jCOM.J1939 Protocol & Programming Interface

The jCOM.J1939 gateway series by Copperhill Technologies represent high-performance, low-latency vehicle network adapters. They allow any host device with a serial COM port (USB or UART) to monitor SAE J1939 data traffic and communicate with the SAE J1939 vehicle network. The gateways support the full SAE J1939 protocol according to J1939/81 Network Management (Address Claiming), J1939/21 Transport Protocol (TP), and J1939/16 (Automatic CAN baud rate detection).

The jCOM.J1939 Gateway Protocol is designed to establish a data exchange between a jCOM.J1939 Series gateway and a host system (e.g. a PC or embedded system such as the Raspberry Pi) per means of serial communication (UART, USB). The protocol enables the host system to take advantage of the gateway's capabilities by providing a set of commands from the host and responses from the gateway.

jCOM.J1939 Gateway Operating Modes

The jCOM.J1939 gateways supports two operating modes to cover all possible scenarios. The operating mode can be set by the host system per command through the serial port (USB or UART) as described in the next chapter.

The modes are:

1. **Listen-Only (Default):** This mode supports a mere J1939 data-monitoring mode, which does not require the use of a NAME and source address, i.e. there is no address claim process.
2. **Communication:** This mode allows full communication, i.e. bidirectional data transfer, between the host system and the J1939 vehicle network.

A jCOM.J1939 gateway works per default as a mere monitoring device in *Listen-Only* mode, however, the gateway will, also per default, not report any data unless the host system (e.g. a PC under Windows/Linux) sets the corresponding filters (ADDFILTER/ADDFILTERX command).

A full communication, i.e. bidirectional data transfer, between the host system and the J1939 vehicle network is only possible after the host system initiates the J1939 Address Claim process by sending the corresponding command (SETPARAM).

All operating modes allow the reception of up to 1785 bytes per message, while the *Communication* operating mode also allows the transmission of up to 1785 bytes per message (BAM or RTS/CTS Session).

The *Communication* operating mode engages the full Address Claim procedure, requiring a NAME, a preferred source address (SA), and an optional address range (in case the preferred SA is already taken).

The transmission of J1939 messages in the *Communication* operating mode is always "real-time," i.e. the message is being transmitted as soon as possible (as soon as the gateway proceeds during the bus arbitration process).

START-UP SEQUENCE

The start-up sequences for each mode are:

Listen-Only:
1. Send RESET command, which also initializes the CAN baud rate (250/500 kbps).
2. Set all filters (ADDFILTER/ADDFILTERX command).
3. Operation starts with setting the first filter.

Communication:
1. Send RESET command, which also initializes the CAN baud rate (250/500 kbps).
2. Initiate Address Claim Process and set operating mode using the SETPARAM or SETPARAM1 command.
3. When using the SETPARAM1 command, the gateway responds with REPSTATUS message.
4. After successful address claim (check status per REPSTATUS message), data transmission is enabled.
5. Set all filters (ADDFILTER/ADDFILTERX command).
6. Receiving messages is enabled with setting the first filter.

SERIAL COMMUNICATIONS PROTOCOL

This chapter describes the message framing protocol used to define the start and body of messages sent between host device and the jCOM.J1939 gateway.

MESSAGE FORMAT

The jCOM.J1939 protocol defines two special tokens, START and ESC. START has the value of 192 decimal and ESC has the value of 219 decimal.

Data is sent to and from the jCOM.J1939 gateway using the industry standard method of byte stuffing. Byte stuffing is the process of inserting additional tokens when the START or ESC tokens are part of the data field.

