65535	S		-
62	Average Fuel Economy	0	108	km		-
63	Instantaneous Fuel Economy	0	108	km		-
64	FEI Momentary Fuel Eco for Diag	0	108	km		-
65	Idle/PTO Shutdown Timer	0	42949672.94	S		-
66	Minimum Speed Path State	-	-	-	0 = General Min Speed 1 = LIM0 Min Speed 2 = LIM1 Min Speed 3 = Klima Min Speed 4 = Idle Inc Dec 5 = Idle Protection 6 = Limphome 7 = Aircon 8 = Underspeed 9 = Optimized Idle 10 = Idle Volume 11 = Carb 30G Noc 12 = TCM Min Speed 13 = DSS Min Speed	-
67	Maximum Speed Path State	-	-	-	0 = General Speed Limit 1 = LIM0 2 = LIM1 3 = Klima 4 = Standstill 5 = Standstill Automatic 6 = Progressive Shift 7 = TSC1 Speed Limitation 8 = Anti Tamper 9 = VSS Error 10 = Noise Control 11 = Driver Inducement 12 = max Speed Limitation 13 = DSS Max Speed	-
68	Torque Path State	-	-	-	0 = Maxtorque Request 1 = Throttle Input 2 = Droop Torque 3 = PTO Torque 4 = DSF0 5 = DSF1 6 = Cruise 7 = Road Speed Limit 8 = Torque Demand 9 = Noise Limiter 10 = TSC1 Torque Control 11 = TSC1 Torque Limitation 12 = Sync Gov	-

No.	Name	Range min	Range max	Unit	Description	Pin
					13 = TSC1 In Speed Control 14 = General Limitation 15 = LIM0 Torque 16 = LIM1 Torque 17 = Aircon Torque 18 = ADM1 Transprot 19 = FUSO Transprot 20 = Engspeed Governors 21 = LRTP 22 = Optimized Idle Torque 23 = EBM Logic 24 = TSC1 RPM Freeze Torque 25 = Zero Torque 26 = TCM Min Trq 27 = TCM Max Trq 28 = TCM In Speed Control 29 = Vari Speed Limit 30 = DSS Max Torque	
69	Speed Path State	-	-	-	0 = Idle Speed 1 = Droop 2 = PTO 3 = TSC1 Speed Control 4 = VSS Error AT 5 = Min Max Interlock 6 = J1939 Torque Control 7 = TSC1 RPM Freeze 8 = Anti Tamper Nmax 9 = TCM Speed Control 10 = TCM Launch Control	-
70	Governor Path State	-	-	-	0 = Idle Gov 1 = Droop Gov 2 = PTO Gov 3 = TSC1 Speed Gov 4 = Overspeed Gov 5 = Optimized Idle Gov 6 = Sync Gov 7 = TSC1 RPM Freeze Gov 8 = TCM Speed Gov 9 = TCM Launch Gov	-
71	J1939 CM1 Fan Sa1 Request	0	100	%		-
72	Engine Ecu Combination	-	-	-	0 = MBE4000 Unknown ECU 1 = MBE4000 PLDSW59 2 = MBE4000 PLDSW60 3 = MBE4000 MCM 4 = MBE900 Unknown ECU 5 = MBE900 PLDSW59 6 = MBE900 PLDSW60 7 = MBE900 MCM 8 = S60 Unknown ECU 9 = S60 MCM 10 = HDEP MCM 11 = HDEP Unknown ECU 12 = Eng ECU Combi NA	-
73	Predictive Cruise Control Internal State	-	-	-	0 = PCC Init 1 = PCC Disabled 2 = PCC Error 3 = PCC Not Active 4 = PCC Active	-
74	Predictive Cruise Control Offset	-20	20	km/h		-
75	Idle Volume Position Signal	0	100	%		-
76	J1939 CM1 Fan Sa2 Request	0	100	%		-
77	Number of MCM Communication Timeouts Prior to MU_ID 76 Fault Logging	0	65535	-		-
78	Amount of Fuel Consumed by Engine	0	3212,75	l/h		-
79	EC P1 Speed	0	4000	1/min		-
80	EC P1 Torque	0	125	%		-

No.	Name	Range min	Range max	Unit	Description	Pin
81	EC P2 Speed	0	4000	1/min		-
82	EC P2 Torque	0	125	%		-
83	EC P3 Speed	0	4000	1/min		-
84	EC P3 Torque	0	125	%		-
85	EC P4 Speed	0	4000	1/min		-
86	EC P4 Torque	0	125	%		-
87	EC P5 Speed	0	4000	1/min		-
88	EC P5 Torque	0	125	%		-
89	EC P6 Speed	0	4000	1/min		-
90	EC P7 Speed	0	4000	1/min		-
91	SPN92 Percent Load at Current Speed	0	254	%		-
92	SPN512 Drivers Demand Percent Torque	-125	129	%		-
93	SPN513 Actual Engine Percent Torque	-125	129	%		-
94	Engine Brake Path State	-	-	-	0 = EBM Not Active 1 = Driver Demand 2 = SBrake VCU 3 = CC Overspeed 4 = RSL Overspeed 5 = CC Torque 6 = RSL Torque 7 = TSC1 Req ETC 8 = TSC1 Req ACC 9 = TSC1 Er LIM 10 = TSC1 TRet Lim 11 = Trans Prot 12 = OI Req 13 = TCM LIM 14 = TCM LIM VIAB	-
95	Requested Remote PTO Speed	-	-	-	0 = PTO minimum speed 1 = PTO fixed speed #1 2 = PTO fixed speed #2 3 = PTO fixed speed #3 255 = no Remote Speed Requested	-
96	RSL Path Vspeed Limiter Information	-	-	-	0 = LIM None 1 = Max Roadspeed 2 = Cruise Higher 3 = LIM0 Input 4 = LIM1 Input 5 = Aircon Input 6 = Tempo Set 7 = Def Drv Induce 8 = ABS Max Roadspeed 9 =GHGE Max Roadspeed 10 = MVS Max Roadspeed 11 = DSS Max Roadspeed 12 = DEF Drv by LIM	-
97	RSL Path Vspeed Adder Information	-	-	-	0 = Add None 1 = PCC 2 = Fuel Eco 3 = Pass Smart 4 = Com Drv Reward 5 = Clipped By LIM	-
98	Latest OI Dropout Reason t0	-	-	-	0 = OI No Fault 1 = OI Vehicle Speed 2 = OI Overtorque 3 = OI ECU Postrum 4 = OI Loop Fault General 5 = OI Not Allowed 6 = OI Enable Fault 7 = OI 30g Nox Limit 8 = OI Zero rpm	-

No.	Name	Range min	Range max	Unit	Description	Pin
					9 = RES 10 = OI Idle Conditions no longer fulfilled 11 = OI Park Brake Condition 12 = OI Engine Hood Condition 13 = OI Transmission Neutral Condition 14 = OI Start Failed 15 = OI Operator Started Engine 16 = OI Cruise Main Off 17 = OI Clutch Condition 18 = OI Loop Fault Vehicle Speed 19 = OI Loop Fault ACC Bus Relay 20 = OI Loop Fault Alarm 21 = OI Loop Fault Lamps 22 = OI Loop Fault Communicatios	
99	Engine Brake Lever Position	0	5	-		-
100 101 102 103	Latest OI Dropout Reason t-1 Latest OI Dropout Reason t-2 Latest OI Dropout Reason t-3 Latest OI Dropout Reason t-4	-	-	-	0 = OI No Fault 1 = OI Vehicle Speed 2 = OI Overtorque 3 = OI ECU Postrum 4 = OI Loop Fault General 5 = OI Not Allowed 6 = OI Enable Fault 7 = OI 30g Nox Limit 8 = OI Zero rpm 9 = RES 10 = OI Idle Conditions no longer fulfilled 11 = OI Park Brake Condition 12 = OI Engine Hood Condition 13 = OI Transmission Neutral Condition 14 = OI Start Failed 15 = OI Operator Started Engine 16 = OI Cruise Main Off 17 = OI Clutch Condition 18 = OI Loop Fault Vehicle Speed 19 = OI Loop Fault ACC Bus Relay 20 = OI Loop Fault Alarm 21 = OI Loop Fault Lamps 22 = OI Loop Fault Communicatios	-
104	Proprietary Vehicle Power Shutdown Message	-	-	-	0 = active 1 = inactive 2 = error 3 = snv	-
105	CC hysteresis band stage	-	-	-	0 = low 1 = medium 2 = high 3 = error 255 = SNA	-

6.3.2. Binary Values

No.	Name	Status	Description	Pin
1/1	Ignition Switch	0 / 1	Ingnition 0 = Open 1 = Closed, shorted to Battery	Pin 2/03
1/2	Service Brake	0 / 1 / 2 / 3	0 = Pedal released, shorted to Ground 1 = Pedal pressed, open 2 = Signal erratic 3 = Signal not available	Pin 2/07
1/3	Parking Brake	0 / 1 / 2 / 3	0 = open 1 = Closed, shorted to Ground 2 = Signal erratic 3 = Signal not available	Pin 1/02
1/4	Clutch Open	0 / 1 / 2 / 3	0 = Pedal released, shorted to Ground 1 = Pedal pressed, open 2 = Signal erratic	-

No.	Name	Status	Description	Pin
			3 = Signal not available	
2/1	Cruise Control Set/Coast	0 / 1 / 2 / 3	0 = open 1 = Closed, shorted to Ground 2 = Signal erratic 3 = Signal not available	Pin 1/12
2/2	Cruise Control Resume/Accel	0 / 1 / 2 / 3	0 = open 1 = Closed, shorted to Ground 2 = Signal erratic 3 = Signal not available	Pin 1/16
2/3	Cruise Control Enable	0 / 1 / 2 / 3	0 = open 1 = Closed, shorted to Ground 2 = Signal erratic 3 = Signal not available	Pin 1/14
2/4	Cruise Control Pause	0 / 1 / 2 / 3	0 = open 1 = Closed, shorted to Ground 2 = Signal erratic 3 = Signal not available	-
3/1	Engine Brake Disable	0 / 1 / 2 / 3	0 = open 1 = Closed, shorted to Ground 2 = Signal erratic 3 = Signal not available	Pin 4/18
3/2	Engine Brake Low	0 / 1 / 2 / 3	0 = open 1 = Closed, shorted to Ground 2 = Signal erratic 3 = Signal not available	Pin 2/14
3/3	Engine Brake Medium	0 / 1 / 2 / 3	0 = open 1 = Closed, shorted to Ground 2 = Signal erratic 3 = Signal not available	Pin 2/15
3/4	Transmission Retarder Active	0 / 1 / 2 / 3	0 = open 1 = Closed, shorted to Ground 2 = Signal erratic 3 = Signal not available	-
4/1	Limiter 0 Set Switch	0 / 1 / 2 / 3	0 = open 1 = Closed, shorted to Ground 2 = Signal erratic 3 = Signal not available	Pin 1/11
4/2	Limiter 1 Set Switch	0 / 1 / 2 / 3	0 = open 1 = Closed, shorted to Ground 2 = Signal erratic 3 = Signal not available	Pin 2/11
4/3	Remote Accelerator Select Switch	0 / 1 / 2 / 3	0 = open 1 = Closed, shorted to Ground 2 = Signal erratic 3 = Signal not available	-
4/4	Cruise Control Status	0 / 1 / 2	0 = Off 1 = On 2 = Standby	-
5/1	Shutdown Override	0 / 1 / 2 / 3	0 = open 1 = Closed, shorted to Ground 2 = Signal erratic 3 = Signal not available	Pin 1/15
5/2	Fan Control Override	0 / 1 / 2 / 3	0 = open 1 = Closed, shorted to Ground 2 = Signal erratic 3 = Signal not available	-
5/3	Hood Tilt Switch	0 / 1 / 2 / 3	0 = open 1 = Closed, shorted to Ground 2 = Signal erratic 3 = Signal not available	-
5/4	Remote VSG Switch	0 / 1 / 2 / 3	0 = open 1 = Closed, shorted to Ground 2 = Signal erratic 3 = Signal not available	-
6/1	Neutral Switch	0 / 1 / 2 / 3	0 = Open, gear engaged 1 = Closed, Gear in Neutral 2 = Signal erratic 3 = Signal not available	Pin 4/16
6/2	Two Speed Axle Switch	0 / 1 / 2 / 3	0 = open	Pin 1/01

No.	Name	Status	Description	Pin
			1 = Closed, shorted to Ground 2 = Signal erratic 3 = Signal not available	
6/3	Idle Validation Switch 1	0 / 1 / 2 / 3	0 = open 1 = Closed, shorted to Ground 2 = Signal erratic 3 = Signal not available	-
6/4	Idle Validation Switch 2	0 / 1 / 2 / 3	0 = open 1 = Closed, shorted to Ground 2 = Signal erratic 3 = Signal not available	-
7/1	ABS System Active	0 / 1 / 2 / 3	0 = open 1 = Closed, shorted to Ground 2 = Signal erratic 3 = Signal not available	-
7/2	External Engine Shutdown Switch	0 / 1 / 2 / 3	0 = open 1 = Closed, shorted to Ground 2 = Signal erratic 3 = Signal not available	Pin 1/10
7/3	External Engine Shutdown via J1939	0 / 1 / 2 / 3	0 = open 1 = Closed, shorted to Ground 2 = Signal erratic 3 = Signal not available	-
7/4	Throttle Inhibit	0 / 1 / 2 / 3	0 = open 1 = Closed, shorted to Ground 2 = Signal erratic 3 = Signal not available	Pin 1/17
8/1	Starter Signal	0 / 1	0 = Off (Open) 1 = On (Shorted to Battery)	Pin 1/18
8/2	Air Conditioner Status	0 / 1 / 2 / 3	0 = Not Active 1 = Active 2 = Invalid 3 = Not available	-
8/3	DPF Regen Switch Status	0 / 1 / 2 / 3	0 = open 1 = Closed, shorted to Ground 2 = Signal erratic 3 = Signal not available	-
8/4	DPF Inhibit Switch Status	0 / 1 / 2 / 3	0 = Not Active, Shorted to Ground 1 = Active, Open 2 = Signal erratic 3 = Signal not available	-
9/1	Amber Warning Lamp	0 / 1 / 2 / 3	0 = Off 1 = On 2 = Not configured 3 = Not available	Pin 2/10
9/2	Red Stop Lamp	0 / 1 / 2 / 3	0 = Off 1 = On 2 = Not configured 3 = Not available	Pin 3/16
9/3	Malfunction Indicator Lamp	0 / 1 / 2 / 3	0 = Off 1 = On 2 = Not configured 3 = Not available	Pin 1/13
9/4	DEF Level Low Lamp	0 / 1 / 2 / 3	0 = Off 1 = On 2 = Not configured 3 = Not available	-
10/1	Cruise Active Lamp	0 / 1 / 2 / 3	0 = Off 1 = On 2 = Not configured 3 = Not available	-
10/2	Deceleration Lamp	0 / 1 / 2 / 3	0 = Off 1 = On 2 = Not configured 3 = Not available	-
10/3	Ether Start	0 / 1 / 2 / 3	0 = Off 1 = On 2 = Not configured 3 = Not available	-

No.	Name	Status	Description	Pin
10/4	Starter Lockout/Run Signal	0 / 1 / 2 / 3	0 = Not active 1 = Active 2 = Invalid 3 = Not available	-
11/1	DPF Regeneration Lamp	0 / 1 / 2 / 3	0 = Off 1 = On 2 = Not configured 3 = Not available	-
11/2	Engine Brake Active	0 / 1 / 2 / 3	0 = Not active 1 = Active 2 = Invalid 3 = Not available	-
11/3	High Exhaust System Temperature Lamp	0 / 1 / 2 / 3	0 = Off 1 = On 2 = Not configured 3 = Not available	-
11/4	Wait to Start Lamp	0 / 1 / 2 / 3	0 = Off 1 = On 2 = Not configured 3 = Not available	-
12/1	Low Battery Voltage Lamp	0 / 1 / 2 / 3	0 = Off 1 = On 2 = Not configured 3 = Not available	-
12/2	Low Coolant Level Lamp	0 / 1 / 2 / 3	0 = Off 1 = On 2 = Not configured 3 = Not available	-
12/3	Low Oil Pressure Lamp	0 / 1 / 2 / 3	0 = Off 1 = On 2 = Not configured 3 = Not available	-
12/4	Water-in-Fuel Lamp	0 / 1 / 2 / 3	0 = Off 1 = On 2 = Not configured 3 = Not available	-
13/1	Top2 Shift Solenoid	0 / 1 / 2 / 3	0 = Off 1 = On 2 = Not configured 3 = Not available	-
13/2	Top2 Lockout Solenoid	0 / 1 / 2 / 3	0 = Off 1 = On 2 = Not configured 3 = Not available	-
13/3	Fast Engine Heat Up Switch	0 / 1 / 2 / 3	0 = Open 1 = Closed, Shorted to Ground 2 = Signal erratic 3 = Signal not available	-
13/4	RPM Freeze Switch	0 / 1 / 2 / 3	0 = Open 1 = Closed, Shorted to Ground 2 = Signal erratic 3 = Signal not available	-
14/1	Idle/PTO Shutdown Driver Alert	0 / 1 / 2 / 3	0 = Not Active 1 = Active 2 = Invalid 3 = Not available	-
14/2	Idle/PTO Shutdown Occurred	0 / 1 / 2 / 3	0 = Not Active 1 = Active 2 = Invalid 3 = Not available	-
14/3	Continuous Shutdown Override Active	0 / 1 / 2 / 3	0 = Not Active 1 = Active 2 = Invalid 3 = Not available	-
14/4	Idle/PTO Timer Active	0 / 1 / 2 / 3	0 = Not Active 1 = Active 2 = Invalid 3 = Not available	-
15/1	Carb Nox Speed Limiter Flag	0 / 1 / 2 / 3	0 = Not Active	-

No.	Name	Status	Description	Pin
			1 = Active 2 = Invalid 3 = Not available	
15/2	Noise Lim Veh Conf Flag	0 / 1 / 2 / 3	0 = Not Active 1 = Active 2 = Invalid 3 = Not available	-
15/3	Rsl Com Deb Status	0 / 1 / 2 / 3	0 = Not Active 1 = Active 2 = Invalid 3 = Not available	-
15/4	Idle Volume Active Status	0 / 1 / 2 / 3	0 = Not Active 1 = Active 2 = Invalid 3 = Not available	-
16/1	Status Limiter 2 Switch	0 / 1 / 2 / 3	0 = Open 1 = Closed, short to Ground 2 = Signal erratic 3 = Sgnal not available	-
16/2	Status Engine Break Disable Switch	0 / 1 / 2 / 3	0 = Open 1 = Closed, short to Ground 2 = Signal erratic 3 = Sgnal not available	-
16/3	Status Cc Retarder Stage 1 Control	0 / 1 / 2 / 3	0 = Not Active 1 = Active 2 = Invalid 3 = Not available	-
16/4	Status Cc Retarder Stage 2 Control	0 / 1 / 2 / 3	0 = Not Active 1 = Active 2 = Invalid 3 = Not available	-
17/1	Cab PTO Set/Coast	0 / 1 / 2 / 3	0 = Not Active 1 = Active 2 = Invalid 3 = Not available	-
17/2	Cab PTO Resume/Accel	0 / 1 / 2 / 3	0 = Not Active 1 = Active 2 = Invalid 3 = Not available	-
17/3	Cab PTO Enable	0 / 1 / 2 / 3	0 = Not Active 1 = Active 2 = Invalid 3 = Not available	-
17/4	Drive Requested Engine Brake Disable	0 / 1 / 2 / 3	0 = Not Active 1 = Active 2 = Invalid 3 = Not available	-
18/1	Retarder Lever Input 0	0 / 1 / 2 / 3	0 = Open 1 = Closed, short to Ground 2 = Signal erratic 3 = Sgnal not available	-
18/2	Retarder Lever Input 1	0 / 1 / 2 / 3	0 = Open 1 = Closed, short to Ground 2 = Signal erratic 3 = Sgnal not available	-
18/3	Retarder Lever Input 2	0 / 1 / 2 / 3	0 = Open 1 = Closed, short to Ground 2 = Signal erratic 3 = Sgnal not available	-
18/4	Retarder Lever Input 3	0 / 1 / 2 / 3	0 = Open 1 = Closed, short to Ground 2 = Signal erratic 3 = Sgnal not available	-
19/1	Retarder Lever Input 4	0 / 1 / 2 / 3	0 = Open 1 = Closed, short to Ground 2 = Signal erratic 3 = Sgnal not available	-
19/2	Retarder Lever Input 5	0 / 1 / 2 / 3	0 = Open 1 = Closed, short to Ground	-

