MGL Avionics

V16 Aviation band transceiver

ICD V3

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MGL Avionics V16 transceiver communications protocols

Version

This document contains preliminary information on the binary communications protocol used by MGL Avionics VHF airband V16 transceivers.

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V3 – 19 September 2019
added COMM command 34 for RS232 OEM applications
V2 – 20 June 2018
added information on status message checksum deviation
added information on additional commands
V1 – original release

The legal stuff

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General

Communications takes place via RS232 or via CAN bus or both

RS232 settings
9600 Baud
8 Data bits
1 Stop bit
No parity

CAN bus settings
11 bit identifiers
250KBaud

The transceiver transmits regular status messages containing sufficient information to build a typical display image. The status message is transmitted every 100mS. During special conditions the status message is sent every 200mS inter spaced with a setup information or technical information message every 200mS (so the overall message rate remains at 100mS).

Messages to the transceiver consist of commands. Most commands result in transmission of an acknowledgment when the command has been received with a matching checksum. Exceptions to this are the PTT command (no response).
PTT command has to be sent every 100 mS to keep PTT active.

Command messages containing frequency request that are not within the permitted airband or illegal channel frequencies are ignored and not acknowledged.

The V16 provides two RS232 ports and one CAN bus. Only RS232 port 1 supports this protocol. RS232 port 2 is reserved for special functions.

Frequencies

Frequencies are transmitted as 4 byte unsigned integer values in the RS232 protocol and 3 byte integer values in the CAN bus protocol,

Frequency values consist of MHZ and 100's of Khz plus a channel number within the 100Khz band.

Values N=0-15 give the channel where channels 1,2,3,5,6,7,9,10,11,13,14,15 are 8.33Khz channels and 0,4,8,12 are the 25Khz spaced channels.

Using published frequencies 8.33Khz channels from 0 to 15 correspond:

N	ICAO	KHZ	
0	0	0	25Khz bandwidth
1	5	0	
2	10	8.333	
3	15	16.666	
4	25	25.000	25Khz bandwidth
5	30	25.000	
6	35	33.333	
7	40	41.666	
8	50	50.000	25Khz bandwidth
9	55	50.000	
10	60	58.333	
11	65	66.666	
12	75	75.000	25Khz bandwidth
13	80	75.000	

14	85	83.333
15	90	91.666

Examples:

25Khz channel 127.175MHZ = 127112
8.33Khz channel 120.235Mhz = 120206 (actual frequency 120.233333 MHZ)

Note that 4 channels operate on two identical frequencies (0,25,50,75) and (5,30,55,80) respectively. The V16 switches internal RX and TX bandwidths accordingly so be sure to request the correct version as needed.

RS232 protocol

General message format:

02	STX
05	DLE
CC	Command
D0	1 to n bytes of data
...	
Dn	
CKS	Checksum

Checksum is a linear XOR of the message contents from Command to the last data byte. The result of this is XOR'ed with the value of $55.
This form of checksum is also known as longitudinal checksum or 8 bit parity.

Note: This protocol is based on the protocol used by the MGL Avionics V6 and V10 transceivers. Note that the commands and status messages are not all identical.

Example RS232 message to set standby frequency (values are in HEX)

02 05 01 18 F0 01 00 E8

The value E8 is the checksum and the frequency requested is 127.000 MHZ (0x1F018).

Note: The status message sent by the V16 has a deviation in the calculation. The status message excludes the command byte. All other messages include the command as shown above.

Commands:

00	Set active frequency
D0	Frequency, binary, LSB first
....	Sets frequency if TX is not active, if active will cause change of frequency
D3	to new value when TX ends.

Note: Frequency must be a valid frequency. Invalid frequencies will be ignored and no acknowledge will be sent for the message.

Sends acknowledge when message received OK

01	Set standby frequency
D0	Frequency, binary, LSB first
....	
D3	

Note: Frequency must be a valid frequency. Invalid frequencies will be ignored and no acknowledge will be sent for the message.

