CAN interface

Industrial engines
DC09, DC13, DC16

Marine engines
DI09, DI13, DI16

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Introduction

The CAN bus that connects to the CAN interface for the installer is called the external CAN bus below.

The CAN protocol contains all messages sent and received by the engine control unit.

REQUIREMENT!

2 messages received by the engine control unit take high priority:

- DLN1-Proprietary
- Cruise Control/Vehicle Speed

If these 2 messages are not received fault codes are generated.

The CAN protocol used is based on SAE J1939 according to ISO 11898.

- The CAN messages available on the external CAN bus are listed under the headings Summary of CAN messages. This also shows the engines for which the different messages apply.
- Detailed information about each individual CAN message is contained under the headings Detailed description of CAN messages.

General guidelines

- The communication speed is 250 kbit/s.
- Control units connected to a CAN bus must be able to handle up to 100% CAN bus load with the correct messages with no significant functional limitations or malfunctions.
- As a rule of thumb, CAN bus load should not exceed 80%.

Abbreviations

Abbreviation	Explanation
BAM	Broadcast Announce Message
CAN	Controller Area Network
DTC	Diagnostic trouble code
EMS	Engine management system
EMS S6	Engine management system for PDE engines
EMS S8	Engine management system for XPI engines
PGN	Parameter Group Number
PTO	Power take-off

Clarifications

Values	
Tmin	Shortest period between 2 messages.
Tmax	Longest period between 2 messages.
Byte	The message starts at byte.
Bit	The message starts with this bit in the stated Byte.
Length	The parameter length in bits.

Summary of CAN messages sent to the engine

The engine control unit receives the CAN messages on the external CAN bus. The messages are used to activate functions in the engine.

These messages can be received by engines in engine generation E2011 manufactured from 7 September 2010:

Message	Identifier (Hex)	Comments
DLN1-Proprietary, all-speed engines	0C FF 80 27	Accelerator pedal position and switches. Engine start and emergency stop. PTO mode and torque limit switches, etc.
DLN1-Proprietary, single-speed engines	0C FF 80 27	Speed offset, droop ON/OFF, speed or torque control. Engine start and emergency stop. Nominal speed and torque limit switches etc.
Tachograph TCO1	0C FE 6C EE	Vehicle speed.
CC/Vehicle Speed - K	18 FE F1 27	Cruise control, twinkle code and shutdown override switches.
DLN6-Proprietary	0C FF 89 27	AC request, quick heat-up (if exhaust brake available), vehicle speed limiter.
Time/Date	18 FE E6 17	Time and date.
TSC1-KE	0C 00 00 27	Torque/speed request from the coordinator.
TSC1-TE	0C 00 00 03	Torque request from transmission.
TSC1-AE	0C 00 00 0B	Torque request from Brake Management System (not normally used).
TSC Proprietary	0C FF F7 2E	Speed request from Bodywork system (all-speed engines).
Cooling Control Proprietary	18 FF 51 27	Request cooling fan speed etc.
CM1-RDE	18 E0 00 10	Requested fan speed percentage.
ETC1	0C F0 02 03	Gear shift information.
ETC2	18 F0 05 03	Actual gear ratio, current gear.
KWP2000 Physical	18 DA 00 XX	KW-2000 commands for diagnostics.
KWP2000 Functional	18 DB ZZ XX	KW-2000 commands for diagnostics.

Summary of CAN messages sent from the engine

These messages can be sent by engines of engine generation E2011 manufactured from 7 September 2010:

Message	Identifier (Hex)	Comments
Engine Temperature	18 FE EE 00	Engine coolant temperature.
Engine Fluid Level/Pressure - E	18 FE EF 00	Oil pressure. Coolant level (used for warning lamp).
Inlet/Exhaust Conditions	18 FE F6 00	Boost pressure.
DLN2-Proprietary	0C FF 81 00	Used for warning lamps. Low pressure, high temp and errors.
DLN7-Proprietary	18 FF 87 00	Urea level.
DLN8	18 FF 88 00	SCR fault.
EEC1	0C F0 04 00	Actual engine % torque, engine speed, etc.
EEC2	0C F0 03 00	Accelerator pedal position, switches, etc. Load at current speed.
EEC3	18 FE DF 00	Nominal friction % torque.
BAM-E	18 EC FF 00	
Engine Config. (J1939)	18 EB FF 00	Torque curve. Reference engine torque, etc.
Engine Config.-Proprietary	18 FF 86 00	Number of cylinders, injection system, etc.
BAM-REX	18 EC FF 29	
CC/Vehicle Speed - E	18 FE F1 00	Cruise control, twinkle code and shutdown override switches.
Fuel Economy	18 FE F2 00	Fuel rate.
Fuel Consumption	18 FE E9 00	Total fuel used.
Engine Hours, Revolutions	18 FE E5 00	Total engine runtime.
DM1 EMS	18 FE CA 00	Engine fault codes.
DM1 EEC3	18 FE CA 3D	SCR fault codes.
General Purpose Message 1	18 FF 60 00	Engine number.
KWP2000 Physical	18 DA XX00	KW-2000 commands for diagnostics.

Detailed description of CAN messages sent to engine

The following tables use the concepts below:

For the content of messages with PGNs specified in SAE J1939:

- Not defined: Not defined in SAE J1939.
- Not used: Defined in SAE 1939 but not used by Scania.

IMPORTANT!

For Not defined and Not used, FF must be sent or received.

The CAN specification applies to both engine control units S6 and S8. The lists contain 2 columns with the headings EMS S6 and EMS S8. The message only applies for the engine control unit that is marked with an X. The engine control unit which the message does not apply to should be considered Not used.

DLN1-Proprietary, all-speed engines

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
0C FF 80 27	20	20	00 PG 80	3	0	0	27	00	80

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
X	X	1	1	8	**Version Of DLN1-Messages Configuration**	A1h		0 to 250	A
X	X	2	1	8	**Accelerator Pedal Position**		0.4% per bit	0 to 100 %	B
					Error (Signal Range Check Error)	FE			
					Not available	FF			
X	X	3	1	2	**AP Low Idle Switch Released**				C
					Throttle pedal not released	00			
					Throttle pedal released	01			
					Error (Plausibility error)	10			
					Not available	11			
X	X		3	2	**AP kickdown switch**				D
					Kick down not active	00			
					Kick down	01			
					Error	10			
					Not available	11			
X	X		5	2	**Engine Start**				E
					OFF	00			
					ON	01			
					Error	10			
					Not available	11			
X	X		7	2	**Engine Emergency Stop Demand**				F
					Engine Emergency Stop Not demanded	00			

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
					Engine Emergency Stop demanded	01			
					Error indicator	10			
					Not available	11			
X	X	4	1	2	**Engine Stop**				G
					Engine Stop Not Demanded	00			
					Engine Stop Demanded	01			
					Error	10			
					Not available	11			
			3..4		Not used				
X			5	2	**Retarder Speed Control Offswitch**				H
					Button not Pressed	00			
					Button Pressed	01			
					Error	10			
					Not available	11			
			7	2	**Retarder Speed Control Setswitch**				H
					Button not Pressed	00			
					Button Pressed	01			
					Error	10			
					Not available	11			
		5	1..4		Not used				
X	X		5	2	**Lamp test**				I
					Lamp test not requested	00			
					Lamp test requested	01			
					Error	10			
					Not available	11			

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
X	X		7	2	**CC-Off**				J
					CC-off not activated	00			
					CC-off activated	01			
					Error	10			
					Not available	11			
X	X	6	1	2	**Increased Idle Speed switch 1 (ISSW1)**				K
					ISSW1 not demanded	00			
					ISSW1 demanded	01			
					Error	10			
					Not available	11			
X	X		3	2	**Increased Idle Speed switch 2 (ISSW2)**				K
					ISSW2 not demanded	00			
					ISSW2 demanded	01			
					Error	10			
					Not available	11			
X	X		5	2	**Torque Limit 1**				L
					Torque Limit 1 not demanded	00			
					Torque Limit 1 demanded	01			
					Error	10			
					Not available	11			
X	X		7	2	**Torque Limit 2**				L
					Torque Limit 2 not demanded	00			
					Torque Limit 2 demanded	01			
					Error	10			
					Not available	11			