No.	Name	Status	Description	Pin
			2 = Signal erratic 3 = Sgnal not available	
19/3	Eco Roll Enabled	0 / 1 / 2 / 3	0 = Not Active 1 = Active 2 = Invalid 3 = Not available	-
19/4	Eco Roll Active	0 / 1 / 2 / 3	0 = Not Active 1 = Active 2 = Invalid 3 = Not available	-
20/1	Creep Enable	0 / 1 / 2 / 3	0 = Not Active 1 = Active 2 = Invalid 3 = Not available	-
20/2	Creep Active	0 / 1 / 2 / 3	0 = Not Active 1 = Active 2 = Invalid 3 = Not available	-
20/3	Shifter Lever Gear Up	0 / 1 / 2 / 3	0 = Off 1 = On 2 = Not configured 3 = Not available	-
20/4	Shifter Lever Gear Down	0 / 1 / 2 / 3	0 = Off 1 = On 2 = Not configured 3 = Not available	-
21/1	Accelerator Pedal Kick Down Status	0 / 1 / 2 / 3	0 = Not active 1 = Active 2 = Invalid 3 = Not available	-
21/2	Clutch Overload Status	0 / 1 / 2 / 3	0 = No Warning 1 = Pre-Warning 2 = Warning 3 = No Warning	-
21/3	Shift Program Status	0 / 1 / 2 / 3	0 = Not active 1 = Active 2 = Invalid 3 = Not available	-
21/4	(reserved)	0 / 1		-

6.4. Diagnostic Service Routines

6.4.1. Routines for CPC4

No.	Routine name	Description	Pin
01	Accelerator Pedal Learning: Request Results Status	Check accelerator pedal learning process status (successful/unsuccesful)	
02	Accelerator Pedal Learning: Start	Start accelerator pedal learning routine	

03	Accelerator Pedal Learning: Stop	Stop accelerator pedal learning routine
		Parameter values:
		#AP learn save data
		0 = do not save AP learn data,
		1 = save AP learn data	

04	Analog Output Function Under Software Control: Request Results Frequency	Check analog output function test result frequency (successful/unsuccesful)
		Parameter values:
		#Signal: Selects output function
		1 = Oil Pressure Lamp,
		2 = Oil Temperature Lamp,
		3 = Oil Pressure Gauge,
		4 = Coolant Temperature Gauge,
		5 = IWA (current value comparator),
		6 = Speedometer	

05	Analog Output Function Under Software Control: Request Results Width	Check analog output function test result width (successful/unsuccesful)
		Parameter values:
		#Signal: Selects output function
		1 = Oil Pressure Lamp,
		2 = Oil Temperature Lamp,
		3 = Oil Pressure Gauge,
		4 = Coolant Temperature Gauge,
		5 = IWA (current value comparator),
		6 = Speedometer	

06	Analog Output Function Under Software Control: Start	Start analog output function test
		Parameter values:
		#Signal: Selects output function
		0 = All,
		1 = Oil Pressure Lamp,
		2 = Oil Temperature Lamp,
		3 = Oil Pressure Gauge,
		4 = Coolant Temperature Gauge,
		5 = IWA (current value comparator),
		6 = Speedometer
		#Frequency = Sets output function signal frequency [Hz], 0..10000 = signal
		#Width = Sets output function duty Cycle [%] 0..100 = signal	

07	Analog output Function Under Software Control: Stop	Stop analog output function test
		Parameter values:
		#Signal: Selects output function
		0 = All,
		1 = Oil Pressure Lamp,
		2 = Coolant Temperature Lamp,
		3 = Oil Pressure Gauge,
		4 = Coolant Temperature Gauge,
		5 = IWA (current value comparator),
		6 = Speedometer	

08	Analog Output Pin Under Software Control: Request Results Frequency	Check analog output pin test frequency result (successful/unsuccesful)
		Parameter values:
		#Signal: Selects output pin
		1 = FPO_01,
		2 = FPO_02,
		5 = AO_01,
		6 = AO_02
			Pin 4/12
			Pin 1/09
			Pin 3/05
			Pin 3/06

09	Analog Output Pin Under Software Control: Request Results Width	Check analog output pin test width result (successful/unsuccesful)
		Parameter values:
		#Signal: Selects output pin
		1 = FPO_01,
			Pin 4/12
			Pin 1/09
			Pin 3/05
			Pin 3/06

No.	Routine name	Description	Pin
		2 = FPO_02, 5 = AO_01, 6 = AO_02	

10	Analog Output Pin Under Software Control: Start	Start analog output pin test
		Parameter values:
		#Signal: Selects output pin
		0 = All,
		1 = FPO_01,
		2 = FPO_02,
		3 = FPO_03,
		4 = FPO_04,
		5 = AO_01,
		6 = AO_02
		#Frequency: Sets output signal frequency[Hz]
		0..10000 = signal
		#Width: Sets output signal duty cycle[%]
		0..100 = signal
			Pin 4/12
			Pin 1/09
			Pin 4/15
			Pin 4/11
			Pin 3/05
			Pin 3/06

11	Analog Output Pin Under Software Control: Stop	Stop analog output pin test
		Parameter values:
		#Signal: Selects output pin
		0 = All,
		1 = FPO_01,
		2 = FPO_02,
		5 = AO_01,
		6 = AO_02
			Pin 4/12
			Pin 1/09
			Pin 3/05
			Pin 3/06

12	Digital Output Function Under Software Control: Request Results Status	Check digital output function test result (successful/unsuccesful)
		Parameter values:
		#Signal: Select output pin
		0 = All,
		1 = Stop Engine Lamp,
		2 = Check Engine Lamp,
		3 = Wait to Start Lamp,
		4 = Malfunction Indicator Lamp,
		5 = Optimized Idle Active Lamp,
		6 = Oil Pressure Lamp,
		7 = Coolant Temperature Lamp,
		8 = Air Filter Lamp,
		9 = EBM active Lamp,
		10 = Oil Level Lamp,
		11 = Accelerator Pedal Lamp,
		12 = DPF Regeneration Lamp,
		13 = High Exhaust Temperature Lamp,
		14 = Water in Fuel Lamp,
		15 = Accelerator Pedal Kick Down,
		16 = TOP2 Lockout,
		17 = TOP2 Shift,
		18 = Optimized Idle Alarm,
		19 = Vehicle Power Shutdown / Ignition Relay,
		20 = Relay 2 Pin 3/09,
		21 = Relay 3 Pin 4/09,
		22 = Relay 4 Pin 4/07,
		23 = Gear 1,
		24 = Gear 2,
		25 = Starter Lockout,
		26 = Engine Brake Active Lamp,
		27 = Cc Retarder Control 1,
		28 = Cc Retarder Control 2,
		29 = DEF Lamp,
		30 = Cc Active Lamp,
		31 = Low Battery Lamp,
		32 = Fuel Filter Restriction Lamp,
		33 = Low Coolant Level Lamp
		34 = DiagFeature FPO03
		35 = DiagFeature FPO04
		36 = XTPC Valve 1
		37 = XTPC Valve 2
		38 = Tier4 DEF Lamp
		39 = EU6 Inducement Lamp
		40 = Tier4 Rock-out Lamp
		41 = Buzzer
		42 = Battery Charge Indication Lamp
		43 = Tier4 Maneuver Lamp
		44 = ServiceBrake Required Lamp	

No.	Routine name	Description	Pin
		45 = Eu6 Limitation Active Lamp 46 = Tier4 Limitation Active Lamp 47 = CC Lim ECE only Lamp 48 = CC Lim active ECE Lamp 49 = CC Lim active Lamp 50 = PTO X Valve 1 51 = PTO X Valve 2 52 = Tier4 Aux Relay 53 = Check Trans Lamp 54 = XTPC Valve GND	

13	Digital Output Function Under Software Control: Start Output Information	Start digital output function test
		Parameter values:
		#Signal: Select output pin
		0 = All,
		1 = Stop Engine Lamp,
		2 = Check Engine Lamp,
		3 = Wait to Start Lamp,
		4 = Malfunction Indicator Lamp,
		5 = Optimized Idle Active Lamp,
		6 = Oil Pressure Lamp,
		7 = Coolant Temperature Lamp,
		8 = Air Filter Lamp,
		9 = EBM active Lamp,
		10 = Oil Level Lamp,
		11 = Accelerator Pedal Lamp,
		12 = DPF Regenration Lamp,
		13 = High Exhaust Temperature Lamp,
		14 = Water in Fuel Lamp,
		15 = Accelerator Pedal Kick Down,
		16 = TOP2 Lockout,
		17 = TOP2 Shift,
		18 = Optimized Idle Alarm,
		19 = Vehicle Power Shutdown / Ignition Relay,
		20 = Relay 2 Pin 3/09,
		21 = Relay 3 Pin 4/09,
		22 = Relay 4 Pin 4/07,
		23 = Gear 1,
		24 = Gear 2,
		25 = Starter Lockout,
		26 = Engine Brake Active Lamp,
		27 = Cc Retarder Control 1,
		28 = Cc Retarder Control 2,
		29 = DEF Lamp,
		30 = Cc Active Lamp,
		31 = Low Battery Lamp,
		32 = Fuel Filter Restriction Lamp,
		33 = Low Coolant Level Lamp
		34 = DiagFeature FPO03
		35 = DiagFeature FPO04
		36 = XTPC Valve 1
		37 = XTPC Valve 2
		38 = Tier4 DEF Lamp
		39 = EU6 Inducement Lamp
		40 = Tier4 Rock-out Lamp
		41 = Buzzer
		42 = Battery Charge Indication Lamp
		43 = Tier4 Maneuver Lamp
		44 = ServiceBrake Required Lamp
		45 = Eu6 Limitation Active Lamp
		46 = Tier4 Limitation Active Lamp
		47 = CC Lim ECE only Lamp
		48 = CC Lim active ECE Lamp
		49 = CC Lim active Lamp
		50 = PTO X Valve 1
		51 = PTO X Valve 2
		52 = Tier4 Aux Relay
		53 = Check Trans Lamp
		54 = XTPC Valve GND
		#on/off:
		0 = on,
		1 = off	

14	Digital Output Function Under Softare Control: Stop Output Information	Stop digital output function test
		Parameter values:
		#Signal: Select output pin
		0 = All,	

No.	Routine name	Description	Pin
		1 = Stop Engine Lamp, 2 = Check Engine Lamp, 3 = Wait to Start Lamp, 4 = Malfunction Indicator Lamp, 5 = Optimized Idle Active Lamp, 6 = Oil Pressure Lamp, 7 = Coolant Temperature Lamp, 8 = Air Filter Lamp, 9 = EBM active Lamp, 10 = Oil Level Lamp, 11 = Accelerator Pedal Lamp, 12 = DPF Regenration Lamp, 13 = High Exhaust Temperature Lamp, 14 = Water in Fuel Lamp, 15 = Accelerator Pedal Kick Down, 16 = TOP2 Lockout, 17 = TOP2 Shift, 18 = Optimized Idle Alarm, 19 = Vehicle Power Shutdown / Ignition Relay, 20 = Relay 2 Pin 3/09, 21 = Relay 3 Pin 4/09, 22 = Relay 4 Pin 4/07, 23 = Gear 1, 24 = Gear 2, 25 = Starter Lockout, 26 = Engine Brake Active Lamp, 27 = Cc Retarder Control 1, 28 = Cc Retarder Control 2, 29 = DEF Lamp, 30 = Cc Active Lamp, 31 = Low Battery Lamp, 32 = Fuel Filter Restriction Lamp, 33 = Low Coolant Level Lamp 34 = DiagFeature FPO03 35 = DiagFeature FPO04 36 = XTPC Valve 1 37 = XTPC Valve 2 38 = Tier4 DEF Lamp 39 = EU6 Inducement Lamp 40 = Tier4 Rock-out Lamp 41 = Buzzer 42 = Battery Charge Indication Lamp 43 = Tier4 Maneuver Lamp 44 = ServiceBrake Required Lamp 45 = Eu6 Limitation Active Lamp 46 = Tier4 Limitation Active Lamp 47 = CC Lim ECE only Lamp 48 = CC Lim active ECE Lamp 49 = CC Lim active Lamp 50 = PTO X Valve 1 51 = PTO X Valve 2 52 = Tier4 Aux Relay 53 = Check Trans Lamp 54 = XTPC Valve GND	

15	Digital Output Pin Under Software Control: Request Results Status	Check digital output pin test result (successful/unsuccesful)
		Parameter values:
		#Signal: Select output pin
		1 = Pin 1/13 (DO_LP_FLEX_01),
		2 = Pin 3/10 (DO_LP_FLEX_02),
		3 = Pin 2/10 (DO_LP_FLEX_03),
		4 = Pin 3/12 (DO_LP_FLEX_04),
		5 = Pin 3/16 (DO_LP_FLEX_05),
		6 = Pin 4/06 (DO_LP_FLEX_06),
		7 = Pin 4/09 (DO_HP_LS_03),
		8 = Pin 3/17 (DO_HP_LS_04),
		9 = Pin 3/07 (DO_HP_FLEX_01),
		10 = Pin 3/08 (DO_HP_FLEX_02),
		11 = Pin 4/10 (DO_HP_FLEX_03),
		12 = Pin 1/05 (DO_LP_LS_01),
		13 = Pin 1/04 (DO_LP_LS_02),
		14 = Pin 3/09 (DO_HP_LS_01),
		15 = Pin 4/07 (DO_HP_LS_02),
		16 = Pin 4/01 (DO_LP_LS_03),
		17 = Pin 4/02 (DO_LP_LS_04),
			Pin 1/04
			Pin 1/05
			Pin 1/13
			Pin 2/10
			Pin 3/02
			Pin 3/07
			Pin 3/08
			Pin 3/09
			Pin 3/10
			Pin 3/12
			Pin 3/16
			Pin 3/17
			Pin 4/01
			Pin 4/02
			Pin 4/06
			Pin 4/07
			Pin 4/09
			Pin 4/10

No.	Routine name	Description	Pin
		18 = Pin 3/02 (DO_LS_AGND)	

16	Digital Output Pin Under Software Control: Start Response	Start digital output pin test
		Parameter values:
		#Signal: Select output pin
		0 = All,
		1 = Pin 1/13 (DO_LP_FLEX_01),
		2 = Pin 3/10 (DO_LP_FLEX_02),
		3 = Pin 2/10 (DO_LP_FLEX_03),
		4 = Pin 3/12 (DO_LP_FLEX_04),
		5 = Pin 3/16 (DO_LP_FLEX_05),
		6 = Pin 4/06 (DO_LP_FLEX_06),
		7 = Pin 4/09 (DO_HP_LS_03),
		8 = Pin 3/17 (DO_HP_LS_04),
		9 = Pin 3/07 (DO_HP_FLEX_01),
		10 = Pin 3/08 (DO_HP_FLEX_02),
		11 = Pin 4/10 (DO_HP_FLEX_03),
		12 = Pin 1/05 (DO_LP_LS_01),
		13 = Pin 1/04 (DO_LP_LS_02),
		14 = Pin 3/09 (DO_HP_LS_01),
		15 = Pin 4/07 (DO_HP_LS_02),
		16 = Pin 4/01 (DO_LP_LS_03),
		17 = Pin 4/02 (DO_LP_LS_04),
		18 = Pin 3/02 (DO_LS_AGND)
		#on/off:
		0 = on,
		1 = off
			Pin 1/04
			Pin 1/05
			Pin 1/13
			Pin 2/10
			Pin 3/02
			Pin 3/07
			Pin 3/08
			Pin 3/09
			Pin 3/10
			Pin 3/12
			Pin 3/16
			Pin 3/17
			Pin 4/01
			Pin 4/02
			Pin 4/06
			Pin 4/07
			Pin 4/09
			Pin 4/10

17	Digital Output Pin Under Software Control: Stop Response	Stop digital output pin test
		Parameter values:
		#Signal: Select output pin
		0 = All,
		1 = Pin 1/13 (DO_LP_FLEX_01),
		2 = Pin 3/10 (DO_LP_FLEX_02),
		3 = Pin 2/10 (DO_LP_FLEX_03),
		4 = Pin 3/12 (DO_LP_FLEX_04),
		5 = Pin 3/16 (DO_LP_FLEX_05),
		6 = Pin 4/06 (DO_LP_FLEX_06),
		7 = Pin 4/09 (DO_HP_LS_03),
		8 = Pin 3/17 (DO_HP_LS_04),
		9 = Pin 3/07 (DO_HP_FLEX_01),
		10 = Pin 3/08 (DO_HP_FLEX_02),
		11 = Pin 4/10 (DO_HP_FLEX_03),
		12 = Pin 1/05 (DO_LP_LS_01),
		13 = Pin 1/04 (DO_LP_LS_02),
		14 = Pin 3/09 (DO_HP_LS_01),
		15 = Pin 4/07 (DO_HP_LS_02),
		16 = Pin 4/01 (DO_LP_LS_03),
		17 = Pin 4/02 (DO_LP_LS_04),
		18 = Pin 3/02 (DO_LS_AGND)
			Pin 1/04
			Pin 1/05
			Pin 1/13
			Pin 2/10
			Pin 3/02
			Pin 3/07
			Pin 3/08
			Pin 3/09
			Pin 3/10
			Pin 3/12
			Pin 3/16
			Pin 3/17
			Pin 4/01
			Pin 4/02
			Pin 4/06
			Pin 4/07
			Pin 4/09
			Pin 4/10

18	Reload Original Factory Settings: Start Routine Status	Set all parameters back to factory default settings **Parameter values:** 1 = Calibration: Start Routine Status 2 = Accumulators: Start Routine Status 3 = Calibration and Accumulators: Start Routine Status 4096 = Fleet Management: Start Routine Status 32767 = All of EEPROM minus SVDO block: Start Routine Status	
19	Software Variant Read: Start Software Variant	Read software version	
20	VIN Current Read	Read vehicle identification number	
21	VIN Current Write	Set vehicle identification number	

7. CAN

Remark: If two CPC4 are used in the same vehicle (e. g. cranes with two engines) they are not allowed to communicate via the same J1939 CAN but should use separated ones, due to the expected bus traffic load!

7.1. Actual Engine Torque

7.1.1. Initial Rx Timeout

The parameter 01/32 (“J1939 Initial Rx Timeout“) sets the time after which the CPC4 sets fault memory entries for missing J1939 Rx CAN messages. This does only concern the initial startup timeout after cranking of the engine to take into consideration the power loss of possible devices during cranking.

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
01	32	J1939 Initial Rx Timeout	0	255	5	s	initial timeout setting for J1939 RX messages- allows for potential device power loss during engine cranking 0..255=signal

7.1.2. Engine Percent Load At Current Speed (PLACS)

In order to check on the actual engine load rate the SAE J1939 signal SPN 92 (“Engine Percent Load At Current Speed”) can be used, which is sent with the CAN message EEC2 (“Electronic Engine Controller 2”) (refer to chapter 7.5).

