

0.9

MIC3/MIC4/MIC5 J1939 Motortech

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1 Introduction

1.1 Purpose of this Document

This document describes the Motortech J1939 implementation in the ignition controllers MIC3 / MIC4 / MIC5.

1.2 Further applicable documents

- SAE j1939
- SAE J1939/21
- SAE J1939/71
- SAE J1939/73
- SAE J1939/81
- [svn://motdev01.motortech.local/development/projects/98.007.0244/trunk/900-Software/930-Design/Status-Bits.odt](#)
- [svn://motdev01.motortech.local/development/projects/98.007.0244/trunk/900-Software/910-Requirements/J1939/BinaryFileLayout.odg](#)
- [svn://motdev01.motortech.local/development/projects/98.007.0244/trunk/900-Software/910-Requirements/J1939/J1939_AddressClaiming.odg](#)
- [svn://motdev01.motortech.local/development/projects/98.007.0244/trunk/900-Software/910-Requirements/J1939/J1939_BinaryFileTransmission.odt](#)
- [svn://motdev01.motortech.local/development/projects/98.007.0244/trunk/900-Software/910-Requirements/J1939/J1939_MemoryWriteAccessStateMachine.odg](#)
- [svn://motdev01.motortech.local/development/projects/98.007.0244/trunk/900-Software/910-Requirements/J1939/J1939_TransportProtocolStateMachine.odg](#)
- [svn://motdev01.motortech.local/development/projects/98.007.0244/trunk/900-Software/910-Requirements/J1939/SequenceDiagramMultipleMemoryAccesses.odg](#)
- [svn://motdev01.motortech.local/development/projects/98.007.0244/trunk/900-Software/910-Requirements/J1939/SequenceDiagramOneMemoryAccess.odg](#)

1.3 Glossary

MIC	Motortech ignition controller (MIC3, MIC4 or MIC5)
MICT	Motortech integrated configuration tool
PF	PDU format
PS	PDU specific

1.4 Notation notes

Ignition controller is used as synonym for the MIC3, MIC4 or MIC5 **M**otortech **i**gnition **c**ontroller. (MIC)

2 J1939 Implementation

2.1 Source address of ignition controller

The J1939 source address of the ignition controller can be configured via

MICT → Communication → J1939 → Source Address.

The default source address value is 52 (0x34), used by single address capable address claiming.

2.2 Timing Sign

Positive Sign: later, retarded

Negative Sign earlier, advanced

2.3 Start Phase / Normal Operation and Schedule A/B

It is not recommended to use start phase / normal operation or schedule A/B, if spark intensity and spark duration should be controlled via J1939.

These values are the sum of a configured parameter, only changeable by configuration download, and a adjustment, which can be modified at runtime. These adjustment is calculated in such a way that spark duration / spark intensity meet the appropriate values, transmitted via J1939.

The configured values used for calculation depend on current active schedule and start phase / normal operation.

Therefore the resulting spark intensity / spark duration can be changed, if the appropriate configured values for schedule A/B and start phase / normal operation are different.

The adjustment calculation uses the configuration value according schedule and start phase / normal operation present at receive time of the PGN.

2.4 Cylinder Numbering

The cylinders are counted in ignition sequence order, that means, that cylinder with lowest firing angle is numbered with 1 and the cylinder with the highest firing angle is numbered as N (= number of cylinders).

2.5 Bit / Byte Numbering

Byte 0								Byte 1								Byte 2								Byte 3							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0

Byte 4								Byte 5								Byte 6								Byte 7							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0

Other than SAE J1939-71 bits and bytes are numbered from 7 (MSB) to 0 (LSB) and not from 8 (MSB) to 1 (LSB)

2.6 Unavailable / unconfigured values

Unavailable or unconfigured values are marked in accordance to SAE J1939-71 with 0xFF, 0xFFFF or 0xFFFFFFFFF.

For example if only 4 ignition outputs are used, cylinders from 5 to number of MIC outputs are treat as unconfigured.

Cylinders above the number of MIC outputs to 24 are treated as unavailable.

2.7 PGNS

Rx PGNs are received by the ignition controller. Tx PGNs are sent by the ignition controller on request or periodically.

PGNs with PDU format 0xFF are proprietary.

2.7.1 Rx PGNs

2.7.1.1 Request (0xEAx_y)

Data length: 3

Default priority: 6

PGN: 0xEAx_y (xy = source address of ignition controller)

Byte	Bit	Name	Value Range	Unit and Scaling
0		PS of requested PGN		
1		PF of requested PGN		
2		Data page of requested PGN		

With this PGN the Tx PGNs can be requested. In case of requesting a invalid Tx PGN a negative acknowledge will be sent from the ignition controller.

