

**MAVLink Include Files:** [minimal.xml](#)

## MAVLink Protocol Version

The current MAVLink version is 2.3. The minor version numbers (after the dot) range from 1-255.

This file has protocol dialect: 0.

## MAVLink Type Enumerations

### FIRMWARE\_VERSION\_TYPE

[Enum] These values define the type of firmware release. These values indicate the first version or release of this type. For example the first alpha release would be 64, the second would be 65.

Value	Field Name	Description
0	<a href="#">FIRMWARE_VERSION_TYPE_DEV</a>	development release
64	<a href="#">FIRMWARE_VERSION_TYPE_ALPHA</a>	alpha release
128	<a href="#">FIRMWARE_VERSION_TYPE_BETA</a>	beta release
192	<a href="#">FIRMWARE_VERSION_TYPE_RC</a>	release candidate
255	<a href="#">FIRMWARE_VERSION_TYPE_OFFICIAL</a>	official stable release

### HL\_FAILURE\_FLAG

[Enum] Flags to report failure cases over the high latency telemetry.

Value	Field Name	Description
1	<a href="#">HL_FAILURE_FLAG_GPS</a>	GPS failure.
2	<a href="#">HL_FAILURE_FLAG_DIFFERENTIAL_PRESSURE</a>	Differential pressure sensor failure.
4	<a href="#">HL_FAILURE_FLAG_ABSOLUTE_PRESSURE</a>	Absolute pressure sensor failure.
8	<a href="#">HL_FAILURE_FLAG_3D_ACCEL</a>	Accelerometer sensor failure.
16	<a href="#">HL_FAILURE_FLAG_3D_GYRO</a>	Gyroscope sensor failure.
32	<a href="#">HL_FAILURE_FLAG_3D_MAG</a>	Magnetometer sensor failure.
64	<a href="#">HL_FAILURE_FLAG_TERRAIN</a>	Terrain subsystem failure.
128	<a href="#">HL_FAILURE_FLAG_BATTERY</a>	Battery failure/critical low battery.
256	<a href="#">HL_FAILURE_FLAG_RC_RECEIVER</a>	RC receiver failure/no rc connection.
512	<a href="#">HL_FAILURE_FLAG_OFFBOARD_LINK</a>	Offboard link failure.
1024	<a href="#">HL_FAILURE_FLAG_ENGINE</a>	Engine failure.
2048	<a href="#">HL_FAILURE_FLAG_GEOFENCE</a>	Geofence violation.
4096	<a href="#">HL_FAILURE_FLAG_ESTIMATOR</a>	Estimator failure, for example measurement rejection or large variances.
8192	<a href="#">HL_FAILURE_FLAG_MISSION</a>	Mission failure.

### MAV\_GOTO

[Enum] Actions that may be specified in [MAV\\_CMD\\_OVERRIDE\\_GOTO](#) to override mission execution.

Value	Field Name	Description
0	<a href="#">MAV_GOTO_DO_HOLD</a>	Hold at the current position.
1	<a href="#">MAV_GOTO_DO_CONTINUE</a>	Continue with the next item in mission execution.
2	<a href="#">MAV_GOTO_HOLD_AT_CURRENT_POSITION</a>	Hold at the current position of the system
3	<a href="#">MAV_GOTO_HOLD_AT_SPECIFIED_POSITION</a>	Hold at the position specified in the parameters of the <a href="#">DO_HOLD</a> action

### MAV\_MODE

[Enum] These defines are predefined OR-combined mode flags. There is no need to use values from this enum, but it simplifies the use of the mode flags. Note that manual input is enabled in all modes as a safety override.

Value	Field Name	Description
0	<a href="#">MAV_MODE_PREFLIGHT</a>	System is not ready to fly, booting, calibrating, etc. No flag is set.
80	<a href="#">MAV_MODE_STABILIZE_DISARMED</a>	System is allowed to be active, under assisted RC control.
208	<a href="#">MAV_MODE_STABILIZE_ARMED</a>	System is allowed to be active, under assisted RC control.
64	<a href="#">MAV_MODE_MANUAL_DISARMED</a>	System is allowed to be active, under manual (RC) control, no stabilization
192	<a href="#">MAV_MODE_MANUAL_ARMED</a>	System is allowed to be active, under manual (RC) control, no stabilization
88	<a href="#">MAV_MODE_GUIDED_DISARMED</a>	System is allowed to be active, under autonomous control, manual setpoint
216	<a href="#">MAV_MODE_GUIDED_ARMED</a>	System is allowed to be active, under autonomous control, manual setpoint
92	<a href="#">MAV_MODE_AUTO_DISARMED</a>	System is allowed to be active, under autonomous control and navigation (the trajectory is decided onboard and not pre-programmed by waypoints)
220	<a href="#">MAV_MODE_AUTO_ARMED</a>	System is allowed to be active, under autonomous control and navigation (the trajectory is decided onboard and not pre-programmed by waypoints)
66	<a href="#">MAV_MODE_TEST_DISARMED</a>	UNDEFINED mode. This solely depends on the autopilot - use with caution, intended for developers only.
194	<a href="#">MAV_MODE_TEST_ARMED</a>	UNDEFINED mode. This solely depends on the autopilot - use with caution, intended for developers only.

### MAV\_SYS\_STATUS\_SENSOR

[Enum] These encode the sensors whose status is sent as part of the [SYS\\_STATUS](#) message.

Value	Field Name	Description
1	<a href="#">MAV_SYS_STATUS_SENSOR_3D_GYRO</a>	0x01 3D gyro
2	<a href="#">MAV_SYS_STATUS_SENSOR_3D_ACCEL</a>	0x02 3D accelerometer
4	<a href="#">MAV_SYS_STATUS_SENSOR_3D_MAG</a>	0x04 3D magnetometer
8	<a href="#">MAV_SYS_STATUS_SENSOR_ABSOLUTE_PRESSURE</a>	0x08 absolute pressure
16	<a href="#">MAV_SYS_STATUS_SENSOR_DIFFERENTIAL_PRESSURE</a>	0x10 differential pressure

32	<a href="#">MAV_SYS_STATUS_SENSOR_GPS</a>	0x20 GPS
64	<a href="#">MAV_SYS_STATUS_SENSOR_OPTICAL_FLOW</a>	0x40 optical flow
128	<a href="#">MAV_SYS_STATUS_SENSOR_VISION_POSITION</a>	0x80 computer vision position
256	<a href="#">MAV_SYS_STATUS_SENSOR_LASER_POSITION</a>	0x100 laser based position
512	<a href="#">MAV_SYS_STATUS_SENSOR_EXTERNAL_GROUND_TRUTH</a>	0x200 external ground truth (Vicon or Leica)
1024	<a href="#">MAV_SYS_STATUS_SENSOR_ANGULAR_RATE_CONTROL</a>	0x400 3D angular rate control
2048	<a href="#">MAV_SYS_STATUS_SENSOR_ATTITUDE_STABILIZATION</a>	0x800 attitude stabilization
4096	<a href="#">MAV_SYS_STATUS_SENSOR_YAW_POSITION</a>	0x1000 yaw position
8192	<a href="#">MAV_SYS_STATUS_SENSOR_Z_ALTITUDE_CONTROL</a>	0x2000 z/altitude control
16384	<a href="#">MAV_SYS_STATUS_SENSOR_XY_POSITION_CONTROL</a>	0x4000 x/y position control
32768	<a href="#">MAV_SYS_STATUS_SENSOR_MOTOR_OUTPUTS</a>	0x8000 motor outputs / control
65536	<a href="#">MAV_SYS_STATUS_SENSOR_RC_RECEIVER</a>	0x10000 rc receiver
131072	<a href="#">MAV_SYS_STATUS_SENSOR_3D_GYRO2</a>	0x20000 2nd 3D gyro
262144	<a href="#">MAV_SYS_STATUS_SENSOR_3D_ACCEL2</a>	0x40000 2nd 3D accelerometer
524288	<a href="#">MAV_SYS_STATUS_SENSOR_3D_MAG2</a>	0x80000 2nd 3D magnetometer
1048576	<a href="#">MAV_SYS_STATUS_GEOFENCE</a>	0x100000 geofence
2097152	<a href="#">MAV_SYS_STATUS_AHRS</a>	0x200000 AHRS subsystem health
4194304	<a href="#">MAV_SYS_STATUS_TERRAIN</a>	0x400000 Terrain subsystem health
8388608	<a href="#">MAV_SYS_STATUS_REVERSE_MOTOR</a>	0x800000 Motors are reversed
16777216	<a href="#">MAV_SYS_STATUS_LOGGING</a>	0x1000000 Logging
33554432	<a href="#">MAV_SYS_STATUS_SENSOR_BATTERY</a>	0x2000000 Battery
67108864	<a href="#">MAV_SYS_STATUS_SENSOR_PROXIMITY</a>	0x4000000 Proximity
134217728	<a href="#">MAV_SYS_STATUS_SENSOR_SATCOM</a>	0x8000000 Satellite Communication
268435456	<a href="#">MAV_SYS_STATUS_PREARM_CHECK</a>	0x10000000 pre-arm check status. Always healthy when armed
536870912	<a href="#">MAV_SYS_STATUS_OBSTACLE_AVOIDANCE</a>	0x20000000 Avoidance/collision prevention
1073741824	<a href="#">MAV_SYS_STATUS_SENSOR_PROPULSION</a>	0x40000000 propulsion (actuator, esc, motor or propellor)

## MAV\_SYS\_STATUS\_SENSOR\_EXTENDED

[Enum] These encode the sensors whose status is sent as part of the [SYS\\_STATUS](#) message in the extended fields.

Value	Field Name	Description
1	<a href="#">MAV_SYS_STATUS_RECOVERY_SYSTEM</a>	0x01 Recovery system (parachute, balloon, retracts etc)

## MAV\_FRAME

[Enum] Coordinate frames used by MAVLink. Not all frames are supported by all commands, messages, or vehicles.

Global frames use the following naming conventions:

- "GLOBAL": Global coordinate frame with WGS84 latitude/longitude and altitude positive over mean sea level (MSL) by default. The following modifiers may be used with "GLOBAL":
- "RELATIVE\_ALT": Altitude is relative to the vehicle home position rather than MSL.
- "TERRAIN\_ALT": Altitude is relative to ground level rather than MSL.
- "INT": Latitude/longitude (in degrees) are scaled by multiplying by 1E7.

Local frames use the following naming conventions:

- "LOCAL": Origin of local frame is fixed relative to earth. Unless otherwise specified this origin is the origin of the vehicle position-estimator ("EKF").
- "BODY": Origin of local frame travels with the vehicle. NOTE, "BODY" does NOT indicate alignment of frame axis with vehicle attitude.
- "OFFSET": Deprecated synonym for "BODY" (origin travels with the vehicle). Not to be used for new frames.

Some deprecated frames do not follow these conventions (e.g. [MAV\\_FRAME\\_BODY\\_NED](#) and [MAV\\_FRAME\\_BODY\\_OFFSET\\_NED](#)).

Value	Field Name	Description
0	<a href="#">MAV_FRAME_GLOBAL</a>	Global (WGS84) coordinate frame + MSL altitude. First value / x: latitude, second value / y: longitude, third value / z: positive altitude over mean sea level (MSL).
1	<a href="#">MAV_FRAME_LOCAL_NED</a>	NED local tangent frame (x: North, y: East, z: Down) with origin fixed relative to earth.
2	<a href="#">MAV_FRAME_MISSION</a>	NOT a coordinate frame, indicates a mission command.
3	<a href="#">MAV_FRAME_GLOBAL_RELATIVE_ALT</a>	Global (WGS84) coordinate frame + altitude relative to the home position.
First value / x: latitude, second value / y: longitude, third value / z: positive altitude with 0 being at the altitude of the home position.		
4	<a href="#">MAV_FRAME_LOCAL_ENU</a>	ENU local tangent frame (x: East, y: North, z: Up) with origin fixed relative to earth.
5	<a href="#">MAV_FRAME_GLOBAL_INT</a>	Global (WGS84) coordinate frame (scaled) + MSL altitude. First value / x: latitude in degrees*1E7, second value / y: longitude in degrees*1E7, third value / z: positive altitude over mean sea level (MSL).
6	<a href="#">MAV_FRAME_GLOBAL_RELATIVE_ALT_INT</a>	Global (WGS84) coordinate frame (scaled) + altitude relative to the home position.
First value / x: latitude in degrees*1E7, second value / y: longitude in degrees*1E7, third value / z: positive		

altitude with 0 being at the altitude of the home position.

7 [MAV\\_FRAME\\_LOCAL\\_OFFSET\\_NED](#)

NED local tangent frame (x: North, y: East, z: Down) with origin that travels with the vehicle.

8 [MAV\\_FRAME\\_BODY\\_NED](#)

**DEPRECATED:** Replaced by [MAV\\_FRAME\\_BODY\\_FRD](#) (2019-08). | Same as [MAV\\_FRAME\\_LOCAL\\_NED](#) when used to represent position values. Same as [MAV\\_FRAME\\_BODY\\_FRD](#) when used with velocity/acceleration values. | | 9 | [MAV\\_FRAME\\_BODY\\_OFFSET\\_NED](#)

**DEPRECATED:** Replaced by [MAV\\_FRAME\\_BODY\\_FRD](#) (2019-08). | This is the same as [MAV\\_FRAME\\_BODY\\_FRD](#). | | 10 | [MAV\\_FRAME\\_GLOBAL\\_TERRAIN\\_ALT](#) | Global (WGS84) coordinate frame with AGL altitude (at the waypoint coordinate). First value / x: latitude in degrees, second value / y: longitude in degrees, third value / z: positive altitude in meters with 0 being at ground level in terrain model. | | 11 | [MAV\\_FRAME\\_GLOBAL\\_TERRAIN\\_ALT\\_INT](#) | Global (WGS84) coordinate frame (scaled) with AGL altitude (at the waypoint coordinate). First value / x: latitude in degrees\*1E7, second value / y: longitude in degrees\*1E7, third value / z: positive altitude in meters with 0 being at ground level in terrain model. | | 12 | [MAV\\_FRAME\\_BODY\\_FRD](#) | FRD local tangent frame (x: Forward, y: Right, z: Down) with origin that travels with vehicle. The forward axis is aligned to the front of the vehicle in the horizontal plane. | | 13 | [MAV\\_FRAME\\_RESERVED\\_13](#)

**DEPRECATED:** Replaced by (2019-04). | [MAV\\_FRAME\\_BODY\\_FLU](#) - Body fixed frame of reference, Z-up (x: Forward, y: Left, z: Up). | | 14 | [MAV\\_FRAME\\_RESERVED\\_14](#)

**DEPRECATED:** Replaced by [MAV\\_FRAME\\_LOCAL\\_FRD](#) (2019-04). | [MAV\\_FRAME\\_MOCAP\\_NED](#) - Odometry local coordinate frame of data given by a motion capture system, Z-down (x: North, y: East, z: Down). | | 15 | [MAV\\_FRAME\\_RESERVED\\_15](#)

**DEPRECATED:** Replaced by [MAV\\_FRAME\\_LOCAL\\_FLU](#) (2019-04). | [MAV\\_FRAME\\_MOCAP\\_ENU](#) - Odometry local coordinate frame of data given by a motion capture system, Z-up (x: East, y: North, z: Up). | | 16 | [MAV\\_FRAME\\_RESERVED\\_16](#)

**DEPRECATED:** Replaced by [MAV\\_FRAME\\_LOCAL\\_FRD](#) (2019-04). | [MAV\\_FRAME\\_VISION\\_NED](#) - Odometry local coordinate frame of data given by a vision estimation system, Z-down (x: North, y: East, z: Down). | | 17 | [MAV\\_FRAME\\_RESERVED\\_17](#)

**DEPRECATED:** Replaced by [MAV\\_FRAME\\_LOCAL\\_FLU](#) (2019-04). | [MAV\\_FRAME\\_VISION\\_ENU](#) - Odometry local coordinate frame of data given by a vision estimation system, Z-up (x: East, y: North, z: Up). | | 18 | [MAV\\_FRAME\\_RESERVED\\_18](#)

**DEPRECATED:** Replaced by [MAV\\_FRAME\\_LOCAL\\_FRD](#) (2019-04). | [MAV\\_FRAME\\_ESTIM\\_NED](#) - Odometry local coordinate frame of data given by an estimator running onboard the vehicle, Z-down (x: North, y: East, z: Down). | | 19 | [MAV\\_FRAME\\_RESERVED\\_19](#)

**DEPRECATED:** Replaced by [MAV\\_FRAME\\_LOCAL\\_FLU](#) (2019-04). | [MAV\\_FRAME\\_ESTIM\\_ENU](#) - Odometry local coordinate frame of data given by an estimator running onboard the vehicle, Z-up (x: East, y: North, z: Up). | | 20 | [MAV\\_FRAME\\_LOCAL\\_FRD](#) | FRD local tangent frame (x: Forward, y: Right, z: Down) with origin fixed relative to earth. The forward axis is aligned to the front of the vehicle in the horizontal plane. | | 21 | [MAV\\_FRAME\\_LOCAL\\_FLU](#) | FLU local tangent frame (x: Forward, y: Left, z: Up) with origin fixed relative to earth. The forward axis is aligned to the front of the vehicle in the horizontal plane. |

## MAVLINK\_DATA\_STREAM\_TYPE

[\[Enum\]](#)

Value	Field Name	Description
0	<a href="#">MAVLINK_DATA_STREAM_IMG_JPEG</a>	
1	<a href="#">MAVLINK_DATA_STREAM_IMG_BMP</a>	
2	<a href="#">MAVLINK_DATA_STREAM_IMG_RAW8U</a>	
3	<a href="#">MAVLINK_DATA_STREAM_IMG_RAW32U</a>	
4	<a href="#">MAVLINK_DATA_STREAM_IMG_PGM</a>	
5	<a href="#">MAVLINK_DATA_STREAM_IMG_PNG</a>	

## FENCE\_ACTION

[\[Enum\]](#) Actions following geofence breach.

Value	Field Name	Description
0	<a href="#">FENCE_ACTION_NONE</a>	Disable fenced mode. If used in a plan this would mean the next fence is disabled.
1	<a href="#">FENCE_ACTION_GUIDED</a>	Fly to geofence <a href="#">MAV_CMD_NAV_FENCE_RETURN_POINT</a> in GUIDED mode. Note: This action is only supported by ArduPlane, and may not be supported in all versions.
2	<a href="#">FENCE_ACTION_REPORT</a>	Report fence breach, but don't take action
3	<a href="#">FENCE_ACTION_GUIDED_THR_PASS</a>	Fly to geofence <a href="#">MAV_CMD_NAV_FENCE_RETURN_POINT</a> with manual throttle control in GUIDED mode. Note: This action is only supported by ArduPlane, and may not be supported in all versions.
4	<a href="#">FENCE_ACTION_RTL</a>	Return/RTL mode.
5	<a href="#">FENCE_ACTION_HOLD</a>	Hold at current location.
6	<a href="#">FENCE_ACTION_TERMINATE</a>	Termination failsafe. Motors are shut down (some flight stacks may trigger other failsafe actions).
7	<a href="#">FENCE_ACTION_LAND</a>	Land at current location.

## FENCE\_BREACH

[\[Enum\]](#)

Value	Field Name	Description
0	<a href="#">FENCE_BREACH_NONE</a>	No last fence breach
1	<a href="#">FENCE_BREACH_MINALT</a>	Breached minimum altitude
2	<a href="#">FENCE_BREACH_MAXALT</a>	Breached maximum altitude
3	<a href="#">FENCE_BREACH_BOUNDARY</a>	Breached fence boundary

## FENCE\_MITIGATE

[\[Enum\]](#) Actions being taken to mitigate/prevent fence breach

Value	Field Name	Description
0	<a href="#">FENCE_MITIGATE_UNKNOWN</a>	Unknown
1	<a href="#">FENCE_MITIGATE_NONE</a>	No actions being taken

2 [FENCE\\_MITIGATE\\_VEL\\_LIMIT](#) Velocity limiting active to prevent breach

## MAV\_MOUNT\_MODE

**DEPRECATED:** Replaced by [GIMBAL\\_MANAGER\\_FLAGS](#) (2020-01).

**[Enum]** Enumeration of possible mount operation modes. This message is used by obsolete/deprecated gimbal messages.

Value	Field Name	Description
0	<a href="#">MAV_MOUNT_MODE_RETRACT</a>	Load and keep safe position (Roll,Pitch,Yaw) from permant memory and stop stabilization
1	<a href="#">MAV_MOUNT_MODE_NEUTRAL</a>	Load and keep neutral position (Roll,Pitch,Yaw) from permanent memory.
2	<a href="#">MAV_MOUNT_MODE_MAVLINK_TARGETING</a>	Load neutral position and start MAVLink Roll,Pitch,Yaw control with stabilization
3	<a href="#">MAV_MOUNT_MODE_RC_TARGETING</a>	Load neutral position and start RC Roll,Pitch,Yaw control with stabilization
4	<a href="#">MAV_MOUNT_MODE_GPS_POINT</a>	Load neutral position and start to point to Lat,Lon,Alt
5	<a href="#">MAV_MOUNT_MODE_SYSID_TARGET</a>	Gimbal tracks system with specified system ID
6	<a href="#">MAV_MOUNT_MODE_HOME_LOCATION</a>	Gimbal tracks home position

## GIMBAL\_DEVICE\_CAP\_FLAGS

**[Enum]** Gimbal device (low level) capability flags (bitmap)

Value	Field Name	Description
1	<a href="#">GIMBAL_DEVICE_CAP_FLAGS_HAS_RETRACT</a>	Gimbal device supports a retracted position
2	<a href="#">GIMBAL_DEVICE_CAP_FLAGS_HAS_NEUTRAL</a>	Gimbal device supports a horizontal, forward looking position, stabilized
4	<a href="#">GIMBAL_DEVICE_CAP_FLAGS_HAS_ROLL_AXIS</a>	Gimbal device supports rotating around roll axis.
8	<a href="#">GIMBAL_DEVICE_CAP_FLAGS_HAS_ROLL_FOLLOW</a>	Gimbal device supports to follow a roll angle relative to the vehicle
16	<a href="#">GIMBAL_DEVICE_CAP_FLAGS_HAS_ROLL_LOCK</a>	Gimbal device supports locking to an roll angle (generally that's the default with roll stabilized)
32	<a href="#">GIMBAL_DEVICE_CAP_FLAGS_HAS_PITCH_AXIS</a>	Gimbal device supports rotating around pitch axis.
64	<a href="#">GIMBAL_DEVICE_CAP_FLAGS_HAS_PITCH_FOLLOW</a>	Gimbal device supports to follow a pitch angle relative to the vehicle
128	<a href="#">GIMBAL_DEVICE_CAP_FLAGS_HAS_PITCH_LOCK</a>	Gimbal device supports locking to an pitch angle (generally that's the default with pitch stabilized)
256	<a href="#">GIMBAL_DEVICE_CAP_FLAGS_HAS_YAW_AXIS</a>	Gimbal device supports rotating around yaw axis.
512	<a href="#">GIMBAL_DEVICE_CAP_FLAGS_HAS_YAW_FOLLOW</a>	Gimbal device supports to follow a yaw angle relative to the vehicle (generally that's the default)
1024	<a href="#">GIMBAL_DEVICE_CAP_FLAGS_HAS_YAW_LOCK</a>	Gimbal device supports locking to an absolute heading (often this is an option available)
2048	<a href="#">GIMBAL_DEVICE_CAP_FLAGS_SUPPORTS_INFINITE_YAW</a>	Gimbal device supports yawing/panning infinitely (e.g. using slip disk).

## GIMBAL\_MANAGER\_CAP\_FLAGS

**[Enum]** Gimbal manager high level capability flags (bitmap). The first 16 bits are identical to the [GIMBAL\\_DEVICE\\_CAP\\_FLAGS](#). However, the gimbal manager does not need to copy the flags from the gimbal but can also enhance the capabilities and thus add flags.