All messages start with a START token, and due to byte stuffing, a START token can never appear in any other part of the message. If the value of 192 is contained in the message length, data field, or checksum, an ESC token is inserted into the data stream followed by a 220, this indicates a value of 192. If an ESC token appears in the message length, data field, or checksum, an ESC token is inserted into the stream followed by a 221, this indicates a value of 219.
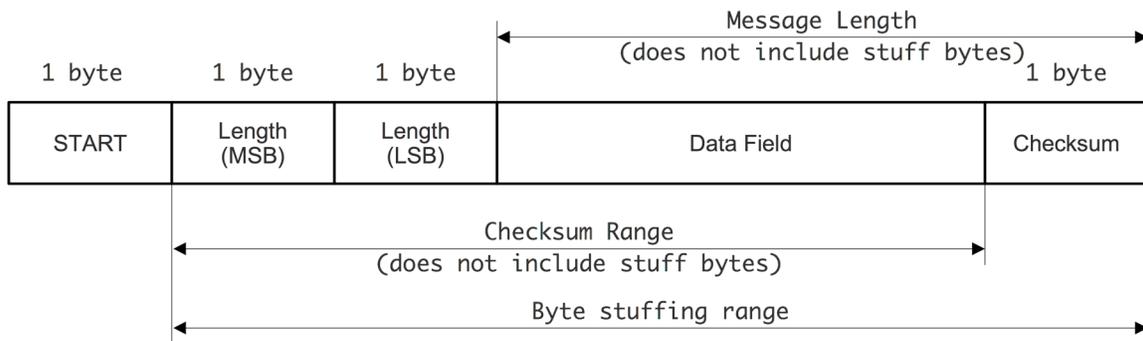
All messages must be byte stuffed, following the START token, by the transmitter and unstuffed by the receiver.

Code	Dec / Hex	Description
START	192 / 0xC0	Start of Message
ESC	219 / 0xDB	Stuffing Byte
START_STUFF	220 / 0xDC	Stuffing Byte
ESC_STUFF	221 / 0xDD	Stuffing Byte
DATA_START	ESC+START_STUFF	Data = 219, 220 / 0xDB, 0xDC
DATA_ESC	ESC+ESC_STUFF	Data = 219, 221 / 0xDB, 0xDD

To send a packet, the transmitting device starts by sending a START character followed by the size of the data to follow, along with the data and the checksum of the packet.

The message length is a 2-byte field (MSB first, followed by LSB) equal to the size of the data field plus checksum, both <u>before</u> byte stuffing.

The checksum is a 2's complement checksum over the length and data fields and is calculated <u>before</u> byte stuffing has been added.

1 byte	1 byte	1 byte	Message Length (does not include stuff bytes)	1 byte
START	Length (MSB)	Length (LSB)	Data Field	Checksum

Checksum Range (does not include stuff bytes)

Byte stuffing range

WHAT IS A 2'S COMPLEMENT CHECKSUM?

A checksum is a technique to check data for transmission errors or tampering. If the last few bytes are the sum of all the preceding bytes, then any errors are likely to be detected.

In this case, the checksum is the sum of all bytes between the data length field (MSB) and the last byte of the actual data field, ignoring any carry, meaning the checksum is always 8 bits long (0 to 255).

A one's complement is just a complement: ~x
A two's complement is a complement and increment, ignoring carry: (~x)+1

MESSAGES

This chapter describes the commands sent to and received from the gateway.

Note: All message definitions are documented in their unstuffed representation. All highlighted sections represent the data field.

Every message is part of the data field, and it starts with a message identifier. This is an eight-bit value that tells the receiver what type of message follows. This is followed by one or more additional data field(s), depending on the message. The message identifiers, data fields, responses, etc. are documented for each message in the following chapters.

The available messages and their message IDs are:

Message	ID	Meaning	Source	Acknowledge
ACK	0	Acknowledgement	Gateway	-
ADDFILTER	1	Add Filter	Host	ACK
DELFILTER	2	Delete Filter	Host	ACK

TXDATA	3	Transmit Data	Host	ACK
RXDATA	4	Receive Data	Gateway	-
RESET	5	Reset jCOM.J1939.USB	Host	ACK
HEART	6	Heartbeat	Gateway	-
SETPARAM	7	Set Protocol Parameters	Host	ACK
REQINFO	8	Request Information	Host	REPSTATUS or RXDATA or VERSION
REPSTATUS	9	Report Protocol Status	Gateway	-
FLASH	10	Starts flash programmer	Host	ACK
SETACK	11	Set Acknowledgement	Host	ACK
SETHEART	12	Set Heartbeat Frequency	Host	ACK
VERSION	13	Report HW/SW Version	Gateway	-
SETPARAM1	14	Set Protocol Parameters With REPSTATUS response	Host	ACK
SETMSGMODE	15	Set Message Mode	Host	ACK
TXDATAL	16	Transmit Data Loopback	Host	ACK
TXDATAP	17	Periodic Data Transmission	Host	ACK
TXDATAPL	18	TXDATAP with Loopback	Host	ACK