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
X	X	7	1	2	**Exhaust brake floor switch**				M
					Switch not activated	00			
					Switch activated	01			
					Error	10			
					Not available	11			
X	X		3	2	**Exhaust brake Brake Assist Switch**				M
					Switch not activated	00			
					Switch activated	01			
					Error	10			
					Not available	11			
X	X		5	2	**Idle Command**				N
					Idle Command not requested	00			
					Idle Command requested	01			
					Error	10			
					Not available	11			
X	X		7	2	**White smoke limit request**				M
					White smoke limit not demanded	00			
					White smoke limit demanded	01			
					Error	10			
					Not available	11			
X	X	8	1	8	**Retarder Selection**		0.4% per bit	0 to 100 %	M
					Error	FEh			
					Not available	FFh			

A: Indicates which version the DLN1 message has. If the version is incorrect a fault code is generated and the engine control unit will use the basic value for the content of the message.

B: Values between 0xFB and 0xFD are not permitted.

C: A plausibility check between Low Idle Switch and Accelerator Pedal Position is performed by the engine control unit.

Low Idle Switch	Accelerator Pedal Position
01	0-0.4%
dont care	0.8-19.6%
00	20-100%

D: A plausibility check between Kickdown switch and Accelerator Pedal Position is performed by the engine control unit.

Kickdown Switch	Accelerator Pedal Position
01	0-99.6%
00	100%

E: Start request if the starter motor is connected and controlled by the engine control unit. Otherwise the message is not used.

F: Is normally used as an emergency stop for the engine. A fault code is also generated for S6.

G: Normally used as an emergency stop of the engine without a fault code being generated.

H: Used only if the engine is fitted with a Scania hydraulic retarder, otherwise Not available will be sent.

I: Lamp test. Activates AC_ACT in the engine control unit, which is used for the Throttle out of order lamp if it is connected.

J: CC-off switches off the cruise control or active power take-off.

K: Select from 4 different power take-off settings.

ISSW1	ISSW2	Power take-off setting
00	00	Normal hand throttle
01	00	Limited hand throttle
00	01	Temporary change of low idle speed
01	01	Fixed engine speed

L: Select from 4 different torque limitation settings. The function is not available on all engines.

TLSW1	TLSW2	Torque limitation
00	00	High torque limitation curve
01	00	Low torque limitation curve
00	01	Torque limitation curve defined by user
01	01	Torque limitation curve defined by user

M: Exhaust brake floor switch, Exhaust brake – Brake Assist Switch or White smoke limit request. The same values as Retarder Selection can be requested for the exhaust brake (if an exhaust brake is fitted and controlled by the engine control unit).

N: Idle Command. T: forces the engine to run on low idle.

DLN1-Proprietary, single-speed engines

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
0C FF 80 27	20	20	00 PG 80	3	0	0	27	00	80

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
X	X	1	1	8	**Version**	A0h		0 to 250	A
X	X	2	1	8	**Nominal speed offset/Requested Torque**		0.4% per bit	0 to 100 %	B
					Error (Signal Range Check Error)	FE			
					Not available	FF			
X	X	3	1	2	**Droop enable**				C
					Droop disabled (zero droop)	00			
					Droop enabled	01			
					Error (Plausibility error)	10			
					Not available	11			
X	X		3	2	**Torque enable**				D
					Engine speed control	00			
					Torque control	01			
					Error (Plausibility error)	10			
					Not available	11			
X	X		5	2	**Engine Start**				E
					OFF	00			
					ON	01			
					Error	10			
					Not available	11			
X	X		7	2	**Engine Stop (with error code)**				F
					Engine Stop Not demanded	00			

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
					Engine Stop demanded	01			
					Error indicator	10			
					Not available	11			
X	X	4	1	2	**Engine Stop (without error code)**				G
					Engine Stop Not Demanded	00			
					Engine Stop Demanded	01			
					Error	10			
					Not available	11			
			3..4		Not used				
			5	4	Not available				
		5			Not available				
X	X	6	1	2	**Nominal speed switch 1 (NSSW1)**				H
					NSSW1 not demanded	00			
					NSSW1 demanded	01			
					Error	10			
					Not available	11			
X	X				**Nominal speed switch 2 (NSSW2)**				H
					NSSW2 not demanded	00			
					NSSW2 demanded	01			
					Error	10			
					Not available	11			
X	X		5	2	**Torque Limit 1**				I
					Torque Limit 1 not demanded	00			
					Torque Limit 1 demanded	01			
					Error	10			

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
					Not available	11			
X	X		7	2	**Torque Limit 2**				I
					Torque Limit 2 not demanded	00			
					Torque Limit 2 demanded	01			
					Error	10			
					Not available	11			
X	X	7	1	2	**Exhaust brake floor switch**				
					Switch not activated	00			
					Switch activated	01			
					Error	10			
					Not available	11			
X	X		3	2	**Exhaust brake – Brake Assist Switch**				
					Switch not activated	00			
					Switch activated	01			
					Error	10			
					Not available	11			
X	X		5	2	**Idle Command**				J
					Idle Command not requested	00			
					Idle Command requested	01			
					Error	10			
					Not available	11			
X	X		7	2	**White smoke limit request**				
					White smoke limit not demanded	00			
					White smoke limit demanded	01			
					Error	10			

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
					Not available	11			
X	X	8	1	8	**Retarder Selection**		0.4% per bit	0 to 100 %	
					Error	FE			
					Not available	FF			

Note:

The DLN1 message for checking a single speed engine can be run together with or be de-prioritised by the message TSC Proprietary.

A: If the version is incorrect a fault code is generated and the engine control unit will use the basic value for the content of the message.

B: If Torque enable is engine speed control, see note D. Increase or decrease the reference speed (with or without droop, see note C) in relation to the nominal engine speed. The setting range can be changed with calibration parameters, normally ±120 rpm.

Example:	
Nominal engine speed at full load	1,500 rpm
Droop	4%
Minimum offset	-120 rpm
Maximum offset	+120 rpm
Nominal speed offset	0x3A = 58% gives an engine speed offset of +19.2 rpm
Reference speed to control unit at full load	1,500 + 19.2 = 1,519.2 rpm
Reference speed to control unit without load	1,500 + 0.004 x 1,500 + 19.2 = 1,579.2 rpm

If Torque enable is Torque control, see note D. The torque request according to the maximum available torque at current engine speed.

C: Activate or deactivate droop function. The droop value can be changed with a calibration parameter or with TSC Proprietary.

D:

00 Means engine speed control using Nominal speed offset, as described in note B.
01 Means torque control using Requested Torque, as described in note B.

E: Start request if the starter motor is connected and controlled by the engine control unit.

F: Normally used as an emergency stop of the engine; when used a fault code is created.

G: Normally used as an emergency stop of the engine; when used no fault code is generated.

H: Select nominal engine speed.

NSSW1	NSSW2	Nominal engine speed
00	00	Set with adjustable parameter
01	00	1,500 rpm
00	01	1,800 rpm
01	01	Low idling

Engine Control Allowed in the message TSC Proprietary can be used to select the nominal engine speed. In that case NSSW1 and NSSW2 are de-prioritised.

I: Select torque limitation curve.

TLSW1	TLSW2	Torque limitation
00	00	High torque limitation curve
01	00	Low torque limitation curve
00	01	Torque limitation curve defined by user
01	01	Torque limitation curve defined by user

J: Idle Command: forces the engine to run on low idle.