2.7.1.2 Time and Date Adjust (0xD5xy)

Data length: 8
Default priority: 6
PGN: 0xD5xy (xy = source address of ignition controller)

Byte	Bit	Name	Value Range	Unit and Scaling
0		Adjust Seconds	0x00 .. 0xFA	1:0,25s
1		Adjust Minutes	0x00 .. 0xFA	1:1m
2		Adjust Hours	0x00 .. 0xFA	1:1h
3		Adjust Month	0x00 .. 0xFA	1:1m
4		Adjust Day	0x00 .. 0xFA	1:0,25days
5		Adjust Year	0x00 .. 0xFA	1:year, Offset 1985
6		Adjust Local Minute Offset	0x00 .. 0xFA	1:1m, Offset -125h
7		Adjust Local Hour Offset	0x00 .. 0xFA	1:1h, Offset -125h

The realtime clock (RTC) of the ignitioncontroller stores the local time. In case of UTC with offset the RTC is set to the resulting local time. Is the time standard unknown, the received time will be assumed as local time without offset. Pure UTC is ignored.

The flowchart for interpret time, date and local hour offset is described in J1939-21,May2012, Appendix D. The time in bytes 0 to 7 is coded as followed:

- Adjust Seconds
 - Operational range: 0 to 59,75 seconds
 - PGNs with values beyond the operational range will be completely discarded
- Adjust Minutes
 - Operational range: 0 to 59 seconds
 - PGNs with values beyond the operational range will be completely discarded
- Adjust Hours
 - Operational range: 0 to 23 seconds
 - PGNs with values beyond the operational range will be completely discarded
 - Values beyond the range from 0x00 to 0xFA are discarded, the last valid value will be used
- Adjust Month
 - Operational range: 1 to 12, 1 → January ... 12 → December
 - PGNs with values beyond the operational range will be completely discarded
- Adjust Day
 - Operational range: 1 to 124, 1 to 4 → day 1; 5 to 8 → day 2, ... 121 to 124 → day 31
 - PGNs with values beyond the operational range will be completely discarded
- Adjust Year
 - Operational range: 15 to 114, 15 → 2000, 114 → 2099, offset from year 1985
 - The operational range is restricted to range 15 to 114 due to hardware requirements of the used RTC.
 - PGNs with values beyond the operational range will be completely discarded
- Adjust Local Minute Offset
 - Operational range: -59 m to +59 m, -59 m → 66, +59 m → 184
- Adjust Local Hour Offset
 - Operational range: -23 h to +23 h, -23 h → 102, 23 h → 148

The used time standard is interpreted from Adjust Local Hour Offset as follows:

Adjust Local Hour Offset	Time Standard	RTC Setting
0xFF	unknown time standard	RTC is left unchanged
0xFA	local time without offset	RTC is set

Adjust Local Hour Offset	Time Standard	RTC Setting
0xF9	UTC	not supported, RTC is left unchanged
0x66 to 0x94	UTC with offset	set RTC to resulting local time, if Adjust Local Minute offset is valid (i.e. 0x42 to 0xB8)

It is recommended, to use local time without offset mode (Adjust Local Hour Offset = 0xFA)

2.7.1.3 Global Timing and Intensity (0xEFxy)

Data length: 8
Priority: 6
PGN: 0xEFxy (xy = source address of ignition controller)

Byte	Bit	Name	Value Range	Unit and Scaling
0		Global Timing Correction	0x0000 .. 0xFAFF	1:1/128°, Offset -200°
1				
2		Reserved		
3		Reserved		
4		Spark Intensity A	0x00 .. 0xFA	1:1mA
5		Spark Intensity B	0x00 .. 0xFA	1:1mA
6		Reserved		
7		Reserved		

The global timing is the sum of base timing, potentiometer timing, analog current and voltage input timing, speed curve and global timing correction.

If global timing should be controlled only by global timing correction, transmitted via this PGN, all other above mentioned timings can be set to zero or disabled via MICT.

The spark intensity is the sum of configured spark intensity and a internal offset. The ignition controller calculate these offsets, so that the resulting spark intensity meets the via this PGN transmitted value.

The global timing correction and the offsets for spark intensity A and B are stored persistently. After downloading a new configuration, these values will be set to 0, therefore this PGN should be sent after every configuration download.

There are one spark intensity configuration parameters per schedule A, one for schedule B, one for start phase and one for normal operation. Therefore these PGN should be sent every time the start phase is entered or left, if there are different spark intensity configuration for start and normal operation phase.