Value	Field Name	Description
1	<a href="#">GIMBAL_MANAGER_CAP_FLAGS_HAS_RETRACT</a>	Based on <a href="#">GIMBAL_DEVICE_CAP_FLAGS_HAS_RETRACT</a> .
2	<a href="#">GIMBAL_MANAGER_CAP_FLAGS_HAS_NEUTRAL</a>	Based on <a href="#">GIMBAL_DEVICE_CAP_FLAGS_HAS_NEUTRAL</a> .
4	<a href="#">GIMBAL_MANAGER_CAP_FLAGS_HAS_ROLL_AXIS</a>	Based on <a href="#">GIMBAL_DEVICE_CAP_FLAGS_HAS_ROLL_AXIS</a> .
8	<a href="#">GIMBAL_MANAGER_CAP_FLAGS_HAS_ROLL_FOLLOW</a>	Based on <a href="#">GIMBAL_DEVICE_CAP_FLAGS_HAS_ROLL_FOLLOW</a> .
16	<a href="#">GIMBAL_MANAGER_CAP_FLAGS_HAS_ROLL_LOCK</a>	Based on <a href="#">GIMBAL_DEVICE_CAP_FLAGS_HAS_ROLL_LOCK</a> .
32	<a href="#">GIMBAL_MANAGER_CAP_FLAGS_HAS_PITCH_AXIS</a>	Based on <a href="#">GIMBAL_DEVICE_CAP_FLAGS_HAS_PITCH_AXIS</a> .
64	<a href="#">GIMBAL_MANAGER_CAP_FLAGS_HAS_PITCH_FOLLOW</a>	Based on <a href="#">GIMBAL_DEVICE_CAP_FLAGS_HAS_PITCH_FOLLOW</a> .
128	<a href="#">GIMBAL_MANAGER_CAP_FLAGS_HAS_PITCH_LOCK</a>	Based on <a href="#">GIMBAL_DEVICE_CAP_FLAGS_HAS_PITCH_LOCK</a> .
256	<a href="#">GIMBAL_MANAGER_CAP_FLAGS_HAS_YAW_AXIS</a>	Based on <a href="#">GIMBAL_DEVICE_CAP_FLAGS_HAS_YAW_AXIS</a> .
512	<a href="#">GIMBAL_MANAGER_CAP_FLAGS_HAS_YAW_FOLLOW</a>	Based on <a href="#">GIMBAL_DEVICE_CAP_FLAGS_HAS_YAW_FOLLOW</a> .
1024	<a href="#">GIMBAL_MANAGER_CAP_FLAGS_HAS_YAW_LOCK</a>	Based on <a href="#">GIMBAL_DEVICE_CAP_FLAGS_HAS_YAW_LOCK</a> .
2048	<a href="#">GIMBAL_MANAGER_CAP_FLAGS_SUPPORTS_INFINITE_YAW</a>	Based on <a href="#">GIMBAL_DEVICE_CAP_FLAGS_SUPPORTS_INFINITE_YAW</a> .
65536	<a href="#">GIMBAL_MANAGER_CAP_FLAGS_CAN_POINT_LOCATION_LOCAL</a>	Gimbal manager supports to point to a local position.
131072	<a href="#">GIMBAL_MANAGER_CAP_FLAGS_CAN_POINT_LOCATION_GLOBAL</a>	Gimbal manager supports to point to a global latitude, longitude, altitude position.

## GIMBAL\_DEVICE\_FLAGS

**[Enum]** Flags for gimbal device (lower level) operation.

Value	Field Name	Description
1	<a href="#">GIMBAL_DEVICE_FLAGS_RETRACT</a>	Set to retracted safe position (no stabilization), takes presedence over all other flags.
2	<a href="#">GIMBAL_DEVICE_FLAGS_NEUTRAL</a>	Set to neutral/default position, taking precedence over all other flags except RETRACT. Neutral is commonly forward-facing and horizontal (pitch=yaw=0) but may be any orientation.
4	<a href="#">GIMBAL_DEVICE_FLAGS_ROLL_LOCK</a>	Lock roll angle to absolute angle relative to horizon (not relative to drone). This is generally the default with a stabilizing gimbal.
8	<a href="#">GIMBAL_DEVICE_FLAGS_PITCH_LOCK</a>	Lock pitch angle to absolute angle relative to horizon (not relative to drone). This is generally the default.
16	<a href="#">GIMBAL_DEVICE_FLAGS_YAW_LOCK</a>	Lock yaw angle to absolute angle relative to North (not relative to drone). If this flag is set, the quaternion is in the Earth frame with the x-axis pointing North (yaw absolute). If this flag is not set, the quaternion frame is in the Earth frame rotated so that the x-axis is pointing forward (yaw relative to vehicle).

## GIMBAL\_MANAGER\_FLAGS

[Enum] Flags for high level gimbal manager operation The first 16 bits are identical to the [GIMBAL\\_DEVICE\\_FLAGS](#).

Value	Field Name	Description
1	<a href="#">GIMBAL_MANAGER_FLAGS_RETRACT</a>	Based on GIMBAL_DEVICE_FLAGS_RETRACT
2	<a href="#">GIMBAL_MANAGER_FLAGS_NEUTRAL</a>	Based on GIMBAL_DEVICE_FLAGS_NEUTRAL
4	<a href="#">GIMBAL_MANAGER_FLAGS_ROLL_LOCK</a>	Based on GIMBAL_DEVICE_FLAGS_ROLL_LOCK
8	<a href="#">GIMBAL_MANAGER_FLAGS_PITCH_LOCK</a>	Based on GIMBAL_DEVICE_FLAGS_PITCH_LOCK
16	<a href="#">GIMBAL_MANAGER_FLAGS_YAW_LOCK</a>	Based on GIMBAL_DEVICE_FLAGS_YAW_LOCK

## GIMBAL\_DEVICE\_ERROR\_FLAGS

[Enum] Gimbal device (low level) error flags (bitmap, 0 means no error)

Value	Field Name	Description
1	<a href="#">GIMBAL_DEVICE_ERROR_FLAGS_AT_ROLL_LIMIT</a>	Gimbal device is limited by hardware roll limit.
2	<a href="#">GIMBAL_DEVICE_ERROR_FLAGS_AT_PITCH_LIMIT</a>	Gimbal device is limited by hardware pitch limit.
4	<a href="#">GIMBAL_DEVICE_ERROR_FLAGS_AT_YAW_LIMIT</a>	Gimbal device is limited by hardware yaw limit.
8	<a href="#">GIMBAL_DEVICE_ERROR_FLAGS_ENCODER_ERROR</a>	There is an error with the gimbal encoders.
16	<a href="#">GIMBAL_DEVICE_ERROR_FLAGS_POWER_ERROR</a>	There is an error with the gimbal power source.
32	<a href="#">GIMBAL_DEVICE_ERROR_FLAGS_MOTOR_ERROR</a>	There is an error with the gimbal motor's.
64	<a href="#">GIMBAL_DEVICE_ERROR_FLAGS_SOFTWARE_ERROR</a>	There is an error with the gimbal's software.
128	<a href="#">GIMBAL_DEVICE_ERROR_FLAGS_COMMS_ERROR</a>	There is an error with the gimbal's communication.
256	<a href="#">GIMBAL_DEVICE_ERROR_FLAGS_CALIBRATION_RUNNING</a>	Gimbal is currently calibrating.

## GRIPPER\_ACTIONS

[Enum] Gripper actions.

Value	Field Name	Description
0	<a href="#">GRIPPER_ACTION_RELEASE</a>	Gripper release cargo.
1	<a href="#">GRIPPER_ACTION_GRAB</a>	Gripper grab onto cargo.

## WINCH\_ACTIONS

[Enum] Winch actions.

Value	Field Name	Description
0	<a href="#">WINCH_RELAXED</a>	Allow motor to freewheel.
1	<a href="#">WINCH_RELATIVE_LENGTH_CONTROL</a>	Wind or unwind specified length of line, optionally using specified rate.
2	<a href="#">WINCH_RATE_CONTROL</a>	Wind or unwind line at specified rate.
3	<a href="#">WINCH_LOCK</a>	Perform the locking sequence to relieve motor while in the fully retracted position. Only action and instance command parameters are used, others are ignored.
4	<a href="#">WINCH_DELIVER</a>	Sequence of drop, slow down, touch down, reel up, lock. Only action and instance command parameters are used, others are ignored.
5	<a href="#">WINCH_HOLD</a>	Engage motor and hold current position. Only action and instance command parameters are used, others are ignored.
6	<a href="#">WINCH_RETRACT</a>	Return the reel to the fully retracted position. Only action and instance command parameters are used, others are ignored.
7	<a href="#">WINCH_LOAD_LINE</a>	Load the reel with line. The winch will calculate the total loaded length and stop when the tension exceeds a threshold. Only action and instance command parameters are used, others are ignored.
8	<a href="#">WINCH_ABANDON_LINE</a>	Spool out the entire length of the line. Only action and instance command parameters are used, others are ignored.

## UAVCAN\_NODE\_HEALTH

[Enum] Generalized UAVCAN node health

Value	Field Name	Description
0	<a href="#">UAVCAN_NODE_HEALTH_OK</a>	The node is functioning properly.
1	<a href="#">UAVCAN_NODE_HEALTH_WARNING</a>	A critical parameter went out of range or the node has encountered a minor failure.
2	<a href="#">UAVCAN_NODE_HEALTH_ERROR</a>	The node has encountered a major failure.
3	<a href="#">UAVCAN_NODE_HEALTH_CRITICAL</a>	The node has suffered a fatal malfunction.

## UAVCAN\_NODE\_MODE

[Enum] Generalized UAVCAN node mode

Value	Field Name	Description
0	<a href="#">UAVCAN_NODE_MODE_OPERATIONAL</a>	The node is performing its primary functions.
1	<a href="#">UAVCAN_NODE_MODE_INITIALIZATION</a>	The node is initializing; this mode is entered immediately after startup.
2	<a href="#">UAVCAN_NODE_MODE_MAINTENANCE</a>	The node is under maintenance.
3	<a href="#">UAVCAN_NODE_MODE_SOFTWARE_UPDATE</a>	The node is in the process of updating its software.
7	<a href="#">UAVCAN_NODE_MODE_OFFLINE</a>	The node is no longer available online.

## ESC\_CONNECTION\_TYPE

[Enum] Indicates the ESC connection type.

Value	Field Name	Description
0	<a href="#">ESC_CONNECTION_TYPE_PPM</a>	Traditional PPM ESC.
1	<a href="#">ESC_CONNECTION_TYPE_SERIAL</a>	Serial Bus connected ESC.
2	<a href="#">ESC_CONNECTION_TYPE_ONESHOT</a>	One Shot PPM ESC.

3	<a href="#">ESC_CONNECTION_TYPE_I2C</a>	I2C ESC.
4	<a href="#">ESC_CONNECTION_TYPE_CAN</a>	CAN-Bus ESC.
5	<a href="#">ESC_CONNECTION_TYPE_DSHOT</a>	DSHOT ESC.

## ESC\_FAILURE\_FLAGS

[\[Enum\]](#) Flags to report ESC failures.

Value	Field Name	Description
0	<a href="#">ESC_FAILURE_NONE</a>	No ESC failure.
1	<a href="#">ESC_FAILURE_OVER_CURRENT</a>	Over current failure.
2	<a href="#">ESC_FAILURE_OVER_VOLTAGE</a>	Over voltage failure.
4	<a href="#">ESC_FAILURE_OVER_TEMPERATURE</a>	Over temperature failure.
8	<a href="#">ESC_FAILURE_OVER_RPM</a>	Over RPM failure.
16	<a href="#">ESC_FAILURE_INCONSISTENT_CMD</a>	Inconsistent command failure i.e. out of bounds.
32	<a href="#">ESC_FAILURE_MOTOR_STUCK</a>	Motor stuck failure.
64	<a href="#">ESC_FAILURE_GENERIC</a>	Generic ESC failure.

## STORAGE\_STATUS

[\[Enum\]](#) Flags to indicate the status of camera storage.

Value	Field Name	Description
0	<a href="#">STORAGE_STATUS_EMPTY</a>	Storage is missing (no microSD card loaded for example.)
1	<a href="#">STORAGE_STATUS_UNFORMATTED</a>	Storage present but unformatted.
2	<a href="#">STORAGE_STATUS_READY</a>	Storage present and ready.
3	<a href="#">STORAGE_STATUS_NOT_SUPPORTED</a>	Camera does not supply storage status information. Capacity information in <a href="#">STORAGE_INFORMATION</a> fields will be ignored.

## STORAGE\_TYPE

[\[Enum\]](#) Flags to indicate the type of storage.

Value	Field Name	Description
0	<a href="#">STORAGE_TYPE_UNKNOWN</a>	Storage type is not known.
1	<a href="#">STORAGE_TYPE_USB_STICK</a>	Storage type is USB device.
2	<a href="#">STORAGE_TYPE_SD</a>	Storage type is SD card.
3	<a href="#">STORAGE_TYPE_MICROSD</a>	Storage type is microSD card.
4	<a href="#">STORAGE_TYPE_CF</a>	Storage type is CFast.
5	<a href="#">STORAGE_TYPE_CFE</a>	Storage type is CFexpress.
6	<a href="#">STORAGE_TYPE_XOD</a>	Storage type is XQD.
7	<a href="#">STORAGE_TYPE_HD</a>	Storage type is HD mass storage type.
254	<a href="#">STORAGE_TYPE_OTHER</a>	Storage type is other, not listed type.

## STORAGE\_USAGE\_FLAG

[\[Enum\]](#) Flags to indicate usage for a particular storage (see [STORAGE\\_INFORMATION](#).storage\_usage and [MAV\\_CMD\\_SET\\_STORAGE\\_USAGE](#)).

Value	Field Name	Description
1	<a href="#">STORAGE_USAGE_FLAG_SET</a>	Always set to 1 (indicates <a href="#">STORAGE_INFORMATION</a> .storage_usage is supported).
2	<a href="#">STORAGE_USAGE_FLAG_PHOTO</a>	Storage for saving photos.
4	<a href="#">STORAGE_USAGE_FLAG_VIDEO</a>	Storage for saving videos.
8	<a href="#">STORAGE_USAGE_FLAG_LOGS</a>	Storage for saving logs.

## ORBIT\_YAW\_BEHAVIOUR

[\[Enum\]](#) Yaw behaviour during orbit flight.

Value	Field Name	Description
0	<a href="#">ORBIT_YAW_BEHAVIOUR_HOLD_FRONT_TO_CIRCLE_CENTER</a>	Vehicle front points to the center (default).
1	<a href="#">ORBIT_YAW_BEHAVIOUR_HOLD_INITIAL_HEADING</a>	Vehicle front holds heading when message received.
2	<a href="#">ORBIT_YAW_BEHAVIOUR_UNCONTROLLED</a>	Yaw uncontrolled.
3	<a href="#">ORBIT_YAW_BEHAVIOUR_HOLD_FRONT_TANGENT_TO_CIRCLE</a>	Vehicle front follows flight path (tangential to circle).
4	<a href="#">ORBIT_YAW_BEHAVIOUR_RC_CONTROLLED</a>	Yaw controlled by RC input.

## WIFI\_CONFIG\_AP\_RESPONSE

[\[Enum\]](#) Possible responses from a [WIFI\\_CONFIG\\_AP](#) message.

Value	Field Name	Description
0	<a href="#">WIFI_CONFIG_AP_RESPONSE_UNDEFINED</a>	Undefined response. Likely an indicative of a system that doesn't support this request.
1	<a href="#">WIFI_CONFIG_AP_RESPONSE_ACCEPTED</a>	Changes accepted.
2	<a href="#">WIFI_CONFIG_AP_RESPONSE_REJECTED</a>	Changes rejected.
3	<a href="#">WIFI_CONFIG_AP_RESPONSE_MODE_ERROR</a>	Invalid Mode.
4	<a href="#">WIFI_CONFIG_AP_RESPONSE_SSID_ERROR</a>	Invalid SSID.
5	<a href="#">WIFI_CONFIG_AP_RESPONSE_PASSWORD_ERROR</a>	Invalid Password.

## CELLULAR\_CONFIG\_RESPONSE

[\[Enum\]](#) Possible responses from a [CELLULAR\\_CONFIG](#) message.

Value	Field Name	Description
0	<a href="#">CELLULAR_CONFIG_RESPONSE_ACCEPTED</a>	Changes accepted.

1	<a href="#">CELLULAR_CONFIG_RESPONSE_APN_ERROR</a>	Invalid APN.
2	<a href="#">CELLULAR_CONFIG_RESPONSE_PIN_ERROR</a>	Invalid PIN.
3	<a href="#">CELLULAR_CONFIG_RESPONSE_REJECTED</a>	Changes rejected.
4	<a href="#">CELLULAR_CONFIG_BLOCKED_PUK_REQUIRED</a>	PUK is required to unblock SIM card.

## WIFI\_CONFIG\_AP\_MODE

[Enum] WiFi Mode.

Value	Field Name	Description
0	<a href="#">WIFI_CONFIG_AP_MODE_UNDEFINED</a>	WiFi mode is undefined.
1	<a href="#">WIFI_CONFIG_AP_MODE_AP</a>	WiFi configured as an access point.
2	<a href="#">WIFI_CONFIG_AP_MODE_STATION</a>	WiFi configured as a station connected to an existing local WiFi network.
3	<a href="#">WIFI_CONFIG_AP_MODE_DISABLED</a>	WiFi disabled.

## COMP\_METADATA\_TYPE

[Enum] Supported component metadata types. These are used in the "general" metadata file returned by [COMPONENT\\_METADATA](#) to provide information about supported metadata types. The types are not used directly in MAVLink messages.

Value	Field Name	Description
0	<a href="#">COMP_METADATA_TYPE_GENERAL</a>	General information about the component. General metadata includes information about other metadata types supported by the component. Files of this type must be supported, and must be downloadable from vehicle using a MAVLink FTP URI.
1	<a href="#">COMP_METADATA_TYPE_PARAMETER</a>	Parameter meta data.
2	<a href="#">COMP_METADATA_TYPE_COMMANDS</a>	Meta data that specifies which commands and command parameters the vehicle supports. (WIP)
3	<a href="#">COMP_METADATA_TYPE_PERIPHERALS</a>	Meta data that specifies external non-MAVLink peripherals.
4	<a href="#">COMP_METADATA_TYPE_EVENTS</a>	Meta data for the events interface.
5	<a href="#">COMP_METADATA_TYPE_ACTUATORS</a>	Meta data for actuator configuration (motors, servos and vehicle geometry) and testing.

## ACTUATOR\_CONFIGURATION

[Enum] Actuator configuration, used to change a setting on an actuator. Component information metadata can be used to know which outputs support which commands.

Value	Field Name	Description
0	<a href="#">ACTUATOR_CONFIGURATION_NONE</a>	Do nothing.
1	<a href="#">ACTUATOR_CONFIGURATION_BEEP</a>	Command the actuator to beep now.
2	<a href="#">ACTUATOR_CONFIGURATION_3D_MODE_ON</a>	Permanently set the actuator (ESC) to 3D mode (reversible thrust).
3	<a href="#">ACTUATOR_CONFIGURATION_3D_MODE_OFF</a>	Permanently set the actuator (ESC) to non 3D mode (non-reversible thrust).
4	<a href="#">ACTUATOR_CONFIGURATION_SPIN_DIRECTION1</a>	Permanently set the actuator (ESC) to spin direction 1 (which can be clockwise or counter-clockwise).
5	<a href="#">ACTUATOR_CONFIGURATION_SPIN_DIRECTION2</a>	Permanently set the actuator (ESC) to spin direction 2 (opposite of direction 1).

## ACTUATOR\_OUTPUT\_FUNCTION

[Enum] Actuator output function. Values greater or equal to 1000 are autopilot-specific.

Value	Field Name	Description
0	<a href="#">ACTUATOR_OUTPUT_FUNCTION_NONE</a>	No function (disabled).
1	<a href="#">ACTUATOR_OUTPUT_FUNCTION_MOTOR1</a>	Motor 1
2	<a href="#">ACTUATOR_OUTPUT_FUNCTION_MOTOR2</a>	Motor 2
3	<a href="#">ACTUATOR_OUTPUT_FUNCTION_MOTOR3</a>	Motor 3
4	<a href="#">ACTUATOR_OUTPUT_FUNCTION_MOTOR4</a>	Motor 4
5	<a href="#">ACTUATOR_OUTPUT_FUNCTION_MOTOR5</a>	Motor 5
6	<a href="#">ACTUATOR_OUTPUT_FUNCTION_MOTOR6</a>	Motor 6
7	<a href="#">ACTUATOR_OUTPUT_FUNCTION_MOTOR7</a>	Motor 7
8	<a href="#">ACTUATOR_OUTPUT_FUNCTION_MOTOR8</a>	Motor 8
9	<a href="#">ACTUATOR_OUTPUT_FUNCTION_MOTOR9</a>	Motor 9
10	<a href="#">ACTUATOR_OUTPUT_FUNCTION_MOTOR10</a>	Motor 10
11	<a href="#">ACTUATOR_OUTPUT_FUNCTION_MOTOR11</a>	Motor 11
12	<a href="#">ACTUATOR_OUTPUT_FUNCTION_MOTOR12</a>	Motor 12
13	<a href="#">ACTUATOR_OUTPUT_FUNCTION_MOTOR13</a>	Motor 13
14	<a href="#">ACTUATOR_OUTPUT_FUNCTION_MOTOR14</a>	Motor 14
15	<a href="#">ACTUATOR_OUTPUT_FUNCTION_MOTOR15</a>	Motor 15
16	<a href="#">ACTUATOR_OUTPUT_FUNCTION_MOTOR16</a>	Motor 16
33	<a href="#">ACTUATOR_OUTPUT_FUNCTION_SERVO1</a>	Servo 1
34	<a href="#">ACTUATOR_OUTPUT_FUNCTION_SERVO2</a>	Servo 2
35	<a href="#">ACTUATOR_OUTPUT_FUNCTION_SERVO3</a>	Servo 3
36	<a href="#">ACTUATOR_OUTPUT_FUNCTION_SERVO4</a>	Servo 4
37	<a href="#">ACTUATOR_OUTPUT_FUNCTION_SERVO5</a>	Servo 5
38	<a href="#">ACTUATOR_OUTPUT_FUNCTION_SERVO6</a>	Servo 6
39	<a href="#">ACTUATOR_OUTPUT_FUNCTION_SERVO7</a>	Servo 7
40	<a href="#">ACTUATOR_OUTPUT_FUNCTION_SERVO8</a>	Servo 8
41	<a href="#">ACTUATOR_OUTPUT_FUNCTION_SERVO9</a>	Servo 9
42	<a href="#">ACTUATOR_OUTPUT_FUNCTION_SERVO10</a>	Servo 10
43	<a href="#">ACTUATOR_OUTPUT_FUNCTION_SERVO11</a>	Servo 11
44	<a href="#">ACTUATOR_OUTPUT_FUNCTION_SERVO12</a>	Servo 12
45	<a href="#">ACTUATOR_OUTPUT_FUNCTION_SERVO13</a>	Servo 13
46	<a href="#">ACTUATOR_OUTPUT_FUNCTION_SERVO14</a>	Servo 14
47	<a href="#">ACTUATOR_OUTPUT_FUNCTION_SERVO15</a>	Servo 15



48 [ACTUATOR\\_OUTPUT\\_FUNCTION\\_SERVO16](#) Servo 16

## AUTOTUNE\_AXIS

[Enum] Enable axes that will be tuned via autotuning. Used in [MAV\\_CMD\\_DO\\_AUTOTUNE\\_ENABLE](#).

Value	Field Name	Description
0	<a href="#">AUTOTUNE_AXIS_DEFAULT</a>	Flight stack tunes axis according to its default settings.
1	<a href="#">AUTOTUNE_AXIS_ROLL</a>	Autotune roll axis.
2	<a href="#">AUTOTUNE_AXIS_PITCH</a>	Autotune pitch axis.
4	<a href="#">AUTOTUNE_AXIS_YAW</a>	Autotune yaw axis.

## PREFLIGHT\_STORAGE\_PARAMETER\_ACTION

[Enum] Actions for reading/writing parameters between persistent and volatile storage when using [MAV\\_CMD\\_PREFLIGHT\\_STORAGE](#). (Commonly parameters are loaded from persistent storage (flash/EEPROM) into volatile storage (RAM) on startup and written back when they are changed.)

Value	Field Name	Description
0	<a href="#">PARAM_READ_PERSISTENT</a>	Read all parameters from persistent storage. Replaces values in volatile storage.
1	<a href="#">PARAM_WRITE_PERSISTENT</a>	Write all parameter values to persistent storage (flash/EEPROM)
2	<a href="#">PARAM_RESET_CONFIG_DEFAULT</a>	Reset all user configurable parameters to their default value (including airframe selection, sensor calibration data, safety settings, and so on). Does not reset values that contain operation counters and vehicle computed statistics.
3	<a href="#">PARAM_RESET_SENSOR_DEFAULT</a>	Reset only sensor calibration parameters to factory defaults (or firmware default if not available)
4	<a href="#">PARAM_RESET_ALL_DEFAULT</a>	Reset all parameters, including operation counters, to default values

## PREFLIGHT\_STORAGE\_MISSION\_ACTION

[Enum] Actions for reading and writing plan information (mission, rally points, geofence) between persistent and volatile storage when using [MAV\\_CMD\\_PREFLIGHT\\_STORAGE](#). (Commonly missions are loaded from persistent storage (flash/EEPROM) into volatile storage (RAM) on startup and written back when they are changed.)

Value	Field Name	Description
0	<a href="#">MISSION_READ_PERSISTENT</a>	Read current mission data from persistent storage
1	<a href="#">MISSION_WRITE_PERSISTENT</a>	Write current mission data to persistent storage
2	<a href="#">MISSION_RESET_DEFAULT</a>	Erase all mission data stored on the vehicle (both persistent and volatile storage)

## MAV\_DATA\_STREAM

**DEPRECATED:** Replaced by [MESSAGE\\_INTERVAL](#) (2015-06).

[Enum] A data stream is not a fixed set of messages, but rather a recommendation to the autopilot software. Individual autopilots may or may not obey the recommended messages.

