jCOM1939 – SAE J1939 Gateway
Protocol & Programming Interface

The jCOM1939 gateway is a high-performance, low-latency vehicle network adapter. It allows any host device with a serial COM port to monitor SAE J1939 data traffic and communicate with the SAE J1939 vehicle network. The gateway supports the full SAE J1939 protocol according to J1939/81 Network Management (Address Claiming) and J1939/21 Transport Protocol (TP).

The SAE J1939 Gateway Protocol is designed to establish a data exchange between a jCOM1939 gateway and a host system (e.g. a PC) per means of serial communication (RS232, 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.

jCOM1939 Gateway Operating Modes

The jCOM1939 gateway 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 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. **Event:** Through this mode, the jCOM1939 gateway will report J1939 data as soon as they occur, which also requires that the receiving host system is capable of catching data in real-time.

The jCOM1939 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 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). The same command allows the host system to set the operating mode, either *Event* or *Polling*.

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

The *Event* 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 *Event* 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. Set all filters (ADDFILTER command).
2. Operation starts with setting the first filter.

Event:

1. Initiate Address Claim Process and set operating mode using the SETPARAM or SETPARAM1 command.
2. When using the SETPARAM1 command, the gateway responds with REPSTATUS message.
3. After successful address claim (check status per REPSTATUS message), data transmission is enabled.
4. Set all filters (ADDFILTER command).
5. Receiving messages is enabled with setting the first filter.

jCOM1939 Gateway - 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 jCOM1939 gateway.

Message Format

The jCOM1939 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 jCOM1939 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.

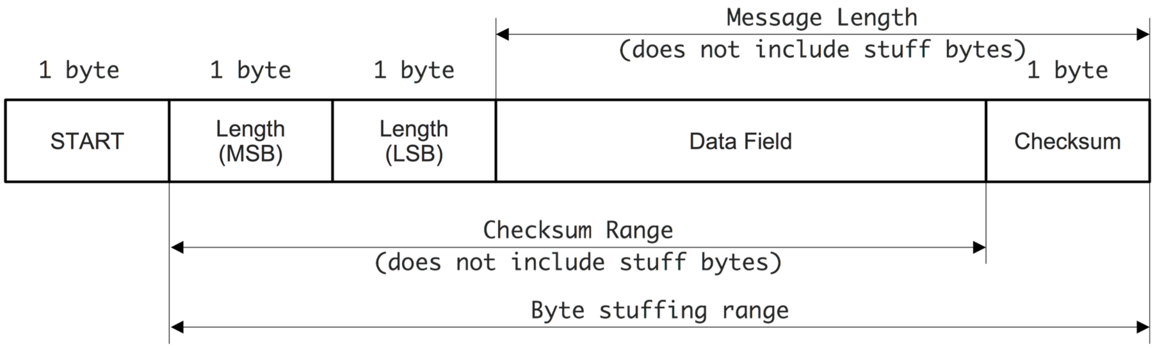
All messages must be byte stuffed, following the START token, by the transmitter and unstuffed by the receiver.

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 before byte stuffing.

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



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:

Command Message	ID	Meaning	Source	Acknowledgment
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 jCOM1939	Host	ACK
HEART	6	Heartbeat	Gateway	-
SETPARAM	7	Set Protocol Parameters	Host	ACK
REQINFO	8	Request Information from gateway	Host	REPSTATUS or RXDATA or VERSION
REPSTATUS	9	Report J1939 Protocol Status	Gateway	-
FLASH	10	Starts the in-circuit 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 With Loopback	Host	ACK

ACK – Acknowledgment

This message is sent by the jCOM1939 to 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 jCOM1939 gateway allows up to 80 message filters. 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 jCOM1939 gateway will, per default, not pass on any data messages unless their associated PGN is set (ADDFILTER 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 delete all filters.

Note:

- The gateway will, per default, not pass on any data messages unless their associated PGN is set (ADDFILTER 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 *Event* 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 jCOM1939 gateway will, depending on the destination address, manage the transmission per broadcast (BAM) or peer-to-peer (RTS/CTS) session.
- The jCOM1939 gateway will allow you the use of any 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), but 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 as 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

RXDATA – Receive Data

This message is transmitted to the host device as soon as the jCOM1939 gateway receives a J1939 message (*Event* operating mode) or when requested per REQINFO message. The message can be between 0 and 1785 bytes long.

Note:

- 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 *Event* 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 still be 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.

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
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.

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

Index	Code	Value
0	MSG_TOKEN_START	192
1	Length MSB	0
2	Length LSB	08
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

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

Note:

- The Address Claim process is initiated by overwriting the Listen-Only mode (gateway default) to *Event* 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 above-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 jCOM1939 gateway, 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.