2.7.1.4 Spark Durations 1 – 3 (0xFF4A – 0xFF4C)

Data length: 8
Priority: 6
PGN: 0xFF4A – 0xFF4C

Byte	Bit	Name	Value Range	Unit and Scaling
0		Spark Duration Cyl 1 / 9 / 17	0x00 ... 0xFA	1:10µs
1		Spark Duration Cyl 2 / 10 / 18	0x00 ... 0xFA	1:10µs
2		Spark Duration Cyl 3 / 11 / 19	0x00 ... 0xFA	1:10µs
3		Spark Duration Cyl 4 / 12 / 20	0x00 ... 0xFA	1:10µs
4		Spark Duration Cyl 5 / 13 / 21	0x00 ... 0xFA	1:10µs
5		Spark Duration Cyl 6 / 14 / 22	0x00 ... 0xFA	1:10µs
6		Spark Duration Cyl 7 / 15 / 23	0x00 ... 0xFA	1:10µs
7		Spark Duration Cyl 8 / 16 / 24	0x00 ... 0xFA	1:10µs

PGN 0xFF4A controls spark duration of cylinders 1 – 8, PGN 0xFF4B of cylinders 9 – 16 and PGN 0xFF4C of cylinders 17 – 24.

The ignition controller calculates a cylinder individual spark duration offset, so that the resulting spark duration meets the via this PGN transmitted value.

The calculated offset is stored persistently but will be set to 0 after configuration download.

Because there are four configured spark duration parameters, one per schedule A/B and one per start phase/normal operation, this PGN must be sent every time, the configured parameter changes.

2.7.1.5 Misc Setup (0xFF4D)

Data length: 8
Priority: 6
PGN:: 0xFF4D

Byte	Bit	Name	Value Range	Unit and Scaling
0		Offset Index Mark Position	0x00 ... 0xFA	1:0,1°, Offset -12,5°
1		Command		
2		Sub Command		
3		Optional Cmd Parameter 0		
4		Optional Cmd Parameter 1		
5		Optional Cmd Parameter 2		
6		Optional Cmd Parameter 3		
7		Optional Cmd Parameter 4		

The reset position is the sum of configured index/reset position and the offset index mark position. The index mark position is stored persistently but is set to 0 after configuration download.

The index/reset position can be configured via

MICT → Pickups → Index/Reset Position.

The following commands are available:

Command		Sub Command		Optional Parameter				
Value	Name	Value	Name	0	1	2	3	4
0	do nothing	---	---	---	---	---	---	---
1	configuration start	---	---	---	---	---	---	---
2	configuration end	---	---	---	---	---	---	---
3	configuration end with discard	---	---	---	---	---	---	---
4	acknowledge warnings	---	---	---	---	---	---	---
5	acknowledge operational errors	---	---	---	---	---	---	---
6	acknowledge alarms	---	---	---	---	---	---	---
7	Reserved	---	---	---	---	---	---	---
8	Reserved	---	---	---	---	---	---	---
9	access ctrl	0	enable	---	master pin		---	---
		1	disable	---	master pin		---	---
		2	change pin	level	old pin		new pin	

Command		Sub Command		Optional Parameter				
Value	Name	Value	Name	0	1	2	3	4
		3	reset all pins	---	master pin		---	---

2.7.1.6 Individual Timing Offsets 1 – 3 (0xFFF5 – 0xFFF7)

Data length: 8
Priority: 6
PGN: 0xFFF5 – 0xFFF7

Byte	Bit	Name	Value Range	Unit and Scaling
0		Timing Offset Cyl 1 / 9 / 17	0x00 ... 0xFA	1:0,1°, Offset -12,5°
1		Timing Offset Cyl 2 / 10 / 18	0x00 ... 0xFA	1:0,1°, Offset -12,5°
2		Timing Offset Cyl 3 / 11 / 19	0x00 ... 0xFA	1:0,1°, Offset -12,5°
3		Timing Offset Cyl 4 / 12 / 20	0x00 ... 0xFA	1:0,1°, Offset -12,5°
4		Timing Offset Cyl 5 / 13 / 21	0x00 ... 0xFA	1:0,1°, Offset -12,5°
5		Timing Offset Cyl 6 / 14 / 22	0x00 ... 0xFA	1:0,1°, Offset -12,5°
6		Timing Offset Cyl 7 / 15 / 23	0x00 ... 0xFA	1:0,1°, Offset -12,5°
7		Timing Offset Cyl 8 / 16 / 24	0x00 ... 0xFA	1:0,1°, Offset -12,5°

PGN 0xFFF5 controls timing offset of cylinders 1 – 8, PGN 0xFFF6 of cylinders 9 – 16 and PGN 0xFFF7 of cylinders 17 – 24.

The cylinder individual timing offsets are stored persistently and will be set to 0 after configuration download.