Value	Field Name	Description
0	<a href="#">MAV_DATA_STREAM_ALL</a>	Enable all data streams
1	<a href="#">MAV_DATA_STREAM_RAW_SENSORS</a>	Enable <a href="#">IMU_RAW</a> , <a href="#">GPS_RAW</a> , <a href="#">GPS_STATUS</a> packets.
2	<a href="#">MAV_DATA_STREAM_EXTENDED_STATUS</a>	Enable <a href="#">GPS_STATUS</a> , <a href="#">CONTROL_STATUS</a> , <a href="#">AUX_STATUS</a>
3	<a href="#">MAV_DATA_STREAM_RC_CHANNELS</a>	Enable <a href="#">RC_CHANNELS_SCALED</a> , <a href="#">RC_CHANNELS_RAW</a> , <a href="#">SERVO_OUTPUT_RAW</a>
4	<a href="#">MAV_DATA_STREAM_RAW_CONTROLLER</a>	Enable <a href="#">ATTITUDE_CONTROLLER_OUTPUT</a> , <a href="#">POSITION_CONTROLLER_OUTPUT</a> , <a href="#">NAV_CONTROLLER_OUTPUT</a> .
6	<a href="#">MAV_DATA_STREAM_POSITION</a>	Enable <a href="#">LOCAL_POSITION</a> , <a href="#">GLOBAL_POSITION_INT</a> messages.
10	<a href="#">MAV_DATA_STREAM_EXTRA1</a>	Dependent on the autopilot
11	<a href="#">MAV_DATA_STREAM_EXTRA2</a>	Dependent on the autopilot
12	<a href="#">MAV_DATA_STREAM_EXTRA3</a>	Dependent on the autopilot

## MAV\_ROI

**DEPRECATED:** Replaced by [MAV\\_CMD\\_DO\\_SET\\_ROI](#) \* (2018-01).

[Enum] The ROI (region of interest) for the vehicle. This can be used by the vehicle for camera/vehicle attitude alignment (see [MAV\\_CMD\\_NAV\\_ROI](#)).

Value	Field Name	Description
0	<a href="#">MAV_ROI_NONE</a>	No region of interest.
1	<a href="#">MAV_ROI_WPNEXT</a>	Point toward next waypoint, with optional pitch/roll/yaw offset.
2	<a href="#">MAV_ROI_WPINDEX</a>	Point toward given waypoint.
3	<a href="#">MAV_ROI_LOCATION</a>	Point toward fixed location.
4	<a href="#">MAV_ROI_TARGET</a>	Point toward of given id.

## MAV\_CMD\_ACK

[Enum] ACK / NACK / ERROR values as a result of MAV\_CMDS and for mission item transmission.

Value	Field Name	Description
0	<a href="#">MAV_CMD_ACK_OK</a>	Command / mission item is ok.
1	<a href="#">MAV_CMD_ACK_ERR_FAIL</a>	Generic error message if none of the other reasons fails or if no detailed error reporting is implemented.
2	<a href="#">MAV_CMD_ACK_ERR_ACCESS_DENIED</a>	The system is refusing to accept this command from this source / communication partner.
3	<a href="#">MAV_CMD_ACK_ERR_NOT_SUPPORTED</a>	Command or mission item is not supported, other commands would be accepted.
4	<a href="#">MAV_CMD_ACK_ERR_COORDINATE_FRAME_NOT_SUPPORTED</a>	The coordinate frame of this command / mission item is not supported.



5	<a href="#">MAV_CMD_ACK_ERR_COORDINATES_OUT_OF_RANGE</a>	The coordinate frame of this command is ok, but the coordinate values exceed the safety limits of this system. This is a generic error; please use the more specific error messages below if possible.
6	<a href="#">MAV_CMD_ACK_ERR_X_LAT_OUT_OF_RANGE</a>	The X or latitude value is out of range.
7	<a href="#">MAV_CMD_ACK_ERR_Y_LON_OUT_OF_RANGE</a>	The Y or longitude value is out of range.
8	<a href="#">MAV_CMD_ACK_ERR_Z_ALT_OUT_OF_RANGE</a>	The Z or altitude value is out of range.

## MAV\_PARAM\_TYPE

[\[Enum\]](#) Specifies the datatype of a MAVLink parameter.

Value	Field Name	Description
1	<a href="#">MAV_PARAM_TYPE_UINT8</a>	8-bit unsigned integer
2	<a href="#">MAV_PARAM_TYPE_INT8</a>	8-bit signed integer
3	<a href="#">MAV_PARAM_TYPE_UINT16</a>	16-bit unsigned integer
4	<a href="#">MAV_PARAM_TYPE_INT16</a>	16-bit signed integer
5	<a href="#">MAV_PARAM_TYPE_UINT32</a>	32-bit unsigned integer
6	<a href="#">MAV_PARAM_TYPE_INT32</a>	32-bit signed integer
7	<a href="#">MAV_PARAM_TYPE_UINT64</a>	64-bit unsigned integer
8	<a href="#">MAV_PARAM_TYPE_INT64</a>	64-bit signed integer
9	<a href="#">MAV_PARAM_TYPE_REAL32</a>	32-bit floating-point
10	<a href="#">MAV_PARAM_TYPE_REAL64</a>	64-bit floating-point

## MAV\_PARAM\_EXT\_TYPE

[\[Enum\]](#) Specifies the datatype of a MAVLink extended parameter.

Value	Field Name	Description
1	<a href="#">MAV_PARAM_EXT_TYPE_UINT8</a>	8-bit unsigned integer
2	<a href="#">MAV_PARAM_EXT_TYPE_INT8</a>	8-bit signed integer
3	<a href="#">MAV_PARAM_EXT_TYPE_UINT16</a>	16-bit unsigned integer
4	<a href="#">MAV_PARAM_EXT_TYPE_INT16</a>	16-bit signed integer
5	<a href="#">MAV_PARAM_EXT_TYPE_UINT32</a>	32-bit unsigned integer
6	<a href="#">MAV_PARAM_EXT_TYPE_INT32</a>	32-bit signed integer
7	<a href="#">MAV_PARAM_EXT_TYPE_UINT64</a>	64-bit unsigned integer
8	<a href="#">MAV_PARAM_EXT_TYPE_INT64</a>	64-bit signed integer
9	<a href="#">MAV_PARAM_EXT_TYPE_REAL32</a>	32-bit floating-point
10	<a href="#">MAV_PARAM_EXT_TYPE_REAL64</a>	64-bit floating-point
11	<a href="#">MAV_PARAM_EXT_TYPE_CUSTOM</a>	Custom Type

## MAV\_RESULT

[\[Enum\]](#) Result from a MAVLink command ([MAV\\_CMD](#))

Value	Field Name	Description
0	<a href="#">MAV_RESULT_ACCEPTED</a>	Command is valid (is supported and has valid parameters), and was executed.
1	<a href="#">MAV_RESULT_TEMPORARILY_REJECTED</a>	Command is valid, but cannot be executed at this time. This is used to indicate a problem that should be fixed just by waiting (e.g. a state machine is busy, can't arm because have not got GPS lock, etc.). Retrying later should work.
2	<a href="#">MAV_RESULT_DENIED</a>	Command is invalid (is supported but has invalid parameters). Retrying same command and parameters will not work.
3	<a href="#">MAV_RESULT_UNSUPPORTED</a>	Command is not supported (unknown).
4	<a href="#">MAV_RESULT_FAILED</a>	Command is valid, but execution has failed. This is used to indicate any non-temporary or unexpected problem, i.e. any problem that must be fixed before the command can succeed/be retried. For example, attempting to write a file when out of memory, attempting to arm when sensors are not calibrated, etc.
5	<a href="#">MAV_RESULT_IN_PROGRESS</a>	Command is valid and is being executed. This will be followed by further progress updates, i.e. the component may send further <a href="#">COMMAND_ACK</a> messages with result <a href="#">MAV_RESULT_IN_PROGRESS</a> (at a rate decided by the implementation), and must terminate by sending a <a href="#">COMMAND_ACK</a> message with final result of the operation. The <a href="#">COMMAND_ACK</a> .progress field can be used to indicate the progress of the operation.
6	<a href="#">MAV_RESULT_CANCELLED</a>	Command has been cancelled (as a result of receiving a <a href="#">COMMAND_CANCEL</a> message).

## MAV\_MISSION\_RESULT

[\[Enum\]](#) Result of mission operation (in a [MISSION\\_ACK](#) message).

Value	Field Name	Description
0	<a href="#">MAV_MISSION_ACCEPTED</a>	mission accepted OK
1	<a href="#">MAV_MISSION_ERROR</a>	Generic error / not accepting mission commands at all right now.
2	<a href="#">MAV_MISSION_UNSUPPORTED_FRAME</a>	Coordinate frame is not supported.
3	<a href="#">MAV_MISSION_UNSUPPORTED</a>	Command is not supported.
4	<a href="#">MAV_MISSION_NO_SPACE</a>	Mission items exceed storage space.
5	<a href="#">MAV_MISSION_INVALID</a>	One of the parameters has an invalid value.
6	<a href="#">MAV_MISSION_INVALID_PARAM1</a>	param1 has an invalid value.
7	<a href="#">MAV_MISSION_INVALID_PARAM2</a>	param2 has an invalid value.
8	<a href="#">MAV_MISSION_INVALID_PARAM3</a>	param3 has an invalid value.
9	<a href="#">MAV_MISSION_INVALID_PARAM4</a>	param4 has an invalid value.
10	<a href="#">MAV_MISSION_INVALID_PARAM5_X</a>	x / param5 has an invalid value.
11	<a href="#">MAV_MISSION_INVALID_PARAM6_Y</a>	y / param6 has an invalid value.

12	<a href="#">MAV_MISSION_INVALID_PARAM7</a>	z / param7 has an invalid value.
13	<a href="#">MAV_MISSION_INVALID_SEQUENCE</a>	Mission item received out of sequence
14	<a href="#">MAV_MISSION_DENIED</a>	Not accepting any mission commands from this communication partner.
15	<a href="#">MAV_MISSION_OPERATION_CANCELLED</a>	Current mission operation cancelled (e.g. mission upload, mission download).

## MAV\_SEVERITY

[Enum] Indicates the severity level, generally used for status messages to indicate their relative urgency. Based on RFC-5424 using expanded definitions at: <http://www.kiwisyslog.com/kb/info:-syslog-message-levels/>.

Value	Field Name	Description
0	<a href="#">MAV_SEVERITY_EMERGENCY</a>	System is unusable. This is a "panic" condition.
1	<a href="#">MAV_SEVERITY_ALERT</a>	Action should be taken immediately. Indicates error in non-critical systems.
2	<a href="#">MAV_SEVERITY_CRITICAL</a>	Action must be taken immediately. Indicates failure in a primary system.
3	<a href="#">MAV_SEVERITY_ERROR</a>	Indicates an error in secondary/redundant systems.
4	<a href="#">MAV_SEVERITY_WARNING</a>	Indicates about a possible future error if this is not resolved within a given timeframe. Example would be a low battery warning.
5	<a href="#">MAV_SEVERITY_NOTICE</a>	An unusual event has occurred, though not an error condition. This should be investigated for the root cause.
6	<a href="#">MAV_SEVERITY_INFO</a>	Normal operational messages. Useful for logging. No action is required for these messages.
7	<a href="#">MAV_SEVERITY_DEBUG</a>	Useful non-operational messages that can assist in debugging. These should not occur during normal operation.

## MAV\_POWER\_STATUS

[Enum] Power supply status flags (bitmask)

Value	Field Name	Description
1	<a href="#">MAV_POWER_STATUS_BRICK_VALID</a>	main brick power supply valid
2	<a href="#">MAV_POWER_STATUS_SERVO_VALID</a>	main servo power supply valid for FMU
4	<a href="#">MAV_POWER_STATUS_USB_CONNECTED</a>	USB power is connected
8	<a href="#">MAV_POWER_STATUS_PERIPH_OVERCURRENT</a>	peripheral supply is in over-current state
16	<a href="#">MAV_POWER_STATUS_PERIPH_HIPOWER_OVERCURRENT</a>	hi-power peripheral supply is in over-current state
32	<a href="#">MAV_POWER_STATUS_CHANGED</a>	Power status has changed since boot

## SERIAL\_CONTROL\_DEV

[Enum] SERIAL\_CONTROL device types

Value	Field Name	Description
0	<a href="#">SERIAL_CONTROL_DEV_TELEM1</a>	First telemetry port
1	<a href="#">SERIAL_CONTROL_DEV_TELEM2</a>	Second telemetry port
2	<a href="#">SERIAL_CONTROL_DEV_GPS1</a>	First GPS port
3	<a href="#">SERIAL_CONTROL_DEV_GPS2</a>	Second GPS port
10	<a href="#">SERIAL_CONTROL_DEV_SHELL</a>	system shell
100	<a href="#">SERIAL_CONTROL_SERIAL0</a>	SERIAL0
101	<a href="#">SERIAL_CONTROL_SERIAL1</a>	SERIAL1
102	<a href="#">SERIAL_CONTROL_SERIAL2</a>	SERIAL2
103	<a href="#">SERIAL_CONTROL_SERIAL3</a>	SERIAL3
104	<a href="#">SERIAL_CONTROL_SERIAL4</a>	SERIAL4
105	<a href="#">SERIAL_CONTROL_SERIAL5</a>	SERIAL5
106	<a href="#">SERIAL_CONTROL_SERIAL6</a>	SERIAL6
107	<a href="#">SERIAL_CONTROL_SERIAL7</a>	SERIAL7
108	<a href="#">SERIAL_CONTROL_SERIAL8</a>	SERIAL8
109	<a href="#">SERIAL_CONTROL_SERIAL9</a>	SERIAL9

## SERIAL\_CONTROL\_FLAG

[Enum] SERIAL\_CONTROL flags (bitmask)

Value	Field Name	Description
1	<a href="#">SERIAL_CONTROL_FLAG_REPLY</a>	Set if this is a reply
2	<a href="#">SERIAL_CONTROL_FLAG_RESPOND</a>	Set if the sender wants the receiver to send a response as another <a href="#">SERIAL_CONTROL</a> message
4	<a href="#">SERIAL_CONTROL_FLAG_EXCLUSIVE</a>	Set if access to the serial port should be removed from whatever driver is currently using it, giving exclusive access to the <a href="#">SERIAL_CONTROL</a> protocol. The port can be handed back by sending a request without this flag set
8	<a href="#">SERIAL_CONTROL_FLAG_BLOCKING</a>	Block on writes to the serial port
16	<a href="#">SERIAL_CONTROL_FLAG_MULTI</a>	Send multiple replies until port is drained

## MAV\_DISTANCE\_SENSOR

[Enum] Enumeration of distance sensor types

Value	Field Name	Description
0	<a href="#">MAV_DISTANCE_SENSOR_LASER</a>	Laser rangefinder, e.g. LightWare SF02/F or PulsedLight units
1	<a href="#">MAV_DISTANCE_SENSOR_ULTRASOUND</a>	Ultrasound rangefinder, e.g. MaxBotix units
2	<a href="#">MAV_DISTANCE_SENSOR_INFRARED</a>	Infrared rangefinder, e.g. Sharp units
3	<a href="#">MAV_DISTANCE_SENSOR_RADAR</a>	Radar type, e.g. uLanding units
4	<a href="#">MAV_DISTANCE_SENSOR_UNKNOWN</a>	Broken or unknown type, e.g. analog units

## MAV\_SENSOR\_ORIENTATION

[Enum] Enumeration of sensor orientation, according to its rotations

Value	Field Name	Description
0	<a href="#">MAV_SENSOR_ROTATION_NONE</a>	Roll: 0, Pitch: 0, Yaw: 0
1	<a href="#">MAV_SENSOR_ROTATION_YAW_45</a>	Roll: 0, Pitch: 0, Yaw: 45
2	<a href="#">MAV_SENSOR_ROTATION_YAW_90</a>	Roll: 0, Pitch: 0, Yaw: 90
3	<a href="#">MAV_SENSOR_ROTATION_YAW_135</a>	Roll: 0, Pitch: 0, Yaw: 135
4	<a href="#">MAV_SENSOR_ROTATION_YAW_180</a>	Roll: 0, Pitch: 0, Yaw: 180
5	<a href="#">MAV_SENSOR_ROTATION_YAW_225</a>	Roll: 0, Pitch: 0, Yaw: 225
6	<a href="#">MAV_SENSOR_ROTATION_YAW_270</a>	Roll: 0, Pitch: 0, Yaw: 270
7	<a href="#">MAV_SENSOR_ROTATION_YAW_315</a>	Roll: 0, Pitch: 0, Yaw: 315
8	<a href="#">MAV_SENSOR_ROTATION_ROLL_180</a>	Roll: 180, Pitch: 0, Yaw: 0
9	<a href="#">MAV_SENSOR_ROTATION_ROLL_180_YAW_45</a>	Roll: 180, Pitch: 0, Yaw: 45
10	<a href="#">MAV_SENSOR_ROTATION_ROLL_180_YAW_90</a>	Roll: 180, Pitch: 0, Yaw: 90
11	<a href="#">MAV_SENSOR_ROTATION_ROLL_180_YAW_135</a>	Roll: 180, Pitch: 0, Yaw: 135
12	<a href="#">MAV_SENSOR_ROTATION_PITCH_180</a>	Roll: 0, Pitch: 180, Yaw: 0
13	<a href="#">MAV_SENSOR_ROTATION_ROLL_180_YAW_225</a>	Roll: 180, Pitch: 0, Yaw: 225
14	<a href="#">MAV_SENSOR_ROTATION_ROLL_180_YAW_270</a>	Roll: 180, Pitch: 0, Yaw: 270
15	<a href="#">MAV_SENSOR_ROTATION_ROLL_180_YAW_315</a>	Roll: 180, Pitch: 0, Yaw: 315
16	<a href="#">MAV_SENSOR_ROTATION_ROLL_90</a>	Roll: 90, Pitch: 0, Yaw: 0
17	<a href="#">MAV_SENSOR_ROTATION_ROLL_90_YAW_45</a>	Roll: 90, Pitch: 0, Yaw: 45
18	<a href="#">MAV_SENSOR_ROTATION_ROLL_90_YAW_90</a>	Roll: 90, Pitch: 0, Yaw: 90
19	<a href="#">MAV_SENSOR_ROTATION_ROLL_90_YAW_135</a>	Roll: 90, Pitch: 0, Yaw: 135
20	<a href="#">MAV_SENSOR_ROTATION_ROLL_270</a>	Roll: 270, Pitch: 0, Yaw: 0
21	<a href="#">MAV_SENSOR_ROTATION_ROLL_270_YAW_45</a>	Roll: 270, Pitch: 0, Yaw: 45
22	<a href="#">MAV_SENSOR_ROTATION_ROLL_270_YAW_90</a>	Roll: 270, Pitch: 0, Yaw: 90
23	<a href="#">MAV_SENSOR_ROTATION_ROLL_270_YAW_135</a>	Roll: 270, Pitch: 0, Yaw: 135
24	<a href="#">MAV_SENSOR_ROTATION_PITCH_90</a>	Roll: 0, Pitch: 90, Yaw: 0
25	<a href="#">MAV_SENSOR_ROTATION_PITCH_270</a>	Roll: 0, Pitch: 270, Yaw: 0
26	<a href="#">MAV_SENSOR_ROTATION_PITCH_180_YAW_90</a>	Roll: 0, Pitch: 180, Yaw: 90
27	<a href="#">MAV_SENSOR_ROTATION_PITCH_180_YAW_270</a>	Roll: 0, Pitch: 180, Yaw: 270
28	<a href="#">MAV_SENSOR_ROTATION_ROLL_90_PITCH_90</a>	Roll: 90, Pitch: 90, Yaw: 0
29	<a href="#">MAV_SENSOR_ROTATION_ROLL_180_PITCH_90</a>	Roll: 180, Pitch: 90, Yaw: 0
30	<a href="#">MAV_SENSOR_ROTATION_ROLL_270_PITCH_90</a>	Roll: 270, Pitch: 90, Yaw: 0
31	<a href="#">MAV_SENSOR_ROTATION_ROLL_90_PITCH_180</a>	Roll: 90, Pitch: 180, Yaw: 0
32	<a href="#">MAV_SENSOR_ROTATION_ROLL_270_PITCH_180</a>	Roll: 270, Pitch: 180, Yaw: 0
33	<a href="#">MAV_SENSOR_ROTATION_ROLL_90_PITCH_270</a>	Roll: 90, Pitch: 270, Yaw: 0
34	<a href="#">MAV_SENSOR_ROTATION_ROLL_180_PITCH_270</a>	Roll: 180, Pitch: 270, Yaw: 0
35	<a href="#">MAV_SENSOR_ROTATION_ROLL_270_PITCH_270</a>	Roll: 270, Pitch: 270, Yaw: 0
36	<a href="#">MAV_SENSOR_ROTATION_ROLL_90_PITCH_180_YAW_90</a>	Roll: 90, Pitch: 180, Yaw: 90
37	<a href="#">MAV_SENSOR_ROTATION_ROLL_90_YAW_270</a>	Roll: 90, Pitch: 0, Yaw: 270
38	<a href="#">MAV_SENSOR_ROTATION_ROLL_90_PITCH_68_YAW_293</a>	Roll: 90, Pitch: 68, Yaw: 293
39	<a href="#">MAV_SENSOR_ROTATION_PITCH_315</a>	Pitch: 315
40	<a href="#">MAV_SENSOR_ROTATION_ROLL_90_PITCH_315</a>	Roll: 90, Pitch: 315
100	<a href="#">MAV_SENSOR_ROTATION_CUSTOM</a>	Custom orientation

## MAV\_PROTOCOL\_CAPABILITY

[Enum] Bitmask of (optional) autopilot capabilities (64 bit). If a bit is set, the autopilot supports this capability.

Value	Field Name	Description
1	<a href="#">MAV_PROTOCOL_CAPABILITY_MISSION_FLOAT</a>	Autopilot supports the <a href="#">MISSION_ITEM</a> float message type.
Note that <a href="#">MISSION_ITEM</a> is deprecated, and autopilots should use <a href="#">MISSION_INT</a> instead.		
2	<a href="#">MAV_PROTOCOL_CAPABILITY_PARAM_FLOAT</a>	

**DEPRECATED:** Replaced by [MAV\\_PROTOCOL\\_CAPABILITY\\_PARAM\\_ENCODE\\_C\\_CAST](#) (2022-03). | Autopilot supports the new param float message type. | | 4 | [MAV\\_PROTOCOL\\_CAPABILITY\\_MISSION\\_INT](#) | Autopilot supports [MISSION\\_ITEM\\_INT](#) scaled integer message type. Note that this flag must always be set if missions are supported, because missions must always use [MISSION\\_ITEM\\_INT](#) (rather than [MISSION\\_ITEM](#), which is deprecated). | | 8 | [MAV\\_PROTOCOL\\_CAPABILITY\\_COMMAND\\_INT](#) | Autopilot supports [COMMAND\\_INT](#) scaled integer message type. | | 16 | [MAV\\_PROTOCOL\\_CAPABILITY\\_PARAM\\_ENCODE\\_BYTEWISE](#) | Parameter protocol uses byte-wise encoding of parameter values into param\_value (float) fields: <https://mavlink.io/en/services/parameter.html#parameter-encoding>. Note that either this flag or [MAV\\_PROTOCOL\\_CAPABILITY\\_PARAM\\_ENCODE\\_BYTEWISE](#) should be set if the parameter protocol is supported. | | 32 | [MAV\\_PROTOCOL\\_CAPABILITY\\_FTP](#) | Autopilot supports the File Transfer Protocol v1: <https://mavlink.io/en/services/ftp.html>. | | 64 | [MAV\\_PROTOCOL\\_CAPABILITY\\_SET\\_ATTITUDE\\_TARGET](#) | Autopilot supports commanding attitude offboard. | | 128 | [MAV\\_PROTOCOL\\_CAPABILITY\\_SET\\_POSITION\\_TARGET\\_LOCAL\\_NED](#) | Autopilot supports commanding position and velocity targets in local NED frame. | | 256 | [MAV\\_PROTOCOL\\_CAPABILITY\\_SET\\_POSITION\\_TARGET\\_GLOBAL\\_INT](#) | Autopilot supports commanding position and velocity targets in global scaled integers. | | 512 | [MAV\\_PROTOCOL\\_CAPABILITY\\_TERRAIN](#) | Autopilot supports terrain protocol / data handling. | | 1024 | [MAV\\_PROTOCOL\\_CAPABILITY\\_SET\\_ACTUATOR\\_TARGET](#) | Autopilot supports direct actuator control. | | 2048 | [MAV\\_PROTOCOL\\_CAPABILITY\\_FLIGHT\\_TERMINATION](#) | Autopilot supports the [MAV\\_CMD\\_DO\\_FLIGHTTERMINATION](#) command (flight termination). | | 4096 | [MAV\\_PROTOCOL\\_CAPABILITY\\_COMPASS\\_CALIBRATION](#) | Autopilot supports onboard compass calibration. | | 8192 | [MAV\\_PROTOCOL\\_CAPABILITY\\_MAVLINK2](#) | Autopilot supports MAVLink version 2. | | 16384 | [MAV\\_PROTOCOL\\_CAPABILITY\\_MISSION\\_FENCE](#) | Autopilot supports mission fence protocol. | | 32768 | [MAV\\_PROTOCOL\\_CAPABILITY\\_MISSION\\_RALLY](#) | Autopilot supports mission rally point protocol. | | 65536 | [MAV\\_PROTOCOL\\_CAPABILITY\\_RESERVED2](#) | Reserved for future use. | | 131072 | [MAV\\_PROTOCOL\\_CAPABILITY\\_PARAM\\_ENCODE\\_C\\_CAST](#) | Parameter protocol uses C-cast of parameter values to set the param\_value (float) fields: <https://mavlink.io/en/services/parameter.html#parameter-encoding>. Note that either this flag or [MAV\\_PROTOCOL\\_CAPABILITY\\_PARAM\\_ENCODE\\_BYTEWISE](#) should be set if the parameter protocol is supported. |

## MAV\_MISSION\_TYPE

[Enum] Type of mission items being requested/sent in mission protocol.