Tachograph TCO1

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
0C FE 6C EE	20	20	00 FE 6C	3	0	0	EE		6C

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
		1..4			Not Used				
X	X	5	1	16	**Tachograph Output Shaft Speed**		0.125 rpm per bit	0 to 8,031.75 rpm	
					Error	FExx			
					Not available	FFxx			
X	X	7	1	16	**Tachograph Vehicle Speed**		1/256 km/h per bit	0 to 250.996 km/h	A
					Error	FExx			
					Not available	FFxx			

A: This signal is the primary source of vehicle speed.

Cruise Control/Vehicle Speed - K

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
18 FE F1 27	100	100	00 FE F1	6	0	0	27		F1

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
		1	1	2	Not Used				
X	X		3	2	**Parking Brake Switch**				
					Parking brake not set	00			
					Parking brake set	01			
					Error indicator	10			
					Not available or not installed	11			
			5..8		Not Defined				
		2..3			Not Used				
		4	1	2	Not Used				
X	X		3	2	**Cruise Control Enable Switch**				
					Cruise control disabled	00			
					Cruise control enabled	01			
					Error indicator	10			
					Not available or not installed	11			
X	X		5	2	**Brake Switch**				
					Brake pedal released	00			
					Brake pedal depressed	01			
					Error indicator	10			
					Not available or not installed	11			
X	X		7	2	**Clutch Switch**				
					Clutch pedal released	00			

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
					Clutch pedal depressed	01			
					Error indicator	10			
					Not available or not installed	11			
		5	1	2	Not used				
X	X		3	2	**Cruise Control Coast (Decelerate) Switch**				
					Cruise control activator not in the position ”coast”	00			
					Cruise control activator in position ”coast”	01			
					Error indicator	10			
					Not available or not installed	11			
X	X		5	2	**Cruise Control Resume Switch**				
					Cruise control activator not in the position ”resume”	00			
					Cruise control activator in position ”resume”	01			
					Error indicator	10			
					Not available or not installed	11			
X	X		7	2	**Cruise Control Accelerate Switch**				
					Cruise control activator not in the position ”accelerate”	00			
					Cruise control activator in position ”accelerate”	01			
					Error indicator	10			
					Not available or not installed	11			
		6..7			Not Used				
		8	1..4		Not Used				
X			5	2	**Engine Test Mode Switch**				A
					Off	00			

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
					On	01			
					Error indicator	10			
					Not available or not installed	11			
X	X		7	2	**Engine Shutdown Override Switch**				B
					Off	00			
					On	01			
					Error indicator	10			
					Not available or not installed	11			

A: Request to start sending fault codes and delete saved fault codes.

If the switch is pressed down for more than 0.2 s and then released, the engine control unit starts sending fault codes in the DLN2-Proprietary message.

If the switch is depressed for between 2.5 and 10 seconds during system start (15 voltage switched on), saved fault codes are deleted. The fault codes which can only be read with SDP3 are not deleted.

B: This switch can be used to stop the engine from switching off due to low oil pressure, low coolant level or high coolant temperature.

DLN6-Proprietary

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
0C FF 89 27	1000	1000	00 FF 89	3	0	0	27		89

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
		1..3			Not Used				
X	X	4	1	2	**Road Speed Governor (Speed Limiter)**				
					Speed Limit 1 demanded	00			
					Speed Limit 2 demanded	01			
					Error indicator	10			
					Not available	11			
			3	4	**DPF Manual Activation**				
					No Req	0000			
					Unvalidated Man Regen Req	0001			
					Manual Regeneration Request	0010			
					Reserved	0011..1101			
					Error	1110			
					Don't Care	1111			
			7	2	**DPF Manual Inhibit**				
					No Request	00			
					Inhibit Regeneration Request	01			
					Error	10			
					Not available	11			
		5	1	16	**High Resolution Barometric Pressure**		0.05 kPa per bit	0 to 3,212.75 kPa	
					Error indicator	FExxh			

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
					Not available	FFxxh			
		7			Not Used				
	X	8	1	2	**Battery Management Idle Speed Increase Request**				
					Idle speed increase not requested	00			
					Idle speed increase requested	01			
					Error	10			
					Not available	11			
	X	8	3	6	**Requested Generator PWM**				
					Error	111110			
					Not available	111111			

Time/Date

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
18 FE E6 17	1000	1000	00 FE E6	6	0	0	17		E6

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
X	X	1	1	8	**Seconds**		0.25 s per bit	0 to 59.75 s	
					Error	FEh			
					Not available	FFh			
X	X	2	1	8	**Minutes**		1 min per bit	0 to 59 min	
					Error	FEh			
					Not available	FFh	1 h per bit	0 to 23 h	
X	X	3	1	8	**Hours**				
					Error	FEh			
					Not available	FFh			
X	X	4	1	8	**Month**		1 month per bit	1 to 12 months	
					Error	FEh			
					Not available	FFh			
X	X	5	1	8	**Day**		0.25 day per bit	0.25 to 31.75 days	
					Error	FEh			
					Not available	FFh			
X	X	6	1	8	**Year**		1 year per bit	1985 to 2235	
					Error	FEh			
					Not available	FFh			
		7..8			Not Used				

TSC1-KE

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
0C 00 00 27	10	-	00 00 00	3	0	0	27		

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
		1	1	2	**Engine Override Control Mode**				
X	X				Override Disabled	00			
X	X				Speed Control	01			
					Torque Control	10			
X	X				Speed/Torque Limit Control	11			
X	X		3	2	**Engine Requested Speed Control Conditions**				A
					Transient Optimized for driveline disengaged and non-lockup condition	00			
					Stability Optimized for driveline disengaged and non-lockup condition 1	01			
					Stability Optimized for driveline engaged and/or in lockup condition 2	10			
					Stability Optimized for driveline engaged and/or in lockup condition	11			
X	X		5	2	**Override Control Mode Priority**				B
					Highest Priority	00			
					High Priority	01			
					Medium Priority	10			
					Low Priority	11			
			7..8		Not Defined				
X	X	2	1	16	**Requested Speed/Speed Limit**		0.125 rpm	0 to 8,031.875 rpm	

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
					Error indicator	FExx			
					Not available	FFxx			
		4	1	8	**Engine Requested Torque/Torque Limit**		1%	-125 to +125 %	
					Error indicator	FE			
					Not available	FF			
		5..8			Not Defined				

Note:

The TSC1 message with the lowest source address has the highest priority.

A: If status 10 is received, a more powerful regulator is used; otherwise a normal regulator is used.

B: If medium or low priority is received, the request from TSC1 can be de-prioritised by Accelerator Pedal in the DLN1 message. If highest or high priority is received, the normal accelerator pedal has no effect.

TSC1-TE

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
0C 00 00 03	10	-	00 00 00	3	0	0	03	00	

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
X	X	1	1	2	**Engine Override Control Mode**				
					Override Disabled	00			
					Speed Control	01			
					Torque Control	10			
					Speed/Torque Limit Control	11			
X			3	2	**Engine Requested Speed Control Conditions**				A
					Transient Optimized for driveline disengaged and non-lockup condition	00			
					Stability Optimized for driveline disengaged and non-lockup condition 1	01			
					Stability Optimized for driveline engaged and/or in lockup condition 2	10			
					Stability Optimized for driveline engaged and/or in lockup condition	11			
X	X		5	2	**Override Control Mode Priority**				B
					Highest Priority	00			
					High Priority	01			
					Medium Priority	10			
					Low Priority	11			
			7..8		Not Defined				
X	X	2	1	16	**Requested Speed/Speed Limit**		0.125 rpm	0 to 8,031.875 rpm	

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
					Error indicator	FExx			
					Not available	FFxx			
X	X	4	1	8	**Engine Requested Torque/Torque Limit**		1%	-125 to +125 %	
					Error indicator	FE			
					Not available	FF			
		5..8			Not Defined				

Note:

The TSC1 message with the lowest source address has the highest priority.

A: If status 10 is received, a more powerful regulator is used; otherwise a normal regulator is used.

B: If medium or low priority is received, the request from TSC1 can be de-prioritised by Accelerator Pedal in the DLN1 message. If highest or high priority is received, the normal accelerator pedal has no effect.

