Gateway API (GWAPI) Specifications

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Revision History

Version	Date	Description
0.1	08/30/10	Preliminary outline provided by Damon Stewart
0.2	09/01/10	Formatting and edits applied by Kelly Lewis during demo implementation
1.0	02/11/11	V1.2.009 API release
1.1	07/11/11	V1.2.010 and V2.0.0 API release
1.2	11/21/11	Added more information on protocol version differences
1.3	02/07/12	Added RSL Command and Response message types
1.4	02/18/13	Added MNP V2 protocol version to Network Status Message Definition
1.5	03/08/13	Added SDM-DL and Parent Message
1.6	01/07/14	Changed references to sensors to Wireless Devices Removed any requirements for encryption Frame data payload was increased from 43 to 59 (Max Packet of 64)
1.7	01/21/14	Network Count is now zero based Registered Device List Request and Response now reports 4 records
1.8	12/03/15	USB Pro Stuff,

Table of Contents

1 Gateway API (GWAPI)

This section describes the API frames that are required between the Gateway application (PC app or hardware gateway) and a Monnit APN to support a wireless network.

1.1 API Format

The following table shows the frame structure for all API frames. Individual commands will be enumerated later. Max packet size is 64 bytes (fits into a USB Interrupt transfer).

Field Name	Size (bytes)	Description
Start Delimiter	1	Single byte that identifies the beginning of a new API frame. This value is 0xC5 (197d)
Length	1	The number of bytes that are contained in the API frame. The length specifies the number of bytes included from “Options” through “Data”. It does not include the Start Deliminator, Length, and CRC byte.
Options	1	Optional features enabled in this frame 0x02 – Urgent Flag 0x04 – Device waiting for queued message
Command	1	The API command type that defines the allocation the

		the Data portion of this API frame.
Data	Variable 0 – 59 Max	The data for the specified command ID
CRC	1	A CRC calculated from the received bytes in the packet. The CRC calculation is applied the same region as the Length.

1.2 Multi-byte Format

The GWAPI protocol uses **LITTLE-ENDIAN** for all multi-byte values (e.g. Int16, UInt16, Int32, UInt 32). Therefore, a number represented in this format will have the following order LSB...MSB.

For example: 123456789d → 0x075BCD15 → byte array {0x15, 0xCD, 0x5B, 0x07}

1.3 API Command Definition

1.3.1 Form Network Request

Command: 0x20
Description: Sending this API frame causes the APN to form a new network. Any time the APN receives this command, it leaves the current network, clears its internal device registration list, and forms a new network. The AP will send a "Network Status Message" response after completing requested task. This command can take up to 30 seconds to complete.

Field Name	Size (bytes)	Description
Channel Mask	4	Bit-mask describing which channels the AP should scan when forming a network
Network ID	1	0 = Random network ID >= fixed network ID

1.3.2 Update Network State Request

Command: 0x21
Description: APN sends this to update time and/or the state of the APN. The APN will send a "Network Status Message" in response after receiving this.

State	Size (bytes)	Description
State	1	0 = Reset/Idle 1 = Active / Resume 2+ = RESERVED
Current Time	4	If the "Protocol Version" from the Network Status Message is 0, then "Current Time" is formatted to

		represent the number of half-seconds in a 24 hour period. If "Protocol Version" is 1, then "Current Time" is formatted to represent the number of seconds since "01-01-2010 00:00:00"

1.3.3 Register Wireless Device Request

Command: 0x22
Description: Command sent by the GW to add a Device's Serial ID to the list of devices recognized by an APN. The APN will send a "Network Status Message" in response after receiving this.

Field Name	Size (bytes)	Description
Sensor Address	4	The serial identification number of a Monnit Device requested to join network.

1.3.4 Network Status Report

Command: 0x23
Description: Sent in response to a "Form Network Request", "Update Network State", or "Register Sensor Request. These commands can modify the Network, therefore this report provides the GW with the current network information.

Field Name	Size (bytes)	Description
APN Serial ID	4	The serial identification number of the APN.
Network Device Count	2	The number of devices in the APN's network. A value of "0" represents AP and no sensors.
Selected Channel	1	The selected channel number of the network
Network ID	1	The selected network ID
Current State	1	0 = Reset/Idle 1 = Active / Resume 2 = Factory Mode
Protocol Version	0.5	Upper Nibble Field (0bXXXX0000) 0 – V0: Compliant with V1.2.0.7 – V1.2.0.8 Interface 1 – V1: Compliant with V1.2.0.9 – V2.0.0.0 Interface 2 – V2: Compliant with V2.0.0.1 – V2.4.0.6 Interface 3 – V3: Compliant with V2.5.0.0 – Current Interface
Status	0.5	Lower Nibble Field (0b0000XXXX) 0 = Success, >0 = Failure 1 – Haven't formed network 2 – Invalid state change, go idle first