Value	Field Name	Description
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0	<a href="#">MAV_MISSION_TYPE_MISSION</a>	Items are mission commands for main mission.
1	<a href="#">MAV_MISSION_TYPE_FENCE</a>	Specifies GeoFence area(s). Items are MAV_CMD_NAV_FENCE_GeoFence items.
2	<a href="#">MAV_MISSION_TYPE_RALLY</a>	Specifies the rally points for the vehicle. Rally points are alternative RTL points. Items are <a href="#">MAV_CMD_NAV_RALLY_POINT</a> rally point items.
255	<a href="#">MAV_MISSION_TYPE_ALL</a>	Only used in <a href="#">MISSION_CLEAR_ALL</a> to clear all mission types.

## MAV\_ESTIMATOR\_TYPE

[Enum] Enumeration of estimator types

Value	Field Name	Description
0	<a href="#">MAV_ESTIMATOR_TYPE_UNKNOWN</a>	Unknown type of the estimator.
1	<a href="#">MAV_ESTIMATOR_TYPE_NAIVE</a>	This is a naive estimator without any real covariance feedback.
2	<a href="#">MAV_ESTIMATOR_TYPE_VISION</a>	Computer vision based estimate. Might be up to scale.
3	<a href="#">MAV_ESTIMATOR_TYPE_VIO</a>	Visual-inertial estimate.
4	<a href="#">MAV_ESTIMATOR_TYPE_GPS</a>	Plain GPS estimate.
5	<a href="#">MAV_ESTIMATOR_TYPE_GPS_INS</a>	Estimator integrating GPS and inertial sensing.
6	<a href="#">MAV_ESTIMATOR_TYPE_MOCAP</a>	Estimate from external motion capturing system.
7	<a href="#">MAV_ESTIMATOR_TYPE_LIDAR</a>	Estimator based on lidar sensor input.
8	<a href="#">MAV_ESTIMATOR_TYPE_AUTOPILOT</a>	Estimator on autopilot.

## MAV\_BATTERY\_TYPE

[Enum] Enumeration of battery types

Value	Field Name	Description
0	<a href="#">MAV_BATTERY_TYPE_UNKNOWN</a>	Not specified.
1	<a href="#">MAV_BATTERY_TYPE_LIPO</a>	Lithium polymer battery
2	<a href="#">MAV_BATTERY_TYPE_LIFE</a>	Lithium-iron-phosphate battery
3	<a href="#">MAV_BATTERY_TYPE_LION</a>	Lithium-ION battery
4	<a href="#">MAV_BATTERY_TYPE_NIMH</a>	Nickel metal hydride battery

## MAV\_BATTERY\_FUNCTION

[Enum] Enumeration of battery functions

Value	Field Name	Description
0	<a href="#">MAV_BATTERY_FUNCTION_UNKNOWN</a>	Battery function is unknown
1	<a href="#">MAV_BATTERY_FUNCTION_ALL</a>	Battery supports all flight systems
2	<a href="#">MAV_BATTERY_FUNCTION_PROPULSION</a>	Battery for the propulsion system
3	<a href="#">MAV_BATTERY_FUNCTION_AVIONICS</a>	Avionics battery
4	<a href="#">MAV_BATTERY_TYPE_PAYLOAD</a>	Payload battery

## MAV\_BATTERY\_CHARGE\_STATE

[Enum] Enumeration for battery charge states.

Value	Field Name	Description
0	<a href="#">MAV_BATTERY_CHARGE_STATE_UNDEFINED</a>	Low battery state is not provided
1	<a href="#">MAV_BATTERY_CHARGE_STATE_OK</a>	Battery is not in low state. Normal operation.
2	<a href="#">MAV_BATTERY_CHARGE_STATE_LOW</a>	Battery state is low, warn and monitor close.
3	<a href="#">MAV_BATTERY_CHARGE_STATE_CRITICAL</a>	Battery state is critical, return or abort immediately.
4	<a href="#">MAV_BATTERY_CHARGE_STATE_EMERGENCY</a>	Battery state is too low for ordinary abort sequence. Perform fastest possible emergency stop to prevent damage.
5	<a href="#">MAV_BATTERY_CHARGE_STATE_FAILED</a>	Battery failed, damage unavoidable. Possible causes (faults) are listed in <a href="#">MAV_BATTERY_FAULT</a> .
6	<a href="#">MAV_BATTERY_CHARGE_STATE_UNHEALTHY</a>	Battery is diagnosed to be defective or an error occurred, usage is discouraged / prohibited. Possible causes (faults) are listed in <a href="#">MAV_BATTERY_FAULT</a> .
7	<a href="#">MAV_BATTERY_CHARGE_STATE_CHARGING</a>	Battery is charging.

## MAV\_BATTERY\_MODE

[Enum] Battery mode. Note, the normal operation mode (i.e. when flying) should be reported as [MAV\\_BATTERY\\_MODE\\_UNKNOWN](#) to allow message trimming in normal flight.

Value	Field Name	Description
0	<a href="#">MAV_BATTERY_MODE_UNKNOWN</a>	Battery mode not supported/unknown battery mode/normal operation.
1	<a href="#">MAV_BATTERY_MODE_AUTO_DISCHARGING</a>	Battery is auto discharging (towards storage level).
2	<a href="#">MAV_BATTERY_MODE_HOT_SWAP</a>	Battery in hot-swap mode (current limited to prevent spikes that might damage sensitive electrical circuits).

## MAV\_BATTERY\_FAULT

[Enum] Smart battery supply status/fault flags (bitmask) for health indication. The battery must also report either [MAV\\_BATTERY\\_CHARGE\\_STATE\\_FAILED](#) or [MAV\\_BATTERY\\_CHARGE\\_STATE\\_UNHEALTHY](#) if any of these are set.

Value	Field Name	Description
1	<a href="#">MAV_BATTERY_FAULT_DEEP_DISCHARGE</a>	Battery has deep discharged.
2	<a href="#">MAV_BATTERY_FAULT_SPIKES</a>	Voltage spikes.
4	<a href="#">MAV_BATTERY_FAULT_CELL_FAIL</a>	One or more cells have failed. Battery should also report <a href="#">MAV_BATTERY_CHARGE_STATE_FAILED</a> (and should not be used).
8	<a href="#">MAV_BATTERY_FAULT_OVER_CURRENT</a>	Over-current fault.
16	<a href="#">MAV_BATTERY_FAULT_OVER_TEMPERATURE</a>	Over-temperature fault.
32	<a href="#">MAV_BATTERY_FAULT_UNDER_TEMPERATURE</a>	Under-temperature fault.

64	<a href="#">MAV_BATTERY_FAULT_INCOMPATIBLE_VOLTAGE</a>	Vehicle voltage is not compatible with this battery (batteries on same power rail should have similar voltage).
128	<a href="#">MAV_BATTERY_FAULT_INCOMPATIBLE_FIRMWARE</a>	Battery firmware is not compatible with current autopilot firmware.
256	<a href="#">BATTERY_FAULT_INCOMPATIBLE_CELLS_CONFIGURATION</a>	Battery is not compatible due to cell configuration (e.g. 5s1p when vehicle requires 6s).

## MAV\_GENERATOR\_STATUS\_FLAG

[Enum] Flags to report status/failure cases for a power generator (used in [GENERATOR\\_STATUS](#)). Note that FAULTS are conditions that cause the generator to fail. Warnings are conditions that require attention before the next use (they indicate the system is not operating properly).

Value	Field Name	Description
1	<a href="#">MAV_GENERATOR_STATUS_FLAG_OFF</a>	Generator is off.
2	<a href="#">MAV_GENERATOR_STATUS_FLAG_READY</a>	Generator is ready to start generating power.
4	<a href="#">MAV_GENERATOR_STATUS_FLAG_GENERATING</a>	Generator is generating power.
8	<a href="#">MAV_GENERATOR_STATUS_FLAG_CHARGING</a>	Generator is charging the batteries (generating enough power to charge and provide the load).
16	<a href="#">MAV_GENERATOR_STATUS_FLAG_REDUCED_POWER</a>	Generator is operating at a reduced maximum power.
32	<a href="#">MAV_GENERATOR_STATUS_FLAG_MAXPOWER</a>	Generator is providing the maximum output.
64	<a href="#">MAV_GENERATOR_STATUS_FLAG_OVERTEMP_WARNING</a>	Generator is near the maximum operating temperature, cooling is insufficient.
128	<a href="#">MAV_GENERATOR_STATUS_FLAG_OVERTEMP_FAULT</a>	Generator hit the maximum operating temperature and shutdown.
256	<a href="#">MAV_GENERATOR_STATUS_FLAG_ELECTRONICS_OVERTEMP_WARNING</a>	Power electronics are near the maximum operating temperature, cooling is insufficient.
512	<a href="#">MAV_GENERATOR_STATUS_FLAG_ELECTRONICS_OVERTEMP_FAULT</a>	Power electronics hit the maximum operating temperature and shutdown.
1024	<a href="#">MAV_GENERATOR_STATUS_FLAG_ELECTRONICS_FAULT</a>	Power electronics experienced a fault and shutdown.
2048	<a href="#">MAV_GENERATOR_STATUS_FLAG_POWERSOURCE_FAULT</a>	The power source supplying the generator failed e.g. mechanical generator stopped, tether is no longer providing power, solar cell is in shade, hydrogen reaction no longer happening.
4096	<a href="#">MAV_GENERATOR_STATUS_FLAG_COMMUNICATION_WARNING</a>	Generator controller having communication problems.
8192	<a href="#">MAV_GENERATOR_STATUS_FLAG_COOLING_WARNING</a>	Power electronic or generator cooling system error.
16384	<a href="#">MAV_GENERATOR_STATUS_FLAG_POWER_RAIL_FAULT</a>	Generator controller power rail experienced a fault.
32768	<a href="#">MAV_GENERATOR_STATUS_FLAG_OVERCURRENT_FAULT</a>	Generator controller exceeded the overcurrent threshold and shutdown to prevent damage.
65536	<a href="#">MAV_GENERATOR_STATUS_FLAG_BATTERY_OVERCHARGE_CURRENT_FAULT</a>	Generator controller detected a high current going into the batteries and shutdown to prevent battery damage.
131072	<a href="#">MAV_GENERATOR_STATUS_FLAG_OVERVOLTAGE_FAULT</a>	Generator controller exceeded it's overvoltage threshold and shutdown to prevent it exceeding the voltage rating.
262144	<a href="#">MAV_GENERATOR_STATUS_FLAG_BATTERY_UNDERVOLT_FAULT</a>	Batteries are under voltage (generator will not start).
524288	<a href="#">MAV_GENERATOR_STATUS_FLAG_START_INHIBITED</a>	Generator start is inhibited by e.g. a safety switch.
1048576	<a href="#">MAV_GENERATOR_STATUS_FLAG_MAINTENANCE_REQUIRED</a>	Generator requires maintenance.
2097152	<a href="#">MAV_GENERATOR_STATUS_FLAG_WARMING_UP</a>	Generator is not ready to generate yet.
4194304	<a href="#">MAV_GENERATOR_STATUS_FLAG_IDLE</a>	Generator is idle.

## MAV\_VTOL\_STATE

[Enum] Enumeration of VTOL states

Value	Field Name	Description
0	<a href="#">MAV_VTOL_STATE_UNDEFINED</a>	MAV is not configured as VTOL
1	<a href="#">MAV_VTOL_STATE_TRANSITION_TO_FW</a>	VTOL is in transition from multicopter to fixed-wing
2	<a href="#">MAV_VTOL_STATE_TRANSITION_TO_MC</a>	VTOL is in transition from fixed-wing to multicopter
3	<a href="#">MAV_VTOL_STATE_MC</a>	VTOL is in multicopter state
4	<a href="#">MAV_VTOL_STATE_FW</a>	VTOL is in fixed-wing state

## MAV\_LANDED\_STATE

[Enum] Enumeration of landed detector states

Value	Field Name	Description
0	<a href="#">MAV_LANDED_STATE_UNDEFINED</a>	MAV landed state is unknown
1	<a href="#">MAV_LANDED_STATE_ON_GROUND</a>	MAV is landed (on ground)
2	<a href="#">MAV_LANDED_STATE_IN_AIR</a>	MAV is in air
3	<a href="#">MAV_LANDED_STATE_TAKEOFF</a>	MAV currently taking off
4	<a href="#">MAV_LANDED_STATE_LANDING</a>	MAV currently landing

## ADSB\_ALTITUDE\_TYPE

[Enum] Enumeration of the ADSB altimeter types

Value	Field Name	Description
0	<a href="#">ADSB_ALTITUDE_TYPE_PRESSURE_QNH</a>	Altitude reported from a Baro source using QNH reference
1	<a href="#">ADSB_ALTITUDE_TYPE_GEOMETRIC</a>	Altitude reported from a GNSS source

## ADSB\_EMITTER\_TYPE

[Enum] ADSB classification for the type of vehicle emitting the transponder signal

Value	Field Name	Description
0	<a href="#">ADSB_EMITTER_TYPE_NO_INFO</a>	
1	<a href="#">ADSB_EMITTER_TYPE_LIGHT</a>	
2	<a href="#">ADSB_EMITTER_TYPE_SMALL</a>	
3	<a href="#">ADSB_EMITTER_TYPE_LARGE</a>	
4	<a href="#">ADSB_EMITTER_TYPE_HIGH_VORTEX_LARGE</a>	
5	<a href="#">ADSB_EMITTER_TYPE_HEAVY</a>	
6	<a href="#">ADSB_EMITTER_TYPE_HIGHLY_MANUV</a>	
7	<a href="#">ADSB_EMITTER_TYPE_ROTOCRAFT</a>	
8	<a href="#">ADSB_EMITTER_TYPE_UNASSIGNED</a>	
9	<a href="#">ADSB_EMITTER_TYPE_GLIDER</a>	
10	<a href="#">ADSB_EMITTER_TYPE_LIGHTER_AIR</a>	
11	<a href="#">ADSB_EMITTER_TYPE_PARACHUTE</a>	
12	<a href="#">ADSB_EMITTER_TYPE_ULTRA_LIGHT</a>	
13	<a href="#">ADSB_EMITTER_TYPE_UNASSIGNED2</a>	
14	<a href="#">ADSB_EMITTER_TYPE_UAV</a>	
15	<a href="#">ADSB_EMITTER_TYPE_SPACE</a>	
16	<a href="#">ADSB_EMITTER_TYPE_UNASSIGNED3</a>	
17	<a href="#">ADSB_EMITTER_TYPE_EMERGENCY_SURFACE</a>	
18	<a href="#">ADSB_EMITTER_TYPE_SERVICE_SURFACE</a>	
19	<a href="#">ADSB_EMITTER_TYPE_POINT_OBSTACLE</a>	

## ADSB\_FLAGS

[Enum] These flags indicate status such as data validity of each data source. Set = data valid

Value	Field Name	Description
1	<a href="#">ADSB_FLAGS_VALID_COORDS</a>	
2	<a href="#">ADSB_FLAGS_VALID_ALTITUDE</a>	
4	<a href="#">ADSB_FLAGS_VALID_HEADING</a>	
8	<a href="#">ADSB_FLAGS_VALID_VELOCITY</a>	
16	<a href="#">ADSB_FLAGS_VALID_CALLSIGN</a>	
32	<a href="#">ADSB_FLAGS_VALID_SQUAWK</a>	
64	<a href="#">ADSB_FLAGS_SIMULATED</a>	
128	<a href="#">ADSB_FLAGS_VERTICAL_VELOCITY_VALID</a>	
256	<a href="#">ADSB_FLAGS_BARO_VALID</a>	
32768	<a href="#">ADSB_FLAGS_SOURCE_UAT</a>	

## MAV\_DO\_REPOSITION\_FLAGS

[Enum] Bitmap of options for the MAV\_CMD\_DO\_REPOSITION

Value	Field Name	Description
1	<a href="#">MAV_DO_REPOSITION_FLAGS_CHANGE_MODE</a>	The aircraft should immediately transition into guided. This should not be set for follow me applications

## ESTIMATOR\_STATUS\_FLAGS

[Enum] Flags in [ESTIMATOR\\_STATUS](#) message

Value	Field Name	Description
1	<a href="#">ESTIMATOR_ATTITUDE</a>	True if the attitude estimate is good
2	<a href="#">ESTIMATOR_VELOCITY_HORIZ</a>	True if the horizontal velocity estimate is good
4	<a href="#">ESTIMATOR_VELOCITY_VERT</a>	True if the vertical velocity estimate is good
8	<a href="#">ESTIMATOR_POS_HORIZ_REL</a>	True if the horizontal position (relative) estimate is good
16	<a href="#">ESTIMATOR_POS_HORIZ_ABS</a>	True if the horizontal position (absolute) estimate is good
32	<a href="#">ESTIMATOR_POS_VERT_ABS</a>	True if the vertical position (absolute) estimate is good
64	<a href="#">ESTIMATOR_POS_VERT_AGL</a>	True if the vertical position (above ground) estimate is good
128	<a href="#">ESTIMATOR_CONST_POS_MODE</a>	True if the EKF is in a constant position mode and is not using external measurements (eg GPS or optical flow)
256	<a href="#">ESTIMATOR_PRED_POS_HORIZ_REL</a>	True if the EKF has sufficient data to enter a mode that will provide a (relative) position estimate
512	<a href="#">ESTIMATOR_PRED_POS_HORIZ_ABS</a>	True if the EKF has sufficient data to enter a mode that will provide a (absolute) position estimate
1024	<a href="#">ESTIMATOR_GPS_GLITCH</a>	True if the EKF has detected a GPS glitch
2048	<a href="#">ESTIMATOR_ACCEL_ERROR</a>	True if the EKF has detected bad accelerometer data

## MOTOR\_TEST\_ORDER

[Enum] Sequence that motors are tested when using [MAV\\_CMD\\_DO\\_MOTOR\\_TEST](#).

Value	Field Name	Description
0	<a href="#">MOTOR_TEST_ORDER_DEFAULT</a>	Default autopilot motor test method.
1	<a href="#">MOTOR_TEST_ORDER_SEQUENCE</a>	Motor numbers are specified as their index in a predefined vehicle-specific sequence.

2 [MOTOR\\_TEST\\_ORDER\\_BOARD](#) Motor numbers are specified as the output as labeled on the board.

## MOTOR\_TEST\_THROTTLE\_TYPE

[Enum] Defines how throttle value is represented in [MAV\\_CMD\\_DO\\_MOTOR\\_TEST](#).

Value	Field Name	Description
0	<a href="#">MOTOR_TEST_THROTTLE_PERCENT</a>	Throttle as a percentage (0 ~ 100)
1	<a href="#">MOTOR_TEST_THROTTLE_PWM</a>	Throttle as an absolute PWM value (normally in range of 1000~2000).
2	<a href="#">MOTOR_TEST_THROTTLE_PILOT</a>	Throttle pass-through from pilot's transmitter.
3	<a href="#">MOTOR_TEST_COMPASS_CAL</a>	Per-motor compass calibration test.

## GPS\_INPUT\_IGNORE\_FLAGS

[Enum]

Value	Field Name	Description
1	<a href="#">GPS_INPUT_IGNORE_FLAG_ALT</a>	ignore altitude field
2	<a href="#">GPS_INPUT_IGNORE_FLAG_HDOP</a>	ignore hdop field
4	<a href="#">GPS_INPUT_IGNORE_FLAG_VDOP</a>	ignore vdop field
8	<a href="#">GPS_INPUT_IGNORE_FLAG_VEL_HORIZ</a>	ignore horizontal velocity field (vn and ve)
16	<a href="#">GPS_INPUT_IGNORE_FLAG_VEL_VERT</a>	ignore vertical velocity field (vd)
32	<a href="#">GPS_INPUT_IGNORE_FLAG_SPEED_ACCURACY</a>	ignore speed accuracy field
64	<a href="#">GPS_INPUT_IGNORE_FLAG_HORIZONTAL_ACCURACY</a>	ignore horizontal accuracy field
128	<a href="#">GPS_INPUT_IGNORE_FLAG_VERTICAL_ACCURACY</a>	ignore vertical accuracy field

## MAV\_COLLISION\_ACTION

[Enum] Possible actions an aircraft can take to avoid a collision.

Value	Field Name	Description
0	<a href="#">MAV_COLLISION_ACTION_NONE</a>	Ignore any potential collisions
1	<a href="#">MAV_COLLISION_ACTION_REPORT</a>	Report potential collision
2	<a href="#">MAV_COLLISION_ACTION_ASCEND_OR_DESCEND</a>	Ascend or Descend to avoid threat
3	<a href="#">MAV_COLLISION_ACTION_MOVE_HORIZONTALLY</a>	Move horizontally to avoid threat
4	<a href="#">MAV_COLLISION_ACTION_MOVE_PERPENDICULAR</a>	Aircraft to move perpendicular to the collision's velocity vector
5	<a href="#">MAV_COLLISION_ACTION_RTL</a>	Aircraft to fly directly back to its launch point
6	<a href="#">MAV_COLLISION_ACTION_HOVER</a>	Aircraft to stop in place

## MAV\_COLLISION\_THREAT\_LEVEL

[Enum] Aircraft-rated danger from this threat.

Value	Field Name	Description
0	<a href="#">MAV_COLLISION_THREAT_LEVEL_NONE</a>	Not a threat
1	<a href="#">MAV_COLLISION_THREAT_LEVEL_LOW</a>	Craft is mildly concerned about this threat
2	<a href="#">MAV_COLLISION_THREAT_LEVEL_HIGH</a>	Craft is panicking, and may take actions to avoid threat

## MAV\_COLLISION\_SRC

[Enum] Source of information about this collision.

Value	Field Name	Description
0	<a href="#">MAV_COLLISION_SRC_ADSB</a>	ID field references <a href="#">ADSB_VEHICLE</a> packets
1	<a href="#">MAV_COLLISION_SRC_MAVLINK_GPS_GLOBAL_INT</a>	ID field references MAVLink SRC ID

## GPS\_FIX\_TYPE

[Enum] Type of GPS fix

Value	Field Name	Description
0	<a href="#">GPS_FIX_TYPE_NO_GPS</a>	No GPS connected
1	<a href="#">GPS_FIX_TYPE_NO_FIX</a>	No position information, GPS is connected
2	<a href="#">GPS_FIX_TYPE_2D_FIX</a>	2D position
3	<a href="#">GPS_FIX_TYPE_3D_FIX</a>	3D position
4	<a href="#">GPS_FIX_TYPE_DGPS</a>	DGPS/SBAS aided 3D position
5	<a href="#">GPS_FIX_TYPE_RTK_FLOAT</a>	RTK float, 3D position
6	<a href="#">GPS_FIX_TYPE_RTK_FIXED</a>	RTK Fixed, 3D position
7	<a href="#">GPS_FIX_TYPE_STATIC</a>	Static fixed, typically used for base stations
8	<a href="#">GPS_FIX_TYPE_PPP</a>	PPP, 3D position.

## RTK\_BASELINE\_COORDINATE\_SYSTEM

[Enum] RTK GPS baseline coordinate system, used for RTK corrections

Value	Field Name	Description
0	<a href="#">RTK_BASELINE_COORDINATE_SYSTEM_ECEF</a>	Earth-centered, Earth-fixed
1	<a href="#">RTK_BASELINE_COORDINATE_SYSTEM_NED</a>	RTK basestation centered, north, east, down

## LANDING\_TARGET\_TYPE

[Enum] Type of landing target

Value	Field Name	Description
0	<a href="#">LANDING_TARGET_TYPE_LIGHT_BEACON</a>	



		Landing target signaled by light beacon (ex: IR-LOCK)
1	<a href="#">LANDING_TARGET_TYPE_RADIO_BEACON</a>	Landing target signaled by radio beacon (ex: ILS, NDB)
2	<a href="#">LANDING_TARGET_TYPE_VISION_FIDUCIAL</a>	Landing target represented by a fiducial marker (ex: ARTag)
3	<a href="#">LANDING_TARGET_TYPE_VISION_OTHER</a>	Landing target represented by a pre-defined visual shape/feature (ex: X-marker, H-marker, square)

## VTOL\_TRANSITION\_HEADING

[Enum] Direction of VTOL transition

Value	Field Name	Description
0	<a href="#">VTOL_TRANSITION_HEADING_VEHICLE_DEFAULT</a>	Respect the heading configuration of the vehicle.
1	<a href="#">VTOL_TRANSITION_HEADING_NEXT_WAYPOINT</a>	Use the heading pointing towards the next waypoint.
2	<a href="#">VTOL_TRANSITION_HEADING_TAKEOFF</a>	Use the heading on takeoff (while sitting on the ground).
3	<a href="#">VTOL_TRANSITION_HEADING_SPECIFIED</a>	Use the specified heading in parameter 4.
4	<a href="#">VTOL_TRANSITION_HEADING_ANY</a>	Use the current heading when reaching takeoff altitude (potentially facing the wind when weather-vaning is active).