2.7.2 Tx PGNs

2.7.2.1 Engine Spark Voltage 6 – 1 (0xFD72 – 0xFD77)

Transmission rate: on request
Data length: 8
Priority: 6
PGN: 0xFD72 – 0xFD77

Byte	Bit	Name	Value Range	Unit and Scaling
0		Secondary Voltage Cylinder 21 / 17 / 13 / 9 / 5 / 1	0x0000 ... 0xFAFF	1:1V, Offset 0V
1				
2		Secondary Voltage Cylinder 22 / 18 / 14 / 10 / 6 / 2	0x0000 ... 0xFAFF	1:1V, Offset 0V
3				
4		Secondary Voltage Cylinder 23 / 19 / 15 / 11 / 7 / 3	0x0000 ... 0xFAFF	1:1V, Offset 0V
5				
6		Secondary Voltage Cylinder 24 / 20 / 16 / 12 / 8 / 4	0x0000 ... 0xFAFF	1:1V, Offset 0V
7				

PGN 0xFD72 shows secondary voltage of cylinders 21 – 24, PGN 0xFD73 of cylinders 17 – 20, PGN 0xFD74 of cylinders 13 – 16, PGN 0xFD75 of cylinders 9 – 12, PGN 0xFD76 of cylinders 5 – 8 and PGN 0xFD77 of cylinders 1 – 4.

Secondary voltage estimation must be supported by the selected coil type. The maximum breakdown voltage configured via

MICT → Schedule A/B → Energy → Max. Breakdown Voltage

must be set to the correct value. This value depends on the selected coil.

If secondary estimation is disabled due to above mentioned causes, 0xFFFF will be sent.

2.7.2.2 Time and Date (0xFEE6)

Transmission rate: on request
Data length: 8
Priority: 6
PGN: 0xFEE6

Byte	Bit	Name	Value Range	Unit and Scaling
0		Adjust Seconds	0x00 .. 0xFA	1:0,25s
1		Adjust Minutes	0x00 .. 0xFA	1:1m
2		Adjust Hours	0x00 .. 0xFA	1:1h
3		Adjust Month	0x00 .. 0xFA	1:1m
4		Adjust Day	0x00 .. 0xFA	1:0,25days
5		Adjust Year	0x00 .. 0xFA	1:year, Offset 1985
6		Adjust Local Minute Offset	0x00 .. 0xFA	1:1m, Offset -125h
7		Adjust Local Hour Offset	0x00 .. 0xFA	1:1h, Offset -125h

The realtime clock (RTC) is set to local time, UTC with local offset is not supported.

The time in bytes 0 to 7 is coded as followed:

- Adjust Seconds
 - Operational range: 0 to 59,75 seconds
 - The resolution of the RTC is restricted to seconds.
- Adjust Minutes
 - Operational range: 0 to 59 seconds
- Adjust Hours
 - Operational range: 0 to 23 seconds
- Adjust Month
 - Operational range: 1 to 12, 1 → January ... 12 → December
- Adjust Day
 - Operational range: 1 to 124, 1 to 4 → day 1; 5 to 8 → day 2, ... 121 to 124 → day 31
- Adjust Year
 - Operational range: 15 to 114, 15 → 2000, 114 → 2099, offset from year 1985
 - The operational range is restricted to range 15 to 114 due to hardware requirements of the used RTC.
- Adjust Local Minute Offset
 - To indicate usage of local time *Adjust Local Minute Offset* is set to 0xFF.
- Adjust Local Hour Offset
 - To indicate usage of local time *Adjust Local Hour Offset* is set to 0xFA.

2.7.2.3 MIC Status(0xFF0F)

Transmission rate: on request ,on change, every 1000ms, minimum time 50ms
Data length: 8
Priority: 6
PGN: 0xFF0F

Byte	Bit	Name	Description
0	0	Device Status: Ready	The device is ready and waiting for pickup signal activity.
	1	Device Status: Operation	Pickup signal activity was detected and so far no error occurred. The current substate is indicated by byte 0, bit 5 to byte 1, bit 0
	2	Device Status: Configuration	The device is beeing configured.
	3	Device Status: Self Test	Self test in progress

Byte	Bit	Name	Description
	4	Reserved	
	5	Device Status: Firing Active	Ignition is operating.
	6	Device Status: Firing Locked	Pickup signals are available and valid but ignition is locked.
	7	Device Status: Wait for Engine Stop	Pickup signals are available, it has been fired above security speed and the ignition was locked. The engine has to stop before it can be started again.
1	0	Device Status: Synchronization	Pickup signals are available and being checked.
	1	Operational Error	A operational error has occurred.
	2	System Error	A system error has occurred.
	3	Reserved	
	4	Condensed Primary Open	Primary Open is indicated for at least one output.
	5	Condensed Primary Short	Primary Short is indicated for at least one output.
	6	Condensed Secondary Open	Secondary Open is indicated for at least one output.
	7	Condensed Secondary Short	Secondary Short is indicated for at least one output.
2	0	Start Phase	The engine is in start phase.
	1	Firing Enabled	Firing is enabled. Usually this equals the logic state of the start/stop input. 0: Firing locked 1: Firing enabled
	2	Schedule A/B	Current schedule 0: Schedule A 1: Schedule B
	3	Primary Open Detection Enabled	During ignition: detection/estimation currently enabled Otherwise: detection/estimation supported by selected coil
	4	Primary Short Detection Enabled	
	5	Secondary Open Detection Enabled	
	6	Secondary Short Detection Enabled	
	7	Secondary Voltage Estimation Enabled	
3	0	GPO	Logic state of GPO1 0: Not switched 1: Switched
	1	Reserved	
	2	Reserved	
	3	Reserved	
	4	GPI	Input level of GPI1
	5	Reserved	
	6	Reserved	
	7	Reserved	
4	0	Warning: Temperature Limit Reached	The warning is set if the device temperature exceeds the limit of 90 °C (194 °F) for two minutes.