TSC1-AE

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
0C 00 00 0B	10	-	00 00 00	3	0	0	0B	00	

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
X	X	1	1	2	**Engine Override Control Mode**				
					Override Disabled	00			
					Speed Control	01			
					Torque Control	10			
					Speed/Torque Limit Control	11			
X			3	2	**Engine Requested Speed Control Conditions**				A
					Transient Optimized for driveline disengaged and non-lockup condition	00			
					Stability Optimized for driveline disengaged and non-lockup condition 1	01			
					Stability Optimized for driveline engaged and/or in lockup condition 2	10			
					Stability Optimized for driveline engaged and/or in lockup condition	11			
X	X		5	2	**Override Control Mode Priority**				B
					Highest Priority	00			
					High Priority	01			
					Medium Priority	10			
					Low Priority	11			
			7..8		Not Defined				
X	X	2	1	16	**Requested Speed/Speed Limit**		0.125 rpm	0 to 8,031.875 rpm	

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
					Error indicator	FExx			
					Not available	FFxx			
X	X	4	1	8	**Engine Requested Torque/Torque Limit**		1%	-125 to +125 %	
					Error indicator	FE			
					Not available	FF			
		5..8			Not defined				

Note:

The TSC1 message with the lowest source address has the highest priority.

A: If status 10 is received, a more powerful regulator is used; otherwise a normal regulator is used.

B: If medium or low priority is received, the request from TSC1 can be de-prioritised by Accelerator Pedal in the DLN1 message. If highest or high priority is received, the normal accelerator pedal has no effect.

TSC Proprietary, single-speed engines[1]

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
0C FF F7 27	50	-	00 FF F7	3	0	0	27		F7

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
X	X	1	1	2	**Engine Override Control Mode**				
					Override Disabled	00			
					Speed Control	01			A
					Torque Control	10			B
					Speed/Torque Limit Control	11			
X	X		3	2	**Requested Governor**				C
					Normal Governor	00			
					Soft Governor	01			
					Stiff Governor	10			
					Not Defined	11			
X	X		5	2	**Override Control Mode Priority**				D
					Highest Priority	00			
					High Priority	01			
					Medium Priority	10			
					Low Priority	11			
			7..8		Not Defined				
X	X	2	1	16	**Requested Speed**		0.125 rpm per bit	0 to 8,031.875 rpm	A
					Error Indicator	FExx			
					Not Available	FFxx			
X	X	4	1	8	**Engine Requested Torque/Torque Limit**		1%	-125 to +125 %	B
					Error indicator	FE			

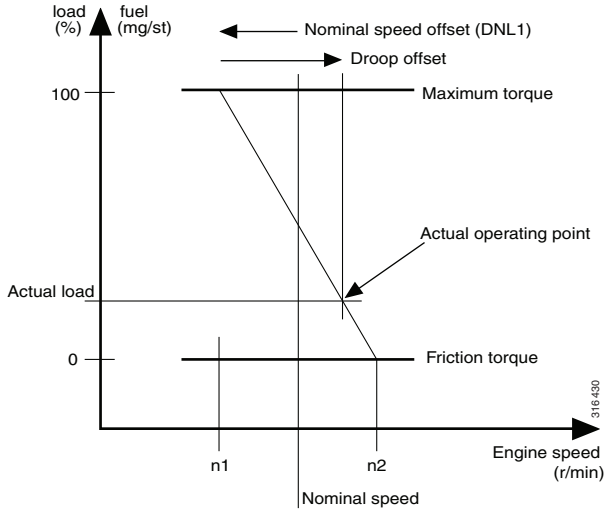
EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
					Not available	FF			
X	X	5	1	2	**Droop Adjust Enable**				E
					Droop adjust disabled	00			
					Droop adjust enabled	01			
					Error Indicator	10			
					Not Available or Not Installed	11			
X	X		3	2	**Droop Adjust Increase**				E
					Adjust switch NOT in position increase	00			
					Adjust switch in position increase	01			
					Error Indicator	10			
					Not Available or Not Installed	11			
X	X		5	2	**Droop Adjust Decrease**				
					Adjust switch NOT in position Decrease	00			
					Adjust switch in position Decrease	01			
					Error Indicator	10			
					Not Available or Not Installed	11			
			7..8		Not Defined				
X	X	6	1	8	**Requested Droop**		0.1% per bit	0 to 25 %	F
					Error indicator	FE			
					Not available	FF			
		7..8			Not Defined				

1. This message is also supported by Stage IV/Tier 4f all-speed engines.

The TSC Proprietary message can be co-run with the DLN1 message to control single-speed engines.

The TSC Proprietary message has higher priority than the DLN1 message. If the message is not received by the engine control unit or if the values are Not available, Error or Out of range, congruent values in the DLN1 message will be used. Alternatively, EMS parameters are used.

A: The nominal engine speed is the engine speed at a defined load (stored in the engine control unit, normally 100% and only valid when the droop level is >0%). The requested engine speed depends on the current load, speed offset and droop.



*The droop value is defined as (n2 - n1)/Nominal rpm * 100 (%).*

B: It is possible to control torque instead of engine speed. The torque level is related to the maximum available torque. The values between -125% and 0% are seen as 0%, and the values between 100% and 125% are seen as 100%.

C: It is possible to select hardness on the engine speed regulator.

D: It is possible to select whether the normal offset signal (Nominal speed offset in DLN1) is to be used or not.

- If Override Control Mode Priority is equal to Highest Priority or High Priority, Nominal speed offset is ignored in DLN1.
- If Override Control Mode Priority is equal to Medium Priority or Low Priority, Nominal speed offset is used in DLN1.

E: It is possible to adjust the droop value which has been stored in the engine control unit. The current droop value is sent with Single-Speed Droop Value in the message DLN2-Proprietary.

F: It is possible to request the desired droop value directly.

Cooling Control Proprietary

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
18 FF 51 27	1000	1000	00 FF 51	6	0	0	27	00	51

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
		1			Not Used				
	X	2	1	8	**Request Cooling Fan Speed**		16	0 to 4,000 rpm	
					Error	FE			
					Not available	FF			
		3..8			Not Used				

CM1-RDE

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
18 E0 00 10	1000	1000	00 E0 00	6	0	0	10	00	

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
X		1	1	8	**Requested Percent Fan Speed**		0,4 % per bit	0 till 100 %	
					Error	FEh			
					Not Available/Take No Action	FFh			
		2..8			Not used				

ETC1

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
0C F0 02 03	10	10	00 F0 02	3	0	0	03		02

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
X	X	1	1	2	**Driveline Engaged**				
					Driveline disengaged	00			
					Driveline engaged	01			
					Error indicator	10			
					Not available or not installed	11			
X	X		3	2	**Torque Converter Lockup Engaged**				
					Torque converter lockup disengaged	00			
					Torque converter lockup engaged	01			
					Reserved	10			
					Don’t care / take no action	11			
X	X		5	2	**Shift in progress**				
					Shift is not in process	00			
					Shift in process	01			
					Error indicator	10			
					Not available or not installed	11			
			7..8		Not Defined				
X	X	2	1	16	**Output Shaft Speed**		0.125 rpm	0 to 8,031.875 rpm	
					Error Indicator	FExx			
					Not Available	FFxx			
		4			Not Used				
X	X	5	1	2	**Momentary Engine Overspeed Enable**				

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
					Momentary engine overspeed is disabled	00			
					Momentary engine overspeed is enabled	01			
					Reserved	10			
					Take no action	11			
			3		Not Used				
			4..8		Not Defined				
	X	6	1	16	**Input Shaft Speed**		0.125	0 to 8,031.875 rpm	
					Error	FExx			
					Not Available	FFxx			
		8			Not Used				

ETC2

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
18 F0 05 03	100	100	00 F0 05	6	0	0	03		05