## CAMERA\_CAP\_FLAGS

[Enum] Camera capability flags (Bitmap)

Value	Field Name	Description
1	<a href="#">CAMERA_CAP_FLAGS_CAPTURE_VIDEO</a>	Camera is able to record video
2	<a href="#">CAMERA_CAP_FLAGS_CAPTURE_IMAGE</a>	Camera is able to capture images
4	<a href="#">CAMERA_CAP_FLAGS_HAS_MODES</a>	Camera has separate Video and Image/Photo modes ( <a href="#">MAV_CMD_SET_CAMERA_MODE</a> )
8	<a href="#">CAMERA_CAP_FLAGS_CAN_CAPTURE_IMAGE_IN_VIDEO_MODE</a>	Camera can capture images while in video mode
16	<a href="#">CAMERA_CAP_FLAGS_CAN_CAPTURE_VIDEO_IN_IMAGE_MODE</a>	Camera can capture videos while in Photo/Image mode
32	<a href="#">CAMERA_CAP_FLAGS_HAS_IMAGE_SURVEY_MODE</a>	Camera has image survey mode ( <a href="#">MAV_CMD_SET_CAMERA_MODE</a> )
64	<a href="#">CAMERA_CAP_FLAGS_HAS_BASIC_ZOOM</a>	Camera has basic zoom control ( <a href="#">MAV_CMD_SET_CAMERA_ZOOM</a> )
128	<a href="#">CAMERA_CAP_FLAGS_HAS_BASIC_FOCUS</a>	Camera has basic focus control ( <a href="#">MAV_CMD_SET_CAMERA_FOCUS</a> )
256	<a href="#">CAMERA_CAP_FLAGS_HAS_VIDEO_STREAM</a>	Camera has video streaming capabilities (request <a href="#">VIDEO_STREAM_INFORMATION</a> with <a href="#">MAV_CMD_REQUEST_MESSAGE</a> for video streaming info)
512	<a href="#">CAMERA_CAP_FLAGS_HAS_TRACKING_POINT</a>	Camera supports tracking of a point on the camera view.
1024	<a href="#">CAMERA_CAP_FLAGS_HAS_TRACKING_RECTANGLE</a>	Camera supports tracking of a selection rectangle on the camera view.
2048	<a href="#">CAMERA_CAP_FLAGS_HAS_TRACKING_GEO_STATUS</a>	Camera supports tracking geo status ( <a href="#">CAMERA_TRACKING_GEO_STATUS</a> ).

## VIDEO\_STREAM\_STATUS\_FLAGS

[Enum] Stream status flags (Bitmap)

Value	Field Name	Description
1	<a href="#">VIDEO_STREAM_STATUS_FLAGS_RUNNING</a>	Stream is active (running)
2	<a href="#">VIDEO_STREAM_STATUS_FLAGS_THERMAL</a>	Stream is thermal imaging

## VIDEO\_STREAM\_TYPE

[Enum] Video stream types

Value	Field Name	Description
0	<a href="#">VIDEO_STREAM_TYPE_RTSP</a>	Stream is RTSP
1	<a href="#">VIDEO_STREAM_TYPE RTPUDP</a>	Stream is RTP UDP (URI gives the port number)
2	<a href="#">VIDEO_STREAM_TYPE_TCP_MPEG</a>	Stream is MPEG on TCP
3	<a href="#">VIDEO_STREAM_TYPE_MPEG_TS_H264</a>	Stream is h.264 on MPEG TS (URI gives the port number)

## CAMERA\_TRACKING\_STATUS\_FLAGS

[Enum] Camera tracking status flags

Value	Field Name	Description
0	<a href="#">CAMERA_TRACKING_STATUS_FLAGS_IDLE</a>	Camera is not tracking
1	<a href="#">CAMERA_TRACKING_STATUS_FLAGS_ACTIVE</a>	Camera is tracking
2	<a href="#">CAMERA_TRACKING_STATUS_FLAGS_ERROR</a>	Camera tracking in error state

## CAMERA\_TRACKING\_MODE

[Enum] Camera tracking modes

Value	Field Name	Description
0	<a href="#">CAMERA_TRACKING_MODE_NONE</a>	Not tracking
1	<a href="#">CAMERA_TRACKING_MODE_POINT</a>	Target is a point
2	<a href="#">CAMERA_TRACKING_MODE_RECTANGLE</a>	Target is a rectangle

## CAMERA\_TRACKING\_TARGET\_DATA

[Enum] Camera tracking target data (shows where tracked target is within image)

Value	Field Name	Description
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0	<a href="#">CAMERA_TRACKING_TARGET_DATA_NONE</a>	No target data
1	<a href="#">CAMERA_TRACKING_TARGET_DATA_EMBEDDED</a>	Target data embedded in image data (proprietary)
2	<a href="#">CAMERA_TRACKING_TARGET_DATA_RENDERED</a>	Target data rendered in image
4	<a href="#">CAMERA_TRACKING_TARGET_DATA_IN_STATUS</a>	Target data within status message (Point or Rectangle)

## CAMERA\_ZOOM\_TYPE

[Enum] Zoom types for MAV\_CMD\_SET\_CAMERA\_ZOOM

Value	Field Name	Description
0	<a href="#">ZOOM_TYPE_STEP</a>	Zoom one step increment (-1 for wide, 1 for tele)
1	<a href="#">ZOOM_TYPE_CONTINUOUS</a>	Continuous zoom up/down until stopped (-1 for wide, 1 for tele, 0 to stop zooming)
2	<a href="#">ZOOM_TYPE_RANGE</a>	Zoom value as proportion of full camera range (a value between 0.0 and 100.0)
3	<a href="#">ZOOM_TYPE_FOCAL_LENGTH</a>	Zoom value/variable focal length in millimetres. Note that there is no message to get the valid zoom range of the camera, so this can type can only be used for cameras where the zoom range is known (implying that this cannot reliably be used in a GCS for an arbitrary camera)

## SET\_FOCUS\_TYPE

[Enum] Focus types for MAV\_CMD\_SET\_CAMERA\_FOCUS

Value	Field Name	Description
0	<a href="#">FOCUS_TYPE_STEP</a>	Focus one step increment (-1 for focusing in, 1 for focusing out towards infinity).
1	<a href="#">FOCUS_TYPE_CONTINUOUS</a>	Continuous focus up/down until stopped (-1 for focusing in, 1 for focusing out towards infinity, 0 to stop focusing)
2	<a href="#">FOCUS_TYPE_RANGE</a>	Focus value as proportion of full camera focus range (a value between 0.0 and 100.0)
3	<a href="#">FOCUS_TYPE_METERS</a>	Focus value in metres. Note that there is no message to get the valid focus range of the camera, so this can type can only be used for cameras where the range is known (implying that this cannot reliably be used in a GCS for an arbitrary camera).
4	<a href="#">FOCUS_TYPE_AUTO</a>	Focus automatically.
5	<a href="#">FOCUS_TYPE_AUTO_SINGLE</a>	Single auto focus. Mainly used for still pictures. Usually abbreviated as AF-S.
6	<a href="#">FOCUS_TYPE_AUTO_CONTINUOUS</a>	Continuous auto focus. Mainly used for dynamic scenes. Abbreviated as AF-C.

## PARAM\_ACK

[Enum] Result from [PARAM\\_EXT\\_SET](#) message (or a [PARAM\\_SET](#) within a transaction).

Value	Field Name	Description
0	<a href="#">PARAM_ACK_ACCEPTED</a>	Parameter value ACCEPTED and SET
1	<a href="#">PARAM_ACK_VALUE_UNSUPPORTED</a>	Parameter value UNKNOWN/UNSUPPORTED
2	<a href="#">PARAM_ACK_FAILED</a>	Parameter failed to set
3	<a href="#">PARAM_ACK_IN_PROGRESS</a>	Parameter value received but not yet set/accepted. A subsequent <a href="#">PARAM_ACK_TRANSACTION</a> or <a href="#">PARAM_EXT_ACK</a> with the final result will follow once operation is completed. This is returned immediately for parameters that take longer to set, indicating that the the parameter was received and does not need to be resent.

## CAMERA\_MODE

[Enum] Camera Modes.

Value	Field Name	Description
0	<a href="#">CAMERA_MODE_IMAGE</a>	Camera is in image/photo capture mode.
1	<a href="#">CAMERA_MODE_VIDEO</a>	Camera is in video capture mode.
2	<a href="#">CAMERA_MODE_IMAGE_SURVEY</a>	Camera is in image survey capture mode. It allows for camera controller to do specific settings for surveys.

## MAV\_ARM\_AUTH\_DENIED\_REASON

[Enum]

Value	Field Name	Description
0	<a href="#">MAV_ARM_AUTH_DENIED_REASON_GENERIC</a>	Not a specific reason
1	<a href="#">MAV_ARM_AUTH_DENIED_REASON_NONE</a>	Authorizer will send the error as string to GCS
2	<a href="#">MAV_ARM_AUTH_DENIED_REASON_INVALID_WAYPOINT</a>	At least one waypoint have a invalid value
3	<a href="#">MAV_ARM_AUTH_DENIED_REASON_TIMEOUT</a>	Timeout in the authorizer process(in case it depends on network)
4	<a href="#">MAV_ARM_AUTH_DENIED_REASON_AIRSPACE_IN_USE</a>	Airspace of the mission in use by another vehicle, second result parameter can have the waypoint id that caused it to be denied.
5	<a href="#">MAV_ARM_AUTH_DENIED_REASON_BAD_WEATHER</a>	Weather is not good to fly

## RC\_TYPE

[Enum] RC type

Value	Field Name	Description
0	<a href="#">RC_TYPE_SPEKTRUM_DSM2</a>	Spektrum DSM2
1	<a href="#">RC_TYPE_SPEKTRUM_DSMX</a>	Spektrum DSMX

## POSITION\_TARGET\_TPEMASK

[Enum] Bitmap to indicate which dimensions should be ignored by the vehicle: a value of 0b0000000000000000 or 0b0000001000000000 indicates that none of the setpoint dimensions should be ignored. If bit 9 is set the floats afx afy afz should be interpreted as force instead of acceleration.

Value	Field Name	Description
1	<a href="#">POSITION_TARGET_TPEMASK_X_IGNORE</a>	Ignore position x
2	<a href="#">POSITION_TARGET_TPEMASK_Y_IGNORE</a>	Ignore position y

4	<a href="#">POSITION_TARGET_TYEMASK_Z_IGNORE</a>	Ignore position z
8	<a href="#">POSITION_TARGET_TYEMASK_VX_IGNORE</a>	Ignore velocity x
16	<a href="#">POSITION_TARGET_TYEMASK_VY_IGNORE</a>	Ignore velocity y
32	<a href="#">POSITION_TARGET_TYEMASK_VZ_IGNORE</a>	Ignore velocity z
64	<a href="#">POSITION_TARGET_TYEMASK_AX_IGNORE</a>	Ignore acceleration x
128	<a href="#">POSITION_TARGET_TYEMASK_AY_IGNORE</a>	Ignore acceleration y
256	<a href="#">POSITION_TARGET_TYEMASK_AZ_IGNORE</a>	Ignore acceleration z
512	<a href="#">POSITION_TARGET_TYEMASK_FORCE_SET</a>	Use force instead of acceleration
1024	<a href="#">POSITION_TARGET_TYEMASK_YAW_IGNORE</a>	Ignore yaw
2048	<a href="#">POSITION_TARGET_TYEMASK_YAW_RATE_IGNORE</a>	Ignore yaw rate

## ATTITUDE\_TARGET\_TYEMASK

[Enum] Bitmap to indicate which dimensions should be ignored by the vehicle: a value of 0b00000000 indicates that none of the setpoint dimensions should be ignored.

Value	Field Name	Description
1	<a href="#">ATTITUDE_TARGET_TYEMASK_BODY_ROLL_RATE_IGNORE</a>	Ignore body roll rate
2	<a href="#">ATTITUDE_TARGET_TYEMASK_BODY_PITCH_RATE_IGNORE</a>	Ignore body pitch rate
4	<a href="#">ATTITUDE_TARGET_TYEMASK_BODY_YAW_RATE_IGNORE</a>	Ignore body yaw rate
32	<a href="#">ATTITUDE_TARGET_TYEMASK_THRUST_BODY_SET</a>	Use 3D body thrust setpoint instead of throttle
64	<a href="#">ATTITUDE_TARGET_TYEMASK_THROTTLE_IGNORE</a>	Ignore throttle
128	<a href="#">ATTITUDE_TARGET_TYEMASK_ATTITUDE_IGNORE</a>	Ignore attitude

## UTM\_FLIGHT\_STATE

[Enum] Airborne status of UAS.

Value	Field Name	Description
1	<a href="#">UTM_FLIGHT_STATE_UNKNOWN</a>	The flight state can't be determined.
2	<a href="#">UTM_FLIGHT_STATE_GROUND</a>	UAS on ground.
3	<a href="#">UTM_FLIGHT_STATE_AIRBORNE</a>	UAS airborne.
16	<a href="#">UTM_FLIGHT_STATE_EMERGENCY</a>	UAS is in an emergency flight state.
32	<a href="#">UTM_FLIGHT_STATE_NOCTRL</a>	UAS has no active controls.

## UTM\_DATA\_AVAIL\_FLAGS

[Enum] Flags for the global position report.

Value	Field Name	Description
1	<a href="#">UTM_DATA_AVAIL_FLAGS_TIME_VALID</a>	The field time contains valid data.
2	<a href="#">UTM_DATA_AVAIL_FLAGS_UAS_ID_AVAILABLE</a>	The field uas_id contains valid data.
4	<a href="#">UTM_DATA_AVAIL_FLAGS_POSITION_AVAILABLE</a>	The fields lat, lon and h_acc contain valid data.
8	<a href="#">UTM_DATA_AVAIL_FLAGS_ALTITUDE_AVAILABLE</a>	The fields alt and v_acc contain valid data.
16	<a href="#">UTM_DATA_AVAIL_FLAGS_RELATIVE_ALTITUDE_AVAILABLE</a>	The field relative_alt contains valid data.
32	<a href="#">UTM_DATA_AVAIL_FLAGS_HORIZONTAL_VELO_AVAILABLE</a>	The fields vx and vy contain valid data.
64	<a href="#">UTM_DATA_AVAIL_FLAGS_VERTICAL_VELO_AVAILABLE</a>	The field vz contains valid data.
128	<a href="#">UTM_DATA_AVAIL_FLAGS_NEXT_WAYPOINT_AVAILABLE</a>	The fields next_lat, next_lon and next_alt contain valid data.

## CELLULAR\_STATUS\_FLAG

[Enum] These flags encode the cellular network status

Value	Field Name	Description
0	<a href="#">CELLULAR_STATUS_FLAG_UNKNOWN</a>	State unknown or not reportable.
1	<a href="#">CELLULAR_STATUS_FLAG_FAILED</a>	Modem is unusable
2	<a href="#">CELLULAR_STATUS_FLAG_INITIALIZING</a>	Modem is being initialized
3	<a href="#">CELLULAR_STATUS_FLAG_LOCKED</a>	Modem is locked
4	<a href="#">CELLULAR_STATUS_FLAG_DISABLED</a>	Modem is not enabled and is powered down
5	<a href="#">CELLULAR_STATUS_FLAG_DISABLING</a>	Modem is currently transitioning to the <a href="#">CELLULAR_STATUS_FLAG_DISABLED</a> state
6	<a href="#">CELLULAR_STATUS_FLAG_ENABLING</a>	Modem is currently transitioning to the <a href="#">CELLULAR_STATUS_FLAG_ENABLED</a> state
7	<a href="#">CELLULAR_STATUS_FLAG_ENABLED</a>	Modem is enabled and powered on but not registered with a network provider and not available for data connections
8	<a href="#">CELLULAR_STATUS_FLAG_SEARCHING</a>	Modem is searching for a network provider to register
9	<a href="#">CELLULAR_STATUS_FLAG_REGISTERED</a>	Modem is registered with a network provider, and data connections and messaging may be available for use
10	<a href="#">CELLULAR_STATUS_FLAG_DISCONNECTING</a>	Modem is disconnecting and deactivating the last active packet data bearer. This state will not be entered if more than one packet data bearer is active and one of the active bearers is deactivated
11	<a href="#">CELLULAR_STATUS_FLAG_CONNECTING</a>	Modem is activating and connecting the first packet data bearer. Subsequent bearer activations when another bearer is already active do not cause this state to be entered
12	<a href="#">CELLULAR_STATUS_FLAG_CONNECTED</a>	One or more packet data bearers is active and connected

## CELLULAR\_NETWORK\_FAILED\_REASON

[Enum] These flags are used to diagnose the failure state of CELLULAR\_STATUS

Value	Field Name	Description
0	<a href="#">CELLULAR_NETWORK_FAILED_REASON_NONE</a>	No error
1	<a href="#">CELLULAR_NETWORK_FAILED_REASON_UNKNOWN</a>	Error state is unknown
2	<a href="#">CELLULAR_NETWORK_FAILED_REASON_SIM_MISSING</a>	SIM is required for the modem but missing

3 [CELLULAR\\_NETWORK\\_FAILED\\_REASON\\_SIM\\_ERROR](#) SIM is available, but not usable for connection

## CELLULAR\_NETWORK\_RADIO\_TYPE

[\[Enum\]](#) Cellular network radio type

Value	Field Name	Description
0	<a href="#">CELLULAR_NETWORK_RADIO_TYPE_NONE</a>	
1	<a href="#">CELLULAR_NETWORK_RADIO_TYPE_GSM</a>	
2	<a href="#">CELLULAR_NETWORK_RADIO_TYPE_CDMA</a>	
3	<a href="#">CELLULAR_NETWORK_RADIO_TYPE_WCDMA</a>	
4	<a href="#">CELLULAR_NETWORK_RADIO_TYPE_LTE</a>	

## PRECISION\_LAND\_MODE

[\[Enum\]](#) Precision land modes (used in [MAV\\_CMD\\_NAV\\_LAND](#)).

Value	Field Name	Description
0	<a href="#">PRECISION_LAND_MODE_DISABLED</a>	Normal (non-precision) landing.
1	<a href="#">PRECISION_LAND_MODE_OPPORTUNISTIC</a>	Use precision landing if beacon detected when land command accepted, otherwise land normally.
2	<a href="#">PRECISION_LAND_MODE_REQUIRED</a>	Use precision landing, searching for beacon if not found when land command accepted (land normally if beacon cannot be found).

## PARACHUTE\_ACTION

[\[Enum\]](#) Parachute actions. Trigger release and enable/disable auto-release.

Value	Field Name	Description
0	<a href="#">PARACHUTE_DISABLE</a>	Disable auto-release of parachute (i.e. release triggered by crash detectors).
1	<a href="#">PARACHUTE_ENABLE</a>	Enable auto-release of parachute.
2	<a href="#">PARACHUTE_RELEASE</a>	Release parachute and kill motors.

## MAV\_TUNNEL\_PAYLOAD\_TYPE

[\[Enum\]](#)

Value	Field Name	Description
0	<a href="#">MAV_TUNNEL_PAYLOAD_TYPE_UNKNOWN</a>	Encoding of payload unknown.
200	<a href="#">MAV_TUNNEL_PAYLOAD_TYPE_STORM32_RESERVED0</a>	Registered for STorM32 gimbal controller.
201	<a href="#">MAV_TUNNEL_PAYLOAD_TYPE_STORM32_RESERVED1</a>	Registered for STorM32 gimbal controller.
202	<a href="#">MAV_TUNNEL_PAYLOAD_TYPE_STORM32_RESERVED2</a>	Registered for STorM32 gimbal controller.
203	<a href="#">MAV_TUNNEL_PAYLOAD_TYPE_STORM32_RESERVED3</a>	Registered for STorM32 gimbal controller.
204	<a href="#">MAV_TUNNEL_PAYLOAD_TYPE_STORM32_RESERVED4</a>	Registered for STorM32 gimbal controller.
205	<a href="#">MAV_TUNNEL_PAYLOAD_TYPE_STORM32_RESERVED5</a>	Registered for STorM32 gimbal controller.
206	<a href="#">MAV_TUNNEL_PAYLOAD_TYPE_STORM32_RESERVED6</a>	Registered for STorM32 gimbal controller.
207	<a href="#">MAV_TUNNEL_PAYLOAD_TYPE_STORM32_RESERVED7</a>	Registered for STorM32 gimbal controller.
208	<a href="#">MAV_TUNNEL_PAYLOAD_TYPE_STORM32_RESERVED8</a>	Registered for STorM32 gimbal controller.
209	<a href="#">MAV_TUNNEL_PAYLOAD_TYPE_STORM32_RESERVED9</a>	Registered for STorM32 gimbal controller.

## MAV\_ODID\_ID\_TYPE

[\[Enum\]](#)

Value	Field Name	Description
0	<a href="#">MAV_ODID_ID_TYPE_NONE</a>	No type defined.
1	<a href="#">MAV_ODID_ID_TYPE_SERIAL_NUMBER</a>	Manufacturer Serial Number (ANSI/CTA-2063 format).
2	<a href="#">MAV_ODID_ID_TYPE_CAA_REGISTRATION_ID</a>	CAA (Civil Aviation Authority) registered ID. Format: [ICAO Country Code].[CAA Assigned ID].
3	<a href="#">MAV_ODID_ID_TYPE_UTM_ASSIGNED_UUID</a>	UTM (Unmanned Traffic Management) assigned UUID (RFC4122).
4	<a href="#">MAV_ODID_ID_TYPE_SPECIFIC_SESSION_ID</a>	A 20 byte ID for a specific flight/session. The exact ID type is indicated by the first byte of uas_id and these type values are managed by ICAO.

## MAV\_ODID\_UA\_TYPE

[\[Enum\]](#)

Value	Field Name	Description
0	<a href="#">MAV_ODID_UA_TYPE_NONE</a>	No UA (Unmanned Aircraft) type defined.
1	<a href="#">MAV_ODID_UA_TYPE_AEROPLANE</a>	Aeroplane/Airplane. Fixed wing.
2	<a href="#">MAV_ODID_UA_TYPE_HELICOPTER_OR_MULTIROTOR</a>	Helicopter or multirotor.
3	<a href="#">MAV_ODID_UA_TYPE_GYROPLANE</a>	Gyroplane.
4	<a href="#">MAV_ODID_UA_TYPE_HYBRID_LIFT</a>	VTOL (Vertical Take-Off and Landing). Fixed wing aircraft that can take off vertically.
5	<a href="#">MAV_ODID_UA_TYPE_ORNITHOPTER</a>	Ornithopter.
6	<a href="#">MAV_ODID_UA_TYPE_GLIDER</a>	Glider.
7	<a href="#">MAV_ODID_UA_TYPE_KITE</a>	Kite.
8	<a href="#">MAV_ODID_UA_TYPE_FREE_BALLOON</a>	Free Balloon.
9	<a href="#">MAV_ODID_UA_TYPE_CAPTIVE_BALLOON</a>	Captive Balloon.
10	<a href="#">MAV_ODID_UA_TYPE_AIRSHIP</a>	Airship. E.g. a blimp.
11	<a href="#">MAV_ODID_UA_TYPE_FREE_FALL_PARACHUTE</a>	Free Fall/Parachute (unpowered).
12	<a href="#">MAV_ODID_UA_TYPE_ROCKET</a>	Rocket.
13	<a href="#">MAV_ODID_UA_TYPE_TETHERED_POWERED_AIRCRAFT</a>	Tethered powered aircraft.
14	<a href="#">MAV_ODID_UA_TYPE_GROUND_OBSACLE</a>	Ground Obstacle.

15    [MAV\\_ODID\\_UA\\_TYPE\\_OTHER](#)

Other type of aircraft not listed earlier.

## MAV\_ODID\_STATUS

[\[Enum\]](#)

Value	Field Name	Description
0	<a href="#">MAV_ODID_STATUS_UNDECLARED</a>	The status of the (UA) Unmanned Aircraft is undefined.
1	<a href="#">MAV_ODID_STATUS_GROUND</a>	The UA is on the ground.
2	<a href="#">MAV_ODID_STATUS_AIRBORNE</a>	The UA is in the air.
3	<a href="#">MAV_ODID_STATUS_EMERGENCY</a>	The UA is having an emergency.
4	<a href="#">MAV_ODID_STATUS_REMOTE_ID_SYSTEM_FAILURE</a>	The remote ID system is failing or unreliable in some way.

## MAV\_ODID\_HEIGHT\_REF

[\[Enum\]](#)

Value	Field Name	Description
0	<a href="#">MAV_ODID_HEIGHT_REF_OVER_TAKEOFF</a>	The height field is relative to the take-off location.
1	<a href="#">MAV_ODID_HEIGHT_REF_OVER_GROUND</a>	The height field is relative to ground.

## MAV\_ODID\_HOR\_ACC

[\[Enum\]](#)

Value	Field Name	Description
0	<a href="#">MAV_ODID_HOR_ACC_UNKNOWN</a>	The horizontal accuracy is unknown.
1	<a href="#">MAV_ODID_HOR_ACC_10NM</a>	The horizontal accuracy is smaller than 10 Nautical Miles. 18.52 km.
2	<a href="#">MAV_ODID_HOR_ACC_4NM</a>	The horizontal accuracy is smaller than 4 Nautical Miles. 7.408 km.
3	<a href="#">MAV_ODID_HOR_ACC_2NM</a>	The horizontal accuracy is smaller than 2 Nautical Miles. 3.704 km.
4	<a href="#">MAV_ODID_HOR_ACC_1NM</a>	The horizontal accuracy is smaller than 1 Nautical Miles. 1.852 km.
5	<a href="#">MAV_ODID_HOR_ACC_0_5NM</a>	The horizontal accuracy is smaller than 0.5 Nautical Miles. 926 m.
6	<a href="#">MAV_ODID_HOR_ACC_0_3NM</a>	The horizontal accuracy is smaller than 0.3 Nautical Miles. 555.6 m.
7	<a href="#">MAV_ODID_HOR_ACC_0_1NM</a>	The horizontal accuracy is smaller than 0.1 Nautical Miles. 185.2 m.
8	<a href="#">MAV_ODID_HOR_ACC_0_05NM</a>	The horizontal accuracy is smaller than 0.05 Nautical Miles. 92.6 m.
9	<a href="#">MAV_ODID_HOR_ACC_30_METER</a>	The horizontal accuracy is smaller than 30 meter.
10	<a href="#">MAV_ODID_HOR_ACC_10_METER</a>	The horizontal accuracy is smaller than 10 meter.
11	<a href="#">MAV_ODID_HOR_ACC_3_METER</a>	The horizontal accuracy is smaller than 3 meter.
12	<a href="#">MAV_ODID_HOR_ACC_1_METER</a>	The horizontal accuracy is smaller than 1 meter.