Byte	Bit	Name	Description
			If the device temperature falls below the threshold, the warning is automatically reset.
	1	Warning: Power Output Limit Reached	The warning is set if the power output exceeds the limit of 80 W for two minutes. If the power supply is below 16 V this warning occurs also with lower power output. If the power output falls below the threshold, the warning is automatically reset.
	2	Warning: Warning: Invalid Coil Data	During configuration coil data have been received but these data were incomplete or invalid when the configuration state was left. The warning is not set if no coil data have been received. If configuration state is left after receiving complete and valid coil data the warning is reset.
	3	Warning: Configuration Invalid	The warning is set if the configuration is invalid after leaving configuration state. Otherwise the warning is reset.
	4	Warning: Invalid Trigger Configuration	The warning is set if a configuration with invalid pickup settings has been transferred. The warning is automatically reset after transferring a valid pickup configuration.
	5	Warning: Configuration CRC Error	The configuration stored in a non-volatile memory could not have been read because a CRC check failed. The warning is reset after a new valid configuration is stored.
	6	Analog Current Input Failure	The analog current input signal fails.
5	7	Analog Voltage Input Failure	The analog voltage input signal fails.
	0	Auxiliary Analog Input Supply Voltage Failure	The measured value of the auxiliary analog input supply voltage deviates from the configured value.
	1	Auxiliary Pickup Supply Voltage Failure	The measured value of the auxiliary pickup supply voltage deviates from the configured value.
	2	Global Timing Limited	The global timing point is currently limited by the timing limits.
	3	Reserved	
	4	Reserved	
	5	Reserved	
	6	Reserved	
6		Reserved	
7		Reserved	

2.7.2.4 Configuration Signature (0xFF10)

Transmission rate: on request
Data length: 8
Priority: 6
PGN: 0xFF10

Byte	Bit	Name	Value Range	Unit and Scaling
0		Signature		0 = configuration via MICT

Byte	Bit	Name	Value Range	Unit and Scaling
1		Reserved		
2		Reserved		
3		Reserved		
4	0	Reserved		
	1	Access Ctrl State	0 .. 1	0 = AccessCtrl disabled 1 = AccessCtrl enabled
	2	Reserved		
	3	Reserved		
	4	Reserved		
	5	Reserved		
	6	Reserved		
	7	Reserved		
5		Command Reply		
6		Reserved		
7		Reserved		

If the MIC enter the configuration state, the signature will be set to 0. In case of configuration via J1939 memory access the signature can be set to a characteristic value to identify this configuration.

Therefore configuration via MICT can be detected.

The AccessCtrl state is signaled via bit 1 of byte 4, the return value of the last command, initiated by PGN 0xFF4D (MiscSetup), can be read via byte 5.

2.7.2.5 MIC Error 1 (0xFF11)

Transmission rate: on request ,on change, every 5000ms, minimum time 50ms

Data length: 8

Priority: 6

PGN: 0xFF11

Byte	Bit	Name	Description
0	0	General Error	General error. See message log for details. In case of operational error the error can be acknowledged. In case of system error the device must be restarted.
	1	Overspeed	Overspeed
	2	Pickup Signal in Self-Test Detected	The self test was aborted because pickup signal activity has been detected.
	3	Alarm Shutdown	The ignition was shutdown due to a alarm.
	4	Output Board Identification Failed	Output board identification data could not be read, are corrupted or do not mach the device.
	5	Power Failure	The high power voltage power supply has signaled a failure.
	6	Temperature Sensor Failure	During temperature measurement an error occurred.
	7	Current Sensor Failure	During current measurement an error occurred.
1	0	Temperature Limit Exceeded	The error is triggered if the device temperature exceeds 95 °C (203 °F) or if it exceeds 90 °C (194 °F) for ten minutes
	1	Power Output Limit Exceeded	The error is triggered if the power outputs exceeds 100 W or if it exceeds 80 W for three minutes.