Generally the PLACS value is computed as the ratio between the actual engine torque and the actual maximum engine torque (each minus the actual friction torque). Yet it is important to known that there are two different values of actual engine torque that can be taken into account. To switch between these two methods the parameter 01/94 (“SPN 92 Conversion Mode”) is to be used. If the parameter is set to:

- 0: the actual engine load at the actual engine speed (based on the torque-speed characteristic) **or**
- 1: the actual engine load at the actual engine speed (based on the operating condition of the engine)

is used for the calculation.

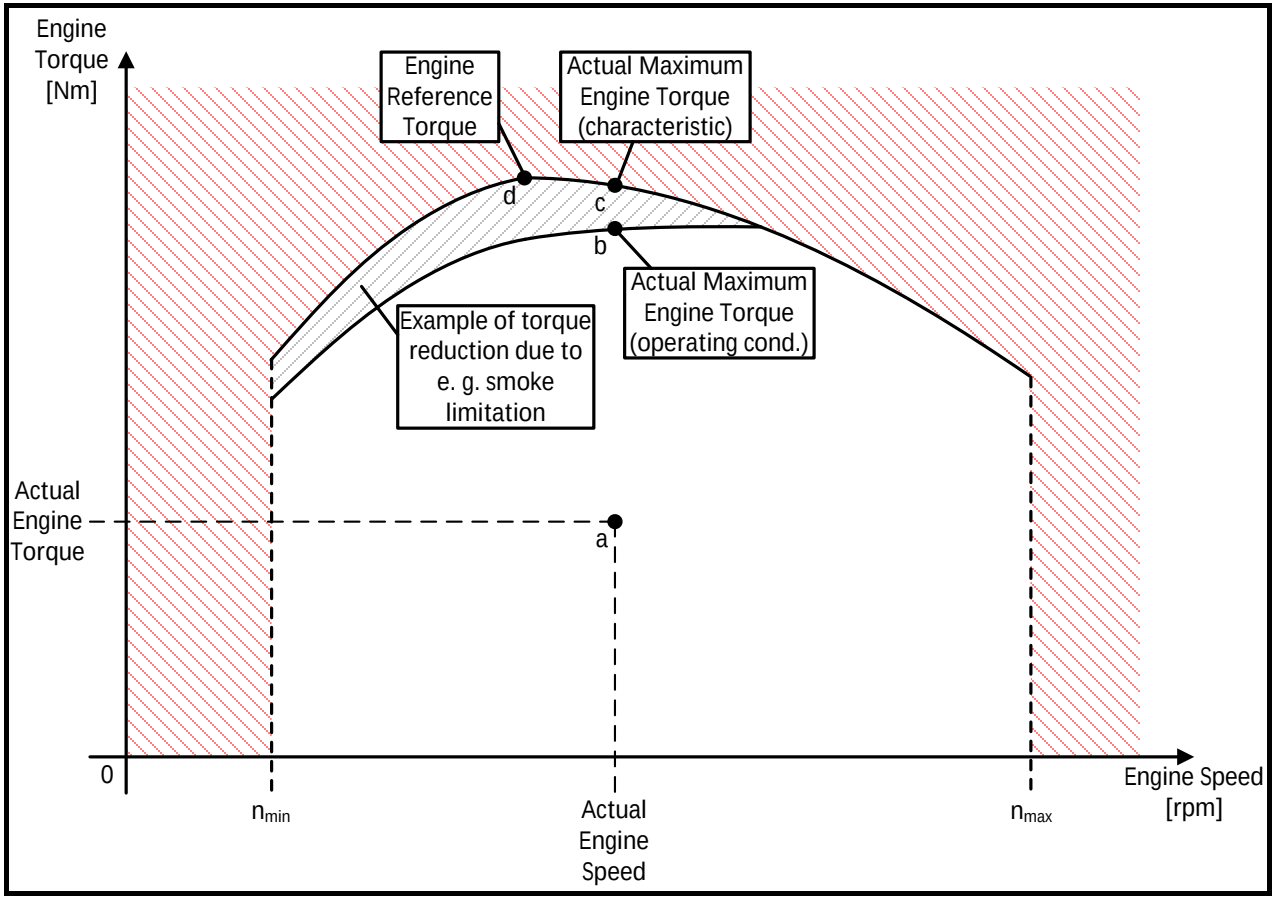


Fig 7.1: Illustrated example of the PLACS and AEPT formula interaction

$PLACS = \frac{\text{Actual Engine Torque (a)} + \text{Actual Friction Torque}}{\text{Actual Maximum Engine Torque (characteristic)(c)} + \text{Actual Friction Torque}}$	$PLACS = \frac{\text{Actual Engine Torque(a)} + \text{Actual Friction Torque}}{\text{Actual Maximum Engine Torque (operating cond.)(b)} + \text{Actual Friction Torque}}$

Parameters:

PGR	No.	Parameter	min	max	default	unit	description
01	94	SPN 92 Conversion Mode	0	1	1		mode on how SPN92 (Engine Percent Load at Current Speed) should be sent on J1939. Either smoke limitation is considered (for AGS2) or not 0=Smoke Limitation not considered, 1=Smoke Limitation considered

Outputs:

– SAE J1939 Signal: PGN 61443, “Electronic Engine Controller 2” (EEC2)
SPN 92, “Engine Percent Load At Current Speed”

Example:

If the used automated gearbox uses e. g. a smoke limitation the maximum engine load provided by the engine will not match the theoretical maximum computed by means of the engine torque curve. In this case, to receive the correct maximum torque value via SPN 92 it is necessary to use the above mentioned parameter to take the existing limitations into account.

7.1.3. Actual Engine Percent Torque (AEPT)

A second possibility to check on the Actual engine torque is the SAE J1939 signal SPN 513 (“Actual Engine – Percent Torque”). It is send with the CAN message EEC1 (“Electronic Engine Controller 1”) (refer to chapter 7.5).

This signal provides the ratio between the actual engine torque (minus the actual friction torque) and an engine reference torque which does not chance with the current engine operating conditions.

Diagnoctics:

– Analog Value: EEC1 Controlling Device SA (chapter 6.3.1)

$$AEPT = \frac{\text{Actual Engine Torque(a)} + \text{Actual Friction Torque}}{\text{Engine Reference Torque(d)}}$$

Outputs:

– SAE J1939 Signal: EEC1, “Electronic Engine Controller 1”,
SPN 513, “Actual Engine – Percent Torque”

7.2. Engine Limp Home / PT-CAN Failure

If a CAN failure occurs, the engine operating mode changes to engine limp home mode. The MCM2 response to a CAN failure can be set in parameter 01/15 (“Engine CAN Limp Home Mode”).

Parameter:

PGR	No.	Parameter	min	max	default	unit	description
01	15	Engine CAN Limp Home Mode	0	3	0		Engine CAN Limp Home Mode Limp home mode if engine CAN fails 0=idle speed, 1=engine stop, 2=limp home speed, 3=limp home speed

The following table shows a more detailed description of the possible parameter values:

Parameter value	Description
0 = idle speed	MCM idle speed (fuelmap)
1 = engine stops	Engine shutdown
2 = limp home speed	MCM calibration dependant (current value 800 min^{-1})
3 = limp home speed	Reserved (equals value 2)

7.3. J1939 CAN message – RESET

The J1939 CAN signal “Trip Group 1” received via J1939 CAN message RESET (PGN 56832) is used to reset the trip fuel value send via J1939 CAN signal “Engine Trip Fuel” (SPN 182) in the J1939 CAN message LFC (PGN 65257, “Fuel Consumption (Liquid)”). The beforementioned CAN message consists of 2 bits which can be set to the following values:

Bit setting	Value description
00	Take no action
01	Reset
10	Reserved
11	Not applicable

Parameter:

PGR	No.	Parameter	min	max	default	unit	description
01	76	J1939 Source Addr Reset	0	255	254		SAE J1939 Source Address RESET 0..255=signal

7.4. J1939 Rx Messages and Signals

Content	**Supported J1939 Rx messages and signals**
ECU	**CPC4**
SW-Version	**R32_00_000A**
	Not used for Tier4 / Euro6

“Periodic / Request”	Shows whether the message is send periodically or only if requested by a bus node.
“Source Address”	Configured Source Address(es) of the different CAN messages.
“Info”	Information regarding signal specific data

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	Periodic	Request	Source Address	Info
65135	ACC1	4	3..1	Adaptive Cruise Control Mode	1590	100ms		ACC Source Address SAE J1939	
65135	ACC1	7	2,1	ACC Target Detected	1798	100ms		ACC Source Address SAE J1939	
65135	ACC1	7	8,7	Forward Collision Warning	5022	100ms		ACC Source Address SAE J1939	
65198	AIR1	1	8..1	Pneumatic Supply Pressure	46	1000ms		AIR1 Source Address 1 SAE J1939	Source Address1
65198	AIR1	1	8..1	Pneumatic Supply Pressure	46	1000ms		AIR1 Source Address 2 SAE J1939	Source Address2
65198	AIR1	2	8..1	Parking and/or Trailer Air Pressure	1086	1000ms		AIR1 Source Address 1 SAE J1939	Source Address1
65198	AIR1	2	8..1	Parking and/or Trailer Air Pressure	1086	1000ms		AIR1 Source Address 2 SAE J1939	Source Address2
65198	AIR1	3	8..1	Service Brake Circuite 1 Air Pressure	1087	1000ms		AIR1 Source Address 1 SAE J1939	Source Address1
65198	AIR1	3	8..1	Service Brake Circuite 1 Air Pressure	1087	1000ms		AIR1 Source Address 2 SAE J1939	Source Address2
65198	AIR1	4	8..1	Service Brake Circuite 2 Air Pressure	1088	1000ms		AIR1 Source Address 1 SAE J1939	Source Address1
65198	AIR1	4	8..1	Service Brake Circuite 2 Air Pressure	1088	1000ms		AIR1 Source Address 2 SAE J1939	Source Address2
65198	AIR1	5	8..1	Auxiliary Equipment Supply Pressure	1089	1000ms		AIR1 Source Address 1 SAE J1939	Source Address1
65198	AIR1	5	8..1	Auxiliary Equipment Supply Pressure	1089	1000ms		AIR1 Source Address 2 SAE J1939	Source Address2
65198	AIR1	6	8..1	Air Suspension Supply Pressure	1090	1000ms		AIR1 Source Address 1 SAE J1939	Source Address1
65198	AIR1	6	8..1	Air Suspension Supply Pressure	1090	1000ms		AIR1 Source Address 2 SAE J1939	Source Address2
65198	AIR1	7	2,1	Air Compressor Status	1351	1000ms		AIR1 Source Address 1 SAE J1939	Source Address1
65198	AIR1	7	2,1	Air Compressor Status	1351	1000ms		AIR1 Source Address 2 SAE J1939	Source Address2

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	Periodic	Request	Source Address	Info
65269	AMB	5,4	8..1	Ambient Air Temperature	171	1000ms		J1939 AMB Source Address	
65126	BM	1	2,1	Battery Main Switch Hold State	1681	1000ms		BM Source Address SAE J1939	
65265	CCVS1	1	2,1	Two Speed Axle Switch	69	100ms		CC1 Source Address SAE J1939 CC2 Source Address SAE J1939 CC3 Source Address SAE J1939	The three source address parrameters have to be set to different values!
65265	CCVS1	1	4,3	Parking Brake Switch	70	100ms		CC1 Source Address SAE J1939 CC2 Source Address SAE J1939 CC3 Source Address SAE J1939	The three source address parrameters have to be set to different values!
65265	CCVS1	1	6,5	Cruise Control Pause Switch	1633	100ms		CC1 Source Address SAE J1939 CC2 Source Address SAE J1939 CC3 Source Address SAE J1939	The three source address parrameters have to be set to different values!
65265	CCVS1	3,2	8..1	Wheel-Based Vehicle Speed	84	100ms		CC1 Source Address SAE J1939 CC2 Source Address SAE J1939 CC3 Source Address SAE J1939	The three source address parrameters have to be set to different values!
65265	CCVS1	4	4,3	Cruise Control Enabel Switch	596	100ms		CC1 Source Address SAE J1939 CC2 Source Address SAE J1939 CC3 Source Address SAE J1939	The three source address parrameters have to be set to different values!
65265	CCVS1	4	6,5	Brake Switch	597	100ms		CC1 Source Address SAE J1939 CC2 Source Address SAE J1939 CC3 Source Address SAE J1939	The three source address parrameters have to be set to different values!
65265	CCVS1	4	8,7	Clutch Switch	598	100ms		CC1 Source Address SAE J1939 CC2 Source Address SAE J1939 CC3 Source Address SAE J1939	The three source address parrameters have to be set to different values!
65265	CCVS1	5	2,1	Cruise Control Set Switch	599	100ms		CC1 Source Address SAE J1939 CC2 Source Address SAE J1939 CC3 Source Address SAE J1939	The three source address parrameters have to be set to different values!
65265	CCVS1	5	4,3	Cruise Control Coast (Decelerate) Switch	600	100ms		CC1 Source Address SAE J1939 CC2 Source Address SAE J1939 CC3 Source Address SAE J1939	The three source address parrameters have to be set to different values!
65265	CCVS1	5	6,5	Cruise Control Resume Switch	601	100ms		CC1 Source Address SAE J1939 CC2 Source Address SAE J1939 CC3 Source Address SAE J1939	The three source address parrameters have to be set to different values!
65265	CCVS1	5	8,7	Cruise Control Accelerate Switch	602	100ms		CC1 Source Address SAE J1939 CC2 Source Address SAE J1939 CC3 Source Address SAE J1939	The three source address parrameters have to be set to different values!
65265	CCVS1	8	8,7	Engine Shutdown Override Switch	1237	100ms		CC1 Source Address SAE J1939 CC2 Source Address SAE J1939 CC3 Source Address SAE J1939	The three source address parrameters have to be set to different values!
2560	CCVS2	1	2,1	Cruise Control disable Command	5603	100ms		ACC Source Address SAE J1939	
2560	CCVS2	1	4,3	Cruise Control Resume Command	5604	100ms		ACC Source Address SAE J1939	
2560	CCVS2	1	6,5	Cruise Control Pause Command	5605	100ms		ACC Source Address SAE J1939	

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	Periodic	Request	Source Address	Info
57344	CM1	1	8..1	Requested Percent Fan Speed	986	1000ms		CM1 DPF Source Addr SAE J1939 CM1 Fan Source Addr2 SAE J1939 DPF CM1 Source Address J1939 CM1 Fan Source Addr1 SAE J1939 CM1 Source Address 5 SAE J1939	
57344	CM1	6	2,1	Diesel Particulate Filter Regenaration Inhibit Switch	3695	1000ms		CM1 DPF Source Addr SAE J1939 CM1 Fan Source Addr2 SAE J1939 DPF CM1 Source Address J1939 CM1 Fan Source Addr1 SAE J1939 CM1 Source Address 5 SAE J1939	
57344	CM1	6	4,3	Diesel Particulate Filter Regeneration Force Switch	3696	1000ms		CM1 DPF Source Addr SAE J1939 CM1 Fan Source Addr2 SAE J1939 DPF CM1 Source Address J1939 CM1 Fan Source Addr1 SAE J1939 CM1 Source Address 5 SAE J1939	
57344	CM1	8	8..1	Selected Maximum Vehicle Speed Limit	2596	1000ms		CM1 DPF Source Addr SAE J1939 CM1 Fan Source Addr2 SAE J1939 DPF CM1 Source Address J1939 CM1 Fan Source Addr1 SAE J1939 CM1 Source Address 5 SAE J1939	
64980	CM3	1	3..1	Transfer Case Selector Switch	2796		x	CM3 Source Address SAE J1939	
64773	DLCD1	1	4,3	Engine Amber Warning Lamp Data	5094		x	Engine Source Address J1939 (0x0)	
64773	DLCD1	1	6,5	Engine Red Stop Lamp Data	5095		x	Engine Source Address J1939 (0x0)	
64773	DLCD1	1	8,7	OBD Malfunktion Indicator Lamp Data	5096		x	Engine Source Address J1939 (0x0)	
64773	DLCD1	2	2,1	Engine Brake Active Lamp Data	5097		x	Engine Source Address J1939 (0x0)	
64773	DLCD1	2	4,3	Compression Brake Enable Switch Indicator Lamp Data	5098		x	Engine Source Address J1939 (0x0)	
64773	DLCD1	2	6,5	Engine Oil Pressure Low Lamp Data	5099		x	Engine Source Address J1939 (0x0)	
64773	DLCD1	2	8,7	Engine Coolant Temperature High Lamp Data	5100		x	Engine Source Address J1939 (0x0)	
64773	DLCD1	3	2,1	Engine Coolant Level Low Lamp Data	5101		x	Engine Source Address J1939 (0x0)	
64773	DLCD1	3	4,3	Engine Idle Management Active Lamp Data	5102		x	Engine Source Address J1939 (0x0)	
64773	DLCD1	3	6,5	Engine Air Filter Restriction Lamp Data	5103		x	Engine Source Address J1939 (0x0)	
64773	DLCD1	3	8,7	Engine Fuel Filter Restricted Lamp Data	5470		x	Engine Source Address J1939 (0x0)	
65226	DM1	1	4,3	Amber Warning Lamp Status	624	1000ms		Trans Source Address J1939	

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	Periodic	Request	Source Address	Info
65226	DM1	1	6,5	Red Stop Lamp Status	623	1000ms		Trans Source Address J1939	
65226	DM1	5	5,1	Failture Mode Identifier	1215	1000ms		Trans Source Address J1939	
65226	DM1	5 4	8..6 8..1	Suspect Parameter Number	1214	1000ms		Trans Source Address J1939	
57088	DM13	1	2,1	J1939 Network #1, Primary vehicle network	639		x		
57088	DM13	1	6,5	J1587	608		x		
57088	DM13	1	8,7	Current Data Link	1230		x		
57088	DM13	4	8,5	Hold Signal	1236		x		
61446	EAC1	2	2,1	Differential Lock State - Front Axle 1	567	500ms		EAC1 Source Address SAE J1939	
61446	EAC1	2	4,3	Differential Lock State - Front Axle 2	568	500ms		EAC1 Source Address SAE J1939	
61446	EAC1	2	6,5	Differential Lock State - Rear Axle 1	569	500ms		EAC1 Source Address SAE J1939	
61446	EAC1	2	8,7	Differential Lock State - Rear Axle 2	570	500ms		EAC1 Source Address SAE J1939	
61446	EAC1	3	2,1	Differential Lock State - Central	564	500ms		EAC1 Source Address SAE J1939	
61446	EAC1	3	4,3	Differential Lock State - Central Front	565	500ms		EAC1 Source Address SAE J1939	
61446	EAC1	3	6,5	Differential Lock State - Central Rear	566	500ms		EAC1 Source Address SAE J1939	
61441	EBC1	1	2,1	ASR Engine Control Active	561	100ms		ABS Source Address SAE J1939	
61441	EBC1	1	4,3	ASR Brake Control Active	562	100ms		ABS Source Address SAE J1939	
61441	EBC1	1	6,5	Anti-Lock Braking (ABS) Active	563	100ms		ABS Source Address SAE J1939	
61441	EBC1	1	8,7	EBS Brake Switch	1121	100ms		ABS Source Address SAE J1939	
61441	EBC1	2	8..1	Brake Pedal Position	521	100ms		ABS Source Address SAE J1939	
61441	EBC1	3	6,5	ASR "Hill Holder" Switch	577	100ms		ABS Source Address SAE J1939	
61441	EBC1	4	8,7	Remote Accelerator Enable Switch	969	100ms		J1939 Second Engine Address	
61441	EBC1	5	8..1	Engine Retarder Selection	973	100ms		EBC1 Source Address SAE J1939	
61441	EBC1	6	2,1	ABS Fully Operational	1243	100ms		ABS Source Address SAE J1939	
61441	EBC1	6	8,7	ATC/ASR Information Signal	1793	100ms		ABS Source Address SAE J1939	
61441	EBC1	8	6,5	Trailer ABS Status	1836	100ms		ABS Source Address SAE J1939	
61441	EBC1	8	8,7	Tractor-Mounted Trailer ABS Warning Signal	1792	100ms		ABS Source Address SAE J1939	
65215	EBC2	2,1	8..1	Front Axle Speed	904	100ms		ABS Source Address SAE J1939	
65215	EBC2	3	8..1	Relative Speed; Front Axle, Left	905	100ms		ABS Source Address SAE J1939	