1.3.5 Queued Message Request

Command: 0x24
Description:
All Other APNs - Notifies the APN that the GW has a packet to send to the specified destination. The APN sends a "Wireless Device Status Report" in response to this command.
USB Pro – Command sent by the GW to request queued up message from the APN. The GW sends an incrementing counter value starting at 0 to the APN. APN will respond with a queued up message which may be any of these types:

Wrieless Device Status Report	0x25
Sensor Data Message (SDM)	0x55
SDM Data Logged	0x56
Parent Message	0x52
Read Data Sector Response	0x71
Write Data Sector Response	0x73
App Command Response	0x75

or if there are no queued up messages the APN sends "Queued Message Request" with Message Status of 12 = End of queue. Other potential message types are indicated in the Message Status field below.

Field Name	Size (bytes)	Description
Device ID	4	The Serial ID of the device
Message Status	1	***All Other APNs*** 0 = Not queued 1 = Queued ***USB Pro:*** GW sends: Counter 0 – 255, counter starts at 0 initially and resets to 0 when End of queue received from APN. Wrapping from 255 to 0 is allowed. APN uses the counter to determine if the last queued message was properly received by the GW. APN sends: 12 = End of queue 13 = Write memory error 14 = Read memory error

1.3.6 Wireless Device Status Report

Command: 0x25
Description: Message that informs the GW that a wireless device's status has changed. The gateway will send this in response to a Queued Message Request, when a new device attempts to join (successfully or unsuccessfully), or when the GW request to send traffic to a device that is not currently part of the network.

Field Name	Size (bytes)	Description
Device ID	4	The Serial ID of the device

Node Type	2	Designator for various types of sensor nodes. See Sensor Application Documentation for types. 0xFFFF is a “don't care” and should not be interpreted.
Status	1	0x00 – Device given permission to join network 0x01 – Device denied permission to join network 0x02 – APN message queued flag set/cleared correctly 0x03 – Address not recognized 0x04 – Addressed message not deliverable

1.3.7 Registered Device List Request

Command: 0x26
Description: Command sent by the GW to get a Registered Device List Response and is used to discover portions of the APN's registered device list.

Field Name	Size (bytes)	Description
INDEX	1	Value to select which number of record groups requested. Zero indexed. Up to four sensors are returned per request, therefore values of 0 – 127 are permitted. Records to return : INDEX*4 – (INDEX*4+3) • 0: Request records 0 – 3 • 1: Request records 4 – 7 • 2: Request records 8 – 11 • … • 127: Request records 508 – 511

1.3.8 Registered Sensor List Response

Command: 0x27
Description: Response sent by the APN when the GW sends a Registered Device List Request and is used to discover portions of the APN's registered device list.

Field Name	Size (bytes)	Description
INDEX	1	Value stating which number of record groups requested. Zero indexed. Up to eight sensors are returned per request, therefore values of 0 – 127 are permitted.
Record 0	4	IDs of the registered devices at the specified index called for by the Index Requested field. If value is 0x00000000 then the entry is void. If value is 0xFFFFFFFF, then the entry is unused.
Record 1	4	

Record 2	4	Otherwise, the entry contains a valid Sensor Id. If an "UNUSED"entry is read, all later entries will also be "UNUSED".
Record 3	4	

1.3.9 Read Data Sector Request

Command: 0x70
Description: Request data sector read from any Monnit device. A "Read Data Sector Response" is returned in response to this command. See Application Framework Document for definition of the possible sectors to read.

Field Name	Size (bytes)	Description
Device ID	4	The Serial ID of the device
Sector Number	1	Data Sector to read

1.3.10 Read Data Sector Response

Command: 0x71
Description: Read results from any Monnit device. Data comes in the form of a 16 or 32-byte sector. See Application Framework Document for definition of the possible sectors to read.

Field Name	Size (bytes)	Description
Device ID	4	The Serial ID of the device
Sector Number	1	Data sector to read
Status	1	Status of the read request 0 = success , >0 = failure 1 = invalid sector
Data	16/32	Data read from the specified sector

1.3.11 Write Data Sector Request

Command: 0x72
Description: Request to write data sector fields in any Monnit device. A "Write Data Sector Response" is returned in response to this command. See Application Framework Document for definition of the possible available sectors to write.

Field Name	Size (bytes)	Description
Device ID	4	The Serial ID of the device
Sector Number	1	Data sector to write

Data	16/32	Data to write to the specified sector

1.3.12 Write Data Sector Response

Command: 0x73
Description: Result of the "Write Data Sector Command" from any Monnit device. See Application Framework Document for definition of the possible available sectors to write.