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 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 can be used after calling this function.

After sending the FLASH command, all LEDs on the jCOM1939 will 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. 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

jCOM1939 Gateway – Windows Programming Interface

This chapter describes the programming interface under the Windows operating system. All code samples are based on Visual Studio 2012 using C#.

The modules (classes) used are:

- COMport.cs – Handles the COM port communication.
- jCOM1939.cs – Handles the communication protocol between the host system and the J1939 gateway.

COMport.cs

While this class contains a number of functions, the only two function calls needed for an application are:

- **COMport.Initialize** – Determines the available COM ports and initializes the selected port.
- **COMport.Terminate** – Closes the currently open COM port. This function should always be called upon termination of the Windows application.

The selection of the COM port connected to the jCOM1939 gateway is a first mandatory step to establish communication. The COM port number as assigned by the operating system may differ from computer to computer.

COMport.Initialize

Description: Initializes COM port; determines available ports
Parameters: int nComPort;
Return Code: OK / ERROR

The selection of the COM port connected to the jCOM1939 gateway is a first mandatory step to establish communication. The COM port number as assigned by the operating system may differ from computer to computer.

For that reason, use nComPort = -1 to accomplish the COM port scanning. The program will fill all COM port information into an array (*sPorts[]*) and also recommend the appropriate port number (*nSelPort*). The variable *nPorts* contains the number of ports found. In order to initialize a COM port, the code must pass *nComPort* to the function, where *nComPort* is the index pointing to the entry in *sPorts*.

Usage:

```
if(COMPort.Initialize(3) == ERROR)
      MessageBox.Show("Unable to initialize COMK port 3.");
```

Note: In the above sample the COM port number is 3, but it used as a mere example.

The following code sample demonstrates the scanning of COM ports and filling the retrieved information into a combo-box control (cboCOMPort):

```
    if (COMPort.Initialize(-1) != 0)
        MessageBox.Show("No COM port available!");
    else
    {
        // Fill the COM combobox
        for (int nIndex = 0; nIndex < COMPort.nPorts; nIndex++)
            cboCOMPort.Items.Add(COMPort.sPorts[nIndex]);

        // Select the combobox index
        cboCOMPort.SelectedIndex = COMPort.nSelPort;

        // Close the serial port
        COMPort._serialport.Close();

    }// end else

}// end if
```

The following code initializes the COM port:

```
if (COMPort.Initialize(cboCOMPort.SelectedIndex) != 0)
 MessageBox.Show("Sorry! There is a problem with the COM port.", "Attention!");
```

COMport.Terminate

Description: Closes the currently opened COM port
Parameters: None
Return Code: None

The function uses the current settings to determine the open port and closes it.

Usage:

```
COMPort.Terminate();
```

jCOM1939.cs

The jCOM1939 class handles the communication protocol between the host system and the J1939 gateway, i.e. all messages as described in chapter *jCOM1939 Gateway - Serial Communications Protocol* are represented by corresponding function calls. They are:

Command Message	ID	Meaning	Source	Function Call
ACK	0	Acknowledgement	Gateway	RX_J1939
ADDFILTER	1	Add Filter	Host	FA_J1939
DELFILTER	2	Delete Filter	Host	FD_J1939
TXDATA	3	Transmit Data	Host	TX_J1939
RXDATA	4	Receive Data	Gateway	RX_J1939
RESET	5	Reset jCOM1939	Host	RESET_J1939
HEART	6	Heartbeat	Gateway	RX_J1939
SETPARAM	7	Set Protocol Parameters	Host	SET_J1939
REQINFO	8	Request Information from gateway	Host	RQ_1939
REPSTATUS	9	Report J1939 Protocol Status	Gateway	RX_J1939
FLASH	10	Starts the in-circuit programmer	Host	FLASH
SETACK	11	Set Acknowledgement	Host	SA_J1939

SETHEART	12	Set Heartbeat Frequency	Host	SH_J1939
VERSION	13	Report HW/SW Version	Gateway	RX_J1939
SETPARAM1	14	Set Protocol Parameters with REPSTATUS response	Host	SET_J1939
SETMSGMODE	15	Set Message Mode	Host	MM_J1939
LOOPBACK	16	Message Loopback	Host	LOOPBACK_J1939

jCOM1939.RX_J1939

Description: Checks for received messages from the J1939 gateway

Parameters: ref long lPGN, ref int nDest, ref int nSrc, ref int nPriority, ref byte[] nData, ref int nDataLen
lPGN = Received PGN
nDest = Destination Address
nSrc = Source Address
nPriority = PGN Priority
nData = Received data
nDataLen = Number of received data bytes