## MAV\_ODID\_VER\_ACC

[\[Enum\]](#)

Value	Field Name	Description
0	<a href="#">MAV_ODID_VER_ACC_UNKNOWN</a>	The vertical accuracy is unknown.
1	<a href="#">MAV_ODID_VER_ACC_150_METER</a>	The vertical accuracy is smaller than 150 meter.
2	<a href="#">MAV_ODID_VER_ACC_45_METER</a>	The vertical accuracy is smaller than 45 meter.
3	<a href="#">MAV_ODID_VER_ACC_25_METER</a>	The vertical accuracy is smaller than 25 meter.
4	<a href="#">MAV_ODID_VER_ACC_10_METER</a>	The vertical accuracy is smaller than 10 meter.
5	<a href="#">MAV_ODID_VER_ACC_3_METER</a>	The vertical accuracy is smaller than 3 meter.
6	<a href="#">MAV_ODID_VER_ACC_1_METER</a>	The vertical accuracy is smaller than 1 meter.

## MAV\_ODID\_SPEED\_ACC

[\[Enum\]](#)

Value	Field Name	Description
0	<a href="#">MAV_ODID_SPEED_ACC_UNKNOWN</a>	The speed accuracy is unknown.
1	<a href="#">MAV_ODID_SPEED_ACC_10_METERS_PER_SECOND</a>	The speed accuracy is smaller than 10 meters per second.
2	<a href="#">MAV_ODID_SPEED_ACC_3_METERS_PER_SECOND</a>	The speed accuracy is smaller than 3 meters per second.
3	<a href="#">MAV_ODID_SPEED_ACC_1_METERS_PER_SECOND</a>	The speed accuracy is smaller than 1 meters per second.
4	<a href="#">MAV_ODID_SPEED_ACC_0_3_METERS_PER_SECOND</a>	The speed accuracy is smaller than 0.3 meters per second.

## MAV\_ODID\_TIME\_ACC

[\[Enum\]](#)

Value	Field Name	Description
0	<a href="#">MAV_ODID_TIME_ACC_UNKNOWN</a>	The timestamp accuracy is unknown.
1	<a href="#">MAV_ODID_TIME_ACC_0_1_SECOND</a>	The timestamp accuracy is smaller than or equal to 0.1 second.
2	<a href="#">MAV_ODID_TIME_ACC_0_2_SECOND</a>	The timestamp accuracy is smaller than or equal to 0.2 second.
3	<a href="#">MAV_ODID_TIME_ACC_0_3_SECOND</a>	The timestamp accuracy is smaller than or equal to 0.3 second.
4	<a href="#">MAV_ODID_TIME_ACC_0_4_SECOND</a>	The timestamp accuracy is smaller than or equal to 0.4 second.
5	<a href="#">MAV_ODID_TIME_ACC_0_5_SECOND</a>	The timestamp accuracy is smaller than or equal to 0.5 second.
6	<a href="#">MAV_ODID_TIME_ACC_0_6_SECOND</a>	The timestamp accuracy is smaller than or equal to 0.6 second.
7	<a href="#">MAV_ODID_TIME_ACC_0_7_SECOND</a>	The timestamp accuracy is smaller than or equal to 0.7 second.
8	<a href="#">MAV_ODID_TIME_ACC_0_8_SECOND</a>	The timestamp accuracy is smaller than or equal to 0.8 second.
9	<a href="#">MAV_ODID_TIME_ACC_0_9_SECOND</a>	The timestamp accuracy is smaller than or equal to 0.9 second.
10	<a href="#">MAV_ODID_TIME_ACC_1_0_SECOND</a>	The timestamp accuracy is smaller than or equal to 1.0 second.
11	<a href="#">MAV_ODID_TIME_ACC_1_1_SECOND</a>	The timestamp accuracy is smaller than or equal to 1.1 second.
12	<a href="#">MAV_ODID_TIME_ACC_1_2_SECOND</a>	The timestamp accuracy is smaller than or equal to 1.2 second.
13	<a href="#">MAV_ODID_TIME_ACC_1_3_SECOND</a>	The timestamp accuracy is smaller than or equal to 1.3 second.

- 14 [MAV\\_ODID\\_TIME\\_ACC\\_1\\_4\\_SECOND](#) The timestamp accuracy is smaller than or equal to 1.4 second.
- 15 [MAV\\_ODID\\_TIME\\_ACC\\_1\\_5\\_SECOND](#) The timestamp accuracy is smaller than or equal to 1.5 second.

## MAV\_ODID\_AUTH\_TYPE

[Enum]

Value	Field Name	Description
0	<a href="#">MAV_ODID_AUTH_TYPE_NONE</a>	No authentication type is specified.
1	<a href="#">MAV_ODID_AUTH_TYPE_UAS_ID_SIGNATURE</a>	Signature for the UAS (Unmanned Aircraft System) ID.
2	<a href="#">MAV_ODID_AUTH_TYPE_OPERATOR_ID_SIGNATURE</a>	Signature for the Operator ID.
3	<a href="#">MAV_ODID_AUTH_TYPE_MESSAGE_SET_SIGNATURE</a>	Signature for the entire message set.
4	<a href="#">MAV_ODID_AUTH_TYPE_NETWORK_REMOTE_ID</a>	Authentication is provided by Network Remote ID.
5	<a href="#">MAV_ODID_AUTH_TYPE_SPECIFIC_AUTHENTICATION</a>	The exact authentication type is indicated by the first byte of authentication_data and these type values are managed by ICAO.

## MAV\_ODID\_DESC\_TYPE

[Enum]

Value	Field Name	Description
0	<a href="#">MAV_ODID_DESC_TYPE_TEXT</a>	Optional free-form text description of the purpose of the flight.
1	<a href="#">MAV_ODID_DESC_TYPE_EMERGENCY</a>	Optional additional clarification when status == <a href="#">MAV_ODID_STATUS_EMERGENCY</a> .
2	<a href="#">MAV_ODID_DESC_TYPE_EXTENDED_STATUS</a>	Optional additional clarification when status != <a href="#">MAV_ODID_STATUS_EMERGENCY</a> .

## MAV\_ODID\_OPERATOR\_LOCATION\_TYPE

[Enum]

Value	Field Name	Description
0	<a href="#">MAV_ODID_OPERATOR_LOCATION_TYPE_TAKEOFF</a>	The location/altitude of the operator is the same as the take-off location.
1	<a href="#">MAV_ODID_OPERATOR_LOCATION_TYPE_LIVE_GNSS</a>	The location/altitude of the operator is dynamic. E.g. based on live GNSS data.
2	<a href="#">MAV_ODID_OPERATOR_LOCATION_TYPE_FIXED</a>	The location/altitude of the operator are fixed values.

## MAV\_ODID\_CLASSIFICATION\_TYPE

[Enum]

Value	Field Name	Description
0	<a href="#">MAV_ODID_CLASSIFICATION_TYPE_UNDECLARED</a>	The classification type for the UA is undeclared.
1	<a href="#">MAV_ODID_CLASSIFICATION_TYPE_EU</a>	The classification type for the UA follows EU (European Union) specifications.

## MAV\_ODID\_CATEGORY\_EU

[Enum]

Value	Field Name	Description
0	<a href="#">MAV_ODID_CATEGORY_EU_UNDECLARED</a>	The category for the UA, according to the EU specification, is undeclared.
1	<a href="#">MAV_ODID_CATEGORY_EU_OPEN</a>	The category for the UA, according to the EU specification, is the Open category.
2	<a href="#">MAV_ODID_CATEGORY_EU_SPECIFIC</a>	The category for the UA, according to the EU specification, is the Specific category.
3	<a href="#">MAV_ODID_CATEGORY_EU_CERTIFIED</a>	The category for the UA, according to the EU specification, is the Certified category.

## MAV\_ODID\_CLASS\_EU

[Enum]

Value	Field Name	Description
0	<a href="#">MAV_ODID_CLASS_EU_UNDECLARED</a>	The class for the UA, according to the EU specification, is undeclared.
1	<a href="#">MAV_ODID_CLASS_EU_CLASS_0</a>	The class for the UA, according to the EU specification, is Class 0.
2	<a href="#">MAV_ODID_CLASS_EU_CLASS_1</a>	The class for the UA, according to the EU specification, is Class 1.
3	<a href="#">MAV_ODID_CLASS_EU_CLASS_2</a>	The class for the UA, according to the EU specification, is Class 2.
4	<a href="#">MAV_ODID_CLASS_EU_CLASS_3</a>	The class for the UA, according to the EU specification, is Class 3.
5	<a href="#">MAV_ODID_CLASS_EU_CLASS_4</a>	The class for the UA, according to the EU specification, is Class 4.
6	<a href="#">MAV_ODID_CLASS_EU_CLASS_5</a>	The class for the UA, according to the EU specification, is Class 5.
7	<a href="#">MAV_ODID_CLASS_EU_CLASS_6</a>	The class for the UA, according to the EU specification, is Class 6.

## MAV\_ODID\_OPERATOR\_ID\_TYPE

[Enum]

Value	Field Name	Description
0	<a href="#">MAV_ODID_OPERATOR_ID_TYPE_CAA</a>	CAA (Civil Aviation Authority) registered operator ID.

## TUNE\_FORMAT

[Enum] Tune formats (used for vehicle buzzer/tone generation).

Value	Field Name	Description
1	<a href="#">TUNE_FORMAT_QBASIC1_1</a>	Format is QBasic 1.1 Play: <a href="https://www.qbasic.net/en/reference/qb11/Statement/PLAY-006.htm">https://www.qbasic.net/en/reference/qb11/Statement/PLAY-006.htm</a> .
2	<a href="#">TUNE_FORMAT_MML_MODERN</a>	Format is Modern Music Markup Language (MML): <a href="https://en.wikipedia.org/wiki/Music\_\_Macro\_\_Language#Modern\_\_MML">https://en.wikipedia.org/wiki/Music\_\_Macro\_\_Language#Modern\_\_MML</a> .

## AIS\_TYPE

[Enum] Type of AIS vessel, enum duplicated from AIS standard, <https://gpsd.gitlab.io/gpsd/AIVDM.html>

Value	Field Name	Description
0	<a href="#">AIS_TYPE_UNKNOWN</a>	Not available (default).
1	<a href="#">AIS_TYPE_RESERVED_1</a>	
2	<a href="#">AIS_TYPE_RESERVED_2</a>	
3	<a href="#">AIS_TYPE_RESERVED_3</a>	
4	<a href="#">AIS_TYPE_RESERVED_4</a>	
5	<a href="#">AIS_TYPE_RESERVED_5</a>	
6	<a href="#">AIS_TYPE_RESERVED_6</a>	
7	<a href="#">AIS_TYPE_RESERVED_7</a>	
8	<a href="#">AIS_TYPE_RESERVED_8</a>	
9	<a href="#">AIS_TYPE_RESERVED_9</a>	
10	<a href="#">AIS_TYPE_RESERVED_10</a>	
11	<a href="#">AIS_TYPE_RESERVED_11</a>	
12	<a href="#">AIS_TYPE_RESERVED_12</a>	
13	<a href="#">AIS_TYPE_RESERVED_13</a>	
14	<a href="#">AIS_TYPE_RESERVED_14</a>	
15	<a href="#">AIS_TYPE_RESERVED_15</a>	
16	<a href="#">AIS_TYPE_RESERVED_16</a>	
17	<a href="#">AIS_TYPE_RESERVED_17</a>	
18	<a href="#">AIS_TYPE_RESERVED_18</a>	
19	<a href="#">AIS_TYPE_RESERVED_19</a>	
20	<a href="#">AIS_TYPE_WIG</a>	Wing In Ground effect.
21	<a href="#">AIS_TYPE_WIG_HAZARDOUS_A</a>	
22	<a href="#">AIS_TYPE_WIG_HAZARDOUS_B</a>	
23	<a href="#">AIS_TYPE_WIG_HAZARDOUS_C</a>	
24	<a href="#">AIS_TYPE_WIG_HAZARDOUS_D</a>	
25	<a href="#">AIS_TYPE_WIG_RESERVED_1</a>	
26	<a href="#">AIS_TYPE_WIG_RESERVED_2</a>	
27	<a href="#">AIS_TYPE_WIG_RESERVED_3</a>	
28	<a href="#">AIS_TYPE_WIG_RESERVED_4</a>	
29	<a href="#">AIS_TYPE_WIG_RESERVED_5</a>	
30	<a href="#">AIS_TYPE_FISHING</a>	Towing: length exceeds 200m or breadth exceeds 25m. Dredging or other underwater ops.
31	<a href="#">AIS_TYPE_TOWING</a>	
32	<a href="#">AIS_TYPE_TOWING_LARGE</a>	
33	<a href="#">AIS_TYPE_DREDGING</a>	
34	<a href="#">AIS_TYPE_DIVING</a>	
35	<a href="#">AIS_TYPE_MILITARY</a>	
36	<a href="#">AIS_TYPE_SAILING</a>	
37	<a href="#">AIS_TYPE_PLEASURE</a>	
38	<a href="#">AIS_TYPE_RESERVED_20</a>	
39	<a href="#">AIS_TYPE_RESERVED_21</a>	
40	<a href="#">AIS_TYPE_HSC</a>	High Speed Craft.
41	<a href="#">AIS_TYPE_HSC_HAZARDOUS_A</a>	
42	<a href="#">AIS_TYPE_HSC_HAZARDOUS_B</a>	
43	<a href="#">AIS_TYPE_HSC_HAZARDOUS_C</a>	
44	<a href="#">AIS_TYPE_HSC_HAZARDOUS_D</a>	
45	<a href="#">AIS_TYPE_HSC_RESERVED_1</a>	
46	<a href="#">AIS_TYPE_HSC_RESERVED_2</a>	
47	<a href="#">AIS_TYPE_HSC_RESERVED_3</a>	
48	<a href="#">AIS_TYPE_HSC_RESERVED_4</a>	
49	<a href="#">AIS_TYPE_HSC_UNKNOWN</a>	
50	<a href="#">AIS_TYPE_PILOT</a>	Search And Rescue vessel.
51	<a href="#">AIS_TYPE_SAR</a>	
52	<a href="#">AIS_TYPE_TUG</a>	
53	<a href="#">AIS_TYPE_PORT_TENDER</a>	Anti-pollution equipment.
54	<a href="#">AIS_TYPE_ANTI_POLLUTION</a>	
55	<a href="#">AIS_TYPE_LAW_ENFORCEMENT</a>	
56	<a href="#">AIS_TYPE_SPARE_LOCAL_1</a>	Noncombatant ship according to RR Resolution No. 18.
57	<a href="#">AIS_TYPE_SPARE_LOCAL_2</a>	
58	<a href="#">AIS_TYPE_MEDICAL_TRANSPORT</a>	
59	<a href="#">AIS_TYPE_NONECOMBATANT</a>	
60	<a href="#">AIS_TYPE_PASSENGER</a>	
61	<a href="#">AIS_TYPE_PASSENGER_HAZARDOUS_A</a>	
62	<a href="#">AIS_TYPE_PASSENGER_HAZARDOUS_B</a>	
63	<a href="#">AIS_TYPE_AIS_TYPE_PASSENGER_HAZARDOUS_C</a>	
64	<a href="#">AIS_TYPE_PASSENGER_HAZARDOUS_D</a>	
65	<a href="#">AIS_TYPE_PASSENGER_RESERVED_1</a>	
66	<a href="#">AIS_TYPE_PASSENGER_RESERVED_2</a>	
67	<a href="#">AIS_TYPE_PASSENGER_RESERVED_3</a>	
68	<a href="#">AIS_TYPE_AIS_TYPE_PASSENGER_RESERVED_4</a>	
69	<a href="#">AIS_TYPE_PASSENGER_UNKNOWN</a>	
70	<a href="#">AIS_TYPE_CARGO</a>	
71	<a href="#">AIS_TYPE_CARGO_HAZARDOUS_A</a>	
72	<a href="#">AIS_TYPE_CARGO_HAZARDOUS_B</a>	
73	<a href="#">AIS_TYPE_CARGO_HAZARDOUS_C</a>	



74 [AIS\\_TYPE\\_CARGO\\_HAZARDOUS\\_D](#)  
75 [AIS\\_TYPE\\_CARGO\\_RESERVED\\_1](#)  
76 [AIS\\_TYPE\\_CARGO\\_RESERVED\\_2](#)  
77 [AIS\\_TYPE\\_CARGO\\_RESERVED\\_3](#)  
78 [AIS\\_TYPE\\_CARGO\\_RESERVED\\_4](#)  
79 [AIS\\_TYPE\\_CARGO\\_UNKNOWN](#)  
80 [AIS\\_TYPE\\_TANKER](#)  
81 [AIS\\_TYPE\\_TANKER\\_HAZARDOUS\\_A](#)  
82 [AIS\\_TYPE\\_TANKER\\_HAZARDOUS\\_B](#)  
83 [AIS\\_TYPE\\_TANKER\\_HAZARDOUS\\_C](#)  
84 [AIS\\_TYPE\\_TANKER\\_HAZARDOUS\\_D](#)  
85 [AIS\\_TYPE\\_TANKER\\_RESERVED\\_1](#)  
86 [AIS\\_TYPE\\_TANKER\\_RESERVED\\_2](#)  
87 [AIS\\_TYPE\\_TANKER\\_RESERVED\\_3](#)  
88 [AIS\\_TYPE\\_TANKER\\_RESERVED\\_4](#)  
89 [AIS\\_TYPE\\_TANKER\\_UNKNOWN](#)  
90 [AIS\\_TYPE\\_OTHER](#)  
91 [AIS\\_TYPE\\_OTHER\\_HAZARDOUS\\_A](#)  
92 [AIS\\_TYPE\\_OTHER\\_HAZARDOUS\\_B](#)  
93 [AIS\\_TYPE\\_OTHER\\_HAZARDOUS\\_C](#)  
94 [AIS\\_TYPE\\_OTHER\\_HAZARDOUS\\_D](#)  
95 [AIS\\_TYPE\\_OTHER\\_RESERVED\\_1](#)  
96 [AIS\\_TYPE\\_OTHER\\_RESERVED\\_2](#)  
97 [AIS\\_TYPE\\_OTHER\\_RESERVED\\_3](#)  
98 [AIS\\_TYPE\\_OTHER\\_RESERVED\\_4](#)  
99 [AIS\\_TYPE\\_OTHER\\_UNKNOWN](#)

## AIS\_NAV\_STATUS

[Enum] Navigational status of AIS vessel, enum duplicated from AIS standard, <https://gpsd.gitlab.io/gpsd/AIVDM.html>

Value	Field Name	Description
0	<a href="#">UNDER_WAY</a>	Under way using engine.
1	<a href="#">AIS_NAV_ANCHORED</a>	
2	<a href="#">AIS_NAV_UN_COMMANDED</a>	
3	<a href="#">AIS_NAV_RESTRICTED_MANOEUVERABILITY</a>	
4	<a href="#">AIS_NAV_DRAUGHT_CONSTRAINED</a>	
5	<a href="#">AIS_NAV_MOORED</a>	
6	<a href="#">AIS_NAV_AGROUND</a>	
7	<a href="#">AIS_NAV_FISHING</a>	
8	<a href="#">AIS_NAV_SAILING</a>	
9	<a href="#">AIS_NAV_RESERVED_HSC</a>	
10	<a href="#">AIS_NAV_RESERVED_WIG</a>	
11	<a href="#">AIS_NAV_RESERVED_1</a>	
12	<a href="#">AIS_NAV_RESERVED_2</a>	
13	<a href="#">AIS_NAV_RESERVED_3</a>	
14	<a href="#">AIS_NAV_AIS_SART</a>	Search And Rescue Transponder.
15	<a href="#">AIS_NAV_UNKNOWN</a>	Not available (default).

## AIS\_FLAGS

[Enum] These flags are used in the [AIS\\_VESSEL](#).fields bitmask to indicate validity of data in the other message fields. When set, the data is valid.

Value	Field Name	Description
1	<a href="#">AIS_FLAGS_POSITION_ACCURACY</a>	1 = Position accuracy less than 10m, 0 = position accuracy greater than 10m.
2	<a href="#">AIS_FLAGS_VALID_COG</a>	
4	<a href="#">AIS_FLAGS_VALID_VELOCITY</a>	
8	<a href="#">AIS_FLAGS_HIGH_VELOCITY</a>	1 = Velocity over 52.5765m/s (102.2 knots)
16	<a href="#">AIS_FLAGS_VALID_TURN_RATE</a>	
32	<a href="#">AIS_FLAGS_TURN_RATE_SIGN_ONLY</a>	Only the sign of the returned turn rate value is valid, either greater than 5deg/30s or less than -5deg/30s
64	<a href="#">AIS_FLAGS_VALID_DIMENSIONS</a>	
128	<a href="#">AIS_FLAGS_LARGE_BOW_DIMENSION</a>	Distance to bow is larger than 511m
256	<a href="#">AIS_FLAGS_LARGE_STERN_DIMENSION</a>	Distance to stern is larger than 511m
512	<a href="#">AIS_FLAGS_LARGE_PORT_DIMENSION</a>	Distance to port side is larger than 63m
1024	<a href="#">AIS_FLAGS_LARGE_STARBOARD_DIMENSION</a>	Distance to starboard side is larger than 63m
2048	<a href="#">AIS_FLAGS_VALID_CALLSIGN</a>	
4096	<a href="#">AIS_FLAGS_VALID_NAME</a>	

## FAILURE\_UNIT

[Enum] List of possible units where failures can be injected.

Value	Field Name	Description
0	<a href="#">FAILURE_UNIT_SENSOR_GYRO</a>	
1	<a href="#">FAILURE_UNIT_SENSOR_ACCEL</a>	
2	<a href="#">FAILURE_UNIT_SENSOR_MAG</a>	
3	<a href="#">FAILURE_UNIT_SENSOR_BARO</a>	
4	<a href="#">FAILURE_UNIT_SENSOR_GPS</a>	
5	<a href="#">FAILURE_UNIT_SENSOR_OPTICAL_FLOW</a>	
6	<a href="#">FAILURE_UNIT_SENSOR_VIO</a>	

7	<a href="#">FAILURE_UNIT_SENSOR_DISTANCE_SENSOR</a>
8	<a href="#">FAILURE_UNIT_SENSOR_AIRSPEED</a>
100	<a href="#">FAILURE_UNIT_SYSTEM_BATTERY</a>
101	<a href="#">FAILURE_UNIT_SYSTEM_MOTOR</a>
102	<a href="#">FAILURE_UNIT_SYSTEM_SERVO</a>
103	<a href="#">FAILURE_UNIT_SYSTEM_AVOIDANCE</a>
104	<a href="#">FAILURE_UNIT_SYSTEM_RC_SIGNAL</a>
105	<a href="#">FAILURE_UNIT_SYSTEM_MAVLINK_SIGNAL</a>

## FAILURE\_TYPE

[Enum] List of possible failure type to inject.

Value	Field Name	Description
0	<a href="#">FAILURE_TYPE_OK</a>	No failure injected, used to reset a previous failure.
1	<a href="#">FAILURE_TYPE_OFF</a>	Sets unit off, so completely non-responsive.
2	<a href="#">FAILURE_TYPE_STUCK</a>	Unit is stuck e.g. keeps reporting the same value.
3	<a href="#">FAILURE_TYPE_GARBAGE</a>	Unit is reporting complete garbage.
4	<a href="#">FAILURE_TYPE_WRONG</a>	Unit is consistently wrong.
5	<a href="#">FAILURE_TYPE_SLOW</a>	Unit is slow, so e.g. reporting at slower than expected rate.
6	<a href="#">FAILURE_TYPE_DELAYED</a>	Data of unit is delayed in time.
7	<a href="#">FAILURE_TYPE_INTERMITTENT</a>	Unit is sometimes working, sometimes not.

## NAV\_VTOL\_LAND\_OPTIONS

[Enum]

Value	Field Name	Description
0	<a href="#">NAV_VTOL_LAND_OPTIONS_DEFAULT</a>	Default autopilot landing behaviour. Descend in fixed wing mode, transitioning to multicopter mode for vertical landing when close to the ground.
1	<a href="#">NAV_VTOL_LAND_OPTIONS_FW_DESCENT</a>	
The fixed wing descent pattern is at the discretion of the vehicle (e.g. transition altitude, loiter direction, radius, and speed, etc.).		
2	<a href="#">NAV_VTOL_LAND_OPTIONS_HOVER_DESCENT</a>	Land in multicopter mode on reaching the landing coordinates (the whole landing is by "hover descent").