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	Periodic	Request	Source Address	Info
				Wheel					
65215	EBC2	4	8..1	Relative Speed; Front Axle, Right Wheel	906	100ms		ABS Source Address SAE J1939	
64964	EBC5	1	8..6	Hill holder mode	2912	100ms		ABS Source Address SAE J1939	
61443	EEC2	1	2,1	Accelerator Pedal 1 Low Idle Switch	558	50ms		J1939 Second Engine Address	
61443	EEC2	1	4,3	Accelerator Pedal Kickdown Switch	559	50ms		J1939 Second Engine Address	
61443	EEC2	2	8..1	Accelerator Pedal Position 1	91	50ms		J1939 Second Engine Address	
61443	EEC2	4	8..1	Remote Accelerator Pedal Position	974	50ms		J1939 Second Engine Address	
61440	ERC1	2	6,5	Actual Retarder - Percent Torque	520	100ms		Trans Retarder Srce Addr J1939	
61440	ERC1	7	8..1	Retarder Selection, non-engine	1716	100ms		Trans Retarder Srce Addr J1939	
61442	ETC1	1	2,1	Transmission Driveline Engaged	560	10ms		Trans Source Address J1939	
61442	ETC1	1	4,3	Transmission Torque Converter Lockup Engaged	573	10ms		Trans Source Address J1939	
61442	ETC1	1	6,5	Transmission Shift In Process	574	10ms		Trans Source Address J1939	
61442	ETC1	3,2	8..1	Transmission Output Shaft Speed	191	10ms		Trans Source Address J1939	
61442	ETC1	4	8..1	Percent Clutch Slip	522	10ms		Trans Source Address J1939	
61442	ETC1	5	2,1	Engine Momentary Verspeed Enable	606	10ms		Trans Source Address J1939	
61442	ETC1	5	4,3	Progessive Shift Disable	607	10ms		Trans Source Address J1939	
61442	ETC1	7,6	8..1	Transmission Input Shaft Speed	161	10ms		Trans Source Address J1939	
61445	ETC2	1	8..1	Transmission Selected Gear	524	100ms		Trans Source Address J1939	
61445	ETC2	3,2	8..1	Transmission Actual Gear Ratio	526	100ms		Trans Source Address J1939	
61445	ETC2	4	8..1	Transmission Current Gear	523	100ms		Trans Source Address J1939	
61445	ETC2	6,5	8..1	Transmission Requested Range	162	100ms		Trans Source Address J1939	
65098	ETC7	2	6,5	Transmission Engine Crank Enable	2900	100ms		Trans Source Address J1939	
65134	HRW	2,1	8..1	Front Axle, Left Wheel Speed	1592	20ms		ABS Source Address SAE J1939	
65134	HRW	4,3	8..1	Front Axle, Right Wheel Speed	1593	20ms		ABS Source Address SAE J1939	
65134	HRW	6,5	8..1	Rear Axle, Left Wheel Speed	1594	20ms		ABS Source Address SAE J1939	
65134	HRW	8,7	8..1	Rear Axle, Right Wheel Speed	1595	20ms		ABS Source Address SAE J1939	
64971	OHECS	2	8..1	Engine Alternate Rating Select	2882	500ms		Source Address OHECS	
64971	OHECS	3	4..1	Engine Alternate Droop Accelerator 1 Select	2881	500ms		Source Address OHECS	
65280	PropB00_VRDU_E12	1	2,1	ABA_Actv_Stat		100ms		ACC Source Address SAE J1939	0 = Inactive (NACT) 1 = Active (ACTIVE) 2 = Reserved (RES)

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	Periodic	Request	Source Address	Info
									3 = Signal not available (SNA)
65280	PropB00_VRDU_E12	2	4,3	CC_ShutDn_Rq		100ms		ACC Source Address SAE J1939	0 = No request (NRQ) 1 = Request (RQ) 2 = Reserved (RES) 3 = Signal not available (SNA)
65280	PropB00_VRDU_E12	7	8..5	MC_E12_Cval_VRDU		100ms		ACC Source Address SAE J1939	Faktor: 1, Offset: 0, Unit: -, Range: 0..15 = signal
65280	PropB00_VRDU_E12	8	8..1	CRC_E12_Cval_VRDU		100ms		ACC Source Address SAE J1939	Faktor: 1, Offset: 0, Unit: -, Range: 0..255 = signal
65282	PropB02_VRDU	2,1	8..1	ACC_ExtAccel_Rq		20ms		ACC Source Address SAE J1939	Faktor: 0,00048828125, Offset: -15,687, Unit: m/s², Range: 0..65534 = signal
65282	PropB02_VRDU	3	2,1	Acc_Actv_Stat		20ms		ACC Source Address SAE J1939	0 = Inactive (NACT) 1 = Active (ACTIVE) 2 = Reserved (RES) 3 = Signal not available (SNA)
65282	PropB02_VRDU	3	4,3	ACC_ShutDn_Rq		20ms		ACC Source Address SAE J1939	0 = No request (NRQ) 1 = Request (RQ) 2 = Reserved (RES) 3 = Signal not available (SNA)
65282	PropB02_VRDU	7	8..5	MC_E3_Cval_VRDU		20ms		ACC Source Address SAE J1939	Faktor: 1, Offset: 0 Unit: -, Range: 0..15 = signal
65282	PropB02_VRDU	8	8..1	CRC_E3Cval_VRDU		20ms		ACC Source Address SAE J1939	Faktor: 1, Offset: 0 Unit: -, Range: 0..255 = signal
65284	PropB04	1	2,1	EssEngStopFlag		100ms		J1939 PropB04 Source Address	0 = No engine stop 1 = Engine stop request 2 = Error 3 = Signal not available (SNA)
65284	PropB04	1	4,3	ESSEngStartFlag		100ms		J1939 PropB04 Source Address	0 = No engine start 1 = Engine start request 2 = Error 3 = Signal not available (SNA)
65284	PropB04	1	5,6	EssSartLockFlag		100ms		J1939 PropB04 Source Address	0 = No starter lock 1 = Starter lock eequest 2 = Error 3 = Signal not available (SNA)
65284	PropB04	8	4..1	MessageCounter		100ms		J1939 PropB04 Source Address	Faktor: 1, Offset: 0 Unit: -, Range: 0..15 = signal
65284	PropB04	8	8..5	MessageChecksum		100ms		J1939 PropB04 Source Address	Faktor: 1, Offset: 0 Unit: -, Range: 0..15 = signal

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	Periodic	Request	Source Address	Info
65286	PropB06	1	2,1	AccCcModeSwitch		20ms		PROP06 Source Address SAE J1939	0 = Not pressed (OK) 1 = Pressed (OK) 2 = Error (ERR) 3 = Signal not available (SNA)
65286	PropB06	1	4,3	LimIdleModeSwitch		20ms		PROP06 Source Address SAE J1939	0 = Not pressed (OK) 1 = Pressed (OK) 2 = Error (ERR) 3 = Signal not available (SNA)
65286	PropB06	1	6,5	CruiseCtrlInHystSwitchReq		20ms		PROP06 Source Address SAE J1939	0 = Not pressed (OK) 1 = Pressed (OK) 2 = Error (ERR) 3 = Signal not available (SNA)
65286	PropB06	1	8,7	CruiseCtrlDecHystSwitchReq		20ms		PROP06 Source Address SAE J1939	0 = Not pressed (OK) 1 = Pressed (OK) 2 = Error (ERR) 3 = Signal not available (SNA)
65286	PropB06	2	2,1	ManeuverModeReq		20ms		PROP06 Source Address SAE J1939	0 = Not pressed (OK) 1 = Pressed (OK) 2 = Error (ERR) 3 = Signal not available (SNA)
65286	PropB06	2	4,3	RockOutModeReq		20ms		PROP06 Source Address SAE J1939	0 = No request (NRQ) 1 = Request (RQ) 2 = Error (ERR) 3 = Signal not available (SNA)
65286	PropB06	2	6,5	CreepModeDeactReq		20ms		PROP06 Source Address SAE J1939	0 = Not pressed (OK) 1 = Pressed (OK) 2 = Error (ERR) 3 = Signal not available (SNA)
65286	PropB06	2	8,7	EcoRollModeReq		20ms		PROP06 Source Address SAE J1939	0 = No request (NRQ) 1 = Request (RQ) 2 = Error (ERR) 3 = Signal not available (SNA)
65286	PropB06	3	8..1	BrakePedalPosn3_EBS		20ms		PROP06 Source Address SAE J1939	Faktor: 0.4, Offset: 0, Unit: %, Range: 0..250 = signal
65286	PropB06	4	2,1	BrakeSwitchReq2_EBS		20ms		PROP06 Source Address SAE J1939	0 = Not pressed (OK) 1 = Pressed (OK) 2 = Error (ERR) 3 = Signal not available (SNA)
65286	PropB06	4	4,3	SecondCabControlCmd		20ms		PROP06 Source Address SAE J1939	0 = No request (NRQ) 1 = Request (RQ) 2 = Error (ERR) 3 = Signal not available (SNA)

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	Periodic	Request	Source Address	Info
65286	PropB06	7	8,7	AwakeCmd		20ms		PROP06 Source Address SAE J1939	0 = No request (NRQ) 1 = Request (RQ) 2 = Error (ERR) 3 = Signal not available (SNA)
65286	PropB06	8	4..1	MessageCounter		20ms		PROP06 Source Address SAE J1939	Faktor: 1, Offset: 0 Unit: -, Range: 0..15 = signal
65286	PropB06	8	8..5	MessageChecksum		20ms		PROP06 Source Address SAE J1939	Faktor: 1, Offset: 0 Unit: -, Range: 0..15 = signal
65287	PropB07	1	4..1	DrvModeSwitchNormReq_AuxGSI		50ms		PROP07 Source Address SAE J1939	0 = Not defined (OOR) 1 = Switch at neutral (OK) 2 = Switch at D-Norm (OK) 3 = Not defined (OOR) 4 = Switch at R-Norm (OK) 5..12 = Not defined (OOR) 13 = Error, Hardware Poti1 or Poti2 (OK) 14 = Error, Position implausible (OK) 15 = Signal not available (SNA)
65287	PropB07	1	8..5	GearSelSwitchReq_AuxGSI		50ms		PROP07 Source Address SAE J1939	0 = Not defined (OOR) 1 = No switch (OK) 2 = Switch down (OK) 3 = Not defined (OOR) 4 = Switch bent up (OK) 5..12 = Not defined (OOR) 13 = Error, hardware hall sensor (OK) 14 = Error, Position implausible (OK) 15 = Signal not available (SNA)
65287	PropB07	2	2,1	AutoManSwitchReq_AuxGSI		50ms		PROP07 Source Address SAE J1939	0 = Not pressed (OK) 1 = Pressed (OK) 2 = Error (ERR) 3 = Signal not available (SNA)
65287	PropB07	2	4,3	IntenalErrorStat_AuxGSI		50ms		PROP07 Source Address SAE J1939	0 = Not pressed (OK) 1 = Pressed (OK) 2 = Error (ERR) 3 = Signal not available (SNA)

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	Periodic	Request	Source Address	Info
65287	PropB07	2	6,5	ManeuverModeReq		50ms		PROP07 Source Address SAE J1939	0 = Not pressed (OK) 1 = Pressed (OK) 2 = Error (ERR) 3 = Signal not available (SNA)
65287	PropB07	2	8,7	RockOutModeReq		50ms		PROP07 Source Address SAE J1939	0 = No request (NRQ) 1 = Request (RQ) 2 = Error (ERR) 3 = Signal not available (SNA)
65287	PropB07	3	4..1	DrvSuperStructureReq		50ms		PROP07 Source Address SAE J1939	0 = No request 1 = Restricted mode request 2 = Full mode request 3 = Reserved_1 4 = Reserved_2 5..13 = Not defined 14 = Error 15 = Signal not available (SNA)
65287	PropB07	3	6,5	SecondCabControlCmd		50ms		PROP07 Source Address SAE J1939	0 = No request (NRQ) 1 = Request (RQ) 2 = Error (ERR) 3 = Signal not available (SNA)
65287	PropB07	7	8,7	AwakeCmd		50ms		PROP07 Source Address SAE J1939	0 = No request (NRQ) 1 = Request (RQ) 2 = Error (ERR) 3 = Signal not available (SNA)
65287	PropB07	8	4..1	MessageCounter		50ms		PROP07 Source Address SAE J1939	Faktor: 1, Offset: 0 Unit: -, Range: 0..15 = signal
65287	PropB07	8	8..5	MessageChecksum		50ms		PROP07 Source Address SAE J1939	Faktor: 1, Offset: 0 Unit: -, Range: 0..15 = signal
65297	PropB11	1	2,1	Prop11_EngStopReqStat			x	FUSO ISS Source Addr SAE J1939	0 = Not Active 1 = Active 2 = SNV
65297	PropB11	1	4,3	Prop11_EngStartReqStat			x	FUSO ISS Source Addr SAE J1939	0 = Not Active 1 = Active 2 = SNV
65297	PropB11	1	6,5	Prop11_EngCancelStartStopReqStat			x	FUSO ISS Source Addr SAE J1939	0 = Not Active 1 = Active 2 = SNV
65313	PropB21	1	8..1	Prop21_Byte0			x	J1939 SAM Source Address	Faktor: 1, Offset: 0, Unit: -, Range: 0..255 = signal
65313	PropB21	2	8..1	Prop21_Byte1			x	J1939 SAM Source Address	Faktor: 1, Offset: 0, Unit: -,

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	Periodic	Request	Source Address	Info
									Range: 0..255 = signal
65314	PropB22	4	4..1	Prop22PnmLevStat_u4			x	J1939 SAM Source Address	Faktor: 0.1, Offset: 0, Unit: %, Range: 0..10000 = signal
65316	PropB24	2 1	2,1 8..1	Prop24AcPresPerc			x	J1939 Prop24 Source Address4	Faktor: 0.1, Offset: 0, Unit: %, Range: 0..10000 = signal
65287	PropB50	1	8..1	EngSpeedGovernorDroop	5568	500ms		PropB50 Source Address SAE J1939	Faktor: 0.04, Offset: 0, Unit: %, Range: 0..250 = signal
65380	PropB64	1	3..1	Prop64PccStat			x	J1939 PCC Source Address	Predictive Cruise Control, additional HW needed Faktor: 1, Offset: 0, Unit: -, Range: 0..6 = signal
65380	PropB64	3,2	8..1	Prop64DesVspeed			x	J1939 PCC Source Address	Predictive Cruise Control, additional HW needed Faktor: 0.00390625, Offset: 0, Unit: km/h, Range: 0..64000 = signal
65380	PropB64	8	8..1	Prop64RollCnt			x	J1939 PCC Source Address	Predictive Cruise Control, additional HW needed Faktor: 1, Offset: 0, Unit: -, Range: 0..255 = signal
65381	PropB65	2,1	8..1	Prop65VehMass			x	J1939 PCC Source Address	Predictive Cruise Control, additional HW needed Faktor: 1, Offset: 0, Unit: kg, Range: 0..65534 = signal
65381	PropB65	4,3	8..1	Prop65ActRoadGrad			x	J1939 PCC Source Address	Predictive Cruise Control, additional HW needed Faktor: 0.1, Offset: -25, Unit: -, Range: 0..500 = signal
65381	PropB65	6,5	8..1	Prop65ActElev			x	J1939 PCC Source Address	Predictive Cruise Control, additional HW needed Faktor: 1, Offset: -1000, Unit: m, Range: 0..2000 = signal
65381	PropB65	7	8..1	Prop65TerritoryStat			x	J1939 PCC Source Address	Predictive Cruise Control, additional HW needed Faktor: 1, Offset: 0, Unit: -, Range: 0..250 = signal
65381	PropB65	8	8..1	Prop65VspeedCorrPerc			x	J1939 PCC Source Address	Predictive Cruise Control, additional HW needed Faktor: 1, Offset: -125, Unit: -, Range: 0..250 = signal

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	Periodic	Request	Source Address	Info
65264	PTO	6	6,5	Engine Remote PTO Governor Preprogrammed Speed Control Switch	979	100ms		PTO Source Address SAE J1939	
64932	PTODE	1	5,4	Enable Switch - Trasmission input shaft PTO2	3453	100ms		PTODE Source Address SAE J1939	
64932	PTODE	1	7,6	Enable Switch - Transmission input shaft PTO1	3452	100ms		PTODE Source Address SAE J1939	
64932	PTODE	2	2,1	Enable switch - PTO Engine Flywheel	3939	100ms		PTODE Source Address SAE J1939	
56832	RESET	1	2,1	Trip Fault 1	988		x	J1939 Source Addr Reset	
65249	RC	1	4..1	Retarder Type	901	5000ms		Trans Retarder Srce Addr J1939	
65249	RC	1	8..5	Retarder Location	902	5000ms		Trans Retarder Srce Addr J1939	
65249	RC	2	8..1	Retarder Control Method (Retarder Configuration)	557	5000ms		Trans Retarder Srce Addr J1939	
65249	RC	4,3	8..1	Retarder Speed At Idle, Point 1 (Retarder Configuration)	546	5000ms		Trans Retarder Srce Addr J1939	
65249	RC	5	8..1	Percent Torque At Idle, Point 1 (Retarder Configuration)	551	5000ms		Trans Retarder Srce Addr J1939	
65249	RC	7,6	8..1	Maximum Retarder Speed, Point 2 (Retarder Configuration)	548	5000ms		Trans Retarder Srce Addr J1939	
65249	RC	8	8..1	Percent Torque At Maximum Speed, Point 2 (Retarder Configuration)	552	5000ms		Trans Retarder Srce Addr J1939	
65249	RC	10,9	8..1	Retarder Speed At Point 3 (Retarder Configuration)	549	5000ms		Trans Retarder Srce Addr J1939	
65249	RC	11	8..1	Percent Torque At Point 3 (Retarder Configuration)	553	5000ms		Trans Retarder Srce Addr J1939	
65249	RC	13,12	8..1	Retarder Speed At Point 4 (Retarder Configuration)	550	5000ms		Trans Retarder Srce Addr J1939	
65249	RC	14	8..1	Percent Torque At Point 4 (Retarder Configuration)	554	5000ms		Trans Retarder Srce Addr J1939	
65249	RC	16,15	8..1	Retarder Speed At Peak Torque, Point 5 (Retarder Configuration)	547	5000ms		Trans Retarder Srce Addr J1939	
65249	RC	18,17	8..1	Reference Retarder Torque (Retarder Configuration)	556	5000ms		Trans Retarder Srce Addr J1939	
65249	RC	19	8..1	Percent Torque At Peak Torque, Point (Retarder Configuration)	555	5000ms		Trans Retarder Srce Addr J1939	
65275	RF	2	8..1	Hydraulic Retarder Oil Temperature	120	1000ms		Trans Retarder Srce Addr J1939	
256	TC1	1	2,1	Transmission Gear Shift Inhibit Request	681	50ms		TC1 Source Address SAE J1939	
65099	TCFG2	2,1	8..1	Transmission Torque Limit	1845		x	Trans Source Address J1939	
64899	TCI	1	3..1	Transfer case status	3645	100ms		TCI Source Address SAE J1939	