Byte	Bit	Name	Description
	2	Device Started After Supply Voltage Failure	The device was started or powered on again after a supply voltage failure.
	3 - 7	Reserved	
2		Reserved	
3		Reserved	
4	0	Synchronization Problem	Failed to synchronize to this signal combined with another input prevented the system from synchronization
	1	Operational Error	A signal (or timeout) on this input caused an operational error.
	2 - 7	Reserved	
5	0	No Signal	No signal detected on this input although it has been configured
	1	Reserved	
	2	Reserved	
	3	Polarity Detection Failed	Polarity detection failed.
	4	Wrong polarity	The input signal has the wrong polarity. The bit is not reset until the next synchronization.
	5	Reserved	
	6	Reserved	
	7	No Index Mark Found	The index mark for N+1, N-1, ... was not found, i.e. the input has been configured for N+1, but actually reads a N disc.
6	0	Wrong Number of Events	The number of events counted does not match the number of events configured/expected.
	1	Missing Signal	An expected signal was missing. For example the trigger period increased by more than 50%.
	2	Faulty Signal	An unexpected signal was detected. For example the trigger period decreased to less than 50%.
	3	Missing Index Mark	A previously checked index mark was missing. For example the additional pin of a N+1 dis is missing during operation.
	4	Faulty Index	The index derived from this input was too early in relation to another signal of a 3 pickup system was too early or there was noise on the reset signal.
	5	Missing Index	The index derived from this input was too late in relation to another signal or it was missing. For example the CAM signal was expected before a reset signal but missing.
	6	Reserved	
	7	Reserved	
7		Reserved	

2.7.2.6 MIC Error 2 (0xFF12)

Transmission rate: on request ,on change, every 5000ms, minimum time 50ms
 Data length: 8
 Priority: 6
 PGN: 0xFF12

Byte	Bit	Name	Description
0	0	Synchronization Problem	Failed to synchronize to this signal combined with another input prevented the system from synchronization
	1	Operational Error	A signal (or timeout) on this input caused an operational error.
	2 - 7	Reserved	
1	0	No Signal	No signal detected on this input although it has been configured
	1	Reserved	
	2	Reserved	
	3	Polarity Detection Failed	Polarity detection failed.
	4	Wrong polarity	The input signal has the wrong polarity. The bit is not reset until the next synchronization.
	5	Reserved	
	6	Reserved	
	7	No Index Mark Found	The index mark for N+1, N-1, ... was not found, i.e. the input has been configured for N+1, but actually reads a N disc.
2	0	Wrong Number of Events	The number of events counted does not match the number of events configured/expected.
	1	Missing Signal	An expected signal was missing. For example the trigger period increased by more than 50%.
	2	Faulty Signal	An unexpected signal was detected. For example the trigger period decreased to less than 50%.
	3	Missing Index Mark	A previously checked index mark was missing. For example the additional pin of a N+1 dis is missing during operation.
	4	Faulty Index	The index derived from this input was too early in relation to another signal of a 3 pickup system was too early or there was noise on the reset signal.
	5	Missing Index	The index derived from this input was too late in relation to another signal or it was missing. For example the CAM signal was expected before a reset signal but missing.
	6	Reserved	
	7	Reserved	
3		Reserved	
4	0	Synchronization Problem	Failed to synchronize to this signal combined with another input prevented the system from synchronization
	1	Operational Error	A signal (or timeout) on this input caused an operational error.
	2 - 7	Reserved	
5	0	No Signal	No signal detected on this input although it has been configured

Byte	Bit	Name	Description
	1	Reserved	
	2	Reserved	
	3	Polarity Detection Failed	Polarity detection failed.
	4	Wrong polarity	The input signal has the wrong polarity. The bit is not reset until the next synchronization.
	5	Reserved	
	6	Reserved	
	7	No Index Mark Found	The index mark for N+1, N-1, ... was not found, i.e. the input has been configured for N+1, but actually reads a N disc.
6	0	Wrong Number of Events	The number of events counted does not match the number of events configured/expected.
	1	Missing Signal	An expected signal was missing. For example the trigger period increased by more than 50%.
	2	Faulty Signal	An unexpected signal was detected. For example the trigger period decreased to less than 50%.
	3	Missing Index Mark	A previously checked index mark was missing. For example the additional pin of a N+1 dis is missing during operation.
	4	Faulty Index	The index derived from this input was too early in relation to another signal of a 3 pickup system was too early or there was noise on the reset signal.
	5	Missing Index	The index derived from this input was too late in relation to another signal or it was missing. For example the CAM signal was expected before a reset signal but missing.
	6	Reserved	
	7	Reserved	
7		Reserved	

2.7.2.7 Ignition Primary Error (0xFF13)

Transmission rate: on request ,on change, every 5000ms, minimum time 50ms
 Data length: 8
 Priority: 6
 PGN: 0xFF13

Byte	Bit	Name	Value Range	Unit and Scaling
0	0	Primary Open Cylinder 1		
	1	Primary Open Cylinder 2		
	2	Primary Open Cylinder 3		
	3	Primary Open Cylinder 4		
	4	Primary Open Cylinder 5		
	5	Primary Open Cylinder 6		
	6	Primary Open Cylinder 7		
	7	Primary Open Cylinder 8		
1	0	Primary Open Cylinder 9		

