1.0 Odometer Backup – CGEA1.3 v.1.2.2

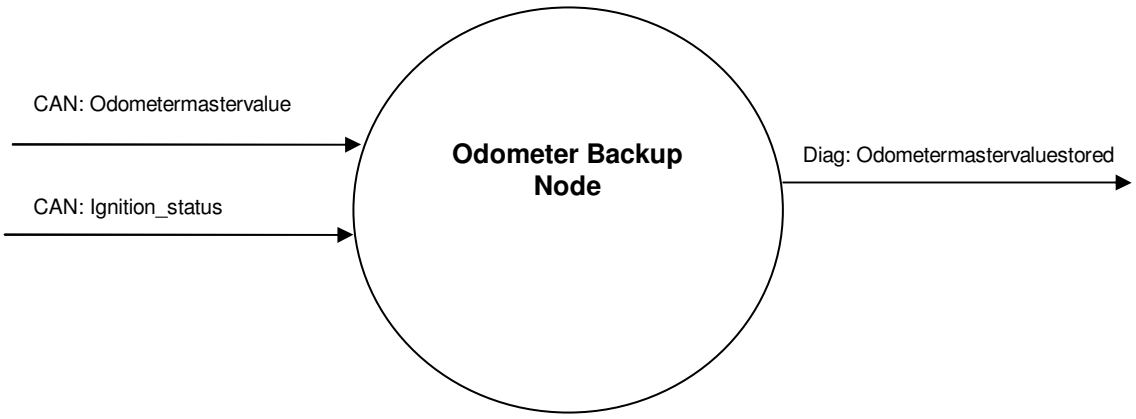
1.1 Functional Description

The purpose of the odometer backup is to provide a redundant storage of the total vehicle distance traveled in the EEPROM of the receiver(backup node) in order to prevent odometer tampering. The odometer value is transmitted by the Instrument cluster by CAN signal. During runtime the backup node must verify the validity of the received odometer signal against the internal backup storage and store it in EEPROM. If the validity testing of the received odometer signal failed, the backup node has to stop the comparison operation and keep the last valid value for module lifetime. This will support the determination of the original total odometer in case the original odometer is lost by a tamper attempt. The internal stored odometer shall be readable by diagnostic identifier.

1.2 Interfaces

1.2.1 Interface Context Diagram (I/O Block Diagram)

Figure 1 Odometer Context Diagram



Note: A Backup Node is the ECU this functional specification has been cascaded to.

1.2.2 Inputs

- Operational_Mode
- Odometer Master Signal

Table 1.0 Ignition_Status Signal CGEA 1.3

Signal Name	Size (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
Ignition_Status	4		SED	1	0		0 (0x0)	15 (0xF)
		Unknown				0x0		
		Off				0x1		
		Accessory				0x2		
		Run				0x4		
		Start				0x8		
		Invalid				0xF		

Table 1.1 Power Mode Signal CGEA 1.2

Signal Name	Size (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
Power Mode	5		SED	1	0		0 (0x0)	Not defined
		Key Out				0x0		
		KeyRecentlyOut				0x1		
		KeyApproved_0				0x2		
		PostAccessory_0				0x3		
		Accessory_1				0x4		
		PostIgnition_1				0x5		
		IgnitionON_2				0x6		
		Running_2				0x7		
		Not used				0x8		
		Crank_3				0x9		
		Not used				0xA		

Note: The ignition status signal name may be different on the carline architectures. Therefore the abstract designations Ignition off / OFF and ignition ON / RUN are used in this document.

- Odometer

Table 1.1 OdometerMasterValue Signal

Signal Name	Size (bits)	Detail	Units	Res.	Offset	State Encoded	Min	Max
OdometerMasterValue	24		km	1	0		0(0x0)	16777214 (0xFFFFFE)
		Invalid				0xFFFFFF		

Note: Although the OdometerMasterValue is a standardized global signal, the transmitter node may be different on the carline architectures, e.g. the OdometerMastervalue can also be transmitted from the instrument cluster through a Gateway node.