The following message frames apply only to JCOM devices with real-time clock (RTC):

RXDATAX	19	Timestamped Receive Data	Gateway	-
SETRTC	20	Set Real-Time Clock	Host	GETRTC
GETRTC	21	Report Real-Time	Gateway	-
ADDFILTERX	22	Add Filter with Sample Rate	Host	ACK

<u>Note</u>: This list of messages is sorted by message ID. The original protocol included only the first 10 messages and further messages were added over time. In order to maintain a strict backwards compatibility, the function of a message, once established, will remain unchanged. Any additional or modified functionality is accomplished through new messages (as an example, see the original TXDATA and the added TXDATAL messages).

ACK – Acknowledgment

This message is sent by the jCOM.J1939to acknowledge the correct receipt of a message from the host system. ACK will not be transmitted in cases where the checksum is wrong or byte-stuffing errors were detected.

Note:
- The ACK message can be suppressed through the SETACK message.

Message Identifier: 0

	Total Length:	6 bytes
	Response:	-

Index	Code	Value
0	MSG_TOKEN_START	192
1	Length MSB	0
2	Length LSB	3
3	MSG_ID_ACK	0
4	Message Id of acknowledged message	xx
5	Checksum	xx

ADDFILTER – Add Filter PGN

This message adds a PGN to the acceptance filter. The jCOM.J1939 gateway allows a limited number of message filters (80 – JCOM.J1939.USB; 100 – JCOM.J1939.USB-X). Set the PGN to 0x100000 to allow all data without filtering; disable the feature by deleting the filter (DELFILTER command) using the same PGN.

Note:
- The jCOM.J1939 gateway will, per default, not pass on any data messages unless their associated PGN is set (ADDFILTER/ADDFILTERX command).
- Setting filters referring to PGNs used for Address Claim or Network Management will be ignored, i.e. the gateway reports only data and request PGNs.
- To enable SAE J1939 request messages (PGN = 0xEAxx), it is sufficient to use the base PGN 0xEA00 (59904) or any PGN in the range from 0xEA00 to 0xEAFF, which will enable the entire range.

	Message Identifier:	1
	Total Length:	8 bytes
	Response:	ACK

Index	Code	Value
0	MSG_TOKEN_START	192
1	Length MSB	0
2	Length LSB	5
3	MSG_ID_FA	1
4	PGN MSB	xx
5	PGN 2ND	xx
6	PGN LSB	xx
7	CHKSUM	xx

DELFILTER – Delete Filter PGN

This message deletes a PGN from the acceptance filter. Set the PGN to 0x100000 to disallow the reception of all data.

Note:
- The gateway will, per default, not pass on any data messages unless their associated PGN is set (ADDFILTER/ADDFILTERX command).
- The DELFILTER function will also delete PGNs that were set by the ADDFILTERX command.

Message Identifier: 2
Total Length: 8 bytes
Response: ACK

Index	Code	Value
0	MSG_TOKEN_START	192
1	Length MSB	0
2	Length LSB	5
3	MSG_ID_FA	2
4	PGN MSB	xx
5	PGN 2ND	xx
6	PGN LSB	xx
7	CHKSUM	xx

TXDATA – Transmit Data

This message schedules a J1939 message for transmission. The message will be sent as soon as the J1939 network allows.

Note:
- The gateway will not transmit any data during the Address Claim process (applies only to the *Communication* operating mode), which can last up to several hundreds of milliseconds.
- A J1939 message can be between 0 and 1785 bytes long. If a message is longer than 8 bytes, the jCOM.J1939 gateway will, depending on the destination address, manage the transmission per broadcast (BAM) or peer-to-peer (RTS/CTS) session.
- The jCOM.J1939 gateway will allow you the use of a random source address, provided that the address claim process was finished successfully. It is highly recommended using the negotiated source address (obtained through the REPSTATUS message). Nevertheless, this feature is provided for maximum flexibility.