## MAV\_WINCH\_STATUS\_FLAG

[Enum] Winch status flags used in WINCH\_STATUS

Value	Field Name	Description
1	<a href="#">MAV_WINCH_STATUS_HEALTHY</a>	Winch is healthy
2	<a href="#">MAV_WINCH_STATUS_FULLY_RETRACTED</a>	Winch line is fully retracted
4	<a href="#">MAV_WINCH_STATUS_MOVING</a>	Winch motor is moving
8	<a href="#">MAV_WINCH_STATUS_CLUTCH_ENGAGED</a>	Winch clutch is engaged allowing motor to move freely.
16	<a href="#">MAV_WINCH_STATUS_LOCKED</a>	Winch is locked by locking mechanism.
32	<a href="#">MAV_WINCH_STATUS_DROPPING</a>	Winch is gravity dropping payload.
64	<a href="#">MAV_WINCH_STATUS_ARRESTING</a>	Winch is arresting payload descent.
128	<a href="#">MAV_WINCH_STATUS_GROUND_SENSE</a>	Winch is using torque measurements to sense the ground.
256	<a href="#">MAV_WINCH_STATUS_RETRACTING</a>	Winch is returning to the fully retracted position.
512	<a href="#">MAV_WINCH_STATUS_REDELIVER</a>	Winch is redelivering the payload. This is a failover state if the line tension goes above a threshold during RETRACTING.
1024	<a href="#">MAV_WINCH_STATUS_ABANDON_LINE</a>	Winch is abandoning the line and possibly payload. Winch unspools the entire calculated line length. This is a failover state from REDELIVER if the number of attempts exceeds a threshold.

## MAG\_CAL\_STATUS

[Enum]

Value	Field Name	Description
0	<a href="#">MAG_CAL_NOT_STARTED</a>	
1	<a href="#">MAG_CAL_WAITING_TO_START</a>	
2	<a href="#">MAG_CAL_RUNNING_STEP_ONE</a>	
3	<a href="#">MAG_CAL_RUNNING_STEP_TWO</a>	
4	<a href="#">MAG_CAL_SUCCESS</a>	
5	<a href="#">MAG_CAL_FAILED</a>	
6	<a href="#">MAG_CAL_BAD_ORIENTATION</a>	
7	<a href="#">MAG_CAL_BAD_RADIUS</a>	

## MAV\_EVENT\_ERROR\_REASON

[Enum] Reason for an event error response.

Value	Field Name	Description
0	<a href="#">MAV_EVENT_ERROR_REASON_UNAVAILABLE</a>	The requested event is not available (anymore).

## MAV\_EVENT\_CURRENT\_SEQUENCE\_FLAGS

[Enum] Flags for [CURRENT\\_EVENT\\_SEQUENCE](#).

Value	Field Name	Description
1	<a href="#">MAV_EVENT_CURRENT_SEQUENCE_FLAGS_RESET</a>	A sequence reset has happened (e.g. vehicle reboot).

## HIL\_SENSOR\_UPDATED\_FLAGS

[Enum] Flags in the [HIL\\_SENSOR](#) message indicate which fields have updated since the last message

Value	Field Name	Description
0	<a href="#">HIL_SENSOR_UPDATED_NONE</a>	None of the fields in <a href="#">HIL_SENSOR</a> have been updated
1	<a href="#">HIL_SENSOR_UPDATED_XACC</a>	The value in the xacc field has been updated
2	<a href="#">HIL_SENSOR_UPDATED_YACC</a>	The value in the yacc field has been updated
4	<a href="#">HIL_SENSOR_UPDATED_ZACC</a>	The value in the zacc field has been updated
8	<a href="#">HIL_SENSOR_UPDATED_XGYRO</a>	The value in the xgyro field has been updated
16	<a href="#">HIL_SENSOR_UPDATED_YGYRO</a>	The value in the ygyro field has been updated
32	<a href="#">HIL_SENSOR_UPDATED_ZGYRO</a>	The value in the zgyro field has been updated
64	<a href="#">HIL_SENSOR_UPDATED_XMAG</a>	The value in the xmag field has been updated
128	<a href="#">HIL_SENSOR_UPDATED_YMAG</a>	The value in the ymag field has been updated
256	<a href="#">HIL_SENSOR_UPDATED_ZMAG</a>	The value in the zmag field has been updated
512	<a href="#">HIL_SENSOR_UPDATED_ABS_PRESSURE</a>	The value in the abs_pressure field has been updated
1024	<a href="#">HIL_SENSOR_UPDATED_DIFF_PRESSURE</a>	The value in the diff_pressure field has been updated
2048	<a href="#">HIL_SENSOR_UPDATED_PRESSURE_ALT</a>	The value in the pressure_alt field has been updated
4096	<a href="#">HIL_SENSOR_UPDATED_TEMPERATURE</a>	The value in the temperature field has been updated

## HIGHRES\_IMU\_UPDATED\_FLAGS

[Enum] Flags in the [HIGHRES\\_IMU](#) message indicate which fields have updated since the last message

Value	Field Name	Description
0	<a href="#">HIGHRES_IMU_UPDATED_NONE</a>	None of the fields in <a href="#">HIGHRES_IMU</a> have been updated
1	<a href="#">HIGHRES_IMU_UPDATED_XACC</a>	The value in the xacc field has been updated
2	<a href="#">HIGHRES_IMU_UPDATED_YACC</a>	The value in the yacc field has been updated
4	<a href="#">HIGHRES_IMU_UPDATED_ZACC</a>	The value in the zacc field has been updated since
8	<a href="#">HIGHRES_IMU_UPDATED_XGYRO</a>	The value in the xgyro field has been updated
16	<a href="#">HIGHRES_IMU_UPDATED_YGYRO</a>	The value in the ygyro field has been updated
32	<a href="#">HIGHRES_IMU_UPDATED_ZGYRO</a>	The value in the zgyro field has been updated
64	<a href="#">HIGHRES_IMU_UPDATED_XMAG</a>	The value in the xmag field has been updated
128	<a href="#">HIGHRES_IMU_UPDATED_YMAG</a>	The value in the ymag field has been updated
256	<a href="#">HIGHRES_IMU_UPDATED_ZMAG</a>	The value in the zmag field has been updated
512	<a href="#">HIGHRES_IMU_UPDATED_ABS_PRESSURE</a>	The value in the abs_pressure field has been updated
1024	<a href="#">HIGHRES_IMU_UPDATED_DIFF_PRESSURE</a>	The value in the diff_pressure field has been updated
2048	<a href="#">HIGHRES_IMU_UPDATED_PRESSURE_ALT</a>	The value in the pressure_alt field has been updated
4096	<a href="#">HIGHRES_IMU_UPDATED_TEMPERATURE</a>	The value in the temperature field has been updated
65535	<a href="#">HIGHRES_IMU_UPDATED_ALL</a>	All fields in <a href="#">HIGHRES_IMU</a> have been updated.

## CAN\_FILTER\_OP

[Enum]

Value	Field Name	Description
0	<a href="#">CAN_FILTER_REPLACE</a>	
1	<a href="#">CAN_FILTER_ADD</a>	
2	<a href="#">CAN_FILTER_REMOVE</a>	

## MAV\_FTP\_ERR

[Enum] MAV FTP error codes (<https://mavlink.io/en/services/ftp.html>)

Value	Field Name	Description
0	<a href="#">MAV_FTP_ERR_NONE</a>	None: No error
1	<a href="#">MAV_FTP_ERR_FAIL</a>	Fail: Unknown failure
2	<a href="#">MAV_FTP_ERR_FAILERRNO</a>	FailErrno: Command failed, Err number sent back in PayloadHeader.data[1].
This is a file-system error number understood by the server operating system.		
3	<a href="#">MAV_FTP_ERR_INVALIDDATASIZE</a>	InvalidDataSize: Payload size is invalid
4	<a href="#">MAV_FTP_ERR_INVALIDSESSION</a>	InvalidSession: Session is not currently open
5	<a href="#">MAV_FTP_ERR_NOSESSIONSAVAILABLE</a>	NoSessionsAvailable: All available sessions are already in use
6	<a href="#">MAV_FTP_ERR_EOF</a>	EOF: Offset past end of file for ListDirectory and ReadFile commands
7	<a href="#">MAV_FTP_ERR_UNKNOWNCOMMAND</a>	UnknownCommand: Unknown command / opcode
8	<a href="#">MAV_FTP_ERR_FILEEXISTS</a>	FileExists: File/directory already exists
9	<a href="#">MAV_FTP_ERR_FILEPROTECTED</a>	FileProtected: File/directory is write protected
10	<a href="#">MAV_FTP_ERR_FILENOTFOUND</a>	FileNotFound: File/directory not found

## MAV\_FTP\_OPCODE

[Enum] MAV FTP opcodes: <https://mavlink.io/en/services/ftp.html>

Value	Field Name	Description
0	<a href="#">MAV_FTP_OPCODE_NONE</a>	None. Ignored, always ACKed
1	<a href="#">MAV_FTP_OPCODE_TERMINATESESSION</a>	TerminateSession: Terminates open Read session
2	<a href="#">MAV_FTP_OPCODE_RESETESSION</a>	ResetSessions: Terminates all open read sessions
3	<a href="#">MAV_FTP_OPCODE_LISTDIRECTORY</a>	ListDirectory: List files and directories in path from offset
4	<a href="#">MAV_FTP_OPCODE_OPENFILERO</a>	OpenFileRO: Opens file at path for reading, returns session
5	<a href="#">MAV_FTP_OPCODE_READFILE</a>	ReadFile: Reads size bytes from offset in session
6	<a href="#">MAV_FTP_OPCODE_CREATEFILE</a>	CreateFile: Creates file at path for writing, returns session
7	<a href="#">MAV_FTP_OPCODE_WRITEFILE</a>	WriteFile: Writes size bytes to offset in session
8	<a href="#">MAV_FTP_OPCODE_REMOVEFILE</a>	RemoveFile: Remove file at path
9	<a href="#">MAV_FTP_OPCODE_CREATEDIRECTORY</a>	CreateDirectory: Creates directory at path
10	<a href="#">MAV_FTP_OPCODE_REMOVEDIRECTORY</a>	RemoveDirectory: Removes directory at path. The directory must be empty.
11	<a href="#">MAV_FTP_OPCODE_OPENFILEWO</a>	OpenFileWO: Opens file at path for writing, returns session
12	<a href="#">MAV_FTP_OPCODE_TRUNCATEFILE</a>	TruncateFile: Truncate file at path to offset length
13	<a href="#">MAV_FTP_OPCODE_RENAME</a>	Rename: Rename path1 to path2
14	<a href="#">MAV_FTP_OPCODE_CALCFILECRC</a>	CalcFileCRC32: Calculate CRC32 for file at path
15	<a href="#">MAV_FTP_OPCODE_BURSTREADFILE</a>	BurstReadFile: Burst download session file
128	<a href="#">MAV_FTP_OPCODE_ACK</a>	ACK: ACK response
129	<a href="#">MAV_FTP_OPCODE_NAK</a>	NAK: NAK response

## MAVLink Commands ([MAV\\_CMD](#))

MAVLink commands ([MAV\\_CMD](#)) and messages are different! These commands define the values of up to 7 parameters that are packaged INSIDE specific messages used in the Mission Protocol and Command Protocol. Use commands for actions in missions or if you need acknowledgment and/or retry logic from a request. Otherwise use messages.

Commands to be executed by the MAV. They can be executed on user request, or as part of a mission script. If the action is used in a mission, the parameter mapping to the waypoint/mission message is as follows: Param 1, Param 2, Param 3, Param 4, X: Param 5, Y:Param 6, Z:Param 7. This command list is similar what ARINC 424 is for commercial aircraft: A data format how to interpret waypoint/mission data. NaN and INT32\_MAX may be used in float/integer params (respectively) to indicate optional/default values (e.g. to use the component's current yaw or latitude rather than a specific value). See [https://mavlink.io/en/guide/xml\\_schema.html#MAV\\_CMD](https://mavlink.io/en/guide/xml_schema.html#MAV_CMD) for information about the structure of the [MAV\\_CMD](#) entries

### MAV\_CMD\_NAV\_WAYPOINT (16)

)

[Command] Navigate to waypoint.

Param (:Label)	Description	Values	Units
1: Hold	Hold time. (ignored by fixed wing, time to stay at waypoint for rotary wing)	*min:*0	s
2: Accept Radius	Acceptance radius (if the sphere with this radius is hit, the waypoint counts as reached)	*min:*0	m
3: Pass Radius	0 to pass through the WP, if > 0 radius to pass by WP. Positive value for clockwise orbit, negative value for counter-clockwise orbit. Allows trajectory control.		m
4: Yaw	Desired yaw angle at waypoint (rotary wing). NaN to use the current system yaw heading mode (e.g. yaw towards next waypoint, yaw to home, etc.).		deg
5: Latitude	Latitude		
6: Longitude	Longitude		
7: Altitude	Altitude		m

### MAV\_CMD\_NAV\_LOITER\_UNLIM (17)

)

[Command] Loiter around this waypoint an unlimited amount of time

Param (:Label)	Description	Units
1	Empty	
2	Empty	
3: Radius	Loiter radius around waypoint for forward-only moving vehicles (not multicopters). If positive loiter clockwise, else counter-clockwise	m
4: Yaw	Desired yaw angle. NaN to use the current system yaw heading mode (e.g. yaw towards next waypoint, yaw to home, etc.).	deg
5: Latitude	Latitude	
6: Longitude	Longitude	
7: Altitude	Altitude	m

### MAV\_CMD\_NAV\_LOITER\_TURNS (18)

)

[Command] Loiter around this waypoint for X turns

Param (:Label)	Description	Values	Units
1: Turns	Number of turns.	*min:*0	
2:		*min:*0	
Heading Required	Leave loiter circle only once heading towards the next waypoint (0 = False)	*max:*1	
3: Radius	Loiter radius around waypoint for forward-only moving vehicles (not multicopters). If positive loiter clockwise, else counter-clockwise	*increment:*1	m

Loiter circle exit location and/or path to next waypoint ("xtrack") for forward-only moving vehicles (not multicopters). 0 for the vehicle to converge towards the center xtrack when it leaves the loiter (the line between the centers of the current and next waypoint), 1 to converge to the direct line between the location that the vehicle exits the loiter radius and the next waypoint. Otherwise the angle (in degrees) between the tangent of the loiter circle and the center xtrack at which the vehicle must leave the loiter (and converge to the center xtrack). NaN to use the current system default xtrack behaviour.

4: Xtrack Location

5: Latitude Latitude

6: Longitude Longitude

7: Altitude Altitude m

#### MAV\_CMD\_NAV\_LOITER\_TIME (19)

)

[\[Command\]](#) Loiter at the specified latitude, longitude and altitude for a certain amount of time. Multicopter vehicles stop at the point (within a vehicle-specific acceptance radius). Forward-only moving vehicles (e.g. fixed-wing) circle the point with the specified radius/direction. If the Heading Required parameter (2) is non-zero forward moving aircraft will only leave the loiter circle once heading towards the next waypoint.

Param (:Label)	Description	Values	Units
1: Time	Loiter time (only starts once Lat, Lon and Alt is reached).	*min:*0	s
2: Heading Required	Leave loiter circle only once heading towards the next waypoint (0 = False)	*min:*0 *max:*1 *increment:*1	
3: Radius	Loiter radius around waypoint for forward-only moving vehicles (not multicopters). If positive loiter clockwise, else counter-clockwise.		m
4: Xtrack Location	Loiter circle exit location and/or path to next waypoint ("xtrack") for forward-only moving vehicles (not multicopters). 0 for the vehicle to converge towards the center xtrack when it leaves the loiter (the line between the centers of the current and next waypoint), 1 to converge to the direct line between the location that the vehicle exits the loiter radius and the next waypoint. Otherwise the angle (in degrees) between the tangent of the loiter circle and the center xtrack at which the vehicle must leave the loiter (and converge to the center xtrack). NaN to use the current system default xtrack behaviour.		
5: Latitude	Latitude		
6: Longitude	Longitude		
7: Altitude	Altitude		m

#### MAV\_CMD\_NAV\_RETURN\_TO\_LAUNCH (20)

)

[\[Command\]](#) Return to launch location

Param (:Label)	Description
1	Empty
2	Empty
3	Empty
4	Empty
5	Empty
6	Empty
7	Empty

#### MAV\_CMD\_NAV\_LAND (21)

)

[\[Command\]](#) Land at location.

Param (:Label)	Description	Values	Units
1: Abort Alt	Minimum target altitude if landing is aborted (0 = undefined/use system default).		m
2: Land Mode	Precision land mode.	<a href="#">PRECISION_LAND_MODE</a>	
3	Empty.		
4: Yaw Angle	Desired yaw angle. NaN to use the current system yaw heading mode (e.g. yaw towards next waypoint, yaw to home, etc.).		deg
5: Latitude	Latitude.		
6: Longitude	Longitude.		
7: Altitude	Landing altitude (ground level in current frame).		m

#### MAV\_CMD\_NAV\_TAKEOFF (22)

)

[\[Command\]](#) Takeoff from ground / hand. Vehicles that support multiple takeoff modes (e.g. VTOL quadplane) should take off using the currently configured mode.

Param (:Label)	Description	Units
1: Pitch	Minimum pitch (if airspeed sensor present), desired pitch without sensor	deg
2	Empty	
3	Empty	
	Yaw angle (if magnetometer present), ignored without magnetometer. NaN to use the current system yaw heading	

4: Yaw      mode (e.g. yaw towards next waypoint, yaw to home, etc.).      deg  
 5: Latitude      Latitude  
 6:      Longitude  
 7: Altitude      Altitude      m

### MAV\_CMD\_NAV\_LAND\_LOCAL (23)

)

[\[Command\]](#) Land at local position (local frame only)

Param (:Label)	Description	Values	Units
1: Target	Landing target number (if available)	*min:*0 *increment:*1	
2: Offset	Maximum accepted offset from desired landing position - computed magnitude from spherical coordinates: $d = \sqrt{x^2 + y^2 + z^2}$ , which gives the maximum accepted distance between the desired landing position and the position where the vehicle is about to land	*min:*0	m
3: Descend Rate	Landing descend rate		m/s
4: Yaw	Desired yaw angle		rad
5: Y Position	Y-axis position		m
6: X Position	X-axis position		m
7: Z Position	Z-axis / ground level position		m

### MAV\_CMD\_NAV\_TAKEOFF\_LOCAL (24)

)

[\[Command\]](#) Takeoff from local position (local frame only)

Param (:Label)	Description	Units
1: Pitch	Minimum pitch (if airspeed sensor present), desired pitch without sensor	rad
2	Empty	
3: Ascend Rate	Takeoff ascend rate	m/s
4: Yaw	Yaw angle (if magnetometer or another yaw estimation source present), ignored without one of these	rad
5: Y Position	Y-axis position	m
6: X Position	X-axis position	m
7: Z Position	Z-axis position	m

### MAV\_CMD\_NAV\_FOLLOW (25)

)

[\[Command\]](#) Vehicle following, i.e. this waypoint represents the position of a moving vehicle

Param (:Label)	Description	Values	Units
1: Following	Following logic to use (e.g. loitering or sinusoidal following) - depends on specific autopilot implementation	*increment:*1	
2: Ground Speed	Ground speed of vehicle to be followed		m/s
3: Radius	Radius around waypoint. If positive loiter clockwise, else counter-clockwise		m
4: Yaw	Desired yaw angle.		deg
5: Latitude	Latitude		
6: Longitude	Longitude		
7: Altitude	Altitude		m

### MAV\_CMD\_NAV\_CONTINUE\_AND\_CHANGE\_ALT (30)

)

[\[Command\]](#) Continue on the current course and climb/descend to specified altitude. When the altitude is reached continue to the next command (i.e., don't proceed to the next command until the desired altitude is reached).

Param (:Label)	Description	Values	Units
1: Action	Climb or Descend (0 = Neutral, command completes when within 5m of this command's altitude, 1 = Climbing, command completes when at or above this command's altitude, 2 = Descending, command completes when at or below this command's altitude.	*min:*0 *max:*2 *increment:*1	
2	Empty		
3	Empty		
4	Empty		
5	Empty		
6	Empty		
7: Altitude	Desired altitude		m

### MAV\_CMD\_NAV\_LOITER\_TO\_ALT (31)

)

[\[Command\]](#) Begin loiter at the specified Latitude and Longitude. If Lat=Lon=0, then loiter at the current position. Don't consider the navigation command complete (don't leave loiter) until the altitude has been reached. Additionally, if the Heading Required parameter is non-zero the aircraft will not leave the loiter until heading toward the next waypoint.

Param (:Label)	Description	Values	Units
1: Heading Required	Leave loiter circle only once heading towards the next waypoint (0 = False)	*min:*0 *max:*1 *increment:*1	
2: Radius	Loiter radius around waypoint for forward-only moving vehicles (not multicopters). If positive loiter clockwise, negative counter-clockwise, 0 means no change to standard loiter.		m
3	Empty		
4: Xtrack Location	Loiter circle exit location and/or path to next waypoint ("xtrack") for forward-only moving vehicles (not multicopters). 0 for the vehicle to converge towards the center xtrack when it leaves the loiter (the line between the centers of the current and next waypoint), 1 to converge to the direct line between the location that the vehicle exits the loiter radius and the next waypoint. Otherwise the angle (in degrees) between the tangent of the loiter circle and the center xtrack at which the vehicle must leave the loiter (and converge to the center xtrack). NaN to use the current system default xtrack behaviour.	*min:*0 *max:*1 *increment:*1	
5: Latitude	Latitude		
6: Longitude	Longitude		
7: Altitude	Altitude		m

### MAV\_CMD\_DO\_FOLLOW (32)

)

[\[Command\]](#) Begin following a target

Param (:Label)	Description	Values	Units
1: System ID	System ID (of the <a href="#">FOLLOW_TARGET</a> beacon). Send 0 to disable follow-me and return to the default position hold mode.	*min:*0 *max:*255 *increment:*1	
2	Reserved		
3	Reserved		
4: Altitude Mode	Altitude mode: 0: Keep current altitude, 1: keep altitude difference to target, 2: go to a fixed altitude above home.	*min:*0 *max:*2 *increment:*1	
5: Altitude	Altitude above home. (used if mode=2)		m
6	Reserved		
7: Time to Land	Time to land in which the MAV should go to the default position hold mode after a message RX timeout.	*min:*0	s

### MAV\_CMD\_DO\_FOLLOW\_REPOSITION (33)

)

[\[Command\]](#) Reposition the MAV after a follow target command has been sent

Param (:Label)	Description	Units
1: Camera Q1	Camera q1 (where 0 is on the ray from the camera to the tracking device)	
2: Camera Q2	Camera q2	
3: Camera Q3	Camera q3	
4: Camera Q4	Camera q4	
5: Altitude Offset	Altitude offset from target	m
6: X Offset	X offset from target	m
7: Y Offset	Y offset from target	m

### MAV\_CMD\_DO\_ORBIT (34)

)

**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[\[Command\]](#) Start orbiting on the circumference of a circle defined by the parameters. Setting values to NaN/INT32\_MAX (as appropriate) results in using defaults.

Param (:Label)	Description	Values	Units
1: Radius	Radius of the circle. Positive: orbit clockwise. Negative: orbit counter-clockwise. NaN: Use vehicle default radius, or current radius if already orbiting.		m
2: Velocity	Tangential Velocity. NaN: Use vehicle default velocity, or current velocity if already orbiting.		m/s
3: Yaw Behavior	Yaw behavior of the vehicle.	<a href="#">ORBIT_YAW_BEHAVIOUR</a>	
4: Orbits	Orbit around the centre point for this many radians (i.e. for a three-quarter orbit set 270*Pi/180). 0: Orbit forever. NaN: Use vehicle default, or current value if already orbiting.	*min:*0	rad
5: Latitude/X	Center point latitude (if no <a href="#">MAV_FRAME</a> specified) / X coordinate according to <a href="#">MAV_FRAME</a> . INT32_MAX (or NaN if sent in <a href="#">COMMAND_LONG</a> ): Use current vehicle position, or current center if already orbiting.		
6: Longitude/Y	Center point longitude (if no <a href="#">MAV_FRAME</a> specified) / Y coordinate according to <a href="#">MAV_FRAME</a> . INT32_MAX (or NaN if sent in <a href="#">COMMAND_LONG</a> ): Use current vehicle position, or current center if already orbiting.		
7: Altitude/Z	Center point altitude (MSL) (if no <a href="#">MAV_FRAME</a> specified) / Z coordinate according to <a href="#">MAV_FRAME</a> . NaN: Use current vehicle altitude.		



## MAV\_CMD\_NAV\_ROI (80)

)

**DEPRECATED:** Replaced by MAV\_CMD\_DO\_SET\_ROI \* (2018-01).

[\[Command\]](#) Sets the region of interest (ROI) for a sensor set or the vehicle itself. This can then be used by the vehicle's control system to control the vehicle attitude and the attitude of various sensors such as cameras.

Param (:Label)	Description	Values
1: ROI Mode	Region of interest mode.	<a href="#">MAV_ROI</a>
2: WP Index	Waypoint index/ target ID. (see <a href="#">MAV_ROI</a> enum)	*min:*0 *increment:*1
3: ROI Index	ROI index (allows a vehicle to manage multiple ROI's)	*min:*0 *increment:*1
4	Empty	
5: X	x the location of the fixed ROI (see <a href="#">MAV_FRAME</a> )	
6: Y	y	
7: Z	z	

## MAV\_CMD\_NAV\_PATHPLANNING (81)

)

[\[Command\]](#) Control autonomous path planning on the MAV.

Param (:Label)	Description	Values	Units
1: Local Ctrl	0: Disable local obstacle avoidance / local path planning (without resetting map), 1: Enable local path planning, 2: Enable and reset local path planning	*min:*0 *max:*2 *increment:*1	
2: Global Ctrl	0: Disable full path planning (without resetting map), 1: Enable, 2: Enable and reset map/occupancy grid, 3: Enable and reset planned route, but not occupancy grid	*min:*0 *max:*3 *increment:*1	
3	Empty		
4: Yaw	Yaw angle at goal		deg
5: Latitude/X	Latitude/X of goal		
6: Longitude/Y	Longitude/Y of goal		
7: Altitude/Z	Altitude/Z of goal		

## MAV\_CMD\_NAV\_SPLINE\_WAYPOINT (82)

)

[\[Command\]](#) Navigate to waypoint using a spline path.