Field Name	Size (bytes)	Description
Device ID	4	The Serial ID of the device
Sector Number	1	Data sector to write
Status	1	Status of the write request 0 = success , >0 = failure 1 = invalid sector 2 = data deemed invalid by application

1.3.13 Application Command Request

Command: 0x74
Description: Sends an action or command to any Monnit device. These are considered to be volatile state changes. See Application Framework Document for definition of the possible Application Commands and corresponding Data.

Field Name	Size (bytes)	Description
Device ID	4	The Serial ID of the device
Application Command	1	Specific Application command to execute.
Data	0 – 38	Data to write to the specified sector

1.3.14 Application Command Response

Command: 0x75
Description: Frame returned in response to a "Application Command Request" received by any Monnit device. See Application Framework Document for definition of the possible Application Commands, and corresponding Data.

Field Name	Size (bytes)	Description
Device ID	4	The Serial ID of the device
Application Command	1	Specific Application command to execute.

Command Status	1	Status of the request 0 = success , >0 = failure
Response Data	0 – 37	Data to write to the specified sector

1.3.15 Data Message Report

Command: 0x55
Description: Asynchronous message sent by a device to communicate data samples acquired by a sensing device. This message generated by an wireless device. See the specific application definition for the various combinations of Type. Please see Monnit Application Definition document for definition of the possible Application Commands, and corresponding Data.

Field Name	Size (bytes)	Description
Device ID	4	The Serial ID of the device
AP RSSI	1	Received Signal Strength Indicator recorded by AP. Value needs to be interpreted as a signed byte.
Field RSSI	1	Received Signal Strength Indicator recorded by field device. Value needs to be interpreted as a signed byte.
Voltage	1	Value representing the battery voltage on the device. To get voltage from this value, V = (150 + value) / 100. So min value is 1.5V and max value is 4.05V.
Type	2	Designates the Application profile number that defines what kind of device generated this message. Used to decode the State and Data fields of this message.
State	1	State specified by Type
Data	0-32	Data specified by Type

1.3.16 Data-Logged Sensor Data Message

Command: 0x56
Description: Asynchronous message sent by a device to communicate data samples acquired by a sensing device but stored for a period of time before delivery. This message generated by a repeater or sensor. See the specific application definition for the various combinations if Type. Please see Monnit Application Definition document for definition of the possible Application Commands, and corresponding Data.

Field Name	Size (bytes)	Description
Device ID	4	The Serial ID of the device
TIME	4	Time that the specific data was generated. Will conform to network time controlled by gateway incremented every second.
AP RSSI	1	Received Signal Strength Indicator recorded by AP. Value needs to be interpreted as a signed byte.
Field RSSI	1	Received Signal Strength Indicator recorded by field device. Value needs to be interpreted as a signed byte.
Voltage	1	Value representing the battery voltage. To get voltage from this value, V = (150 + value) / 100. So min value is 1.5V and max value is 4.05V.
Sensor Type	2	Designates the Application profile number that defines what kind of sensor generated this message. Used to decode the State and Data fields of this message.
State	1	State specified by Type
Data	0-32	Data specified by Type

1.3.17 Parent Message

Command: 0x52
Description: Asynchronous message sent by any non-APN wireless device to report a devices up-link partner. Intended to be used to build a link tree of network devices.

Field Name	Size (bytes)	Description
Device ID	4	The Serial ID of the device
Parent ID	4	The Serial ID of the Parent (Uplink to gateway)
Version	4	Version Ex: x.x.x.x

Bootloader Command Request – MODBUS GW Only
Command: 0xD4
Description: Sends a Bootloader command to a specified sensor, repeater, or AP. Warning, sending these commands can inadvertently and permanently disable the hardware of the targeted Device ID.

To start Bootloader: Send "Bootloader Command = 0xAA", "Sector = 0xFFFF", and populate "Data" with Device ID replicated to fill the space. The response to the Start Bootloader command is sent from with in the BL if successful. The first sector written must be 0x0000. This begins the erase process. Afterword, the sectors written are required to be greater than the last sector. Any write request received that is equal to or less than the current sector number will be acknowledged successful. When the write sequence is complete, then send the Verify command to Test and commit the changes.

Field Name	Size (bytes)	Description
Device ID	4	The Serial ID of the device
Bootloader Command	1	Specific Bootloader command to execute. 0xAA: Enter Bootloader Mode 0x55: Write 32-Byte Sector 0xCC: Verify / Commit
Sector	2	Specifies what Sector to write
Data	32	Data to write to the specified sector

Bootloader Command Response – MODBUS GW Only
Command: 0xD5
Description: Frame returned in response to a " Bootloader Command Request" received by a specified sensor, repeater, or AP.

Field Name	Size (bytes)	Description
Device ID	4	The Serial ID of the device
Bootloader Command	1	Specific Bootloader command executed.
Sector	2	Specifies what Sector was requested
Command Status	1	Status of the request 0 = success , >0 = failure