Message Identifier: 3

Total Length: Variable (19 with 8 data bytes)
Response: ACK

Index	Code	Value
0	MSG_TOKEN_START	192
1	Length MSB	xx
2	Length LSB	xx
3	MSG_ID_TX	3
4	PGN MSB	xx
5	PGN 2ND	xx
6	PGN LSB	xx
7	Destination Address	xx
8	Source Address	xx
9	Priority	0…7
10	Data Field Start	xx
:		
:		
nn	CHKSUM	xx

TXDATAL – Transmit Data With Loopback

This message is designed (and handles data transmission exactly) like the regular TXDATA message. However, when the gateway receives the TXDATAL message, the data will be reflected back to the host system (which is a mandatory feature for gateway applications).

Message Identifier: 16
Total Length: Variable (19 with 8 data bytes)
Response: ACK

Index	Code	Value
0	MSG_TOKEN_START	192
1	Length MSB	xx
2	Length LSB	xx
3	MSG_ID_TX	16
4	PGN MSB	xx
5	PGN 2ND	xx
6	PGN LSB	xx
7	Destination Address	xx
8	Source Address	xx
9	Priority	0…7
10	Data Field Start	xx
:		

:		
nn	CHKSUM	xx

TXDATAP, TXDATAPL – Transmit Data Periodically

These two messages are designed and handle data transmission similar to the regular TXDATA message. They are, however, extended by a message frequency (in milliseconds). When the gateway receives the TXDATAPL message, the data will be reflected back to the host system (which is a mandatory feature for gateway applications).

The jCOM.J1939 gateway allows a limited number of periodically transmitted PGNs (80 – JCOM.J1939.USB; 100 – JCOM.J1939.USB-X).

Note:
- The message frequency (in units of milliseconds) is submitted using two bytes, thus allowing a maximum time of 65.536 seconds.
- The minimum message frequency is limited to 10 milliseconds.
- A message frequency = 0 will disable (delete) the message.

Important!

In accordance with the SAE j1939 protocol, the periodic transmission of PGNs applies only to regular 8-byte data frames, i.e. any messages requiring the Transport protocol (up to 1785 bytes) will be ignored and the message will not be acknowledged.

Message Identifier: 17/18
Total Length: Variable (21 with 8 data bytes)
Response: ACK

Index	Code	Value
0	MSG_TOKEN_START	192
1	Length MSB	xx
2	Length LSB	xx
3	MSG_ID_TXP	17/18
4	PGN MSB	xx
5	PGN 2ND	xx
6	PGN LSB	xx
7	Destination Address	xx
8	Source Address	xx
9	Priority	0…7
10	Frequency (MSB)	xx
11	Frequency (LSB)	xx

12	Data Field Start	xx
:		
:		
nn	CHKSUM	xx

RXDATA – Receive Data

This message is transmitted to the host device as soon as the jCOM.J1939 gateway receives a J1939 message. The message can be between 0 and 1785 bytes long.

Note:
- JCOM devices with real-time clock (RTC) will <u>not</u> use this message; instead they transmit the RXDATAX message
- The gateway will not forward any data as long as the filters are not set.
- The gateway will also not forward any data during the Address Claim process (applies only to the *Communication* operating mode).

Message Identifier: 4
Total Length: Variable (19 with 8 data bytes)
Response: -

Index	Code	Value
0	MSG_TOKEN_START	192
1	Length MSB	xx
2	Length LSB	xx
3	MSG_ID_RX	4
4	PGN MSB	xx
5	PGN 2ND	xx
6	PGN LSB	xx
7	Destination Address	xx
8	Source Address	xx
9	Priority	0…7
10	Data Field Start	xx
:		
:		
nn	CHKSUM	xx

RESET – Gateway Reset

This message requests a gateway reset, causing a re-initialization of all SAE J1939 protocol parameters, which includes setting the operating mode to *Listen-Only*.

The purpose of the RESET command is for synchronizing the gateway with the host system. The gateway's settings will not be affected by a host system power-down, meaning all filter settings plus negotiated address will remain active. To prevent any synchronization issues, it is therefore recommended to issue the RESET command as soon as the host system powers down or starts up.