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	Periodic	Request	Source Address	Info
65132	TCO1	6,5	8..1	Tachograph output shaft speed	1623	50ms		J1939 Source Addr Tachograph	
65132	TCO1	8,7	8..1	Tachograph vehicle speed	1624	50ms		J1939 Source Addr Tachograph	
0	TSC1 (Engine)	1	2,1	Engine Override Control Mode	695		x	ACC Source Address SAE J1939 Trans Source Address J1939 ABS Source Address SAE J1939 TSC1 Source Address SAE J1939 J1939 TSC1 Source Address4 AEBS Source Address SAE J1939	Engine
0	TSC1 (Engine)	1	4,3	Engine Requested Speed Control Conditions	696		x	ACC Source Address SAE J1939 Trans Source Address J1939 ABS Source Address SAE J1939 TSC1 Source Address SAE J1939 J1939 TSC1 Source Address4 AEBS Source Address SAE J1939	Engine
0	TSC1 (Engine)	1	6,5	Override Control Mode Priority	897		x	ACC Source Address SAE J1939 Trans Source Address J1939 ABS Source Address SAE J1939 TSC1 Source Address SAE J1939 J1939 TSC1 Source Address4 AEBS Source Address SAE J1939	Engine
0	TSC1 (Engine)	3,2	8..1	Engine Requested Speed/Speed Limit	898		x	ACC Source Address SAE J1939 Trans Source Address J1939 ABS Source Address SAE J1939 TSC1 Source Address SAE J1939 J1939 TSC1 Source Address4 AEBS Source Address SAE J1939	Engine
0	TSC1 (Engine)	4	8..1	Engine Requested Torque/Torque Limit	518		x	ACC Source Address SAE J1939 Trans Source Address J1939 ABS Source Address SAE J1939 TSC1 Source Address SAE J1939 J1939 TSC1 Source Address4 AEBS Source Address SAE J1939	Engine

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	Periodic	Request	Source Address	Info
0	TSC1 (Engine)	5	3..1	TSC1 Transmission Rate	3349		x	ACC Source Address SAE J1939 Trans Source Address J1939 ABS Source Address SAE J1939 TSC1 Source Address SAE J1939 J1939 TSC1 Source Address4 AEBS Source Address SAE J1939	Engine
0	TSC1 (Engine)	8	4..1	Message Counter	4206		x	ACC Source Address SAE J1939 Trans Source Address J1939 ABS Source Address SAE J1939 TSC1 Source Address SAE J1939 J1939 TSC1 Source Address4 AEBS Source Address SAE J1939	Engine
0	TSC1 (Engine)	8	8..5	Message Checksum	4207		x	ACC Source Address SAE J1939 Trans Source Address J1939 ABS Source Address SAE J1939 TSC1 Source Address SAE J1939 J1939 TSC1 Source Address4 AEBS Source Address SAE J1939	Engine
0	TSC1 (Ret)	1	2,1	Engine Override Control Mode	695		x	ACC Source Address SAE J1939 Trans Source Address J1939 ABS Source Address SAE J1939 TSC1 Source Address SAE J1939 J1939 TSC1 Source Address4 AEBS Source Address SAE J1939	EngineRetarder
0	TSC1 (Ret)	1	4,3	Engine Requested Speed Control Conditions	696		x	ACC Source Address SAE J1939 Trans Source Address J1939 ABS Source Address SAE J1939 TSC1 Source Address SAE J1939 J1939 TSC1 Source Address4 AEBS Source Address SAE J1939	EngineRetarder
0	TSC1 (Ret)	1	6,5	Override Control Mode Priority	897		x	ACC Source Address SAE J1939 Trans Source Address J1939 ABS Source Address SAE J1939 TSC1 Source Address SAE J1939 J1939 TSC1 Source Address4 AEBS Source Address SAE J1939	EngineRetarder

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	Periodic	Request	Source Address	Info
0	TSC1 (Ret)	3,2	8..1	Engine Requested Speed/Speed Limit	898		x	ACC Source Address SAE J1939 Trans Source Address J1939 ABS Source Address SAE J1939 TSC1 Source Address SAE J1939 J1939 TSC1 Source Address4 AEBS Source Address SAE J1939	EngineRetarder
0	TSC1 (Ret)	4	8..1	Engine Requested Torque/Torque Limit	518		x	ACC Source Address SAE J1939 Trans Source Address J1939 ABS Source Address SAE J1939 TSC1 Source Address SAE J1939 J1939 TSC1 Source Address4 AEBS Source Address SAE J1939	EngineRetarder
0	TSC1 (Ret)	8	4..1	Message Counter	4206		x	ACC Source Address SAE J1939 Trans Source Address J1939 ABS Source Address SAE J1939 TSC1 Source Address SAE J1939 J1939 TSC1 Source Address4 AEBS Source Address SAE J1939	EngineRetarder
0	TSC1 (Ret)	8	8..5	Message Checksum	4207		x	ACC Source Address SAE J1939 Trans Source Address J1939 ABS Source Address SAE J1939 TSC1 Source Address SAE J1939 J1939 TSC1 Source Address4 AEBS Source Address SAE J1939	EngineRetarder
0	TSC1 (Trans_Ret)	1	2,1	Engine Override Control Mode	695		x	ABS Source Address SAE J1939 TSC1 Source Address SAE J1939	TransmissionRetarder
0	TSC1 (Trans_Ret)	1	4,3	Engine Requested Speed Control Conditions	696		x	ABS Source Address SAE J1939 TSC1 Source Address SAE J1939	TransmissionRetarder

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	Periodic	Request	Source Address	Info
0	TSC1 (Trans_Ret)	1	6,5	Override Control Mode Priority	897		x	ABS Source Address SAE J1939 TSC1 Source Address SAE J1939	TransmissionRetarder
0	TSC1 (Trans_Ret)	3,2	8..1	Engine Requested Speed/Speed Limit	898		x	ABS Source Address SAE J1939 TSC1 Source Address SAE J1939	TransmissionRetarder
0	TSC1 (Trans_Ret)	4	8..1	Engine Requested Torque/Torque Limit	518		x	ABS Source Address SAE J1939 TSC1 Source Address SAE J1939	TransmissionRetarder
0	TSC1 (Trans_Ret)	8	4..1	Message Counter	4206		x	ABS Source Address SAE J1939 TSC1 Source Address SAE J1939	TransmissionRetarder
0	TSC1 (Trans_Ret)	8	8..5	Message Checksum	4207		x	ABS Source Address SAE J1939 TSC1 Source Address SAE J1939	TransmissionRetarder
65103	VDC1	1	2,1	VDC Information Signal	1813	100ms		VDC1 Source Address SAE J1939	
65103	VDC1	1	4,3	VDC Fully Operational	1814	100ms		VDC1 Source Address SAE J1939	
65103	VDC1	1	6,5	VDC brake light request	1815	100ms		VDC1 Source Address SAE J1939	
65103	VDC1	2	2,1	ROP EngineControl active	1816	100ms		VDC1 Source Address SAE J1939	
65103	VDC1	2	4,3	ROP Brake Control active	1818	100ms		VDC1 Source Address SAE J1939	

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	Periodic	Request	Source Address	Info
65103	VDC1	2	6,5	YC Engine Control active	1817	100ms		VDC1 Source Address SAE J1939	
65103	VDC1	2	8,7	YC Brake Control active	1819	100ms		VDC1 Source Address SAE J1939	

7.5. J1939 Tx Messages and Signals

Content	**Supported J1939 Tx messages and signals**
ECU	**CPC4**
SW-Version	**R32_00_000A**

“Periodic / Request”	Shows whether the message is send periodically (if yes à interval in ms) or only if requested by a bus node.
“Source Address”	Configured Source Address(es) of the different CAN messages.
“Destination Address”	Configured Destination Address(es) of the different CAN messages.
“Info”	Information regarding signal specific data

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	periodic	request	Source Address	Destination Address	Info
64830	A1SCREGT	2,1	8..1	Aftertreatment 1SCR Catalyst Intake Gas Temperature	4360	500ms		Engine Source Address J1939 (0x0)		
64830	A1SCREGT	5,4	8..1	Aftertreatment 1 SCR Catalyst Outlet Gas Temperature	4363	500ms		Engine Source Address J1939 (0x0)		
59392	ACKM	1	8..1	Control Byte	3558		x			
59392	ACKM	8..6	8..1	Parameter Group Number	3559		X			
64912	AETC	1	4..1	AETC Data Collection Standard	3558		x			
64912	AETC	1	8..5	Number of AETC data points	3559		x			
64912	AETC	a	8..1 8..1	AETC Speed Value	3560		x			Variable Size / Length depends on Number of Data Points defined in PGN 64912 / SPN 3559
64912	AETC	b	8..1 8..1	AETC Torque value	3561		x			Variable Size / Length depends on Number of Data Points defined in PGN 64912 / SPN 3559
65269	AMB	1	8..1	Barometic Pressure	108	1000ms		Engine Source Address J1939 (0x0)		
65269	AMB	5,4	8..1	Ambient Air Temperature	171	1000ms		Engine Source Address J1939 (0x0)		
65269	AMB	6	8..1	Engine Air Intake Temperature	172	1000ms		Engine Source Address J1939 (0x0)		

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	periodic	request	Source Address	Destination Address	Info
65237	AS	2,1	8..1	Alternator Speed	589	1000ms		Engine Source Address J1939 (0x0)		
65237	AS	3	2,1	Alternator 1 Status	3353	1000ms		Engine Source Address J1939 (0x0)		
64920	AT1HI	8..5	8..1	Aftertreatment 1 Total Regeneration Time	3523		x	Engine Source Address J1939 (0x0)		
64920	AT1HI	36..33	8..1	Aftertreatment 1 Average Time Between Active Regenerations	5454		x	Engine Source Address J1939 (0x0)		
64920	AT1HI	40..37	8..1	Aftertreatment 1 Average Distance Between Active DPFRegenerations	3523		x	Engine Source Address J1939 (0x0)		
65110	AT1T1I	1	8..1	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Level	1761	1000ms		Engine Source Address J1939 (0x0)		
65110	AT1T1I	2	8..1	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Temperature	3031	1000ms		Engine Source Address J1939 (0x0)		
65110	AT1T1I	5	8..6	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Low Level Indicator	5245	1000ms		Engine Source Address J1939 (0x0)		
65110	AT1T1I	6	8..6	Aftertreatment SCR Operator Inducement Severity	5246	1000ms		Engine Source Address J1939 (0x0)		
65110	AT1T1I	7	8..1	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Heater	3363	1000ms		Engine Source Address J1939 (0x0)		
64947	AT1O2	4,3	8..1	Aftertreatment 1 Diesel Particulate Filter Outlet Gas Temperature	3246	500ms		Engine Source Address J1939 (0x0)		
65261	CCSS	1	8..1	Maximum Vehicle Speed Limt	74		x	Engine Source Address J1939 (0x0)	CPC 0x0 or Global 0xFF	
65261	CCSS	2	8..1	Cruise Control High Set Limit Speed	87		x	Engine Source Address J1939 (0x0)	CPC 0x0 or Global 0xFF	
65261	CCSS	3	8..1	Cruise Control Low Limit Speed	88		x	Engine Source Address J1939 (0x0)	CPC 0x0 or Global 0xFF	
65265	CCVS1	1	2,1	Two Speed Axle Switch	69	100ms		Engine Source Address J1939 (0x0)		
65265	CCVS1	1	4,3	Parking Brake Switch	70	100ms		Engine Source Address J1939 (0x0)		
65265	CCVS1	1	6,5	Cruise Control Pause Switch	1633	100ms		Engine Source Address J1939 (0x0)		
65265	CCVS1	3,2	8..1	Wheel-Based Vehicle Speed	84	100ms		Engine Source Address J1939 (0x0)		

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	periodic	request	Source Address	Destination Address	Info
65265	CCVS1	4	2,1	Cruise Control Active	595	100ms		Engine Source Address J1939 (0x0)		
65265	CCVS1	4	4,3	Cruise Control Enable Switch	596	100ms		Engine Source Address J1939 (0x0)		
65265	CCVS1	4	6,5	Brake Switch	597	100ms		Engine Source Address J1939 (0x0)		
65265	CCVS1	4	8,7	Clutch Switch	598	100ms		Engine Source Address J1939 (0x0)		
65265	CCVS1	5	2,1	Cruise Control Set Switch	599	100ms		Engine Source Address J1939 (0x0)		
65265	CCVS1	5	4,3	Cruise Control Coast (Decelerate) Switch	600	100ms		Engine Source Address J1939 (0x0)		
65265	CCVS1	5	6,5	Cruise Control Resume Switch	601	100ms		Engine Source Address J1939 (0x0)		
65265	CCVS1	5	8,7	Cruise Control Accelerate Switch	602	100ms		Engine Source Address J1939 (0x0)		
65265	CCVS1	6	8..1	Cruise Control Set Speed	86	100ms		Engine Source Address J1939 (0x0)		
65265	CCVS1	7	5..1	PTO Governor State	976	100ms		Engine Source Address J1939 (0x0)		
65265	CCVS1	7	8..6	Cruise Control States	527	100ms		Engine Source Address J1939 (0x0)		
65265	CCVS1	8	2,1	Engine Idle Increment Switch	968	100ms		Engine Source Address J1939 (0x0)		
65265	CCVS1	8	4,3	Engine Idle Decrement Switch	967	100ms		Engine Source Address J1939 (0x0)		
65265	CCVS1	8	8,7	Engine Shutdown Override Switch	1237	100ms		Engine Source Address J1939 (0x0)		
64732	CCVS3	1	2,1	Adaptive Cruise Control Readiness Status	5606	1000ms		Engine Source Address J1939 (0x0)		
64732	CCVS3	1	5..3	Cruise Control System Command State	5607	1000ms		Engine Source Address J1939 (0x0)		
64732	CCVS3	2	8..1	Source Address of Device Disabling Cruise Control	5608	1000ms		Engine Source Address J1939 (0x0)		
64732	CCVS3	3	8..1	Source Address of Device Pausing Cruise Control	5609	1000ms		Engine Source Address J1939 (0x0)		

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	periodic	request	Source Address	Destination Address	Info
65259	CI		8..1	Unit Number (Power Unit)	233		x	Engine Source Address J1939 (0x0)		Variable Size - Current Length: 10 Byte
65259	CI		8..1	Make	586		x	Engine Source Address J1939 (0x0)		Variable Size - Current Length: 5 Byte
65259	CI		8..1	Model	587		x	Engine Source Address J1939 (0x0)		Variable Size - Current Length: 7 Byte
65259	CI		8..1	Serial Number	588		x	Engine Source Address J1939 (0x0)		Variable Size - Current Length: 8 Byte
57344	CM1	1	8..1	Requested Percent Fan Speed	986	1000ms		Engine Source Address J1939 (0x0)		
57344	CM1	6	2,1	Diesel Particulate Filter Regeneration Inhibit Switch	3695	1000ms		Engine Source Address J1939 (0x0)		
57344	CM1	6	4,3	Diesel Pariculate Filter Regeneraton Force Switch	3696	1000ms		Engine Source Address J1939 (0x0)		
64775	DLCC1	1	4,3	Engine Amber Warning Lamp Command	5078			Engine Source Address J1939 (0x0)		
64775	DLCC1	1	6,5	Engine Red Stop Lamp Command	5079			Engine Source Address J1939 (0x0)		
64775	DLCC1	1	8,7	OBD Malfunction Indicator Lamp Command	5080			Engine Source Address J1939 (0x0)		
64775	DLCC1	2	2,1	Engine Brake Active Lamp Command	5081			Engine Source Address J1939 (0x0)		
64775	DLCC1	2	4,3	Compression Brake Enable Switch Indicator Lamp Command	3987			Engine Source Address J1939 (0x0)		
64775	DLCC1	2	6,5	Engine Oil Pressure Low Lamp Command	5082			Engine Source Address J1939 (0x0)		
64775	DLCC1	2	8,7	Engine Coolant Temperature High Lamp Command	5083			Engine Source Address J1939 (0x0)		
64775	DLCC1	3	2,1	Engine Coolant Level Low Lamp Command	5084			Engine Source Address J1939 (0x0)		
64775	DLCC1	3	4,3	Engine Idle Management Active Lamp Command	5085			Engine Source Address J1939 (0x0)		
64775	DLCC1	3	6,5	Engine Air Filter Restriction Lamp Command	5086			Engine Source Address J1939 (0x0)		
64775	DLCC1	3	8,7	Engine Fuel Filter Restricted Lamp Command	5089			Engine Source Address J1939 (0x0)		

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	periodic	request	Source Address	Destination Address	Info
65226	DM1	1	2,1	Protect Lamp Status	987	1000ms		Engine Source Address J1939 (0x0)		
65226	DM1	1	4,5	Amber Warning Lamp Status	624	1000ms		Engine Source Address J1939 (0x0)		
65226	DM1	1	6,5	Red Stop Lamp Status	623	1000ms		Engine Source Address J1939 (0x0)		
65226	DM1	1	8,7	Malfunction Indicator Lamp Status	1213	1000ms		Engine Source Address J1939 (0x0)		
65226	DM1	2	2,1	Flash Protect Lamp	3041	1000ms		Engine Source Address J1939 (0x0)		
65226	DM1	2	4,3	Flash Amber Warning Lamp	3040	1000ms		Engine Source Address J1939 (0x0)		
65226	DM1	2	6,5	Flash Red Stop Lamp	3039	1000ms		Engine Source Address J1939 (0x0)		
65226	DM1	2	8,7	Flash Malfunction Indicator Lamp	3038	1000ms		Engine Source Address J1939 (0x0)		
65226	DM1	5	5..1	Failure Mode Identifier	1215	1000ms		Engine Source Address J1939 (0x0)		
65226	DM1	6	8	SPN Conversion Method	1706	1000ms		Engine Source Address J1939 (0x0)		
65226	DM1	6	7..1	Occurrence Count	1216	1000ms		Engine Source Address J1939 (0x0)		
65226	DM1	4 5	8..1 8..6	Suspect Parameter Number	1214	1000ms		Engine Source Address J1939 (0x0)		
54016	DM19	20..5	8..1	Calibration ID	1635		x			
54016	DM19	4..1	8..1	Calibration Verification Number	1634		x			
65227	DM2	1	2,1	Protect Lamp Status	987		x	Engine Source Address J1939 (0x0)		
65227	DM2	1	4,3	Amber Warning Lamp Status	624		x	Engine Source Address J1939 (0x0)		
65227	DM2	1	6,5	Red Stop Lamp Status	623		x	Engine Source Address J1939 (0x0)		
65227	DM2	1	8,7	Malfunction Indicator Lamp Status	1213		x	Engine Source Address J1939 (0x0)		
65227	DM2	2	2,1	Flash Protect Lamp	3041		x	Engine Source Address J1939 (0x0)		