Return Code: RX_Message = A regular PGN was received
RX_NoMessage = No message was received
RX_FaultyMessage = Message was received but contained errors
RX_HEART = Heartbeat message received
RX_ACK_FA = Acknowledgment for *Filter Add* received
RX_ACK_FD = Acknowledgment for *Filter Delete* received
RX_ACK_TX = Acknowledgment for *Transmit Data* received
RX_ACK_RESET = Acknowledgment for *Reset* received
RX_ACK_SETPARAM = Acknowledgment for *Set Protocol Parameters* received
RX_ACK_SETPARAM1 = Acknowledgment for *Set Protocol Parameters w/ Response* received
RX_RS = *J1939 Protocol Status* received
RX_ACK_MSGMODE = Acknowledgment for *Message Mode* received
RX_ACK_LOOPBACK = Acknowledgment for *Loopback* received
RX_VERSION = *HW/SW Version Report* received

Usage:

```
long lPGN = 0;
int nDest = 0;
int nSrc = 0;
int nPriority = 0;
byte[] nData = new byte[8]; // Will be resized in the RX_J1939 function call
int nDataLen = 0;

int nReceiveMode = jCOM1939.RX_J1939(ref lPGN, ref nDest, ref nSrc, ref
nPriority, ref nData, ref nDataLen);
```

jCOM1939.FA_J1939

Description: Creates a message filter

Parameters: long lPGN

Return Code: None

Usage:

```
long lPGN = 65280;   // Just an example PGN
jCOM1939.FA_J1939(lPGN);
```

jCOM1939.FD_J1939

Description: Deletes a message filter

Parameters: long lPGN
Return Code: None

Usage:

```
long lPGN = 65280;   // Just an example PGN
jCOM1939.FD_J1939(lPGN);
```

jCOM1939.TX_J1939

Description: Transmits a PGN and its data, allowing a message loopback
Parameters: long lPGN, int nDest, int nSrc, int nPriority, byte[] nData, int nDataLen
lPGN = PGN
nDest = Destination Address
nSrc = Source Address
nPriority = PGN Priority
nData = Data
nDataLen = Number of data bytes
bLoopback = true/false
Return Code: None

Usage:

```
long lPGN = 65280;
int nDest = 0;
int nSrc = 0;
int nPriority = 0;
byte[] nData = new byte[8]; // Fill this one with data
int nDataLen = 0;

jCOM1939.TX_J1939(lPGN, nDest, nSrc, nPriority, nData, nDataLen, true);
```

jCOM1939.RESET_J1939

Description: Resets the J1939 gateway
Parameters: None
Return Code: None

Usage:

```
jCOM1939.RESET_J1939();
```

jCOM1939.SET_J1939

Description: Sets J1939 protocol parameters
Parameters: byte nSrcAddr, byte nAddrBottom, byte nAddrTop, byte nOpMode, byte[] pNAME, bool bRequestRESTATUSMessage
nSrcAddr = Preferred node address
nAddrBottom = Bottom of alternative node address range
nAddrTop = Top of alternative node address range
nOpMode = Operating Mode
pNAME = J1939 NAME
bRequestRESTATUSMessage = true if status message is required after address claim process
Return Code: None

Usage:

```
byte nSrcAddr = 128;        // Just examples…
byte nAddrBottom = 129;
byte nAddrTop = 247;
byte[] pNAME = new byte[8]; // Enter the NAME here

jCOM1939.SET_J1939(nSrcAddr, nAddrBottom, nAddrTop, jCOM1939.OPMODE_Event,
                   pNAME, true);
```

jCOM1939.RQ_J1939

Description: Resets the J1939 gateway
Parameters: byte nID
Return Code: None

Usage:

```
jCOM1939.RQ_J1939(jCOM1939.MSG_ID_RS);  // Request status report
```

jCOM1939.FLASH

Description: Invoke the in-circuit programmer
Parameters: None
Return Code: None

Usage:

```
jCOM1939.FLASH();
```

jCOM1939.SA_J1939

Description: Activates/Deactivates ACK message
Parameters: byte nActive (0 = inactive; 1 = active)
Return Code: None

Usage:

```
jCOM1939.SA_J1939(0);
```

jCOM1939.SH_J1939

Description: Set heartbeat frequency in milliseconds
Parameters: byte nFrequency
Return Code: None

Usage:

```
jCOM1939.SA_J1939(1000);
```

jCOM1939.MM_J1939

Description: Sets the gateway message mode
Parameters: byte nMessageMode
Return Code: None

Usage:

```
jCOM1939.MM_J1939(jCOM1939.MSGMODE_ECU);
```