CAN Baud Rate Switching – The RESET command also allows initializing the gateway with a CAN baud rate of 250 kbps or 500 kbps. To do so, modify the "Reset Key 3" value as shown in the message format description below.

Note:
- The gateway-reset command does not affect the heartbeat frequency or ACK message settings.

Message Identifier:　　　　　　　　　　5
Total Length:　　　　　　　　　　　　　8 bytes
Response:　　　　　　　　　　　　　　ACK

Index	Code	Value
0	MSG_TOKEN_START	192
1	Length MSB	0
2	Length LSB	5
3	MSG_ID_RESET	5
4	Reset Key 1	0xA5
5	Reset Key 2	0x69
6	Reset Key 3	0x5A for 250 kbps
		0x5B for 500 kbps
7	CHKSUM	xx

HEART - Heartbeat

This message is per default being transmitted with a one second frequency; it is being used as a so-called "watchdog" function to monitor the serial connection functionality.

The message contains the hardware and software versions in a form of A.BB.CC (for instance, 1.02.03):

- A   - Major Update
- BB   - Minor Update
- CC   - Bug Fix

Following the hardware and software versions are two error counters that allow an insight into the quality of the serial connection:

- Checksum Error
- Byte Stuffing Error

Please be aware that the range of these counters is from 0 to 255, where, at a count greater than 255, the counter will start at zero again. However, action should be taken as soon as a certain (project-specific) count has been reached.

The heartbeat message frequency can be adjusted through the SETHEART message, which also allows suppressing the heartbeat.

HEARTBEAT MESSAGE ARCHITECTURE

With the emergence of new devices with extended functionality such as real-time clock, MicroSD memory card, etc., it was necessary to extend the communication protocol. However, it was necessary to develop a concept that did not necessitate firmware modifications of older devices. Consequently, the heartbeat message, which is utilized by all JCOM devices, comes in a standard and in an extended version.

STANDARD VERSION

This is the original version as supported by all JCOM firmware versions that do not support a MicroSD memory card or real-time clock.

Message Identifier: 6
Total Length: 13 bytes
Response: -

Index	Code	Value
0	MSG_TOKEN_START	192
1	Length MSB	0
2	Length LSB	10
3	MSG_ID_HEART	6
4	HW_VERSIONMAJOR	xx
5	HW_VERSIONMINOR	xx
6	HW_VERSIONBUGFIX	xx
7	SW_VERSIONMAJOR	xx
8	SW_VERSIONMINOR	xx
9	SW_VERSIONBUGFIX	xx
10	ERRCNT_CHECKSUM	xx
11	ERRCNT_STUFFING	xx
12	CHKSUM	xx

EXTENDED VERSION

The extended version utilizes an additional byte, indicating the device's functionality:

Bit 0 = 1   MicroSD memory card supported
Bit 1 = 1   MicroSD inserted
Bit 2 = 1   MicroSD error
Bit 3 = 1   Real-Time clock supported

The primary use of the extended heartbeat message is to inform the JCOM1939 Monitor software about the firmware's capabilities.

Message Identifier: 6
Total Length: 14 bytes
Response: -

Index	Code	Value
0	MSG_TOKEN_START	192
1	Length MSB	0
2	Length LSB	10
3	MSG_ID_HEART	6
4	HW_VERSIONMAJOR	xx
5	HW_VERSIONMINOR	xx
6	HW_VERSIONBUGFIX	xx
7	SW_VERSIONMAJOR	xx
8	SW_VERSIONMINOR	xx
9	SW_VERSIONBUGFIX	xx
10	ERRCNT_CHECKSUM	xx
11	ERRCNT_STUFFING	xx
12	FUNCTION	xx
13	CHKSUM	xx

SETPARAM, SETPARAM1 – Set Protocol Parameters

This message sets the NAME of the control application (CA) according to SAE J1939/81 (Address Claim Process), sets a preferred source address and address range for the address claim process and **starts the Address Claim process**.