Byte	Bit	Name	Value Range	Unit and Scaling
	1	Primary Open Cylinder 10		
	2	Primary Open Cylinder 11		
	3	Primary Open Cylinder 12		
	4	Primary Open Cylinder 13		
	5	Primary Open Cylinder 14		
	6	Primary Open Cylinder 15		
	7	Primary Open Cylinder 16		
2	0	Primary Open Cylinder 17		
	1	Primary Open Cylinder 18		
	2	Primary Open Cylinder 19		
	3	Primary Open Cylinder 20		
	4	Primary Open Cylinder 21		
	5	Primary Open Cylinder 22		
	6	Primary Open Cylinder 23		
	7	Primary Open Cylinder 24		
3		Reserved		
4	0	Primary Short Cylinder 1		
	1	Primary Short Cylinder 2		
	2	Primary Short Cylinder 3		
	3	Primary Short Cylinder 4		
	4	Primary Short Cylinder 5		
	5	Primary Short Cylinder 6		
	6	Primary Short Cylinder 7		
	7	Primary Short Cylinder 8		
5	0	Primary Short Cylinder 9		
	1	Primary Short Cylinder 10		
	2	Primary Short Cylinder 11		
	3	Primary Short Cylinder 12		
	4	Primary Short Cylinder 13		
	5	Primary Short Cylinder 14		
	6	Primary Short Cylinder 15		
	7	Primary Short Cylinder 16		
6	0	Primary Short Cylinder 17		
	1	Primary Short Cylinder 18		
	2	Primary Short Cylinder 19		
	3	Primary Short Cylinder 20		
	4	Primary Short Cylinder 21		
	5	Primary Short Cylinder 22		
	6	Primary Short Cylinder 23		
	7	Primary Short Cylinder 24		
7		Reserved		

2.7.2.8 Ignition Secondary Error (0xFF14)

Transmission rate: on request ,on change, every 5000ms, minimum time 50ms
Data length: 8
Priority: 6
PGN: 0xFF14

Byte	Bit	Name	Value Range	Unit and Scaling
0	0	Secondary Open Cylinder 1		
	1	Secondary Open Cylinder 2		
	2	Secondary Open Cylinder 3		
	3	Secondary Open Cylinder 4		
	4	Secondary Open Cylinder 5		
	5	Secondary Open Cylinder 6		
	6	Secondary Open Cylinder 7		
	7	Secondary Open Cylinder 8		
1	0	Secondary Open Cylinder 9		
	1	Secondary Open Cylinder 10		
	2	Secondary Open Cylinder 11		
	3	Secondary Open Cylinder 12		
	4	Secondary Open Cylinder 13		
	5	Secondary Open Cylinder 14		
	6	Secondary Open Cylinder 15		
	7	Secondary Open Cylinder 16		
2	0	Secondary Open Cylinder 17		
	1	Secondary Open Cylinder 18		
	2	Secondary Open Cylinder 19		
	3	Secondary Open Cylinder 20		
	4	Secondary Open Cylinder 21		
	5	Secondary Open Cylinder 22		
	6	Secondary Open Cylinder 23		
	7	Secondary Open Cylinder 24		
3		Reserved		
4	0	Secondary Short Cylinder 1		
	1	Secondary Short Cylinder 2		
	2	Secondary Short Cylinder 3		
	3	Secondary Short Cylinder 4		
	4	Secondary Short Cylinder 5		
	5	Secondary Short Cylinder 6		
	6	Secondary Short Cylinder 7		
	7	Secondary Short Cylinder 8		
5	0	Secondary Short Cylinder 9		
	1	Secondary Short Cylinder 10		

Byte	Bit	Name	Value Range	Unit and Scaling
	2	Secondary Short Cylinder 11		
	3	Secondary Short Cylinder 12		
	4	Secondary Short Cylinder 13		
	5	Secondary Short Cylinder 14		
	6	Secondary Short Cylinder 15		
	7	Secondary Short Cylinder 16		
6	0	Secondary Short Cylinder 17		
	1	Secondary Short Cylinder 18		
	2	Secondary Short Cylinder 19		
	3	Secondary Short Cylinder 20		
	4	Secondary Short Cylinder 21		
	5	Secondary Short Cylinder 22		
	6	Secondary Short Cylinder 23		
	7	Secondary Short Cylinder 24		
7		Reserved		

2.7.2.9 Ignition Timing 1 – 5 (0xFE82 – 0xFE86), Ignition Timing 6 (0xFFFF4)

Transmission rate: on request
Data length: 8
Priority: 6
PGN: 0xFE82 – 0xFE86 / 0xFFFF4