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
		1			Not Used				
X	X	2	1	16	**Actual Gear Ratio**		0.001	0 to 64.255	
					Error Indicator	FExx			
					Not available	FFxx			
X	X	4	1	8	**Current Gear, - rev, + forw, 0 neut, 126 park**		1 gear	-125 to +125	
					Error Indicator	FE			
					Not available	FF			
		5..8			Not Used				

KWP2000 Physical Addressing

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
18 DA 00 xx			00 DA 00	6	0	0	xx	00	

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
X	X	1..8			**See ISO 15765**				

KWP2000 Functional Addressing

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
18 DB zz xx			00 DB 00	6	0	0	xx	zz	

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
X	X	1..8			**See ISO 15765**				

Detailed description of CAN messages sent from the engine

Engine Temperature

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
18 FE EE 00	1000	1000	00 FE EE	6	0	0	00		EE

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
X	X	1	1	8	**Engine Coolant Temperature**		1°C	-40 to +210 °C	
					Error Indicator	FE			
					Not Available	FF			
		2			Not Used				
X		3	1	16	**Engine Oil Temperature**		0.03125°C	-273°C to +1,735.0°C	A
					Error Indicator	FExx			
					Not Available	FFxx			
		5..8			Not Used				

A: If the engine is equipped with temperature sensors and the function has been selected, the oil temperature value is sent in this message.

Engine Fluid Level/Pressure - E

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
18 FE EF 00	500	500	00 FE EF	6	0	0	00		EF

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
		1..2			Not Used				
	X	3	1	8	**Engine Oil Level**		0.4%	0 to 100 %	
					Error	FE			
					Not Available	FF			
X	X	4	1	8	**Engine Oil Pressure**		4 kPa	0 to 1,000 kPa	
					Error Indicator	FE			
					Not Available	FF			
		5..7			Not Used				
X	X	8	1	8	**Coolant Level**		0.4%	0 to 100 %	A
					Error Indicator	FE			
					Not Available	FF			

A: Only the values 0% (low coolant level) and 100% (normal coolant level) are sent.

Error indicator sent in the event of a sensor error.

Not available is sent if no connected sensor has been selected using SDP3.

Inlet/Exhaust Conditions

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
18 FE F6 00	500	500	00 FE F6	6	0	0	00		F6

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
		1			Not Used				
X	X	2	1	8	**Boost Pressure**		2 kPa	0 to +500 kPa	A
					Error Indicator	FE			
					Not Available	FF			
X	X	3	1	8	**Intake Manifold Temperature**		1°C	-40 to +210 °C	
					Error Indicator	FE			
					Not Available	FF			
		4..8			Not Used				

A: Indicates indicator pressure (relative pressure).

DLN2-Proprietary

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
0C FF 81 00	100	100	00 FF 81	3	0	0	00		81

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
X	X	1	1	8	**Version of DLN-messages Configuration**	A1h		0 to 250	
		2			Not defined				
		3	1	2	**Low Engine Oil Level**				
					Not Low Engine Oil Level	00			
					Low Engine Oil Level	01			
					Error	10			
					Not available	11			
	X		3	2	**High Engine Oil Level**				
					Not High Engine Oil Level	00			
					High Engine Oil Level	01			
					Error	10			
					Not available	11			
X	X		5	2	**Low Engine Oil Pressure**				
					Not Low Engine Oil Pressure	00			
					Low Engine Oil Pressure	01			
					Error	10			
					Not available	11			
			7..8		Not defined				
X	X	4	1	2	**High Engine Coolant Temp**				A
					Not High Engine Coolant Temp	00			
					High Engine Coolant Temp	01			

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
					Error	10			
					Not available	11			
X	X		3	2	**Power Lost Due to High Temp**				B
					No Power Lost Due to High Temp	00			
					Power Lost Due to High Temp	01			
					Error	10			
					Not available	11			
X	X		5	2	**Engine stop limit exceed**				C
					Limit not exceeded	00			
					Limit is exceeded	01			
					Error	10			
					Not available	11			
	X		7	2	**Low Urea Level**				D
					No Low Urea Level	00			
					Low Urea Level	01			
					Error	10			
					Not available	11			
X	X	5	1	2	**Charge 61**				E
					Generator not charging	00			
					Generator Charging	01			
					Reserved	10			
					Don’t care/Take no action	11			
			3..8		Not defined				
X	X	6	1	2	**Test Engine Lamp**				F
					Not activated	00			

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
					Activated	01			
					Error	10			
					Not available	11			
X	X		3	2	**Diagnostic Status**				G
					Twinkling not active	00			
					Twinkling of twinkle code active	01			
					Diagnostic button pressed	10			
					Not Available	11			
X	X		5	2	**New DTC**				H
					Not activated	00			
					Activated	01			
					Error	10			
					Not available	11			
			7..8		Not defined				
X	X	7	1	8	**Single-Speed Droop Value**		0.1%	0 to 25 %	I
					Error	FE			
					Not available	FF			
		8			Not defined				

A: Normally controls the high coolant temperature warning lamp. The message is sent if the coolant temperature exceeds the limit (normally 95°C).

B: The message is sent if the function for reducing engine power due to high engine temperature has been selected and the engine temperature exceeds the upper limit (normally 95°C).

C: The message is sent if the coolant temperature exceeds the shut-off limit which is normally 103°C.

D: For low reductant level, use the DLN8 message instead.

E: For engines with 2 generators, the message Generator not charging is sent when one of the generators is not charging.

F:

- The following applies to Stage IIIB/Tier 4i and less restrictive emissions legislation: As soon as at least one DTC is activated the lamp is Activated. If all DTCs are inactive the lamp is Not activated.
- The following applies to Stage IV/Tier 4f: The lamp is Activated during Lamp On for either Red Stop Lamp Status or Amber Warning Lamp Status in message DM1.
- The engine control unit is started with the signal U15 - ON. During the first few seconds that U15 is activated, the lamp isActivated.
- When the engine control unit is shut off with the signal U15 - OFF, the lamp is Activated until the engine speed is 0 rpm and all engine data is stored in the memory. After that the system is shut down and no more messages are sent. All fault codes are saved in 2 memories – the flash code memory and the DTC memory in the engine control unit.
- The DTCs can be read with the KW2000 command and the flash codes can be sent in this message together with a request in Engine Test Mode Switch in the message Cruise Control/Vehicle Speed - K.

G: When the diagnostic switch in Engine Test Mode Switch in the message CruiseControl/VehicleSpeed - K is activated status 10 is transferred. While the flash codes are transferred status 01 is transferred.

H: When a new DTC has been saved in the engine control unit status 01 is sent for 1 second. Note: Not supported for Stage IV/Tier 4f.

I: For single-speed engines, the current droop value is sent. For all-speed engines the value FF - Not available. is sent.

DLN7-Proprietary

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
18 FF 87 00	1000	1000	00 FF 87	6	0	0	00		87

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
	X	1	1	8	**Urea Level**		0.4%	0 to 100 %	
					Error	FE			
					Not available	FF			
	X	2	1	3	**Malfunction Indicator**				
					NoMI	00			
					MI Due To System Malfunction	01			
					MI Due To No Reagent	10			
					Flashing MI Due To System Malfunction	11			
					Flashing MI Due To No Reagent	100			
					Reserved	110			
					Take No Action	111			
	X	2	4	2	**Incorrect Driver Initiated Engine Shut Down**				
					No Incorrect Shut Down	00			
					Incorrect Shut Down	01			
					Reserved	10			
					Take No Action	11			
	X	2	6	3	**Engine Oil Level Measuring Status**				
					Measurement Ok	00			
					Measurement Result Pending	01			
					Conditions Not Fullfilled	100			
					Sensor Error	101			