With using the SETPARAM1 command, as soon as the address claim process is finished (successful or not), the gateway will send a REPSTATUS message, reporting the address claim status and the negotiated address.

The parameters in this message are:

- NAME according to SAE Standard
- Source Address (Preferred Address)
- Address Range Bottom (optional; if not used set as NULL address = 254)
- Address Range Top (optional; if not used set as NULL address = 254)
- Operating Mode
  - 0 – Listen-Only
  - 1 - Communication

Note:
- The Address Claim process is initiated by overwriting the *Listen-Only* mode (gateway default) to *Communication* mode.

Setting the address range or not will impact the Address Claim process:

1. Full SAE J1939/81 compliant address claim with source address and alternative address range:

The user can set a preferred source address, but, in case the address is already used in the vehicle network, an alternative address range is available for the address claim process.

2. Full SAE J1939/81 compliant address claim with only one source address:

Setting both address range parameters to 254 but submitting a source address (i.e. setting the control application as non-arbitrary-address-capable) will reset the *Arbitrary Address Capable* flag in the NAME.

Note:
- SETPARAM, SETPARAM1 will be rejected (i.e. no ACK will be sent) in case the operating mode is set other than the defined values.
- The SETPARAM1 command (ID = 14) function is identical to the original SETPARAM command, but in addition it initiates the REPSTATUS message, which is being transmitted as soon as the Address Claim process is finished. This allows the host's program to wait for the REPSTATUS message to obtain the negotiated source address.

Message Identifier: 7/14
Total Length: 17 bytes
Response: ACK

Index	Code	Value

0	MSG_TOKEN_START	192
1	Length MSB	0
2	Length LSB	14
3	MSG_ID_SET	7/14
4	NAME LSB	xx
5	NAME	xx
6	NAME	xx
7	NAME	xx
8	NAME	xx
9	NAME	xx
10	NAME	xx
11	NAME MSB	xx
12	Source Address (SA)	xx
13	SA Range Bottom	xx
14	SA Range Top	xx
15	Operating Mode	xx
16	CHKSUM	xx

REQINFO – Request Information from J1939 Gateway

This message, sent from the host system to the jCOM.J1939gateway, requests the transmission of the report message REPSTATUS or the version message VERSION according to the Request ID.

Request ID: REPSTATUS (ID = 9)
                          VERSION (ID = 13)

Note:
- The gateway will return no message when the Request ID is not the REPSTATUS-ID.
- Further request IDs may be added in future firmware versions.

Message Identifier: 8
Total Length: 6 bytes
Response: Depending on Request ID

Index	Code	Value
0	MSG_TOKEN_START	192
1	Length MSB	0
2	Length LSB	3
3	MSG_ID_RQ	8
4	REQUEST_ID	xx
5	CHKSUM	xx

REPSTATUS - Report J1939 Protocol Status and Source Address

This message reports the address claim status and the negotiated source address. REPSTATUS is usually a response to the REQINFO message, but is also transmitted when the source (node) address changed due to an address challenge during operation.

The reported STATUS will be:

  01 – Address Claim in Progress
  02 – Address Claim Successful – Normal Data Traffic
  03 – Address Claim Failed
  04 – Listen-Only Mode

The reported SA will be NULLADDRESS (254) when the address claim process is in progress, the address claim failed, or the operating mode is *Listen-Only*. In case the source address is 254, check the J1939 Protocol Status.

Message Identifier: 9
Total Length: 7 bytes
Response: -

Index	Code	Value
0	MSG_TOKEN_START	192
1	Length MSB	0
2	Length LSB	4
3	MSG_ID_RS	9
4	Status	xx
5	Source Address	xx
6	CHKSUM	xx

FLASH – Starts the In-Circuit Programmer

This message starts the internal in-circuit programmer. This is usually invoked by pulling a pin low during power-up, but with this function it can be started by the host system at any time. A flash programming tool (Flash Magic) can be used after calling this function.

After sending the FLASH command, all LEDs on the jCOM.J1939will be on. In order to switch back to normal operation, you need to go through a power-off-on cycle.