Sends acknowledge when message received OK

02	Increase RX and Intercom volume (3dB), If they are different they will be set to the same value as the intercom volume.
00	Don't care data value (recommend to set to zero)

Sends acknowledge when message received OK

03	Decrease RX and IC volume (3dB), If they are different they will be set to the same value as the intercom volume.
00	Don't care data value (recommend to set to zero)

Sends acknowledge when message received OK

04	Set RX and Intercom volume
00	Volume value 0-31 (lowest to highest)

Sends acknowledge when message received OK

05	Increase squelch
00	Don't care data value (recommend to set to zero)

Sends acknowledge when message received OK

06	Decrease squelch
00	Don't care data value (recommend to set to zero)

Sends acknowledge when message received OK

07	Set squelch
00	Squelch value 0-31 (lowest to highest)

Sends acknowledge when message received OK

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08 Set scanning on/off
00 0 = scanning off
1 = scanning on

Sends acknowledge when message received OK

---

09 Playback request
00 Don't care data value (recommend to set to zero)

Note: If this message is received while playback of last RX is not active, it will activate playback of the last RX. If it is received while a playback is active the playback pointer moves to the message before that and so forth until the last stored message. If no message is available for a request playback terminates (Playback also terminates at any time if a new RX is received).

Sends acknowledge when message received OK

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11 PTT
00 Bit 0 = Pilot PTT. 1=active, 0=not active
Bit 1 = PAX PTT. 1-active, 0=not active

This message must be sent every 100 mS to keep a PTT active. It will timeout and cancel any active PTT after 300mS if no further PTT command is received.
When the PTT is to be released it is recommended that at least one message is sent with the corresponding PTT bit set to zero so the TX is released immediately.
There is no need to send this message when no PTT is active.

This command does not reply with an acknowledge message !!!

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18 Flip active and standby frequencies
00 Don't care (recommend to set to zero)

Sends acknowledge when message received OK

---

20 Setup menu control
nn 0: Setup de-activate (power on state)
1: Setup activate
2: Menu up (previous item) – wraps to end of menu.
3: Menu down (next item) = wraps to start of menu.
4: Change value of current menu item UP, ON, YES or flip state
5: Change value of current menu item DOWN, OFF, NO or flip state
6: Technical setup de-activate (power on state)
7: Technical setup activate

If the V16 is placed in setup menu mode it will automatically cancel this mode if no activity within 60 seconds related to the Menu.

If the menu is active the Setup menu message will be sent every 200mS interspaced with the normal status message. The Setup message contains information on the nature of the current setup item and an ascii text message suitable for display on a control head or EFIS. The control head does not require any specific knowledge of the attached device. It simply activates the menu and displays the text to the user. The user navigates the menu and changes values using the above commands.

Technical setup should never be entered without detailed knowledge and required special equipment. The Technical menu includes a number of calibration items that should never be changed during the life of the V16 unless certain repairs have been carried out. DO NOT CHANGE ANY OF THESE ITEMS unless you have the required equipment and knowledge of the procedures required.

No acknowledge is sent in response to these commands

26	Increase Intercom volume (3dB).
00	Don't care data value (recommend to set to zero)

Sends acknowledge when message received OK

27	Decrease intercom volume (3dB).
00	Don't care data value (recommend to set to zero)

Sends acknowledge when message received OK

28	Set Intercom volume
nn	Volume value 0-31 (lowest to highest)

Sends acknowledge when message received OK

29	Increase RX volume (3dB).
00	Don't care data value (recommend to set to zero)

Sends acknowledge when message received OK

30	Decrease RX volume (3dB).
00	Don't care data value (recommend to set to zero)

Sends acknowledge when message received OK

31	Set RX volume
nn	Volume value 0-31 (lowest to highest)

Sends acknowledge when message received OK

32	Request technical information
nn	Item number requested.

Note: This message is not documented here. It is used during manufacture of the device to obtain transmission of a selection of technical information used to verify device operation.

Sends acknowledge when message received OK

33	Reset device
$55	fixed byte
$AA	fixed byte

This message will restart the V16 by issuing a hardware reset to the processor. This permits a suitable application to activate the boot loader firmware programming algorithm. This permits uploading of new device firmware in the field.

Sends acknowledge when message received OK

34	OEM Setup and Setup retrieval
CMD	A byte value from 0 to 19
nn	Variable number of data bytes (including none) depending on command

No acknowledge is sent in response to these commands.

Commands defined:

0:	Send setup. Format of response is described below
1:	Set TX power to 5W
2:	Set TX power to 10W
3:	Intercom switch input used as playback request
4:	Intercom switch input used as intercom switch (if VOX disabled)
5:	Delay TX OFF
6:	Delay TX ON (inserts a few milliseconds of delay to outgoing audio)
7:	TX Sidetone is from antenna output
8:	TX Sidetone is taken from modulator
9:	TX Sidetone is OFF
10:	TX Sidetone is ON
11:	TX on active RX allowed
12:	TX on active RX not allowed
13:	TX microphone uses VOX
14:	TX microphone does not use VOX (TX HOT Mic)
15:	Aux input gain (values 0 to 8 following as nn)
16:	Aux mute gain (values 0 to 8 following as nn)
17:	Pilot mic gain (values 0 to 63 following as nn)
18:	Pax mic gain (values 0 to 63 following as nn)
19:	VOX level (values 0 to 10 following as nn)