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
					Reserved	110			
					Take No Action	111			
	X	3	1	4	**Engine Oil Level Countdown Timer**				
					Less Then One Minute	0000			
					1 Minute	0001			
					2 Minutes	0010			
					3 Minutes	0011			
					4 Minutes	0100			
					5 Minutes	0101			
					6 Minutes	0110			
					7 Minutes	0111			
					8 Minutes	1000			
					9 Minutes	1001			
					10 Minutes	1010			
					11 Minutes	1011			
					12 Minutes	1100			
					More Than 12 Minutes	1101			
					Error	1110			
					Not available	1111			
	X	3	5	2	**Gas Leakage**				
					No Leakage	00			
					Leakage	01			
					Reserved	10			
					Take No Action	11			
	X	3	7	2	**Engine Air Filter Clogged**				

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
					Air Filter Not Clogged	00			
					Air Filter Clogged	01			
					Reserved	10			
					Don'tCare/TakeNoAction	11			
	X	4	1	8	**Max Vehicle Speed Limit 0**				
					Error	FE			
					Not available	FF			
	X	5	1	8	**Fuel Level**				
					Error	FE			
					Not available	FF			
	X	6	1	8	**Time to Torque Limiting**				A
					No Pending Torque Limit (Parameter Specific Indicator)	FB			
					Error	FE			
					Not available	FF			
	X	7	1	3	**Torque Limit**				B
					No Torque Limit	000			
					Active Torque Limit Due To Emission	001			
					Pending Torque Limit Due To Emission	010			
					Active Torque Limit Due To High Gbx Temp	011			
					Active Torque Limit Due To High Exhaust Temp	100			
					Active Torque Limit General	101			
					Reserved	110			
					Don'tCare/TakeNoAction	111			
	X	8	1	4	**OBD Activation Mode and State**				
					Off	0000			

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
					Ready	0001			
					Not Ready	0010			
					Mode 1	0011			
					Mode 2	0100			
					Mode 3	0101			
					Mode 4	0110			
					Reserved	0111.. 1101			
					Error	1110			
					Not available	1111			
	X	8	5	2	**Afterrun Status**				
					Afterrun incative	00			
					Afterrun active	01			
					Error	10			
					Not available	11			
			7..8		Not Used				

A: The reason for the countdown is sent to Torque Limit in the DLN1 message.

B: Intended for driver information. Remaining time to torque limitation is sent in Time To Torque Limiting in the message DLN7-Proprietary.

DLN8

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
18 FF 88 00	1000	1000	00 FF 88	6	0	0	00		88

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
	X	1	1	8	**Coolant Water Flow**			0 to 2,500 l/min	
					Error	FE			
					Not available	FF			
	X	2	1	8	**Cooling Fan Speed**			0 to 4,000 rpm	
					Error	FE			
					Not available	FF			
		3	1	16	**Applied Vehicle Speed Limit Proprietary**		0.00390625 km/h	0 to 250.99609375 km/h	
					Error	FExx			
					Not available	FFxx			
		5	1	6	**DPF Regeneration Countdown Timer**			0 to 60 min	
					More Than 60 Minutes	111101			
					Error	111110			
					Not available	111111			
	X	5	7	2	**Emission-OBD reactivation mode**				
					Not Active	00			
					Active	01			
					Error	10			
					Not available	11			

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
	X	6	1	3	**StarterMotorTempStatus**				
					Starter Motor Normal Temp	000			
					Starter Motor High Temp	001			
					Starter Motor Inhibited Due To High Temp	010			
					Reserved	110			
					Take No Action	111			
	X	6	4	4	**Emission-OBD inducement state**				A
					No Inducement	0000			
					Active Torque Limit Due To Urea Level	0001			
					Active Speed Limit Due To Urea Level	0010			
					Active Torque Limit Due To SCR Failure	0011			
					Active Speed Limit Due To SCR Failure	0100			
					Error	1110			
					Not available	1111			
	X	7	1	8	**Time to speed limiting**			0 to 255 h	
					No Pending Speed Limit (Parameter Specific Indicator)	FB			
					Error	FE			
					Not available	FF			
	X	8	1	3	**Urea level inducement state**				B
					Urea Level Ok	000			
					Low Urea Level	001			
					Fill Up Urea	010			
					Urea Tank Empty	011			
					Error	FE			
					Not available	FF			

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
	X	8	4	4	**Emission-OBD inducement failure reason**				C
					No Failure	0000			
					Dosing Error	0001			
					Urea Quality	0010			
					Monitor Failure	0011			
					NOx Failure	0100			
					Error	1110			
					Not available	1111			

A:

- When Active Torque Limit Due To SCR Failure is sent the warning lamp for a fault in the SCR system should flash slowly (½ Hz).
- When Active Speed Limit Due To SCR Failure is sent the warning lamp for a fault in the SCR system should flash rapidly (2 Hz).

B:

- When Low Urea Level is sent the warning lamp for low reductant level should light.
- When Fill Up Urea is sent the warning lamp for low reductant level should flash slowly (½ Hz).
- When Urea Tank Empty is sent the warning lamp for low reductant level should flash rapidly (2 Hz).

C: When NOx Failure is sent the warning lamp for a fault in the SCR system should light.

More information about the warning lamps is available in the SCR system installation manual.

EEC1

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
0C F0 04 00	20	20	00 F0 04	3	0	0	00		04

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
X	X	1	1	8	**Engine and Retarder Torque Mode**				
					Low Idle Governor	0000			
					Accelerator Pedal	0001			
					Cruise Control	0010			
					PTO Governor	0011			
					Road Speed Governing	0100			
					ASR Control	0101			
					Transmission Control	0110			
					ABS Control	0111			
					Torque Limiting	1000			
					High Speed Governor	1001			
					Brake System	1010			
					Remote Accelerator	1011			
					Not defined	1100			
					White Smoke Limiting	1101			
					Other	1110			
					Not available	1111			
			5..8		Not Defined				
X	X	2	1	8	**Drivers Demand Engine - Percent Torque**		1%	-125 to +125 %	
					Error Indicator	FE			
					Not available	FF			

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
X	X	3	1	8	**Actual Engine - Percent Torque**		1%	-125 to +125 %	
					Error Indicator	FE			
					Not available	FF			
X	X	4	1	16	**Engine Speed**		0.125 rpm	0 to 8,031.875 rpm	
					Error Indicator	FExx			
					Not available	FFxx			
		6..7			Not Used				
	X	8	1	8	**Engine Demand - PercentTorque**		-125%	-125 to +125 %	
					Error	FE			
					Not available	FF			

EEC2

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
0C F0 03 00	50	50	00 F0 03	3	0	0	00		03

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
X	X	1	1	2	**Accelerator Pedal Low Idle Switch**				
					Accelerator pedal not in low idle condition	00			
					Accelerator pedal in low idle condition	01			
					Error indicator	10			
					Not available or not installed	11			
X	X		3	2	**Accelerator Pedal Kickdown Switch**				
					Kickdown passive	00			
					Kickdown active	01			
					Error indicator	10			
					Not available or not installed	11			
			5..8		Not Used				
X	X	2	1	8	**Accelerator Pedal Position**		0.4%	0 to 100 %	
					Error Indicator	FE			
					Not available	FF			
X	X	3	1	8	**Percent Load at Current Speed**		1%	0 to +125 %	
					Error Indicator	FE			
					Not available	FF			
		4..5			Not Used				
	X	6	1	2	**Vehicle Acceleration Rate Limit Status**				
					Limit Not Active	00			
					Limit Active	01			

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
					Reserved	10			
					Not available	11			
		7..8			Not Used				

EEC3

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
18 FE DF 00	250	250	00 FE DF	6	0	0	00		DF

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
X	X	1	1	8	**Nominal friction - Percent Torque**		1%	-125 to +125 %	
					Error	FE			
					Not available or not installed	FF			
		2.4			Not Used				
	X	5	1	8	**Estimated Engine Parasitic Losses - Percent Torque**		1%	-125 to +125 %	A
					Error	FE			
					Not available	FF			
		6..8			Not Defined				

A: When the value in this parameter is equal to 0xFB, all parasitic losses calculated by the engine are included in the nominal friction percentage torque of the engine (SPN 514).