Message Identifier: 10
Total Length: 5 bytes

Response: -

Index	Code	Value
0	MSG_TOKEN_START	192
1	Length MSB	0
2	Length LSB	2
3	MSG_ID_FLASH	10
4	CHKSUM	xx

SETACK – Set Acknowledgment

This message allows the activation/deactivation of the acknowledgment message ACK.

Note:
- The ACK message will be active per default, unless overwritten by the host system.

Message Identifier: 11
Total Length: 6 bytes
Response: ACK (only when activated)

Index	Code	Value
0	MSG_TOKEN_START	192
1	Length MSB	0
2	Length LSB	3
3	MSG_ID_SETACK	11
4	ACTIVE	xx (0-inactive, 1-active)
5	CHKSUM	xx

SETHEART – Set Heartbeat Frequency

This message allows the setting of the heartbeat frequency in units of milliseconds. The message frequency is assigned by two bytes, allowing a range of 100 – 5000 milliseconds, i.e. a time of less than 100 milliseconds will be corrected to 100, and a time of more than 5000 will be corrected to 5000.

Note:
- Passing a heartbeat frequency of 0 will suppress the message, and it will not be reset to the minimum time of 100 milliseconds.

Message Identifier: 12

	Total Length:	7 bytes
	Response:	ACK

Index	Code	Value
0	MSG_TOKEN_START	192
1	Length MSB	0
2	Length LSB	4
3	MSG_ID_SETHEART	12
4	FREQ MSB	xx
5	FREQ LSB	xx
6	CHKSUM	xx

VERSION – Report Hardware & Software Version

This message is a response to the REQINFO message in which the VERSION ID was used. The actual data is identical to the HEARTBEAT message. For that reason, requesting the VERSION message should only be used after the HEARTBEAT message was suppressed.

	Message Identifier:	13
	Total Length:	11 bytes
	Response:	-

Index	Code	Value
0	MSG_TOKEN_START	192
1	Length MSB	0
2	Length LSB	08
3	MSG_ID_VERSION	13
4	HW_VERSIONMAJOR	xx
5	HW_VERSIONMINOR	xx
6	HW_VERSIONBUGFIX	xx
7	SW_VERSIONMAJOR	xx
8	SW_VERSIONMINOR	xx
9	SW_VERSIONBUGFIX	xx
10	CHKSUM	xx

SETMSGMODE – Set Message Mode

The message mode defines the type of data (PGNs) that is being passed from the gateway to the host system. This command is only necessary for gateway applications where the user needs to see all PGNs including those for protocol control.

The settings are:

- **00** – ECU Message Mode (default after RESET) – The gateway reports only PGNs addressed to the ECU's source address or the global address.
- **01** – Gateway Message Mode 1 – The gateway reports PGNs addressed to all destination addresses including the global address (255).
- **02** – Gateway Message Mode 2 – The gateway reports all PGNs as described in mode 1 but also includes protocol PGNs according to SAE J1939/21 and SAE J1939/81.

Message Identifier: 15
Total Length: 6 bytes
Response: ACK

Index	Code	Value
0	MSG_TOKEN_START	192
1	Length MSB	0
2	Length LSB	03
3	MSG_ID_MSGMODE	15
4	MSGMODE	xx
5	CHKSUM	xx

RXDATAX – Timestamped Receive Data

This message is transmitted to the host device as soon as the jCOM.J1939 gateway receives a J1939 message. The message can be between 0 and 1785 bytes long.

Note:
- This message is only used by JCOM devices with real-time clock (RTC); all other will transmit the RXDATA frame.
- The gateway will not forward any data as long as the filters are not set.
- The gateway will also not forward any data during the Address Claim process (applies only to the *Communication* operating mode).

Message Identifier: 19
Total Length: Variable (27 with 8 data bytes)
Response: -

Index	Code	Value
0	MSG_TOKEN_START	192
1	Length MSB	xx
2	Length LSB	xx
3	MSG_ID_RXDATAX	19
4	PGN MSB	xx

Index	Code	Value	
5	PGN 2ND	xx	
6	PGN LSB	xx	
7	Destination Address	xx	
8	Source Address	xx	
9	Priority	0...7	
10	Data Field Start	xx	
:			
mm	End Data Field		
mm+1	YEAR	xx	; Years since 2000
mm+2	MONTH	xx	; 1...12
mm+3	DAY	xx	; 1...31
mm+4	HOUR	xx	; 0...23
mm+5	MIN	xx	; 0...59
mm+6	SEC	xx	; 0...59
mm+7	MSB_MSEC	xx	; msec 0...999
mm+8	LSB_MSEC	xx	
nn	CHKSUM	xx	

SETRTC – Set Real-Time Clock

Sets the real-time clock.