Format of setup message (requested by command 0)

02	STX
05	DLE

04	Message type
nn	TX Power 5W if not 00
nn	Intercom switch input is playback if not 00
nn	TX delay if not 00
nn	TX sidetone is Modulator if not 00
nn	TX Sidetone is ON if not 00
nn	TX not allowed on active RX if not 00
nn	TX on HOT mic if not 00
nn	Aux gain 0-8
nn	Aux mute gain 0-8
nn	Pilot mic gain 0-63
nn	Pax mic gain 0-63
nn	VOX setting 0-10
nn..nn	8 bytes containing zeros (for future settings)
CKS	Checksum

Format of Acknowledge message (sent by transceiver)

$02 $05 $06 $53 (full message including checksum)

Format of status message (sent by transceiver every 100mS unless setup menu is active)

02	STX
05	DLE
04	Message type
nn	Flags
	Bit 0 – 1 = TX is active
	Bit 1 – 1 = Scanning is active
	Bit 2 – 1 = RX on active frequency
	Bit 3 – 1 = RX on standby frequency
	Bit 4 – 1 = Stuck PTT (PTT active for more than 34 seconds, TX canceled)
nn	Status
	Bit 0 – 1 = Fault detected
	Bit 1 – 1 = Partial shutdown due to unfavorable operating condition
	Bit 2 – 1 = TX power reduced due to heat
	Bit 3 – 1 =TX Power reduced due to low operating voltage
	Bit 4 – 1 = Bad antenna match, TX power possibly reduced
	Note: TX related flags are only active during TX
nn	Current RX volume 0-31
nn	Current Intercom volume 0-31
nn	Current squelch 0-31
n0	Active frequency (4 bytes, LSB first)
....	
n3	
n0	Standby frequency (4 bytes, LSB first)

....
n3

nn	TX power measured at RF connector via directional coupler in 10th of a watt.
nn	VSWR measured via directional coupler in 10th of a unit at RF connector.
nn	RX signal level on active frequency in dBm relative to -140dbm.
nn	RX signal level on standby frequency in dBm relative to -140dbm. Note: Only valid is scanning is active.
nn	TX modulation level 0-63 (63 equals about 70% modulation index)
nn	Temperature at TX power stage in degrees C relative to -50 degrees.
nn	Supply voltage in 10th of a volt relative to +5.0 volts.
CKS	Checksum

Format of the Setup menu message (sent every 200mS if setup menu active)

02	STX
05	DLE
01	Message type
nn	Length of this message
nn	Setup type
nn	Minimum permitted value
nn	Maximum permitted value
nn	Current value
xx	String of ascii characters preceeded by a byte containing number of ascii characters in string.
CKS	Checksum

Setup types:

0	Setup has no value to change. For example, “set to factory default”. In this case you could send Menu command “menu item UP” to activate the function.
1	The most common. Minimum and maximum values are valid and you can change the value using the Up and Down commands.
2	This is not currently used. Treat as reserved value.
3	Menu item flips between two states. Use either UP or Down to select the desired state.

Length of this message field – This field contains the number of bytes in the message excluding the STX, DLE, Message type, length of message and checksum. It works out to the number of ASCII characters in the string + 5. It is used by the receiver to count the number of bytes until end of message.
Note that the string itself contains as first byte the number of characters in the string (Pascal “Shortstring” format).

Note: The status message checksum deviates from the checksum calculation mentioned in this document.
Checksum does not include the Message type (04). The checksum calculation starts with “Flags”.

Technical string

This message is sent on condition to convey further information. It is only used during technical work using dedicated diagnostics equipment.

02	STX
05	DLE
02	Message type
nn	Number of ASCII characters in string
xx	ASCII characters of string
CKS	Checksum

CAN bus protocol

The CAN bus protocol is a duplication of the information on the RS232 protocol packaged into suitable CAN message packets. Each packet may contain up to 8 bytes of data.

CAN packets are identified by address in a CAN network. The address scheme used conforms to the 11 bit message ID standard CAN protocol as well as to the scheme used with MGL Avionics CAN bus equipment.

The ID takes the value 0x44n where “n” can be a value from 0 to 15 depending on message type.

The MGL addressing scheme uses the upper 7 bits of the ID as device identifier and the lower 4 bits to identify specific functions or message types local to that device.

Messages from the V16

Status message

The status message is split over 3 packets send in order every 100mS or 200mS if the menu is active.