BAM-E

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
18 EC FF 00	1000	5000	00 EC 00	6	0	0	00	FF	

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
X	X	1	1	8	**Control byte, Broadcast Announce Message**				
					Error Indicator	FE			
					Not available	FF			
X	X	2	1	16	**Total message size**				
					Error Indicator	FExx			
					Not available	FFxx			
X	X	4	1	8	**Total number of packets**				
					Error Indicator	FE			
					Not available	FF			
		5			Not Used				
X	X	6	1	24	**Parameter group number of the packeted message**	0			

Engine Configuration Messages

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
18 EB FF 00	5000	5000[1]	00 EB 00	6	0	0	00	FF	

1. Sent every 100 ms until the whole message is sent in one BAM cycle.

Note:

The PGN for Engine Configuration J1939 is 00 FE E3.

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
X	X	1	1	16	**Engine Speed at Idle, Point 1**		0.125 rpm	0 to 8,031.875 rpm	
					Error Indicator	FExx			
					Not Available	FFxx			
X	X	3	1	8	**Percent Torque at Idle, Point 1**		1%	-125 to +125 %	
					Error Indicator	FE			
					Not Available	FF			
X	X	4	1	16	**Engine Speed at Point 2**		0.125 rpm	0 to 8,031.875 rpm	
					Error Indicator	FExx			
					Not Available	FFxx			
X	X	6	1	8	**Percent Torque at Point 2**		1%	-125 to +125 %	
					Error Indicator	FE			
					Not Available	FF			
X	X	7	1	16	**Engine Speed at Point 3**		0.125 rpm	0 to 8,031.875 rpm	
					Error Indicator	FExx			
					Not Available	FFxx			
X	X	9	1	8	**Percent Torque at Point 3**		1%	-125 to +125 %	

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
					Error Indicator	FE			
					Not Available	FF			
X	X	10	1	16	**Engine Speed at Point 4**		0.125 rpm	0 to 8,031.875 rpm	
					Error Indicator	FExx			
					Not Available	FFxx			
X	X	12	1	8	**Percent Torque at Point 4**		1%	-125 to +125 %	
					Error Indicator	FE			
					Not Available	FF			
X	X	13	1	16	**Engine Speed at Point 5**		0.125 rpm	0 to 8,031.875 rpm	
					Error Indicator	FExx			
					Not Available	FFxx			
X	X	15	1	8	**Percent Torque at Point 5**		1%	-125 to +125 %	
					Error Indicator	FE			
					Not Available	FF			
X	X	16	1	16	**Engine Speed at High Idle, Point 6**		0.125 rpm	0 to 8,031.875 rpm	
					Error Indicator	FExx			
					Not Available	FFxx			
X	X	18	1	16	**Gain (KP) of the Endspeed Governor**		0.0007813% per rpm	0 to 50.2% per rpm	
					Error Indicator	FExx			
					Not Available	FFxx			
X	X	20	1	16	**Reference Engine Torque**		1 Nm	0 to 64,255 Nm	
					Error Indicator	FExx			
					Not Available	FFxx			
X	X	22	1	16	**Maximum Momentary Engine Override Speed, Point 7**		0.125 rpm	0 to 8,031.875 rpm	
					Error Indicator	FExx			

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
					Not Available	FFxx			
X	X	24	1	8	**Maximum Momentary Override Time Limit**		0.1 s	0 to 25 s	
					Error Indicator	FE			
					Not Available	FF			
X	X	25	1	8	**Requested Speed Control Range Lower Limit**		10 rpm	0 to 2,500 rpm	
					Error Indicator	FE			
					Not Available	FF			
X	X	26	1	8	**Requested Speed Control Range Upper Limit**		10 rpm	0 to 2,500 rpm	
					Error Indicator	FE			
					Not Available	FF			
X	X	27	1	8	**Requested Torque Control Range Lower Limit**		1%	-125 to +125 %	
					Error Indicator	FE			
					Not Available	FF			
X	X	28	1	8	**Requested Torque Control Range Upper Limit**		1%	-125 to +125 %	
					Error Indicator	FE			
					Not Available	FF			

Engine Configuration-Proprietary

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
18 FF 86 00	5000	5000	00 FF 86	6	0	0	00		86

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
X	X	1	1	4	**Number of cylinders**			0 to 14	
					Not Available	1111			
X	X		5	4	**Injection System**				
					To be defined	0000			
					Bosch PDE	0001			
					HPI	0010			
					Inline pump with MS5	011			
					Bosch Common Rail	0100			
					XPI	0101			
					To be defined	0110.. 1111			
X		2	1	8	**Maximum fuel quantity**		1 mg/stroke	100 to 350 mg/stroke	
					Error	FEh			
					Not Available	FFh			
X		3	1	48	**Economy engine speed info**				
		3	1	8	Economy Engine Speed at 30 % Load		8 rpm	500 to 2,500 rpm	
		4	1	8	Economy Engine Speed at 50 % Load		8 rpm	500 to 2,500 rpm	
		5	1	8	Economy Engine Speed at 60 % Load		8 rpm	500 to 2,500 rpm	
		6	1	8	Economy Engine Speed at 70 % Load		8 rpm	500 to 2,500 rpm	
		7	1	8	Economy Engine Speed at 80 % Load		8 rpm	500 to 2,500 rpm	
		8	1	8	Economy Engine Speed at 95 % Load		8 rpm	500 to 2,500 rpm	

BAM-REX

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
18 EC FF 29	1000	5000	00 EC 00	6	0	0	29	FF	

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
X	X	1	1	8	**Control byte, Broadcast Announce Message**				
					Error Indicator	FE			
					Not Available	FF			
X	X	2	1	16	**Total message size**				
					Error Indicator	FExx			
					Not Available	FFxx			
X	X	4	1	8	**Total number of packets**				
					Error Indicator	FE			
					Not Available	FF			
X	X	5	1	8	**Reserved for assignment by SAE**				
					Error Indicator	FE			
					Not Available	FF			
X	X	6	1	24	**Parameter group number of the packeted message**				

Cruise Control/Vehicle Speed - E

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
18 FE F1 00	100	100	00 FE F1	6	0	0	00		F1

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
		1	1..2		Not Used				
X	X		3	2	**Parking Brake Switch**				
					Parking brake not set	00			
					Parking brake set	01			
					Error Indicator	10			
					Not available or not installed	11			
			5..8		Not Defined				
X	X	2	1	16	**Wheel-based Vehicle Speed**		1/256 km/h per bit	0 to 251 km/h	
					Error Indicator	FExx			
					Not Available	FFxx			
X	X	4	1	2	**Cruise Control Active**				
					Cruise control switched off	00			
					Cruise control switched on	01			
					Error Indicator	10			
					Not available or not installed	11			
X	X		3	2	**Cruise Control Enable Switch**				
					Cruise control disabled	00			
					Cruise control enabled	01			
					Error Indicator	10			
					Not available or not installed	11			
X	X		5	2	**Brake Switch**				

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
					Brake pedal released	00			
					Brake pedal depressed	01			
					Error Indicator	10			
					Not available or not installed	11			
X	X		7	2	**Clutch Switch**				
					Clutch pedal released	00			
					Clutch pedal depressed	01			
					Error Indicator	10			
					Not available or not installed	11			
		5	1	2	Not Used				
X	X		3	2	**Cruise Control Coast (Decelerate) Switch**				
					Cruise control activator not in the position ”coast”	00			
					Cruise control activator in position ”coast”	01			
					Error Indicator	10			
					Not available or not installed	11			
X	X		5	2	**Cruise Control Resume Switch**				
					Cruise control activator not in the position ”resume”	00			
					Cruise control activator in position ”resume”	01			
					Error Indicator	10			
					Not available or not installed	11			
X	X		7	2	**Cruise Control Accelerate Switch**				
					Cruise control activator not in the position ”accelerate”	00			
					Cruise control activator in position ”accelerate”	01			
					Error Indicator	10			
					Not available or not installed	11			

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
	X	6	1	8	**Cruise Control Set Speed**			0 to 250 km/h	A
					Error	FE			
					Not available	FF			
	X	7	1	5	**PTO State**				
					Off/Disabled	00			
					Hold	01			
					Not Used	10..10 001			
					Not available	11111			
X	X		6	3	**Cruise Control States**				
					Off/Disabled	000			
					Hold	001			
					Accelerate	010			
					Decelerate/Coast	011			
					Resume	100			
					Set	101			
					Accelerator override	110			
					Not available	111			
		8	1..4		Not Used				
X	X		5	2	**Engine Test Mode Switch**				
					Off	00			
					On	01			
					Error	10			
					Not available or not installed	11			
X	X		7	2	**Engine Shutdown Override Switch**				

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
					Off	00			
					On	01			
					Error	10			
					Not available or not installed	11			

A: The signal is updated with information from CCVS-K.