Note:
- The real-time clock setting applies to two scenarios:
  1. **Operation with battery** – If the gateway is equipped with a battery, you need to use the SETRTC command only when setting the real-time for the first time. The battery assures that the RTC continues even when the gateway is powered off.
  2. **Operation without battery** – Once the time is set and the gateway remains powered, the internal RTC will continue to deliver the correct data. Once the gateway is powered off, the RTC will need to be configured again. We use this feature at startup of our JCOM1939 Monitor software by reading the PC's clock information and passing it on to the gateway.

Message Identifier: 20
Total Length: 11 bytes
Response: GETRTX

Index	Code	Value
0	MSG_TOKEN_START	192
1	Length MSB	xx
2	Length LSB	xx
3	MSG_ID_SETRTC	20

4	YEAR	xx	; Years since 2000
5	MONTH	xx	; 1…12
6	DAY	xx	; 1…31
7	HOUR	xx	; 0…23
8	MIN	xx	; 0…59
9	SEC	xx	; 0…59
10	CHKSUM	xx	

GETRTC– Report Real-Time

Reports the current RTC time.

Message Identifier: 21
Total Length: 11 bytes
Response: -

Index	Code	Value	
0	MSG_TOKEN_START	192	
1	Length MSB	xx	
2	Length LSB	xx	
3	MSG_ID_GETRTC	21	
4	YEAR	xx	; Years since 2000
5	MONTH	xx	; 1…12
6	DAY	xx	; 1…31
7	HOUR	xx	; 0…23
8	MIN	xx	; 0…59
9	SEC	xx	; 0…59
10	CHKSUM	xx	

ADDFILTERX – Add Filter PGN With Sample Rate

Like ADDFILTER, this message adds a PGN to the acceptance filter, however, extended by a "sample rate" in the range of 100 to 65535 milli-seconds. The use of a sample rate reduces the data traffic between the gateway and the host system, and therefore should be higher than the PGN's transmission rate (refer to SAE J1939/71 for details).

The gateway will store only the last received PGN plus its data and report it when the sample rate time has expired. However, when the PGN was not received within a sample rate cycle, the gateway will not transmit it.

The jCOM.J1939 gateway allows a limited number of extended message filters (100 for JCOM.J1939.USB-X; not supported by JCOM.J1939.USB). The PGN 0x100000 as used in ADDFILTER is not supported here.

Note:
- A sample rate of less than 100 msec will invoke ADDFILTER, meaning the sample rate will be ignored.
- Any filters already set by ADDFILTER or ADDFILTERX will be overwritten to support a modification of the sample rate. Sending ADDFILTER will reset the sample rate.
- The jCOM.J1939 gateway will, per default, not pass on any data messages unless their associated PGN is set (ADDFILTER/ADDFILTERX command).
- Setting filters referring to PGNs used for Address Claim or Network Management will be ignored, i.e. the gateway reports only data and requested PGNs.
- Request messages (PGN = 0xEAxx) are not supported; use ADDFILTER.
- It is possible to set PGNs that are only available on request, but it doesn't make sense to do so, since the gateway will report unchanged data using the sample rate.
- PGNs acquired per TP (Transport Protocol) are not supported; the gateway will not report messages with more than eight data bytes.

Message Identifier: 22
Total Length: 10 bytes
Response: ACK

Index	Code	Value	
0	MSG_TOKEN_START	192	
1	Length MSB	0	
2	Length LSB	5	
3	MSG_ID_FAX	22	
4	PGN MSB	xx	
5	PGN 2ND	xx	
6	PGN LSB	xx	
7	RATE_MSB	xx	; Sample rate in msec
8	RATE_LSB	xx	
9	CHKSUM	xx	