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	periodic	request	Source Address	Destination Address	Info
65227	DM2	2	4,3	Flash Amber Warning Lamp	3040		x	Engine Source Address J1939 (0x0)		
65227	DM2	2	6,5	Flash Red Stop Lamp	3039		x	Engine Source Address J1939 (0x0)		
65227	DM2	2	8,7	Flash Malfunction Indicator Lamp	3038		x	Engine Source Address J1939 (0x0)		
65227	DM2	4,3	8..1	Suspect Parameter Number	1214		x	Engine Source Address J1939 (0x0)		
65227	DM2	5	5..1	Failure Mode Identifier	1215		x	Engine Source Address J1939 (0x0)		
65227	DM2	5	8..6	Suspect Parameter Number	1214		x	Engine Source Address J1939 (0x0)		
65227	DM2	6	8	SPN Conversion Method	1706		x	Engine Source Address J1939 (0x0)		
65227	DM2	6	7..1	Occurrence Count	1216		x	Engine Source Address J1939 (0x0)		
64892	DPFC1	1	3..1	Diesel Particulate Filter Lamp Command	3697	1000ms		Engine Source Address J1939 (0x0)		for EU6 only
64892	DPFC1	2	4,3	Diesel Particulate Filter Active Regeneration Status	3700	1000ms		Engine Source Address J1939 (0x0)		for EU6 only
64892	DPFC1	3	2,1	Diesel Particulate Filter Active Regeneration Inhibited Status	3702	1000ms		Engine Source Address J1939 (0x0)		for EU6 only
64892	DPFC1	3	4,3	Diesel Particulate Filter Active Regeneration Inhibited Due to Inhibit Switch	3703	1000ms		Engine Source Address J1939 (0x0)		for EU6 only
64892	DPFC1	3	6,5	Diesel Particulate Filter Active Regeneration Inhibited Due to Clutch Disengaged	3704	1000ms		Engine Source Address J1939 (0x0)		for EU6 only
64892	DPFC1	4	2,1	Diesel Particulate Filter Active Regeneration Inhibited Due to PTO Active	3706	1000ms		Engine Source Address J1939 (0x0)		for EU6 only
64892	DPFC1	4	4,3	Diesel Particulate Filter Active Regeneration Inhibited Due to Accelerator Pedal Off Idle	3707	1000ms		Engine Source Address J1939 (0x0)		for EU6 only
64892	DPFC1	4	8,7	Diesel Particulate Filter Active Regeneration Inhibited Due to Vehicle Speed Above Allowed Speed	3709	1000ms		Engine Source Address J1939 (0x0)		for EU6 only

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	periodic	request	Source Address	Destination Address	Info
64892	DPFC1	5	2,1	Diesel Particulate Filter Active Regeneration Inhibited Due to Parking Brake Not Set	3710	1000ms		Engine Source Address J1939 (0x0)		for EU6 only
64892	DPFC1	5	4,3	Diesel Particulate Filter Active Regeneration Inhibited Due to Low Exhaust Gas Temperature	3711	1000ms		Engine Source Address J1939 (0x0)		for EU6 only
64892	DPFC1	5	8,7	Diesel Particulate Filter Active Regeneration Inhibited Due to System Timeout	3712	1000ms		Engine Source Address J1939 (0x0)		for EU6 only
64892	DPFC1	7	4,3	Exhaust System High Temperature Lamp Command	3698	1000ms		Engine Source Address J1939 (0x0)		for EU6 only
61441	EBC1	1	6,5	Anti-Lock Braking (ABS) Active	563	100ms		Eng Brake Source Address J1939 (0xF) Engine Source Address J1939 (0x0)		EngineRetarder
61441	EBC1	4	8,7	Remote Accelerator Enable Switch	969	100ms		Eng Brake Source Address J1939 (0xF) Engine Source Address J1939 (0x0)		EngineRetarder
61441	EBC1	5	8..1	Engine Retarder Selection	973	100ms		Eng Brake Source Address J1939 (0xF) Engine Source Address J1939 (0x0)		EngineRetarder
65251	EC1	2,1	8..1	Engine Speed At Idle, Point 1 (Engine Configuration)	188	5000ms		Engine Source Address J1939 (0x0)		
65251	EC1	3	8..1	Engine Percent Torque At Idle, Point 1 (Engine Configuration)	539	5000ms		Engine Source Address J1939 (0x0)		
65251	EC1	5,4	8..1	Engine Speed At Point 2 (Engine Configuration)	528	5000ms		Engine Source Address J1939 (0x0)		
65251	EC1	6	8..1	Engine Percent Torque At Point 2 (Engine Configuration)	540	5000ms		Engine Source Address J1939 (0x0)		
65251	EC1	8,7	8..1	Engine Speed At Point 3 (Engine Configuration)	529	5000ms		Engine Source Address J1939 (0x0)		
65251	EC1	9	8..1	Engine Percent Torque At Point 3 (Engine Configuration)	541	5000ms		Engine Source Address J1939 (0x0)		
65251	EC1	11,10	8..1	Engine Speed At Point 4 (Engine Configuration)	530	5000ms		Engine Source Address J1939 (0x0)		
65251	EC1	12	8..1	Engine Percent Torque At Point 4 (Engine Configuration)	542	5000ms		Engine Source Address J1939 (0x0)		

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	periodic	request	Source Address	Destination Address	Info
65251	EC1	14,13	8..1	Engine Speed At Point 5 (Engine Configuration)	531	5000ms		Engine Source Address J1939 (0x0)		
65251	EC1	15	8..1	Engine Percent Torque At Point 5 (Engine Configuration)	543	5000ms		Engine Source Address J1939 (0x0)		
65251	EC1	17,16	8..1	Engine Speed At High Idle, Point 6 (Engine Configuration)	532	5000ms		Engine Source Address J1939 (0x0)		
65251	EC1	19,18	8..1	Engine Gain (Kp) Of The Endspeed Governor (Engine Configuration)	545	5000ms		Engine Source Address J1939 (0x0)		
65251	EC1	21,20	8..1	Engine Reference Torque (Engine Configuration)	544	5000ms		Engine Source Address J1939 (0x0)		
65251	EC1	23,22	8..1	Engine Maximum Momentary Override Speed, Point 7 (Engine Configuration)	533	5000ms		Engine Source Address J1939 (0x0)		
65251	EC1	24	8..1	Engine Maximum Momentary Override Time Limit (Engine Configuration)	534	5000ms		Engine Source Address J1939 (0x0)		
65251	EC1	25	8..1	Engine Requested Speed Control Range Lower Limit (Engine Configuration)	535	5000ms		Engine Source Address J1939 (0x0)		
65251	EC1	26	8..1	Engine Requested Speed Control Range Upper Limit (Engine Configuration)	536	5000ms		Engine Source Address J1939 (0x0)		
65251	EC1	27	8..1	Engine Requested Torque Control Range Lower Limit (Engine Configuration)	537	5000ms		Engine Source Address J1939 (0x0)		
65251	EC1	28	8..1	Engine Requested Torque Control Range Upper Limit (Engine Configuration)	538	5000ms		Engine Source Address J1939 (0x0)		
65251	EC1	30,29	8..1	Engine Extended Range Requested Speed Control Range Upper Limit (Engine configuration)	1712	5000ms		Engine Source Address J1939 (0x0)		
65251	EC1	32,31	8..1	Engine Moment of Inertia	1794	5000ms		Engine Source Address J1939 (0x0)		
65251	EC1	34,33	8..1	Engine Default Torque Limit	1846	5000ms		Engine Source Address J1939 (0x0)		
65251	EC1	35	8..1	Support Variable Rate TSC1 Message	3344	5000ms		Engine Source Address J1939 (0x0)		
61444	EEC1	1	4..1	Engine Torque Mode	899	10ms		Engine Source Address J1939 (0x0)		

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	periodic	request	Source Address	Destination Address	Info
61444	EEC1	2	8..1	Driver's Demand Engine - Percent Torque	512	10ms		Engine Source Address J1939 (0x0)		
61444	EEC1	3	8..1	Actual Engine - Percent Torque	513	10ms		Engine Source Address J1939 (0x0)		
61444	EEC1	5,4	8..1	Engine Speed	190	10ms		Engine Source Address J1939 (0x0)		
61444	EEC1	6	8..1	Source Address of Controlling Device for Engine Control	1483	10ms		Engine Source Address J1939 (0x0)		
61444	EEC1	7	4..1	Engine Starter Mode	1675	10ms		Engine Source Address J1939 (0x0)		
61444	EEC1	8	8..1	Engine Demand - Percent Torque	2432	10ms		Engine Source Address J1939 (0x0)		
61443	EEC2	1	2,1	Accelerator Pedal 1 Low Idle Switch	558	50ms		Engine Source Address J1939 (0x0)		
61443	EEC2	1	4,3	Accelerator Pedal Kickdown Switch	559	50ms		Engine Source Address J1939 (0x0)		
61443	EEC2	1	6,5	Road Speed Limit Status	1437	50ms		Engine Source Address J1939 (0x0)		
61443	EEC2	2	8..1	Accelerator Pedal Position 1	91	50ms		Engine Source Address J1939 (0x0)		
61443	EEC2	3	8..1	Engine Percent Load At Current Speed	92	50ms		Engine Source Address J1939 (0x0)		
61443	EEC2	4	8..1	Remote Accelerator Pedal Position	974	50ms		Engine Source Address J1939 (0x0)		
61443	EEC2	6	2,1	Vehicle acceleration Rate Limit Status	2979	50ms		Engine Source Address J1939 (0x0)		
61443	EEC2	7	8..1	Actual Maximum Available Engine - Percent Torque	3357	50ms		Engine Source Address J1939 (0x0)		
65247	EEC3	1	8..1	Nominal Friction - Percent Torque	514	50ms		Engine Source Address J1939 (0x0)		
65247	EEC3	3,2	8..1	Engine's Desired Operating Speed	515	50ms		Engine Source Address J1939 (0x0)		
65247	EEC3	4	8..1	Engine's Desired Operating Speed Asymmetry Adjustment	519	50ms		Engine Source Address J1939 (0x0)		
65247	EEC3	5	8..1	Estimated Engine Parasitic Losses - Percent Torque	2978	50ms		Engine Source Address J1939 (0x0)		

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	periodic	request	Source Address	Destination Address	Info
65247	EEC3	7,6	8..1	Aftertreatment 1 Exhaust Gas Mass Flow	3236	50ms		Engine Source Address J1939 (0x0)		
65214	EEC4	2,1	8..1	Engine Rated Power	166		x	Engine Source Address J1939 (0x0)	CPC 0x0 or Global 0xFF	
65214	EEC4	4,3	8..1	Engine Rated Speed	189		x	Engine Source Address J1939 (0x0)	CPC 0x0 or Global 0xFF	
65263	EFL/P1	1	8..1	Engine Fuel Delivery Pressure	94	500ms		Engine Source Address J1939 (0x0)		
65263	EFL/P1	3	8..1	Engine Oil Level	98	500ms		Engine Source Address J1939 (0x0)		
65263	EFL/P1	4	8..1	Engine Oil Pressure	100	500ms		Engine Source Address J1939 (0x0)		
65263	EFL/P1	6,5	8..1	Engine Crankcase Pressure	101	500ms		Engine Source Address J1939 (0x0)		
65263	EFL/P1	7	8..1	Engine Coolant Pressure	109	500ms		Engine Source Address J1939 (0x0)		
65263	EFL/P1	8	8..1	Engine Coolant Level	111	500ms		Engine Source Address J1939 (0x0)		
65243	EFL/P2	4,3	8..1	Engine Injector Metering Rail 1 Pressure	157	500ms		Engine Source Address J1939 (0x0)		
61440	ERC1 (Ret)	1	4..1	Retarder Torque Mode	900	100ms		Eng Brake Source Address J1939 (0xF) J1939 Source Addr Evobus Lever (0x21)		EngineRetarder
61440	ERC1 (Ret)	1	6,5	Retarder Enable - Brake Assist switch	571	100ms		Eng Brake Source Address J1939 (0xF) J1939 Source Addr Evobus Lever (0x21)		EngineRetarder
61440	ERC1 (Ret)	1	8,7	Retarder Enable - Shift Assist Switch	572	100ms		Eng Brake Source Address J1939 (0xF) J1939 Source Addr Evobus Lever (0x21)		EngineRetarder
61440	ERC1 (Ret)	2	8..1	Actual Retarder - Percent Torque	520	100ms		Eng Brake Source Address J1939 (0xF) J1939 Source Addr Evobus Lever (0x21)		EngineRetarder
61440	ERC1 (Ret)	5	8..1	Source Address of Controlling Device for Retarder Control	1480	100ms		Eng Brake Source Address J1939 (0xF) J1939 Source Addr Evobus Lever (0x21)		EngineRetarder

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	periodic	request	Source Address	Destination Address	Info
61440	ERC1 (Ret)	6	8..1	Drivers Demand Retarder - Percent Torque	1715	100ms		Eng Brake Source Address J1939 (0xF) J1939 Source Addr Evobus Lever (0x21)		EngineRetarder
61440	ERC1 (Ret)	7	8..1	Retarder Selection, non-engine	1716	100ms		Eng Brake Source Address J1939 (0xF) J1939 Source Addr Evobus Lever (0x21)		EngineRetarder
61440	ERC1 (Trans_Ret)	1	4..1	Retarder Torque Mode	900	100ms		Trans Retarder Srce Addr J1939 (0x10)		TransmissionRetarder
61440	ERC1 (Trans_Ret)	1	6,5	Retarder Enable - Brake Assist switch	571	100ms		Trans Retarder Srce Addr J1939 (0x10)		TransmissionRetarder
61440	ERC1 (Trans_Ret)	1	8,7	Retarder Enable - Shift Assist Switch	572	100ms		Trans Retarder Srce Addr J1939 (0x10)		TransmissionRetarder
61440	ERC1 (Trans_Ret)	2	8..1	Actual Retarder - Percent Torque	520	100ms		Trans Retarder Srce Addr J1939 (0x10)		TransmissionRetarder
61440	ERC1 (Trans_Ret)	5	8..1	Source Address of Controlling Device for Retarder Control	1480	100ms		Trans Retarder Srce Addr J1939 (0x10)		TransmissionRetarder
61440	ERC1 (Trans_Ret)	6	8..1	Drivers Demand Retarder - Percent Torque	1715	100ms		Trans Retarder Srce Addr J1939 (0x10)		TransmissionRetarder
61440	ERC1 (Trans_Ret)	7	8..1	Retarder Selection, non-engine	1716	100ms		Trans Retarder Srce Addr J1939 (0x10)		TransmissionRetarder
61440	ERC1 (Trans_Ret)	8	8..1	Actual Maximum Available Engine - Percent Torque	1717	100ms		Trans Retarder Srce Addr J1939 (0x10)		TransmissionRetarder
65262	ET1	1	8..1	Engine Coolant Temperature	110	1000ms		Engine Source Address J1939 (0x0)		
65262	ET1	2	8..1	Engine Fuel Temperature 1	174	1000ms		Engine Source Address J1939 (0x0)		
65262	ET1	4,3	8..1	Engine Oil Temperature 1	175	1000ms		Engine Source Address J1939 (0x0)		
65262	ET1	7	8..1	Engine Intercooler Temperature	52	1000ms		Engine Source Address J1939 (0x0)		
65188	ET2	4,3	8..1	Engine ECU Temperature	1136	1000ms		Engine Source Address J1939 (0x0)		
65188	ET2	6,5	8..1	Engine Exhaust Gas Recirculation 1 Differential Pressure	411	1000ms		Engine Source Address J1939 (0x0)		
65188	ET2	8,7	8..1	Engine Exhaust Gas Recirculation 1 Temperature	412	1000ms		Engine Source Address J1939 (0x0)		
61442	ETC1	1	2,1	Transmission Driveline Engaged	560	10ms		Trans Source Address J1939 (0x3)		enabled for Daimler Transmission only

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	periodic	request	Source Address	Destination Address	Info
61442	ETC1	1	6,5	Transmission Shift In Process	574	10ms		Trans Source Address J1939 (0x3)		enabled for Daimler Transmission only
61442	ETC1	3,2	8..1	Transmission Output Shaft Speed	191	10ms		Trans Source Address J1939 (0x3)		enabled for Daimler Transmission only
61442	ETC1	4	8..1	Percent Clutch Slip	522	10ms		Trans Source Address J1939 (0x3)		enabled for Daimler Transmission only
61442	ETC1	7,6	8..1	Transmission Input Shaft Speed	161	10ms		Trans Source Address J1939 (0x3)		enabled for Daimler Transmission only
61442	ETC1	8	8..1	Source Address of Controlling Device for Transmission Control	1482	10ms		Trans Source Address J1939 (0x3)		enabled for Daimler Transmission only
61445	ETC2	1	8..1	Transmission Selected Gear	524	100ms		Trans Source Address J1939 (0x3)		enabled for Daimler Transmission only
61445	ETC2	3,2	8..1	Transmission Actual Gear Ratio	526	100ms		Trans Source Address J1939 (0x3)		enabled for Daimler Transmission only
61445	ETC2	4	8..1	Transmission Current Gear	523	100ms		Trans Source Address J1939 (0x3)		enabled for Daimler Transmission only
61445	ETC2	6,5	8..1	Transmission Reguested Range	162	100ms		Trans Source Address J1939 (0x3)		enabled for Daimler Transmission only
61445	ETC2	8,7	8..1	Transmission Current Range	163	100ms		Trans Source Address J1939 (0x3)		enabled for Daimler Transmission only
65195	ETC6	1	8..1	Recommended Gear	1113	1000ms		Trans Source Address J1939 (0x3)		enabled for Daimler Transmission only
65195	ETC6	2	8..1	Highest Possible Gear	1115	1000ms		Trans Source Address J1939 (0x3)		enabled for Daimler Transmission only
65195	ETC6	3	8..1	Lowest Possible gear	1114	1000ms		Trans Source Address J1939 (0x3)		enabled for Daimler Transmission only
65098	ETC7	2	2,1	Transmission Ready for Brake Release	3086	100ms		Trans Source Address J1939 (0x3)		enabled for Daimler Transmission only
65098	ETC7	2	6,5	Transmission Engine Crank Enable	2900	100ms		Trans Source Address J1939 (0x3)		enabled for Daimler Transmission only
65098	ETC7	3	2,1	Transmission Mode 4 Indicator	2539	100ms		Trans Source Address J1939 (0x3)		enabled for Daimler Transmission only
65098	ETC7	3	4,3	Transmission Mode 3 Indicator	2538	100ms		Trans Source Address J1939 (0x3)		enabled for Daimler Transmission only
65098	ETC7	3	6,5	Transmission Mode 2 Indicator	2537	100ms		Trans Source Address J1939 (0x3)		enabled for Daimler Transmission only
65098	ETC7	3	8,7	Transmission Mode 1 Indicator	2536	100ms		Trans Source Address J1939 (0x3)		enabled for Daimler Transmission only
65098	ETC7	5	2,1	Transmission Mode 5 Indicator	4250	100ms		Trans Source Address J1939 (0x3)		enabled for Daimler Transmission only
65098	ETC7	5	4,3	Transmission Mode 6 Indicator	4251	100ms		Trans Source Address J1939 (0x3)		enabled for Daimler Transmission only