Byte	Bit	Name	Value Range	Unit and Scaling
0		Cylinder Ignition Timing 1/5/9/13/17/21	0x0000 .. 0xFAFF	1:1/128°, Offset -200°
1				
2		Cylinder Ignition Timing 2/6/10/14/18/22	0x0000 .. 0xFAFF	1:1/128°, Offset -200°
3				
4		Cylinder Ignition Timing 3/7/11/15/19/23	0x0000 .. 0xFAFF	1:1/128°, Offset -200°
5				
6		Cylinder Ignition Timing 4/8/12/16/20/24	0x0000 .. 0xFAFF	1:1/128°, Offset -200°
7				

PGN 0xFE82 contains relative firing angle of cylinders 1 – 4, PGN 0xFE83 of cylinders 5 – 8, PGN 0xFE84 of cylinders 9 – 12, PGN 0xFE85 of cylinders 13 – 16, PGN 0xFF86 of cylinders 17 – 20 and PGN 0xFFFF4 of cylinders 21 – 24.

2.7.2.10 Desired and Actual Ignition Timing (0xFE87)

Transmission rate: on request
Data length: 8
Priority: 6
PGN:: 0xFE87

Byte	Bit	Name	Value Range	Unit and Scaling
0		Engine Desired Ignition Timing	0x0000 .. 0xFAFF	1:1/128°, Offset -200°
1				

Byte	Bit	Name	Value Range	Unit and Scaling
2		Reserved		
3		Reserved		
4		Reserved		
5		Reserved		
6		Engine Actual Ignition Timing	0x0000 .. 0xFAFF	1:1/128°, Offset -200°
7				

The engine desired ignition timing is the global timing point, the sum of base timing, potentiometer timing, analog current and voltage input timing, speed curve and global timing correction.
The engine actual ignition timing is the engine desired ignition timing, limited by min/max timing points 1 and 2 configured via
MICT → Schedule A/B → General → Min/Max Timing Point 1, Min/Max Timing Point 2.

2.7.2.11 Ignition Primary Energy (0xFF30 – 0xFF32)

Transmission rate: on request
Data length: 8
Priority: 6
PGN: 0xFF30 – 0xFF32

Byte	Bit	Name	Value Range	Unit and Scaling
0		Primary Energy Cyl. 1 / 9 / 17	0x00 ... 0xFA	1:2mJ
1		Primary Energy Cyl. 2 / 10 / 18	0x00 ... 0xFA	1:2mJ
2		Primary Energy Cyl. 3 / 11 / 19	0x00 ... 0xFA	1:2mJ
3		Primary Energy Cyl. 4 / 12 / 20	0x00 ... 0xFA	1:2mJ
4		Primary Energy Cyl. 5 / 13 / 21	0x00 ... 0xFA	1:2mJ
5		Primary Energy Cyl. 6 / 14 / 22	0x00 ... 0xFA	1:2mJ
6		Primary Energy Cyl. 7 / 15 / 23	0x00 ... 0xFA	1:2mJ
7		Primary Energy Cyl. 8 / 16 / 24	0x00 ... 0xFA	1:2mJ

PGN 0xFF30 contains primary energy of cylinders 1 – 8, PGN 0xFF32 of cylinders 9 – 16 and PGN 0xFF33 of cylinders 17 – 24.

2.7.2.12 Engine Misfire Statistics 1 – 3 (0xFF33 – 0xFF35)

Transmission rate: on request
Data length: 8
Priority: 6
PGN: 0xFF33 – 0xFF35

Byte	Bit	Name	Value Range	Unit and Scaling
0		Misfire Rate Cyl.. 1 / 9 / 17	0x00 ... 0xFA	1:1% Misfire Rate last 32 fires
1		Misfire Rate Cyl.. 2 / 10 / 18	0x00 ... 0xFA	1:1% Misfire Rate last 32 fires
2		Misfire Rate Cyl.. 3 / 11 / 19	0x00 ... 0xFA	1:1% Misfire Rate last 32 fires
3		Misfire Rate Cyl.. 4 / 12 / 20	0x00 ... 0xFA	1:1% Misfire Rate last 32 fires
4		Misfire Rate Cyl.. 5 / 13 / 21	0x00 ... 0xFA	1:1% Misfire Rate last 32 fires
5		Misfire Rate Cyl.. 6 / 14 / 22	0x00 ... 0xFA	1:1% Misfire Rate last 32 fires
6		Misfire Rate Cyl.. 7 / 15 / 23	0x00 ... 0xFA	1:1% Misfire Rate last 32 fires
7		Misfire Rate Cyl.. 8 / 16 / 24	0x00 ... 0xFA	1:1% Misfire Rate last 32 fires

PGN 0xFF33 contains misfire rate of cylinders 1 – 8, PGN 0xFF34 of cylinders 9 – 16 and PGN 0xFF35 of cylinders 17 – 24.

The misfire rate is calculated about the last 32 fires.

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