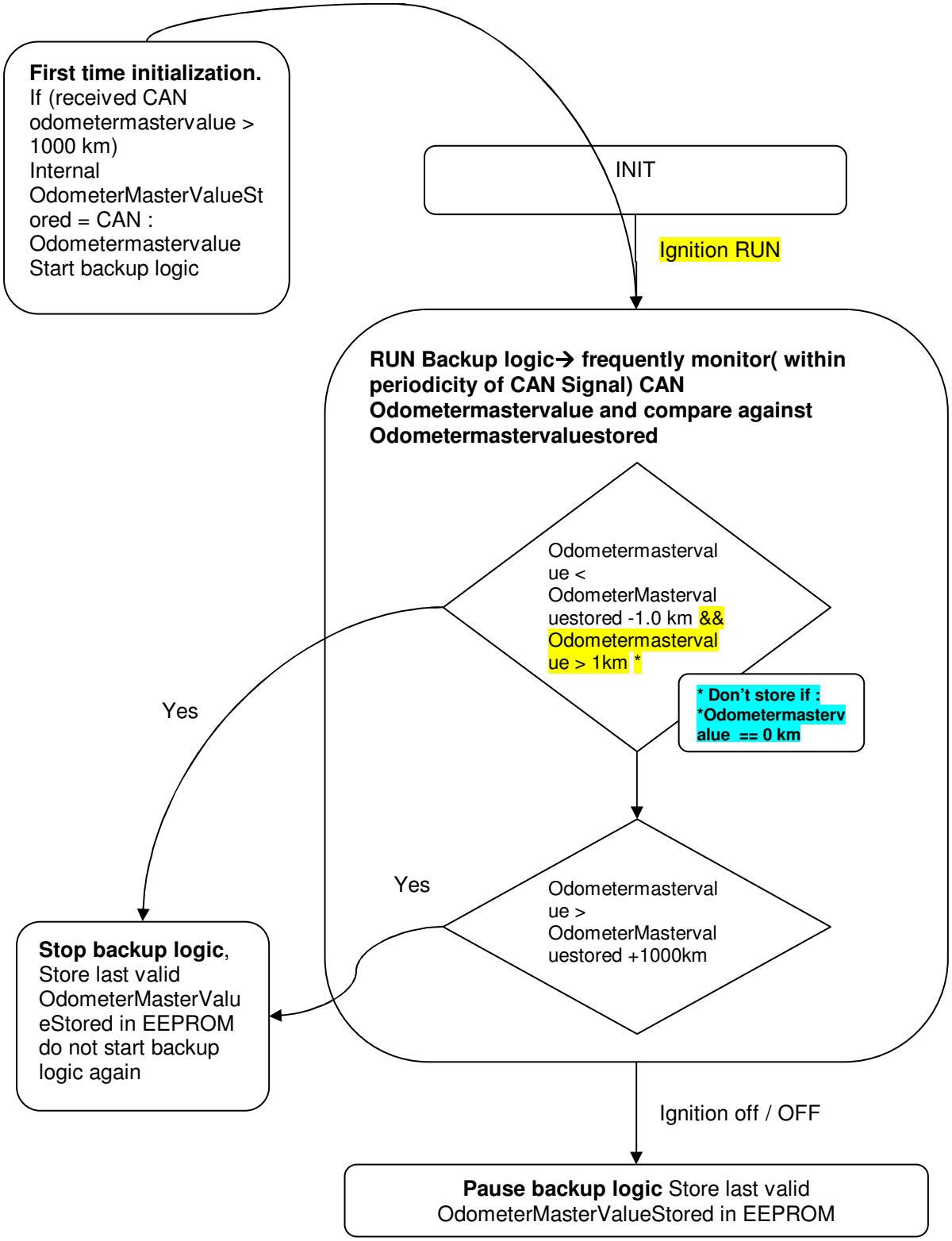
1.3 Function/Performance

1.3.1 Operational Modes

Mode	Differentiating Vehicle Conditions
Sleep Mode	Off
Limited Mode	Off
Normal Mode	backup storage
Crank Mode	-

Operation: Performance and Functional

1.3.1.1 Subsystem Algorithm Flowchart / State Diagram



1.3.1.2 Operation Description (supports algorithm flowchart /state diagram)

State	Explanation
First time initialization	This is done to prevent unintentional backup log during assembly process. Vehicles could possibly be driven until the final handover to the customer. The activation of the backup logic happens once in a lifetime of the backup node, when the received Odometermastervalue is greater than 1000km. The backup logic shall start immediately and the Odometermastervaluestored shall be updated (Odometermastervalue=Odometermastervaluestored and then compared with the received Odometermastervalue.
INIT	Initialization (after the first time initialization) ignition is off
Run backup logic	The received Odometermastervalue must be compared with the Odometermastervalue stored during ON / RUN. 1) If the received Odometermastervalue is smaller than the internal Odometermastervaluestored (-1.0km) and the received Odometermastervalue is greater than 1km (This prevents unintended logging if a fresh cluster with 0 km is replaced in service and the odometer was not updated by the dealer) *If the Backup logic is active the cluster shall not store an received Odometermastervalue of 0 km. This prevents unintended logging during service replacement. or 2) If the received Odometermastervalue is greater than the internal Odometermastervaluestored (+1000km) the backup logic shall be stopped and must not start again for the lifetime of the backupnode.
Stop backup logic	This ensures that a tamper attempt is detected (ideally the backupstorage and IPC millage will always have the same value). and the original mileage prior tampering is not lost If a tamper attempt has occurred.
Pause backup logic	The last valid odometerbackupstorage shall be stored in the contant area of EEPROM. If the storage is performed during runtime or at IGN off can be vendor specific.