Fuel Economy

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
18 FE F2 00	100	100	00 FE F2	6	0	0	00		F2

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
X	X	1	1	16	**Fuel Rate**		0.05 l/h per bit	0 to 3212.75 l/h	
					Error	FExxh			
					Not available	FFxxh			
X	X	3	1	16	**Instantaneous Fuel Economy**		1/512 km/l per bit	0 to 125.5 km/l	
					Error	FExxh			
					Not available	FFxxh			
		5..8			Not Used				

Fuel Consumption

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
18 FE E9 00	1000	1000	00 FE E9	6	0	0	00		E9

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
		1..4			Not Used				
X	X	5	1	32	**Total fuel used**		0.5 l per bit	0 to 2,105,540,607.5 l	
					Error	FExxx xxxh			
					Not Available	FFxxx xxxh			

Engine Hours, Revolutions

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
18 FE E5 00	1000	1000	00 FE E5	6	0	0	00		E5

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
X	X	1	1	32	**Total engine hours**		0.05 h per bit	0 to 210,554,060.75 h	
					Error	FEh			
					Not Available	FFh			
		5..8			Not Used				

DM1 EMS

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
18 FE CA 00	1000	1000	00 FE CA	6	0	0	00		CA

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
		1	1	2	Not Used				
X	X		3	2	**Amber Warning Lamp Status**				A
					Lamp Off	00			
					Lamp On	01			
					Error	10			
					Take no action	11			
X	X		5	2	**Red Stop Lamp Status**				A
					Lamp Off	00			
					Lamp On	01			
					Error	10			
					Take no action	11			
			7..8		Not Used				
X	X	3	1	8	**Suspect Parameter Number LSB**			0 to 255	B
X	X	4	1	8	**Suspect Parameter Number Mid Byte**			0 to 255	B
X	X	5	1	5	**Failure Mode Identifier**				C
					Above normal (most severe)	00			
					Below normal (most severe)	01			
					Data erratic	10			
					Voltage above normal	11			
					Voltage below normal	100			
					Current below normal	101			

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
					Current above normal	110			
					Mechanical system not responding	111			
					Abnormal frequency	1000			
					Abnormal update rate	1001			
					Abnormal rate of change	1010			
					Root cause not known	1011			
					Bad intelligent device	1100			
					Out of calibration	1101			
					Special intstructions	1110			
					Above normal (least severe)	1111			
					Above normal (moderately severe)	10000			
					Below normal (least severe)	10001			
					Below normal (moderatels severe)	10010			
					Received network data in error	10011			
					Data Drifted High	10100			
					Data Drifted Low	10101			
					Not Available	11111			
X	X	5	6	3	**Suspect Parameter Number MS 3-bit**			0 to 7	B
X	X	6	1	7	**Occurrence Count**			0 to 126	
					Not Available	11111 11			
X	X	6	8	1	**SPN Conversion Method**				
					Convert SPNs per the Version 4 definition in SAE J1939-73 chap 5.7.1.11	0			

A: Red Stop Lamp Status indicates a serious fault that means that the operator must immediately initiate a controlled engine shut down.

Amber Warning Lamp Status indicates a fault that means that the operator should visit a workshop as soon as possible.

DM1 fault codes that do not activate Red Stop Lamp Status or Amber Warning Lamp Status are less important. Such fault codes should not be displayed on the machine display. The mechanic need only read these out using a diagnostic tool and rectify the faults during the next planned inspection.

B: See the parameter SPN Conversion for the method and how it is to be interpreted in SAE J1939-73.

C: Greatest significance at bit 5.

DM1 EEC3

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
18 FE CA 3D	1000	1000	00 FE CA	6	0	0	3D		CA

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
		1	1	2	Not Used				
X	X		3	2	**Amber Warning Lamp Status**				A
					Lamp Off	00			
					Lamp On	01			
					Error	10			
					Take no action	11			
X	X		5	2	**Red Stop Lamp Status**				A
					Lamp Off	00			
					Lamp On	01			
					Error	10			
					Take no action	11			
			7..8		Not Used				
X	X	3	1	8	**Suspect Parameter Number LSB**			0 to 255	B
X	X	4	1	8	**Suspect Parameter Number Mid Byte**			0 to 255	B
X	X	5	1	5	**Failure Mode Identifier**				C
					Above normal (most severe)	00			
					Below normal (most severe)	01			
					Data erratic	10			
					Voltage above normal	11			
					Voltage below normal	100			
					Current below normal	101			

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
					Current above normal	110			
					Mechanical system not responding	111			
					Abnormal frequency	1000			
					Abnormal update rate	1001			
					Abnormal rate of change	1010			
					Root cause not known	1011			
					Bad intelligent device	1100			
					Out of calibration	1101			
					Special intstructions	1110			
					Above normal (least severe)	1111			
					Above normal (moderately severe)	10000			
					Below normal (least severe)	10001			
					Below normal (moderatels severe)	10010			
					Received network data in error	10011			
					Data Drifted High	10100			
					Data Drifted Low	10101			
					Not Available	11111			
X	X	5	6	3	**Suspect Parameter Number MS 3-bit**			0 to 7	B
X	X	6	1	7	**Occurrence Count**			0 to 126	
					Not Available	11111 11			
X	X	6	8	1	**SPN Conversion Method**				
					Convert SPNs per the Version 4 definition in SAE J1939-73 chap 5.7.1.11	0			

A: Red Stop Lamp Status indicates a serious fault that means that the operator must immediately initiate a controlled engine shut down.

Amber Warning Lamp Status indicates a fault that means that the operator should visit a workshop as soon as possible.

DM1 fault codes that do not activate Red Stop Lamp Status or Amber Warning Lamp Status are less important. Such fault codes should not be displayed on the machine display. The mechanic need only read these out using a diagnostic tool and rectify the faults during the next planned inspection.

B: See the parameter SPN Conversion for the method and how it is to be interpreted in SAE J1939-73.

C: Greatest significance at bit 5.

General Purpose Message 1

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
18 FF 60 00	5000	5000	00 FF 60	6	0	0	00		60

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
X	X	1	1	32	**Engine No.**		1 per bit	0 h to FFFFFFFF h	A
					Error				
					Not available	FExxxxxx			B
		5..8			Not defined	FFxxxxxx			

A: The engine serial number is sent as a decimal value.

B: No engine serial number has been set in the engine control unit.

KWP2000 Physical Addressing

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
18 DA xx 00			00 DA 00	6	0	0	00	xx	

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
X	X	1..8			**See ISO 15765**				

Vehicle Electrical Power

Identifier	Tmin	Tmax	PGN	Default Priority	R1	DP	Source	Destination	Group Extension
18 FE F7 00	1000	1000	00 FE F7	6	0	0	00		F7

EMS S6	EMS S8	Byte	Bit	Length	Explanation	State	Resolution	Limits	Note
		1..6			Not Used				
X	X	7	1	16	**Keyswitch Battery Potential**		0.05 V per bit	0 to +3,212.75 V	
					Error	FExxh			
					Not Available	FFxxh			