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	periodic	request	Source Address	Destination Address	Info
65098	ETC7	5	6,5	Transmission Mode 7 Indicator	4252	100ms		Trans Source Address J1939 (0x3)		enabled for Daimler Transmission only
65098	ETC7	6	4,3	Transmission Warning Indicator	5344	100ms		Trans Source Address J1939 (0x3)		enabled for Daimler Transmission only
65213	FD1	1	8..1	Estimated Percent Fan Speed	975	1000ms		Engine Source Address J1939 (0x0)		
65213	FD1	2	4..1	Fan Drive State	977	1000ms		Engine Source Address J1939 (0x0)		
65213	FD1	4,3	8..1	Fan Speed	1639	1000ms		Engine Source Address J1939 (0x0)		
65253	HOURS	4..1	8..1	Engine Total Hours Of Operation	247		x	Engine Source Address J1939 (0x0)	CPC 0x0 or Global 0xFF	
65253	HOURS	8..5	8..1	Engine Total Revolution	249		x	Engine Source Address J1939 (0x0)	CPC 0x0 or Global 0xFF	
65270	IC1	2	8..1	Engine Intake Manifold #1 Pressure	102	500ms		Engine Source Address J1939 (0x0)		
65270	IC1	3	8..1	Engine Intake Manifold 1 Temperature	105	500ms		Engine Source Address J1939 (0x0)		
65270	IC1	4	8..1	Engine Air Intake Pressure	106	500ms		Engine Source Address J1939 (0x0)		
65270	IC1	5	8..1	Engine Air Filter 1 Differential Pressure	107	500ms		Engine Source Address J1939 (0x0)		
65270	IC1	7,6	8..1	Engine Exhaust Gas Temperature	173	500ms		Engine Source Address J1939 (0x0)		
64976	IC2	5	8..1	Engine Intake Manifold #1 Absolute Pressure	3563	500ms		Engine Source Address J1939 (0x0)		
65244	IO	4..1	8..1	Engine Total Idle Fuel Used	236		x	Engine Source Address J1939 (0x0)	CPC 0x0 or Global 0xFF	
65244	IO	8..5	8..1	Engine Total Idle Hours	235		x	Engine Source Address J1939 (0x0)	CPC 0x0 or Global 0xFF	
65257	LFC	4..1	8..1	Engine Trip Fuel	182		x	Engine Source Address J1939 (0x0)	CPC 0x0 or Global 0xFF	
65257	LFC	8..5	8..1	Engine Total Fuel Used	250		x	Engine Source Address J1939 (0x0)	CPC 0x0 or Global 0xFF	
65266	LFE1	2,1	8..1	Engine Fuel Rate	183	100ms		Engine Source Address J1939 (0x0)		

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	periodic	request	Source Address	Destination Address	Info
65266	LFE1	4,3	8..1	Engine Instantaneous Fuel Economy	184	100ms		Engine Source Address J1939 (0x0)		
65266	LFE1	6,5	8..1	Engine Average Fuel Economy	185	100ms		Engine Source Address J1939 (0x0)		
65266	LFE1	7	8..1	Engine Throttle Value 1 Position	51	100ms		Engine Source Address J1939 (0x0)		
64997	MVS	1	8..1	Maximum Vehicle Speed Limit 1	2588	1000ms		Engine Source Address J1939 (0x0)		
64997	MVS	2	8..1	Maximum Vehicle Speed Limit 2	2589	1000ms		Engine Source Address J1939 (0x0)		
64997	MVS	3	8..1	Maximum Vehicle Speed Limit 3	2590	1000ms		Engine Source Address J1939 (0x0)		
64997	MVS	4	8..1	Maximum Vehicle Speed Limit 4	2591	1000ms		Engine Source Address J1939 (0x0)		
64997	MVS	5	8..1	Maximum Vehicle Speed Limit 5	2592	1000ms		Engine Source Address J1939 (0x0)		
64997	MVS	6	8..1	Maximum Vehicle Speed Limit 6	2593	1000ms		Engine Source Address J1939 (0x0)		
64997	MVS	7	8..1	Maximum Vehicle Speed Limit 7	2594	1000ms		Engine Source Address J1939 (0x0)		
64997	MVS	8	8..1	Applied Vehicle Speed Limit	2595	1000ms		Engine Source Address J1939 (0x0)		
64967	OHCSS	2	8..1	Engine Alternate Rating Select State	2888	500ms		Engine Source Address J1939 (0x0)		
65282	PropB02	1	8..1	Prop2EngCoolTemp		100ms		Engine Source Address J1939 (0x0)		Faktor: 1, Offset: -40, Unit: °C, Range: 0..250 = signal

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	periodic	request	Source Address	Destination Address	Info
65282	PropB02	2	2,1	Prop2StarterSwitch		100ms		Engine Source Address J1939 (0x0)		0 = Not Active (NACK) 1 = Active (ACK) 3 = Signal not available (SNA)
65282	PropB02	2	4,3	Prop2NeutralSwitch		100ms		Engine Source Address J1939 (0x0)		0 = Not Active (NACK) 1 = Active (ACK) 3 = Signal not available (SNA)
65282	PropB02	2	6,5	Prop2ClutchSwitch		100ms		Engine Source Address J1939 (0x0)		0 = Not Active (NACK) 1 = Active (ACK) 3 = Signal not available (SNA)
65282	PropB02	2	8,7	Prop2IdleUpCancelSwitchStatus		100ms		Engine Source Address J1939 (0x0)		0 = Not Active (NACK) 1 = Active (ACK) 3 = Signal not available (SNA)
65282	PropB02	3	2,1	Prop2EngStartEnStat		100ms		Engine Source Address J1939 (0x0)		0 = Not Active (NACK) 1 = Active (ACK) 3 = Signal not available (SNA)
65282	PropB02	3	4,3	Prop2EngFailStat		100ms		Engine Source Address J1939 (0x0)		0 = Not Active (NACK) 1 = Active (ACK) 3 = Signal not available (SNA)
65282	PropB02	3	6,5	Prop2ColdStartSwitch		100ms		Engine Source Address J1939 (0x0)		0 = Not Active (NACK) 1 = Active (ACK) 3 = Signal not available (SNA)
65282	PropB02	3	8,7	Prop2PtoSwitch		100ms		Engine Source Address J1939 (0x0)		0 = Not Active (NACK) 1 = Active (ACK) 3 = Signal not available (SNA)
65282	PropB02	4	2,1	Prop2EngStopEnStat		100ms		Engine Source Address J1939 (0x0)		0 = Not Active (NACK) 1 = Active (ACK) 3 = Signal not available (SNA)

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	periodic	request	Source Address	Destination Address	Info
65282	PropB02	4	4,3	Prop2EngStopComplStat		100ms		Engine Source Address J1939 (0x0)		0 = Not Active (NACK) 1 = Active (ACK) 3 = Signal not available (SNA)
65282	PropB02	4	6,5	Prop2EngStartFailStat		100ms		Engine Source Address J1939 (0x0)		0 = Not Active (NACK) 1 = Active (ACK) 3 = Signal not available (SNA)
65282	PropB02	4	8,7	Prop2EngStartComplStat		100ms		Engine Source Address J1939 (0x0)		0 = Not Active (NACK) 1 = Active (ACK) 3 = Signal not available (SNA)
65282	PropB02	6,5	8..1	Prop2WheelBAsedVSpeed		100ms		Engine Source Address J1939 (0x0)		Faktor: 0.00390625, Offset: 0, Unit: km/h, Range: 0..250.996 = signal
65282	PropB02	8,7	8..1	Prop2VehicleDeceleration		100ms		Engine Source Address J1939 (0x0)		Faktor: 0.00390625, Offset: 0, Unit: km/h, Range: 0..250.996 = signal
65288	PropB08	1	2,1	AutoShiftNeutralSoundReq		50ms		Engine Source Address J1939 (0x0)		0 = No warning (OK) 1 = Warning (OK) 2 = Error (ERR) 3 = Signal not available (SNA)
65288	PropB08	1	4,3	AgSoundReq		50ms		Engine Source Address J1939 (0x0)		0 = No warning (OK) 1 = Warning (OK) 2 = Error (ERR) 3 = Signal not available (SNA)
65288	PropB08	1	6,5	AgShiftModeStat		50ms		Engine Source Address J1939 (0x0)		0 = No warning (OK) 1 = Warning (OK) 2 = Error (ERR) 3 = Signal not available (SNA)
65288	PropB08	1	8,7	EcoRollPreSelStat		50ms		Engine Source Address J1939 (0x0)		0 = No warning (OK) 1 = Warning (OK) 2 = Error (ERR) 3 = Signal not available (SNA)

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	periodic	request	Source Address	Destination Address	Info
65288	PropB08	2	2,1	EcoRollNeutralReq		50ms		Engine Source Address J1939 (0x0)		0 = No warning (OK) 1 = Warning (OK) 2 = Error (ERR) 3 = Signal not available (SNA)
65288	PropB08	2	4,3	ManeuverModeStat		50ms		Engine Source Address J1939 (0x0)		0 = No request (NRQ) 1 = Request (RQ) 2 = Error (ERR) 3 = Signal not available (SNA)
65288	PropB08	2	6,5	RockOutModeStat		50ms		Engine Source Address J1939 (0x0)		0 = No request (NRQ) 1 = Request (RQ) 2 = Error (ERR) 3 = Signal not available (SNA)
65288	PropB08	2	8,7	FunctionIndicatorLampReq_CCM		50ms		Engine Source Address J1939 (0x0)		0 = No request (NRQ) 1 = Request (RQ) 2 = Error (ERR) 3 = Signal not available (SNA)
65288	PropB08	3	2,1	WarningBuzzerReq_CCM		50ms		Engine Source Address J1939 (0x0)		0 = No request (NRQ) 1 = Request (RQ) 2 = Error (ERR) 3 = Signal not available (SNA)
65288	PropB08	3	4,3	RetarderFuncLampReq		50ms		Engine Source Address J1939 (0x0)		0 = Off 1 = Actuate 2 = Blink 3 = Signal not available (SNA)
65288	PropB08	3	8..5	DrvSuperStructureStat		50ms		Engine Source Address J1939 (0x0)		0 = Inactive 1 = Restricted mode active 2 = Full mode active 3 = reserved 4 = reserved 5..13 = not defined 14 = Error 15 = Signal not available
65288	PropB08	5,4	8..1	RetRefTrq_Cval		50ms		Engine Source Address J1939 (0x0)		Faktor: 1, Offset: 0, Unit: Nm, Range: 0..65255 = signal
65288	PropB08	6	2,1	TCPtoReadyStat		50ms		Engine Source Address J1939 (0x0)		0 = No request (NRQ) 1 = Request (RQ) 2 = Error (ERR) 3 = Signal not available

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	periodic	request	Source Address	Destination Address	Info
										(SNA)
65288	PropB08	6	4,3	SecondCabControlStat		50ms		Engine Source Address J1939 (0x0)		0 = Disabled 1 = Enabled 2 = Error (ERR) 3 = Signal not available (SNA)
65288	PropB08	7	8,7	AwakeCmd		50ms		Engine Source Address J1939 (0x0)		0 = No request (NRQ) 1 = Request (RQ) 2 = Error (ERR) 3 = Signal not available (SNA)
65288	PropB08	8	4..1	MessageCounter		50ms		Engine Source Address J1939 (0x0)		Faktor: 1, Offset: 0, Unit: -, Range: 0..15 = signal
65288	PropB08	8	8..5	MessageChecksum		50ms		Engine Source Address J1939 (0x0)		Faktor: 1, Offset: 0, Unit: -, Range: 0..15 = signal
65289	PropB09	1	8..1	DispCruiseCtrlSetSpeed		100ms		Engine Source Address J1939 (0x0)		Factor: 0.5, Offset: 0, Unit: km/h, Range: 0..250 = signal
65289	PropB09	2	8..1	DispCruiseCtrlHystSpeed		100ms		Engine Source Address J1939 (0x0)		Factor: 1, Offset: 0, Unit: km/h, Range: 0..50 = signal
65289	PropB09	3	6,5	CruiseCtrlLimActvnStat		100ms		Engine Source Address J1939 (0x0)		0 = Inactive (INACTV) 1 = Passive (PASV) 2 = Active (ACTV) 3 = Signal not available (SNA)
65289	PropB09	3	8,7	CruiseCtrlSoundReq		100ms		Engine Source Address J1939 (0x0)		0 = No warning (OK) 1 = Warning (OK) 2 = Error (ERR) 3 = Signal not available (SNA)
65289	PropB09	3	4..1	CruiseCtrlFunctionModeStat		100ms		Engine Source Address J1939 (0x0)		0 = None (OK) 1 = Road speed limiter (OK) 2 = Combined (OK) 3 = Drive CC (OK) 4 = Adaptive CC (OK)

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	periodic	request	Source Address	Destination Address	Info
										5 = Adaptive CC+ (OK) 6..13 = Reserved (OOR) 14 = Error (ERR) 15 = Signal not available (SNA)
65289	PropB09	4	2,1	LimStandByStat		100ms		Engine Source Address J1939 (0x0)		0 = LIM Standby not active (OK) 1 = LIM Standby active (OK) 2 = Error (ERR) 3 = Signal not available (SNA)
65289	PropB09	4	4,3	LimOverSpeedStat		100ms		Engine Source Address J1939 (0x0)		0 = Overspeed warning not active (OK) 1 = Overspeed warning active (OK) 2 = Error (ERR) 3 = Signal not available (SNA)
65289	PropB09	4	6,5	ACC_NotAccWarn_Rq		100ms		Engine Source Address J1939 (0x0)		0 = No warning (OK) 1 = Warning (OK) 2 = Error (ERR) 3 = Signal not available (SNA)
65289	PropB09	4	8,7	ACC_Fcn_Stat		100ms		Engine Source Address J1939 (0x0)		0 = Not active (NACT) 1 = Active (ACTIVE) 2 = Reserved (RES) 3 = Signal not available (SNA)
65290	PropB0A	1	8..1	EngOilRepIenishmentQuant		100ms		Engine Source Address J1939 (0x0)		Factor: 0.1, Offset: -10, Unit: liter, Range: 0..250 = signa
65290	PropB0A	2	4..1	BuzLampReq		100ms		Engine Source Address J1939 (0x0)		0 = Off 1 = On 2 = Slow Blinking (1Hz) 3 = Fast Blinking (2Hz) 4..13 = reserved 14 = Error (ERR) 15 = Signal not available (SNA)

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	periodic	request	Source Address	Destination Address	Info
65290	PropB0A	2	8..5	Tier4DefLampReq		100ms		Engine Source Address J1939 (0x0)		0 = Off 1 = On 2 = Slow Blinking (1Hz) 3 = Fast Blinking (2Hz) 4..13 = reserved 14 = Error (ERR) 15 = Signal not available (SNA)
65290	PropB0A	3	4..1	LimLampReq		100ms		Engine Source Address J1939 (0x0)		0 = Off 1 = On 2 = Slow Blinking (1Hz) 3 = Fast Blinking (2Hz) 4..13 = reserved 14 = Error (ERR) 15 = Signal not available (SNA)
65290	PropB0A	3	8..5	Eu6InduceLampReq		100ms		Engine Source Address J1939 (0x0)		0 = Off 1 = On 2 = Slow Blinking (1Hz) 3 = Fast Blinking (2Hz) 4..13 = reserved 14 = Error (ERR) 15 = Signal not available (SNA)
65290	PropB0A	4	4..1	DpfZoneState		100ms		Engine Source Address J1939 (0x0)		0 = Zone 0 1 = Zone 1 2 = Zone 2 3 = Zone 3 4 = Zone 4 5 = Zone 5 6 = Reserved 7 = Signal not available (SNA)
65290	PropB0A	4	6,5	EngOverSpeedLampReq		100ms		Engine Source Address J1939 (0x0)		0 = No warning 1 = Pre warning 2 = Warning 3 = Signal not available (SNA)
65290	PropB0A	4	8,7	CCLimLampReq		100ms		Engine Source Address J1939 (0x0)		0 = Not active 1 = Active 2 = Flash 3 = Signal not available (SNA)

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	periodic	request	Source Address	Destination Address	Info
65290	PropB0A	5	8..1	HiIdleProcRemTime		100ms		Engine Source Address J1939 (0x0)		Factor: 1, Offset: 0, Unit: min, Range: 0..255 = signal
65291	PropB0B	4..1	8..1	TotalDefCons		1000ms		Engine Source Address J1939 (0x0)		Factor: 1, Offset: 0, Unit: ml, Range: 0..4294967295 = signal
65291	PropB0B	8..5	8..1	TripDefCons		1000ms		Engine Source Address J1939 (0x0)		Factor: 1, Offset: 0, Unit: ml, Range: 0..4294967295 = signal
65303	PropB17	1	2,1	PropBuzz_InsBuzzReq		5000ms		Trans Source Address J1939 (0x3)		0 = Buzzer not requested 1 = Buzzer requested 2 = Error (ERR) 3 = Signal not available (SNA)
65328	PropB30	2,1	8..1	Prop30CcSetVspeed		100ms		Engine Source Address J1939 (0x0)		Faktor: 0.00390625, Offset: 0, Unit: km/h, Range: 0..0 = signal
65328	PropB30	3	2,1	Prop30DrvReqEngBrkDisStat		100ms		Engine Source Address J1939 (0x0)		Faktor: 1, Offset: 0, Unit: -, Range: 0..3 = signal
65361	PropB51	1	2,1	MinOilLevelWarningLampStatus				Engine Source Address J1939 (0x0)		0 = Not Active (NACK) 1 = Active (ACK) 3 = Signal not available (SNA)
65361	PropB51	1	4,3	MaxOilLevelWarningLampStatus				Engine Source Address J1939 (0x0)		0 = Not Active (NACK) 1 = Active (ACK) 3 = Signal not available (SNA)
65361	PropB51	1	6,5	OilPressureWarningLampStatus				Engine Source Address J1939 (0x0)		0 = Not Active (NACK) 1 = Active (ACK) 3 = Signal not available (SNA)
65361	PropB51	1	8,7	ColdStartLampStatus				Engine Source Address J1939 (0x0)		0 = Not Active (NACK) 1 = Active (ACK) 3 = Signal not available (SNA)
65361	PropB51	2	4..1	DpfLampStatus				Engine Source Address J1939 (0x0)		0 = Off 1 = Slow Blinking (1Hz) 2 = Fast Blinking (2Hz) 3 = Continuous 4..14 = reserved 15 = Signal not available (SNA)

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	periodic	request	Source Address	Destination Address	Info
65361	PropB51	2	6,5	WfiStat				Engine Source Address J1939 (0x0)		0 = Not Active (NACK) 1 = Active (ACK) 3 = Signal not available (SNA)
65361	PropB51	2	8,7	CpcFaultCelyStat				Engine Source Address J1939 (0x0)		0 = Not Active (NACK) 1 = Active (ACK) 3 = Signal not available (SNA)
65361	PropB51	3	2,1	EngineBrakeActiveLampStatus				Engine Source Address J1939 (0x0)		0 = Not Active (NACK) 1 = Active (ACK) 3 = Signal not available (SNA)
65361	PropB51	3	4,3	HeatUpLampStatus				Engine Source Address J1939 (0x0)		0 = Not Active (NACK) 1 = Active (ACK) 3 = Signal not available (SNA)
65361	PropB51	3	6,5	RslStat				Engine Source Address J1939 (0x0)		0 = Not Active (NACK) 1 = Active (ACK) 3 = Signal not available (SNA)
65361	PropB51	3	8,7	CruiseControlStatus				Engine Source Address J1939 (0x0)		0 = Not Active (NACK) 1 = Active (ACK) 3 = Signal not available (SNA)
65361	PropB51	4	2,1	AirSuspRslStat				Engine Source Address J1939 (0x0)		0 = Not Active (NACK) 1 = Active (ACK) 3 = Signal not available (SNA)
65361	PropB51	4	4,3	EngBrakeStage2DisableSwitchState				Engine Source Address J1939 (0x0)		0 = Not Active (NACK) 1 = Active (ACK) 3 = Signal not available (SNA)
65361	PropB51	4	6,5	Prop51ScrWarnBuzzStat				Engine Source Address J1939 (0x0)		Faktor: 1, Offset: 0, Unit: -, Range: 0..3 = signal
65361	PropB51	4	8,7	Prop51ScrWarnLampStat				Engine Source Address J1939 (0x0)		Faktor: 1, Offset: 0, Unit: -, Range: 0..3 = signal
65361	PropB51	5	4..1	Prop51FusoSootLev				Engine Source Address J1939 (0x0)		Faktor: 1, Offset: 0, Unit: -, Range: 0..15 = signal
65361	PropB51	5	8..5	Prop51FusoDpfStat				Engine Source Address J1939 (0x0)		Faktor: 1, Offset: 0, Unit: -, Range: 0..15 = signal
65361	PropB51	6	8..1	Prop51DpfRemRegnTime				Engine Source Address J1939 (0x0)		Faktor: 1, Offset: 0, Unit: min, Range: 0..250 = signal