Odometer Backup Storage (OdometerMasterValueStored)
Recommendation: Odometermastervaluestored backup value shall be stored in a minimum of 6 NVM locations to insure read/write cycles do not wear out NVM up to maximum odometer mileage capability. The odometer backup shall continue to function with one or more of the NVM locations failing.
The memory storage model can be vendor specific.

The backup value shall not get lost by battery disconnect or backup node software update (has to be added to the constant memory area of the module).

1.3.1.3 Memory Storage parameter name

Parameter Name	Read/Write	Range	Unit	Default value before first initialization

OdometerMasterValueStored	Setting Menu Feature displayed in the M/C	0 - 16777215	km	0

1.4 Error Handling

1.4.1 Missing Message Strategy

If the Odometermastervalue CAN signal is missing for more than 5 seconds the backup logic must be stopped. If the Odometermastervalue is reiceived afterwards with a value which is greater than 100 km as the internal OdometerMasterValueStored the backup logic must be stopped and must not reinitialize (Stop backup logic). Note: This detects if the sender node (instrument cluster) was disconnected from CAN bus during runtime.

1.4.2 Invalid Message Strategy

n/a

1.4.3 EEPROM failure handling

If a checksum failure occurs on a EEPROM read the backuplogic shall stop (state:Stop backup logic)

1.5 Diagnostics

1.5.1 Part II Performance

Supported Diagnostic DIDs (Service $22 and $2E)

Number	DID / CommonID Name	DID Type	Service	Diagnostic Session	Size	Resolution	MIN	MAX
0xEEF4 supplier range	Vehicle status counter	Unsigned Numeric	$22	0x1, 0x3	3	1	0	16777215

The backup storage must be readable (not writeable) by diagnostic identifier in the supplier range. It is recommended to use the standardized “0xEEF4”. To disguise the backup strategy in service / EOL it is not recommended to use standardized GMRDB identifier such as 61BB,rather use 0xEEF4 – supplier range. The official part 2 documentation of the backup node must state: “Vehicle status counter” as name.

1.5.2 Service

Parameter 0xEEF4 is not designed to be used in service. The backup logic is currently just for engineering purposes.
If a backup node is replaced the new node will learn the odometer from the instrument cluster (init routine). Inhale/Exhale of the Odometermastervaluestored shall not be conducted.

1.6 Revision History

SPSS Module Revision History

Revision Level	Name	Change Description	Date
1.0	W. Krug	First Draft	9/05/2012
1.0	W. Krug	Release 1.0.	17/09/2012
1.1	W. Krug	Release 1.1 – Updates: 1.3.1.1 add clarification of “frequently” → monitor(within periodicity of CAN Signal) 1..3.1.1 clarification : Odometermastervalue < OdometerMastervaluestored -1.0 km (1.0 kilometer difference)	01/10/2012
1.2.1	W.Krug	1.3.1.1. Change to run logic only when engine is running. This was done based on C34X field incidents where cluster are replaced, and the odometer inhale/exhale was done while ignition on. The Cluster will send 0 Km which will lead to unintended logging. Updated prevention to unintended logging if a fresh cluster with 0 km is replaced in service and the odometer was not updated by the dealer) 1.3.1.2 The memory model is just a recommendation from Ford. The supplier shall insure that the memory is not worn out, includes multiple locations and survives battery disconnects. Updated prevention to unintended logging if a fresh cluster with 0 km is replaced in service and the odometer was not updated by the dealer) 1.4.3 EEPROM failure handling added. 1.5.1. Change DID from 0xDCBB to 0xEEF4 based on diagnostics team input. Service shall be not writeable. 1.5.2. Added clarification of backup module replacement in service.	23/11/2012
1.2.2.	W.Krug	1.3.1.1.State chart updated: If backup logic is running, the cluster shall not log and store if an value of 0 km is received. This offers service the flexibility to perform odometer inhale/exhale after the engine has turned on and prevents unintended logging. 1.3.1.2.Explaination accordingly.	