For a description on each item please refer to the text in the RS232 protocol related to the status message.

ID 0x440	Status packet 1, length 8 bytes
Byte 0	Message type = 0
Byte 1	Flags
Byte 2	Status
Byte 3	RX Volume
Byte 4	Intercom Volume
Byte 5	RX Squelch
Byte 6	TX power
Byte 7	VSWR

ID 0x440	Status packet 2, length 7 bytes
Byte 0	Message type = 1
Byte 1-3	Active frequency, three bytes, LSB first
Byte 4	Active frequency RX level
Byte 5	Standby frequency RX level
Byte 6	Modulation index

ID 0x440	Status packet 3, length 6 bytes
Byte 0	Message type = 2
Byte 1-3	Standby frequency, 3 bytes, LSB first
Byte 4	Temperature
Byte 5	Voltage

Menu item message

The menu item message is sent every 200mS as a block of packets in order alternating with the status messages.

The menu message is sent only if the menu is active. For details please see the description in the RS232 protocol related to the menu system.

ID 0x441	Menu packet 1, length 8 bytes
Byte 0	Message type = 0
Byte 1	Setup type
Byte 2	Minimum value
Byte 3	Maximum value
Byte 4	Current value
Byte 5	Length of ascii string in bytes
Byte 6	1st character of string
Byte 7	2nd character of string

ID 0x4n1	Subsequent menu packet(s), length 2 to 8 bytes
Byte 0	Message type – 1,2,3,4,5 (maximum 31 characters in string, 7 per packet)
Byte 1-7	Remaining characters of string to a maximum of 7 characters.

Technical string

This message is sent on condition to convey further information. It is only used during technical work using dedicated diagnostics equipment and activated by command 32.

ID 0x442	Subsequent menu packet(s), length 2 to 8 bytes
Byte 0	Message type – 0
Byte 1	Length of string in bytes
Byte 2-7	Up to 6 characters of string

ID 0x442	Subsequent technical text packet(s), length 2 to 8 bytes
Byte 0	Message type – 1-9 (maximum 63 characters in string, 7 per packet)
Byte 1-7	Remaining characters of string to a maximum of 7 characters.

Messages to the V16

V16 controllers use the assigned CAN ID 0x48n where “n” is a message type identifier. Multiple control heads will use the SAME ID.

ID 0x480	Length variable (minimum 1 byte)
Byte 0	Command ID
Byte 1-7	Optional data for command

Note: the V16 checks the length of a received CAN packet and will only accept packets that have the correct length for a given command. Do not pad a packet. Send it at the correct length.

Command	Length	Function
0	4	Set active frequency (three bytes, LSB first)
1	4	Set standby frequency (three bytes, LSB first)
2	1	Flip active and standby frequencies
3	1	RX and intercom volume UP 3db
4	1	RX and intercom volume DOWN 3db
5	2	Set RX and intercom volume. Value 0-31.
6	1	RX volume UP 3db
7	1	RX volume DOWN 3db
8	2	Set RX volume. Value 0-31.
9	1	Intercom volume UP 3db

10	1	Intercom volume DOWN 3db
11	2	Intercom volume. Value 0-31.
12	1	RX Squelch UP
13	1	RX Squelch DOWN
14	2	Set RX Squelch. Value 0-31.
15	2	Set scanning. 0 = inactive, any other value = active.
16	1	Flip scanning state (active ↔ inactive)
17	2	PTT activation. Bit 0 = PTT Pilot. Bit 1 – PTT PAX. 1=active. Please see RS232 protocol description on this for details.
18	2	Setup menu functions. Please see RS232 protocol description for details on this.
19	1,2,6	Beep control. Activates a beep tone sequencer for headset output. If length 1 = single beep, 40mS if length 2 = if data=0 then stop any beep active. If length 6 = First data byte = 1, bytes 2,3,4,5 are beep pattern, LSB first, Each “1” is beep active. Data byte 6 is duration of every bit in pattern in milliseconds. Pattern play starts with bit 0 of pattern.
20	1	Playback function. Please see description in RS232 protocol on this function.
21	1	Receiver test. Opens squelch for two seconds.

Message pass through to N16 NAV radio

Messages received on the RS232 port intended for the N16 NAV radio are passed through to the N16 via the CAN bus connection.

RS232 messages on the RS232 port that are intended for the N16 have the most significant bit of the command byte set.

Messages originating from the N16 via the CAN bus are transmitted by the V16 using the NAV status message. In addition, if the N16 is in setup mode the NAV setup message will be sent.

These messages are identical to the native RS232 messages sent by the N16 and documented in the N16 ICD.