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	periodic	request	Source Address	Destination Address	Info
65361	PropB51	7	3..1	Prop51FusoCcBrkStat				Engine Source Address J1939 (0x0)		Faktor: 1, Offset: 0, Unit: -, Range: 0..7 = signal
65396	PropB74	2,1	8..1	Prop74CoolLevSensVolt		1000ms		Engine Source Address J1939 (0x0)		Faktor: 0.005, Offset: 0, Unit: V, Range: 0..6439 = signal
65396	PropB74	6	2,1	Prop74HcBurnoffStat		1000ms		Engine Source Address J1939 (0x0)		Faktor: 1, Offset: 0, Unit: -, Range: 0..3 = signal
65404	PropB7C	2,1	8..1	Prop7C_WheelRevsRearNr_u16			x	Engine Source Address J1939 (0x0)	CPC 0x0 or Global 0xFF	Faktor: 1, Offset: 0, Unit: 1/km, Range: 0..1599 = signal
65404	PropB7C	4,3	8..1	Prop7C_WheelRevsFrontNr_u16			x	Engine Source Address J1939 (0x0)	CPC 0x0 or Global 0xFF	Faktor: 1, Offset: 0, Unit: 1/km, Range: 0..1599 = signal
65440	PropB7C	6,5	8..1	Prop7C_WheelBaseDist_u16			x	Engine Source Address J1939 (0x0)	CPC 0x0 or Global 0xFF	Faktor: 1, Offset: 0, Unit: mm, Range: 0..65535 = signal
65264	PTO	3,2	8..1	Power Takeoff Set Speed	187	100ms		Engine Source Address J1939 (0x0)		
65264	PTO	6	2,1	Engine PTO Governor Enable Switch	980	100ms		Engine Source Address J1939 (0x0)		
65264	PTO	6	4,3	Engine Remote PTO Governor Preprogrammed Speed Control Switch	979	100ms		Engine Source Address J1939 (0x0)		
65264	PTO	7	2,1	Engine PTO Governor Set Switch	984	100ms		Engine Source Address J1939 (0x0)		
65264	PTO	7	4,3	Engine PTO Governor Coast/Decelerate Switch	983	100ms		Engine Source Address J1939 (0x0)		
65264	PTO	7	6,5	Engine PTO Governor Resume Switch	982	100ms		Engine Source Address J1939 (0x0)		
65264	PTO	7	8,7	Engine PTO Governor Accelerate Switch	981	100ms		Engine Source Address J1939 (0x0)		
64932	PTODE	5	6,5	Engagement Status - Transmission input shaft PTO 2	3461	100ms		Engine Source Address J1939 (0x0)		
64932	PTODE	5	8,7	Engagement Status - Transmission input shaft PTO 1	3460	100ms		Engine Source Address J1939 (0x0)		
64932	PTODE	6	2,1	Engagement Status - PTO Engine Flywheel	3941	100ms		Engine Source Address J1939 (0x0)		
64932	PTODE	7	2,1	At least one PTO engaged	3948	100ms		Engine Source Address J1939 (0x0)		
65249	RC	4,3	8..1	Retarder Speed At Idle, Point 1	546	5000ms		Trans Retarder Srce Addr		

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	periodic	request	Source Address	Destination Address	Info
				(Retarder Configuration)				J1939 (0xF) Engine Source Address J1939 (0x0)		
65249	RC	5	8..1	Percent Torque At Idle, Point 1 (Retarder Configuration)	551	5000ms		Trans Retarder Srce Addr J1939 (0xF) Engine Source Address J1939 (0x0)		
65249	RC	7,6	8..1	Maximum Retarder Speed, Point 2 (Retarder Configuration)	548	5000ms		Trans Retarder Srce Addr J1939 (0xF) Engine Source Address J1939 (0x0)		
65249	RC	8	8..1	Percent Torque At Maximum Speed, Point 2 (Retarder Configuration)	552	5000ms		Trans Retarder Srce Addr J1939 (0xF) Engine Source Address J1939 (0x0)		
65249	RC	10,9	8..1	Retarder Speed At Point 3 (Retarder Configuration)	549	5000ms		Trans Retarder Srce Addr J1939 (0xF) Engine Source Address J1939 (0x0)		
65249	RC	11	8..1	Percent Torque At Point 3 (Retarder Configuration)	553	5000ms		Trans Retarder Srce Addr J1939 (0xF) Engine Source Address J1939 (0x0)		
65249	RC	13,12	8..1	Retarder Speed At Point 4 (Retarder Configuration)	550	5000ms		Trans Retarder Srce Addr J1939 (0xF) Engine Source Address J1939 (0x0)		
65249	RC	14	8..1	Percent Torque At Point 4 (Retarder Configuration)	554	5000ms		Trans Retarder Srce Addr J1939 (0xF) Engine Source Address J1939 (0x0)		
65249	RC	16,15	8..1	Retarder Speed At Peak Torque, Point 5 (Retarder Configuration)	547	5000ms		Trans Retarder Srce Addr J1939 (0xF) Engine Source Address J1939 (0x0)		
65249	RC	18,17	8..1	Reference Retarder Torque (Retarder Configuration)	556	5000ms		Trans Retarder Srce Addr J1939 (0xF) Engine Source Address J1939 (0x0)		
65249	RC	19	8..1	Percent Torque At Peak Torque, Point (Retarder Configuration)	555	5000ms		Trans Retarder Srce Addr J1939 (0xF) Engine Source Address J1939 (0x0)		

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	periodic	request	Source Address	Destination Address	Info
65252	SHUTDN	1	2,1	Engine Idle Shutdown has Shutdown Engine	593	1000ms		Engine Source Address J1939 (0x0)		
65252	SHUTDN	1	4,3	Engine Idle Shutdown Driver Alert Mode	594	1000ms		Engine Source Address J1939 (0x0)		
65252	SHUTDN	1	6,5	Engine Idle Shutdown Timer Override	592	1000ms		Engine Source Address J1939 (0x0)		
65252	SHUTDN	1	8,7	Engine Idle Shutdown Timer State	590	1000ms		Engine Source Address J1939 (0x0)		
65252	SHUTDN	2	8,7	Engine Idle Shutdown Timer Function	591	1000ms		Engine Source Address J1939 (0x0)		
65252	SHUTDN	3	2,1	A/C High Pressure Fan Switch	985	1000ms		Engine Source Address J1939 (0x0)		
65252	SHUTDN	4	2,1	Engine Wait to Start Lamp	1081	1000ms		Engine Source Address J1939 (0x0)		
65252	SHUTDN	5	2,1	Engine Potection System has Shutdown Engine	1110	1000ms		Engine Source Address J1939 (0x0)		
65252	SHUTDN	5	4,3	Engine Protection System Approaching Shutdown	1109	1000ms		Engine Source Address J1939 (0x0)		
65252	SHUTDN	5	6,5	Engine Protection SystemTimer Override	1108	1000ms		Engine Source Address J1939 (0x0)		
65252	SHUTDN	5	8,7	Engine Protection System Timer State	1107	1000ms		Engine Source Address J1939 (0x0)		
65252	SHUTDN	6	8,7	Engine Protection System Configuration	1111	1000ms		Engine Source Address J1939 (0x0)		
65242	SOFT	1	8..1	Number of Software Identification Fields	965		x	Trans Retarder Srce Addr J1939 (0xF) Engine Source Address J1939 (0x0)		
65242	SOFT		8..1	Software Identification	234		x	Trans Retarder Srce Addr J1939 (0xF) Engine Source Address J1939 (0x0)		Variable Size
65132	TCO1	6,5	8..1	Tachograph output shaft speed	1623	50ms		Engine Source Address J1939 (0x0)		
65254	TD	1	8..1	Seconds	959		x	Engine Source Address J1939 (0x0)	CPC 0x0 or Global 0xFF	
65254	TD	2	8..1	Minutes	960		x	Engine Source Address J1939 (0x0)	CPC 0x0 or Global 0xFF	

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	periodic	request	Source Address	Destination Address	Info
65254	TD	3	8..1	Hours	961		x	Engine Source Address J1939 (0x0)	CPC 0x0 or Global 0xFF	
65254	TD	4	8..1	Month	963		x	Engine Source Address J1939 (0x0)	CPC 0x0 or Global 0xFF	
65254	TD	5	8..1	Day	962		x	Engine Source Address J1939 (0x0)	CPC 0x0 or Global 0xFF	
65254	TD	6	8..1	Year	964		x	Engine Source Address J1939 (0x0)	CPC 0x0 or Global 0xFF	
65272	TRF1	6,5	8..1	Transmission Oil Temperature	177	1000ms		Trans Source Address J1939 (0x3)		enabled for Daimler Transmission only
0	TSC1	1	2,1	Engine Override Control Mode	695	to Ret 50ms		Engine Source Address J1939 (0x0)		Combined engine brake and TRET control (e.g. Evobus)
0	TSC1	1	4,3	Engine Requested Speed Control Conditions	696	to Ret 50ms		Engine Source Address J1939 (0x0)		Combined engine brake and TRET control (e.g. Evobus)
0	TSC1	1	6,5	Override Control Mode Priority	897	to Ret 50ms		Engine Source Address J1939 (0x0)		Combined engine brake and TRET control (e.g. Evobus)
0	TSC1	3,2	8..1	Engine Requested Speed/Speed Limit	898	to Ret 50ms		Engine Source Address J1939 (0x0)		Combined engine brake and TRET control (e.g. Evobus)
0	TSC1	4	1	Engine Requested Torque/Torque Limit	518	to Ret 50ms		Engine Source Address J1939 (0x0)		Combined engine brake and TRET control (e.g. Evobus)
0	TSC1	5	3..1	TSC1 Transmission Rate	3349	to Ret 50ms		Engine Source Address J1939 (0x0)		Combined engine brake and TRET control (e.g. Evobus)
65248	VD	4..1	8..1	Trip Distance	244	100ms		Engine Source Address J1939 (0x0)		
65248	VD	8..5	8..1	Total Vehicle Distance	245	100ms		Engine Source Address J1939 (0x0)		
65217	VDHR	4..1	8..1	High Resolution Total Vehicle Distance	917	1000ms		Engine Source Address J1939 (0x0)		
65217	VDHR	8..5	8..1	High Resolution Trip Distance	918	1000ms		Engine Source Address J1939 (0x0)		
65271	VEP1	6,5	8..1	Battery Potential / Power Input 1	168	1000ms		Engine Source Address J1939 (0x0)		

PGN	Message(SAE)	Byte	Bit	Signal - Name	SPN	periodic	request	Source Address	Destination Address	Info
65271	VEP1	8,7	8..1	Keyswitch Battery Potential	158	1000ms		Engine Source Address J1939 (0x0)		
65255	VH	8..5	8..1	Total Power Takeoff Hours	248		x	Engine Source Address J1939 (0x0)	CPC 0x0 or Global 0xFF	
65260	VI		8..1	Vehicle Identification Number	237		x	Trans Retarder Srce Addr J1939 (0xF) Engine Source Address J1939 (0x0)		Variable Size - Current Length: 17 Byte
65279	WFI	1	2,1	Water In Fuel Indicator	97	10000ms		Engine Source Address J1939 (0x0)		sensor information not available for EU6 and TIER4

7.6. J1939 Routed ACM-Messages (Tier4 only)

	Content	**Supported J1939 Routed MCM Messages**								
	ECU	**ACM**								
	SW-Version	**R32_00_000A (CPC) / E4.53.50 (ACM)**								

PGN	Message Name	Byte	Bit	Signal Name	SPN	Periodic	Request	Source Address	Destination Address
64923	A1DEFI	1	8..1	Aftertreatment 1 Diesel Exhaust Fluid Temperature 2	3515	1000ms		ACM (0x3D)	
64923	A1DEFI	2	8..1	Aftertreatment 1 Diesel Exhaust Fluid Concentration	3516	1000ms		ACM (0x3D)	
64923	A1DEFI	6	4..1	Aftertreatment 1 Diesel Exhaust Fluid Property	3521	1000ms		ACM (0x3D)	
64828	A1DEFSI	2,1	8..1	Aftertreatment 1 Diesel Exhaust Fluid Pump Motor Speed	4374	1000ms		ACM (0x3D)	
64828	A1DEFSI	6	2,1	Aftertreatment 1 Diesel Exhaust Fluid Pump State	5435	1000ms		ACM (0x3D)	
61475	A1SCRDSI1	6	8..1	Aftertreatment 1 Diesel Exhaust Fluid Doser Absolute Pressure	4334	50ms		ACM (0x3D)	
64833	A1SCRDSI2	5	2,1	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 1 State	4340	500ms		ACM (0x3D)	
64833	A1SCRDSI2	6	2,1	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 2 State	4342	500ms		ACM (0x3D)	
64833	A1SCRDSI2	7	2,1	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 3 State	4344	500ms		ACM (0x3D)	
64833	A1SCRDSI2	8	2,1	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 4 State	4346	500ms		ACM (0x3D)	
64908	AT1GP	2,1	8..1	Diesel Particulate Filter Intake Pressure 1	3609	500ms		ACM (0x3D)	
64908	AT1GP	4,3	8..1	Diesel Particulate Filter Outlet Pressure 1	3610	500ms		ACM (0x3D)	
61454	AT1IG1	2,1	8..1	Aftertreatment 1 Intake NOx	3216	50ms		ACM (0x3D)	
64948	AT1IG2	2,1	8..1	Aftertreatment 1 Exhaust Gas Temperature 1	3241	500ms		ACM (0x3D)	
64948	AT1IG2	4,3	8..1	Aftertreatment 1 Diesel Particulate Filter Intake Gas Temperature	3242	500ms		ACM (0x3D)	

PGN	Message Name	Byte	Bit	Signal Name	SPN	Periodic	Request	Source Address	Destination Address
64946	AT1IMG	4,3	8..1	Aftertreatment 1 Diesel Particulate Filter Intermediate Gas Temperature	3250	500ms		ACM (0x3D)	
64946	AT1IMG	6,5	8..1	Aftertreatment 1 Diesel Particulate Filter Differential Pressure	3251	500ms		ACM (0x3D)	
61455	AT1OG1	2,1	8..1	Aftertreatment 1 Outlet NOx	3226	50ms		ACM (0x3D)	

7.7. J1939 Routed MCM-Messages (Tier4 only)

	Content	**Supported J1939 Routed MCM Messages**								
	ECU	**MCM**								
	SW-Version	**R32_00_000A (CPC) / M3.13.48 (MCM)**								

PGN	Message Name	Byte	Bit	Signal Name	SPN	Periodic	Request	Source Address	Destination Address
65194	AF2	4	8..1	Engine Turbocharger Wastegate Valve Position	1693		x	MCM (0x1)	
64929	AT1FC1	2,1	8..1	Aftertreatment 1 Fuel Pressure 1	3480	500ms		MCM (0x1)	
64869	AT1FC2	2,1	8..1	Aftertreatment 1 Fuel Pressure 2	4077	500ms		MCM (0x1)	
64981	EEC5	6,5	8..1	Engine Exhaust Gas Recirculation 1 (EGR1) Valve Control	2791		x	MCM (0x1)	
64981	EEC5	7	4,3	Engine Fuel Control Mode	5323		x	MCM (0x1)	
64981	EEC5	8	8..1	Engine Variable Geometry Turbocharger (VGT) 1 Actuator Position	2795		x	MCM (0x1)	
64931	EEC6	3	8..1	Engine Variable Geometry Turbocharger Actuator #1	641	100ms		MCM (0x1)	
64916	EEC7	2,1	8..1	Engine Exhaust Gas Recirculation 1 Valve Position	27	100ms		MCM (0x1)	
64916	EEC7	6,5	8..1	Engine Crankcase Breather Oil Separator Speed	5444	100ms		MCM (0x1)	
64765	EEC9	8,7	8..1	Commanded Engine Fuel Injection Control Pressure	5314	100ms		MCM (0x1)	
65243	EFL/P2	2,1	8..1	Engine Injection Control Pressure	164	500ms		MCM (0x1)	
65243	EFL/P2	4,3	8..1	Engine Injector Metering Rail 1 Pressure	157	500ms		MCM (0x1)	
65243	EFL/P2	6,5	8..1	Engine Injector Timing Rail 1 Pressure	156	500ms		MCM (0x1)	
65243	EFL/P2	8,7	8..1	Engine Injector Metering Rail 2 Pressure	1349	500ms		MCM (0x1)	
64938	EFL/P4	8	8..1	Engine Charge Air Cooler Outlet Pressure	2631	500ms		MCM (0x1)	
61450	EGF1	2,1	8..1	Engine Exhaust Gas Recirculation 1 (EGR1) Mass Flow Rate	2659	50ms		MCM (0x1)	

PGN	Message Name	Byte	Bit	Signal Name	SPN	Periodic	Request	Source Address	Destination Address
61450	EGF1	4,3	8..1	Engine Intake Air Mass Flow Rate	132	50ms		MCM (0x1)	
65170	EI	3,2	8..1	Engine Exhaust Gas Pressure	1209	100ms		MCM (0x1)	
65129	ET3	2,1	8..1	Engine Intake Manifold 1 Air Temperature (High Resolution)	1636	1000ms		MCM (0x1)	
65129	ET3	4,3	8..1	Engine Coolant Temperature (High Resolution)	1637	1000ms		MCM (0x1)	
65129	ET3	8,7	8..1	Engine Charge Air Cooler Outlet Temperature	2630	1000ms		MCM (0x1)	
64870	ET4	2	8..1	Engine Coolant Pump Outlet Temperature	4193	1000ms		MCM (0x1)	
64976	IC2	4	8..1	Engine Intake Manifold #2 Pressure	3562	500ms		MCM (0x1)	
64976	IC2	5	8..1	Engine Intake Manifold #1 Absolute Pressure	3563	500ms		MCM (0x1)	
65244	IO	4..1	8..1	Engine Total Idle Fuel Used	236		x	MCM (0x1)	
65244	IO	8..5	8..1	Engine Total Idle Hours	235		x	MCM (0x1)	
65154	IT1	2,1	8..1	Engine Cylinder #1 Ignition Timing	1413		x	MCM (0x1)	
65154	IT1	4,3	8..1	Engine Cylinder #2 Ignition Timing	1414		x	MCM (0x1)	
65154	IT1	6,5	8..1	Engine Cylinder #3 Ignition Timing	1415		x	MCM (0x1)	
65154	IT1	8,7	8..1	Engine Cylinder #4 Ignition Timing	1416		x	MCM (0x1)	
65155	IT2	2,1	8..1	Engine Cylinder #5 Ignition Timing	1417		x	MCM (0x1)	
65155	IT2	4,3	8..1	Engine Cylinder #6 Ignition Timing	1418		x	MCM (0x1)	
65159	IT6	8,7	8..1	Engine Actual Ignition Timing	1436		x	MCM (0x1)	
65245	TC	3,2	8..1	Engine Turbocharger 1 Speed	103	1000ms		MCM (0x1)	
65178	TCI2	2,1	8..1	Engine Turbocharger 1 Compressor Inlet Temperature	1172	1000ms		MCM (0x1)	
65177	TCI3	2,1	8..1	Engine Turbocharger 1 Compressor Inlet Pressure	1176	1000ms		MCM (0x1)	
65176	TCI4	2,1	8..1	Engine Turbocharger 1 Turbine Inlet Temperature	1180	1000ms		MCM (0x1)	
65175	TCI5	2,1	8..1	Engine Turbocharger 1 Turbine Outlet Temperature	1184	1000ms		MCM (0x1)	
61466	TFAC	2,1	8..1	Engine Throttle Actuator 1 Control Command	3464	50ms		MCM (0x1)	