Param (:Label)	Description	Values	Units
1: Hold	Hold time. (ignored by fixed wing, time to stay at waypoint for rotary wing)	*min:*0 s	
2	Empty		
3	Empty		
4	Empty		
5: Latitude/X	Latitude/X of goal		
6: Longitude/Y	Longitude/Y of goal		
7: Altitude/Z	Altitude/Z of goal		

## MAV\_CMD\_NAV\_VTOL\_TAKEOFF (84)

)

[\[Command\]](#) Takeoff from ground using VTOL mode, and transition to forward flight with specified heading. The command should be ignored by vehicles that dont support both VTOL and fixed-wing flight (multicopters, boats,etc.).

Param (:Label)	Description	Values	Units
1	Empty		
2: Transition Heading	Front transition heading.	<a href="#">VTOL_TRANSITION_HEADING</a>	
3	Empty		
4: Yaw Angle	Yaw angle. NaN to use the current system yaw heading mode (e.g. yaw towards next waypoint, yaw to home, etc.).		deg
5: Latitude	Latitude		
6: Longitude	Longitude		
7: Altitude	Altitude		m

## MAV\_CMD\_NAV\_VTOL\_LAND (85)

)

[\[Command\]](#) Land using VTOL mode

Param (:Label)	Description	Values	Units
1: Land Options	Landing behaviour.	<a href="#">NAV_VTOL_LAND_OPTIONS</a>	
2	Empty		
3: Approach Altitude	Approach altitude (with the same reference as the Altitude field). NaN if unspecified.		m
4: Yaw	Yaw angle. NaN to use the current system yaw heading mode (e.g. yaw towards next wavpoint, yaw to home, etc.).		deg

5: Latitude	Latitude	
6: Longitude	Longitude	
7: Ground Altitude	Altitude (ground level) relative to the current coordinate frame. NaN to use system default landing altitude (ignore value).	m

#### MAV\_CMD\_NAV\_GUIDED\_ENABLE (92)

)

[\[Command\]](#) hand control over to an external controller

Param (:Label)	Description	Values
1: Enable	On / Off (> 0.5f on) *min:*0 *max:*1 *increment:*1	
2	Empty	
3	Empty	
4	Empty	
5	Empty	
6	Empty	
7	Empty	

#### MAV\_CMD\_NAV\_DELAY (93)

)

[\[Command\]](#) Delay the next navigation command a number of seconds or until a specified time

Param (:Label)	Description	Values	Units
1: Delay	Delay (-1 to enable time-of-day fields)	<i>min:</i>	
-1			
*increment:*1	s		
2: Hour	hour (24h format, UTC, -1 to ignore)	<i>min:</i>	
-1			
*max:*23 *increment:*1			
3: Minute	minute (24h format, UTC, -1 to ignore)	<i>min:</i>	
-1			
*max:*59 *increment:*1			
4: Second	second (24h format, UTC, -1 to ignore)	<i>min:</i>	
-1			
*max:*59 *increment:*1			
5	Empty		
6	Empty		
7	Empty		

#### MAV\_CMD\_NAV\_PAYLOAD\_PLACE (94)

)

[\[Command\]](#) Descend and place payload. Vehicle moves to specified location, descends until it detects a hanging payload has reached the ground, and then releases the payload. If ground is not detected before the reaching the maximum descent value (param1), the command will complete without releasing the payload.

Param (:Label)	Description	Values	Units
1: Max Descent	Maximum distance to descend. *min:*0 m		
2	Empty		
3	Empty		
4	Empty		
5: Latitude	Latitude		
6: Longitude	Longitude		
7: Altitude	Altitude		m

#### MAV\_CMD\_NAV\_LAST (95)

)

[\[Command\]](#) NOP - This command is only used to mark the upper limit of the NAV/ACTION commands in the enumeration

Param (:Label)	Description
1	Empty
2	Empty
3	Empty
4	Empty
5	Empty
6	Empty
7	Empty

#### MAV\_CMD\_CONDITION\_DELAY (112)

)

[\[Command\]](#) Delay mission state machine.

Param (:Label)	Description	Values	Units
1: Delay	Delay	*min:*0 s	
2	Empty		
3	Empty		

4	Empty
5	Empty
6	Empty
7	Empty

#### MAV\_CMD\_CONDITION\_CHANGE\_ALT (113)

)

[\[Command\]](#) Ascend/descend to target altitude at specified rate. Delay mission state machine until desired altitude reached.

Param (:Label)	Description	Units
1: Rate	Descent / Ascend rate.	m/s
2	Empty	
3	Empty	
4	Empty	
5	Empty	
6	Empty	
7: Altitude	Target Altitude	m

#### MAV\_CMD\_CONDITION\_DISTANCE (114)

)

[\[Command\]](#) Delay mission state machine until within desired distance of next NAV point.

Param (:Label)	Description	Values	Units
1: Distance	Distance.	*min:*0 m	
2	Empty		
3	Empty		
4	Empty		
5	Empty		
6	Empty		
7	Empty		

#### MAV\_CMD\_CONDITION\_YAW (115)

)

[\[Command\]](#) Reach a certain target angle.

Param (:Label)	Description	Values	Units
1: Angle	target angle, 0 is north		deg
2: Angular Speed	angular speed		deg/s
3: Direction	direction: -1: counter clockwise, 1: clockwise	<i>min:</i>	
-1			
*max:*1	*increment:*2		
4: Relative	0: absolute angle, 1: relative offset	*min:*0 *max:*1	*increment:*1
5	Empty		
6	Empty		
7	Empty		

#### MAV\_CMD\_CONDITION\_LAST (159)

)

[\[Command\]](#) NOP - This command is only used to mark the upper limit of the CONDITION commands in the enumeration

Param (:Label)	Description
1	Empty
2	Empty
3	Empty
4	Empty
5	Empty
6	Empty
7	Empty

#### MAV\_CMD\_DO\_SET\_MODE (176)

)

[\[Command\]](#) Set system mode.

Param (:Label)	Description	Values
1: Mode	Mode	<a href="#">MAV_MODE</a>
2: Custom Mode	Custom mode - this is system specific, please refer to the individual autopilot specifications for details.	
3: Custom Submode	Custom sub mode - this is system specific, please refer to the individual autopilot specifications for details.	
4	Empty	
5	Empty	
6	Empty	
7	Empty	

#### MAV\_CMD\_DO\_JUMP (177)

)

[\[Command\]](#) Jump to the desired command in the mission list. Repeat this action only the specified number of times

Param (:Label)	Description	Values
1: Number	Sequence number	*min:*0 *increment:*1
2: Repeat	Repeat count	*min:*0 *increment:*1
3	Empty	
4	Empty	
5	Empty	
6	Empty	
7	Empty	

#### MAV\_CMD\_DO\_CHANGE\_SPEED (178)

)

[\[Command\]](#) Change speed and/or throttle set points.

Param (:Label)	Description	Values	Units
1: Speed Type	Speed type (0=Airspeed, 1=Ground Speed, 2=Climb Speed, 3=Descent Speed)	*min:*0 *max:*3 *increment:*1	
2: Speed	Speed (-1 indicates no change)	<i>min:</i>	
-1			
m/s			
3: Throttle	Throttle (-1 indicates no change)	<i>min:</i>	
-1			

| % || 4 | Reserved (set to 0) || | 5 | Reserved (set to 0) || | 6 | Reserved (set to 0) || | 7 | Reserved (set to 0) || |

#### MAV\_CMD\_DO\_SET\_HOME (179)

)

[\[Command\]](#) Sets the home position to either to the current position or a specified position. The home position is the default position that the system will return to and land on. The position is set automatically by the system during the takeoff (and may also be set using this command). Note: the current home position may be emitted in a [HOME\\_POSITION](#) message on request (using [MAV\\_CMD\\_REQUEST\\_MESSAGE](#) with param1=242).

Param (:Label)	Description	Values	Units
1: Use Current	Use current (1=use current location, 0=use specified location)	*min:*0 *max:*1 *increment:*1	
2	Empty		
3	Empty		
4: Yaw	Yaw angle. NaN to use default heading		deg
5: Latitude	Latitude		
6: Longitude	Longitude		
7: Altitude	Altitude		m

#### MAV\_CMD\_DO\_SET\_PARAMETER (180)

)

[\[Command\]](#) Set a system parameter. Caution! Use of this command requires knowledge of the numeric enumeration value of the parameter.

Param (:Label)	Description	Values
1: Number	Parameter number	*min:*0 *increment:*1
2: Value	Parameter value	
3	Empty	
4	Empty	
5	Empty	
6	Empty	
7	Empty	

#### MAV\_CMD\_DO\_SET\_RELAY (181)

)

[\[Command\]](#) Set a relay to a condition.

Param (:Label)	Description	Values
1: Instance	Relay instance number.	*min:*0 *increment:*1
2: Setting	Setting. (1=on, 0=off, others possible depending on system hardware)	*min:*0 *increment:*1
3	Empty	
4	Empty	
5	Empty	
6	Empty	
7	Empty	

#### MAV\_CMD\_DO\_REPEAT\_RELAY (182)

)

[\[Command\]](#) Cycle a relay on and off for a desired number of cycles with a desired period.

Param (:Label)	Description	Values	Units
1: Instance	Relay instance number.	*min:*0 *increment:*1	
2: Count	Cycle count.	*min:*1 *increment:*1	
3: Time	Cycle time.	*min:*0	s

4	Empty
5	Empty
6	Empty
7	Empty

### MAV\_CMD\_DO\_SET\_SERVO (183)

)

[\[Command\]](#) Set a servo to a desired PWM value.

Param (:Label)	Description	Values	Units
1: Instance	Servo instance number.	*min:*0 *increment:*1	
2: PWM	Pulse Width Modulation.	*min:*0 *increment:*1 us	
3	Empty		
4	Empty		
5	Empty		
6	Empty		
7	Empty		

### MAV\_CMD\_DO\_REPEAT\_SERVO (184)

)

[\[Command\]](#) Cycle a between its nominal setting and a desired PWM for a desired number of cycles with a desired period.

Param (:Label)	Description	Values	Units
1: Instance	Servo instance number.	*min:*0 *increment:*1	
2: PWM	Pulse Width Modulation.	*min:*0 *increment:*1 us	
3: Count	Cycle count.	*min:*1 *increment:*1	
4: Time	Cycle time.	*min:*0	s
5	Empty		
6	Empty		
7	Empty		

### MAV\_CMD\_DO\_FLIGHTTERMINATION (185)

)

[\[Command\]](#) Terminate flight immediately. Flight termination immediately and irreversably terminates the current flight, returning the vehicle to ground. The vehicle will ignore RC or other input until it has been power-cycled. Termination may trigger safety measures, including: disabling motors and deployment of parachute on multicopters, and setting flight surfaces to initiate a landing pattern on fixed-wing). On multicopters without a parachute it may trigger a crash landing. Support for this command can be tested using the protocol bit: [MAV\\_PROTOCOL\\_CAPABILITY\\_FLIGHT\\_TERMINATION](#). Support for this command can also be tested by sending the command with param1=0 (< 0.5); the ACK should be either [MAV\\_RESULT\\_FAILED](#) or [MAV\\_RESULT\\_UNSUPPORTED](#).

Param (:Label)	Description	Values
1: Terminate	Flight termination activated if > 0.5. Otherwise not activated and ACK with <a href="#">MAV_RESULT_FAILED</a> .	*min:*0 *max:*1 *increment:*1
2	Empty	
3	Empty	
4	Empty	
5	Empty	
6	Empty	
7	Empty	

### MAV\_CMD\_DO\_CHANGE\_ALTITUDE (186)

)

[\[Command\]](#) Change altitude set point.

Param (:Label)	Description	Values	Units
1: Altitude	Altitude.		m
2: Frame	Frame of new altitude. <a href="#">MAV_FRAME</a>		
3	Empty		
4	Empty		
5	Empty		
6	Empty		
7	Empty		

### MAV\_CMD\_DO\_SET\_ACTUATOR (187)

)

[\[Command\]](#) Sets actuators (e.g. servos) to a desired value. The actuator numbers are mapped to specific outputs (e.g. on any MAIN or AUX PWM or UAVCAN) using a flight-stack specific mechanism (i.e. a parameter).

Param (:Label)	Description	Values
1: Actuator 1	Actuator 1 value, scaled from [-1 to 1]. NaN to ignore.	<i>min:</i>
-1		
*max:*1		
2: Actuator 2	Actuator 2 value, scaled from [-1 to 1]. NaN to ignore.	<i>min:</i>
-1		
*max:*1		

3: Actuator 3	Actuator 3 value, scaled from [-1 to 1]. NaN to ignore.	<i>min:</i>
-1		
*max:*1		
4: Actuator 4	Actuator 4 value, scaled from [-1 to 1]. NaN to ignore.	<i>min:</i>
-1		
*max:*1		
5: Actuator 5	Actuator 5 value, scaled from [-1 to 1]. NaN to ignore.	<i>min:</i>
-1		
*max:*1		
6: Actuator 6	Actuator 6 value, scaled from [-1 to 1]. NaN to ignore.	<i>min:</i>
-1		
*max:*1		
7: Index	Index of actuator set (i.e if set to 1, Actuator 1 becomes Actuator 7) *min:*0 *increment:*1	

### MAV\_CMD\_DO\_LAND\_START (189)

)

[[Command](#)] Mission command to perform a landing. This is used as a marker in a mission to tell the autopilot where a sequence of mission items that represents a landing starts. It may also be sent via a [COMMAND\\_LONG](#) to trigger a landing, in which case the nearest (geographically) landing sequence in the mission will be used. The Latitude/Longitude is optional, and may be set to 0 if not needed. If specified then it will be used to help find the closest landing sequence.

#### Param (:Label) Description

1	Empty
2	Empty
3	Empty
4	Empty
5: Latitude	Latitude
6: Longitude	Longitude
7	Empty

### MAV\_CMD\_DO\_RALLY\_LAND (190)

)

[[Command](#)] Mission command to perform a landing from a rally point.

#### Param (:Label) Description Units

1: Altitude	Break altitude	m
2: Speed	Landing speed	m/s
3	Empty	
4	Empty	
5	Empty	
6	Empty	
7	Empty	

### MAV\_CMD\_DO\_GO\_AROUND (191)

)

[[Command](#)] Mission command to safely abort an autonomous landing.

#### Param (:Label) Description Units

1: Altitude	Altitude	m
2	Empty	
3	Empty	
4	Empty	
5	Empty	
6	Empty	
7	Empty	

### MAV\_CMD\_DO\_REPOSITION (192)

)

[[Command](#)] Reposition the vehicle to a specific WGS84 global position.

Param (:Label)	Description	Values	Units
1: Speed	Ground speed, less than 0 (-1) for default	<i>min:</i>	
-1			
m/s			
2: Bitmask	Bitmask of option flags.	<a href="#">MAV_DO_REPOSITION_FLAGS</a>	
3: Radius	Loiter radius for planes. Positive values only, direction is controlled by Yaw value. A value of zero or NaN is ignored.		m
4: Yaw	Yaw heading. NaN to use the current system yaw heading mode (e.g. yaw towards next waypoint, yaw to home, etc.). For planes indicates loiter direction (0: clockwise, 1: counter clockwise)		deg
5: Latitude	Latitude		
6: Longitude	Longitude		
7: Altitude	Altitude		m

Altitude

### MAV\_CMD\_DO\_PAUSE\_CONTINUE (193)

)

[\[Command\]](#) If in a GPS controlled position mode, hold the current position or continue.

Param (:Label)	Description	Values
1: Continue radius.	0: Pause current mission or reposition command, hold current position. 1: Continue mission. A VTOL capable vehicle should enter hover mode (multicopter and VTOL planes). A plane should loiter with the default loiter radius.	*min:*0 *max:*1 *increment:*1
2	Reserved	
3	Reserved	
4	Reserved	
5	Reserved	
6	Reserved	
7	Reserved	

### MAV\_CMD\_DO\_SET\_REVERSE (194)

)

[\[Command\]](#) Set moving direction to forward or reverse.

Param (:Label)	Description	Values
1: Reverse	Direction (0=Forward, 1=Reverse)	*min:*0 *max:*1 *increment:*1
2	Empty	
3	Empty	
4	Empty	
5	Empty	
6	Empty	
7	Empty	

### MAV\_CMD\_DO\_SET\_ROI\_LOCATION (195)

)

[\[Command\]](#) Sets the region of interest (ROI) to a location. This can then be used by the vehicle's control system to control the vehicle attitude and the attitude of various sensors such as cameras. This command can be sent to a gimbal manager but not to a gimbal device. A gimbal is not to react to this message.

Param (:Label)	Description	Units
1: Gimbal device ID	Component ID of gimbal device to address (or 1-6 for non-MAVLink gimbal), 0 for all gimbal device components. Send command multiple times for more than one gimbal (but not all gimbals).	
2	Empty	
3	Empty	
4	Empty	
5: Latitude	Latitude of ROI location	degE7
6: Longitude	Longitude of ROI location	degE7
7: Altitude	Altitude of ROI location	m

### MAV\_CMD\_DO\_SET\_ROI\_WPNEXT\_OFFSET (196)

)

[\[Command\]](#) Sets the region of interest (ROI) to be toward next waypoint, with optional pitch/roll/yaw offset. This can then be used by the vehicle's control system to control the vehicle attitude and the attitude of various sensors such as cameras. This command can be sent to a gimbal manager but not to a gimbal device. A gimbal device is not to react to this message.

Param (:Label)	Description
1: Gimbal device ID	Component ID of gimbal device to address (or 1-6 for non-MAVLink gimbal), 0 for all gimbal device components. Send command multiple times for more than one gimbal (but not all gimbals).
2	Empty
3	Empty
4	Empty
5: Pitch Offset	Pitch offset from next waypoint, positive pitching up
6: Roll Offset	Roll offset from next waypoint, positive rolling to the right
7: Yaw Offset	Yaw offset from next waypoint, positive yawing to the right

### MAV\_CMD\_DO\_SET\_ROI\_NONE (197)

)

[\[Command\]](#) Cancels any previous ROI command returning the vehicle/sensors to default flight characteristics. This can then be used by the vehicle's control system to control the vehicle attitude and the attitude of various sensors such as cameras. This command can be sent to a gimbal manager but not to a gimbal device. A gimbal device is not to react to this message. After this command the gimbal manager should go back to manual input if available, and otherwise assume a neutral position.

Param (:Label)	Description
-------------------	-------------



1: Gimbal device ID	Component ID of gimbal device to address (or 1-6 for non-MAVLink gimbal), 0 for all gimbal device components. Send command multiple times for more than one gimbal (but not all gimbals).
2	Empty
3	Empty
4	Empty
5	Empty
6	Empty
7	Empty

#### MAV\_CMD\_DO\_SET\_ROI\_SYSID (198)

)

[\[Command\]](#) Mount tracks system with specified system ID. Determination of target vehicle position may be done with [GLOBAL\\_POSITION\\_INT](#) or any other means. This command can be sent to a gimbal manager but not to a gimbal device. A gimbal device is not to react to this message.

Param (:Label)	Description	Values
1: System ID	System ID	*min:*1 *max:*255 *increment:*1
2: Gimbal device ID	Component ID of gimbal device to address (or 1-6 for non-MAVLink gimbal), 0 for all gimbal device components. Send command multiple times for more than one gimbal (but not all gimbals).	

#### MAV\_CMD\_DO\_CONTROL\_VIDEO (200)

)

[\[Command\]](#) Control onboard camera system.

Param (:Label)	Description	Values	Units
1: ID	Camera ID (-1 for all)	<i>min:</i>	
-1			
*increment:*1			
2: Transmission	Transmission: 0: disabled, 1: enabled compressed, 2: enabled raw	*min:*0 *max:*2 *increment:*1	
3: Interval	Transmission mode: 0: video stream, >0: single images every n seconds	*min:*0	s
4: Recording	Recording: 0: disabled, 1: enabled compressed, 2: enabled raw	*min:*0 *max:*2 *increment:*1	
5	Empty		
6	Empty		
7	Empty		

#### MAV\_CMD\_DO\_SET\_ROI (201)

)

**DEPRECATED:** Replaced by MAV\_CMD\_DO\_SET\_ROI\_\* (2018-01).

[\[Command\]](#) Sets the region of interest (ROI) for a sensor set or the vehicle itself. This can then be used by the vehicle's control system to control the vehicle attitude and the attitude of various sensors such as cameras.

Param (:Label)	Description	Values
1: ROI Mode	Region of interest mode.	<a href="#">MAV_ROI</a>
2: WP Index	Waypoint index/ target ID (depends on param 1).	*min:*0 *increment:*1
3: ROI Index	Region of interest index. (allows a vehicle to manage multiple ROI's)	*min:*0 *increment:*1
4	Empty	
5	MAV_ROI_WPNEXT: pitch offset from next waypoint, <a href="#">MAV_ROI_LOCATION</a> : latitude	
6	MAV_ROI_WPNEXT: roll offset from next waypoint, <a href="#">MAV_ROI_LOCATION</a> : longitude	
7	MAV_ROI_WPNEXT: yaw offset from next waypoint, <a href="#">MAV_ROI_LOCATION</a> : altitude	

#### MAV\_CMD\_DO\_DIGICAM\_CONFIGURE (202)

)

[\[Command\]](#) Configure digital camera. This is a fallback message for systems that have not yet implemented [PARAM\\_EXT\\_XXX](#) messages and camera definition files (see [https://mavlink.io/en/services/camera\\_def.html](https://mavlink.io/en/services/camera_def.html) ).

Param (:Label)	Description	Values	Units
1: Mode	Modes: P, TV, AV, M, Etc.	*min:*0 *increment:*1	
2: Shutter Speed	Shutter speed: Divisor number for one second.	*min:*0 *increment:*1	
3: Aperture	Aperture: F stop number.	*min:*0	
4: ISO	ISO number e.g. 80, 100, 200, Etc.	*min:*0 *increment:*1	
5: Exposure	Exposure type enumerator.		
6: Command Identity	Command Identity.		
7: Engine Cut-off	Main engine cut-off time before camera trigger. (0 means no cut-off)	*min:*0 *increment:*1 ds	

#### MAV\_CMD\_DO\_DIGICAM\_CONTROL (203)

)

[\[Command\]](#) Control digital camera. This is a fallback message for systems that have not yet implemented [PARAM\\_EXT\\_XXX](#) messages and camera definition files (see [https://mavlink.io/en/services/camera\\_def.html](https://mavlink.io/en/services/camera_def.html) ).

Param (:Label)	Description
1: Session Control	Session control e.g. show/hide lens
2: Zoom Absolute	Zoom's absolute position
3: Zoom Relative	Zooming step value to offset zoom from the current position

- 4: Focus                      Focus Locking, Unlocking or Re-locking
- 5: Shoot Command          Shooting Command
- 6: Command Identity        Command Identity
- 7: Shot ID                    Test shot identifier. If set to 1, image will only be captured, but not counted towards internal frame count.

#### MAV\_CMD\_DO\_MOUNT\_CONFIGURE (204)

)

**DEPRECATED:** Replaced by [MAV\\_CMD\\_DO\\_GIMBAL\\_MANAGER\\_CONFIGURE](#) (2020-01).

This message has been superseded by [MAV\\_CMD\\_DO\\_GIMBAL\\_MANAGER\\_CONFIGURE](#). The message can still be used to communicate with legacy gimbals implementing it.

[Command] Mission command to configure a camera or antenna mount

Param (:Label)	Description	Values
1: Mode	Mount operation mode	<a href="#">MAV_MOUNT_MODE</a>
2: Stabilize Roll	stabilize roll? (1 = yes, 0 = no)	*min:*0 *max:*1 *increment:*1
3: Stabilize Pitch	stabilize pitch? (1 = yes, 0 = no)	*min:*0 *max:*1 *increment:*1
4: Stabilize Yaw	stabilize yaw? (1 = yes, 0 = no)	*min:*0 *max:*1 *increment:*1
5: Roll Input Mode	roll input (0 = angle body frame, 1 = angular rate, 2 = angle absolute frame)	
6: Pitch Input Mode	pitch input (0 = angle body frame, 1 = angular rate, 2 = angle absolute frame)	
7: Yaw Input Mode	yaw input (0 = angle body frame, 1 = angular rate, 2 = angle absolute frame)	

#### MAV\_CMD\_DO\_MOUNT\_CONTROL (205)

)

**DEPRECATED:** Replaced by [MAV\\_CMD\\_DO\\_GIMBAL\\_MANAGER\\_PITCHYAW](#) (2020-01).

This message is ambiguous and inconsistent. It has been superseded by [MAV\\_CMD\\_DO\\_GIMBAL\\_MANAGER\\_PITCHYAW](#) and [MAV\\_CMD\\_DO\\_SET\\_ROI\\_\\*](#). The message can still be used to communicate with legacy gimbals implementing it.

[Command] Mission command to control a camera or antenna mount

Param (:Label)	Description	Values	Units
1: Pitch	pitch depending on mount mode (degrees or degrees/second depending on pitch input).		
2: Roll	roll depending on mount mode (degrees or degrees/second depending on roll input).		
3: Yaw	yaw depending on mount mode (degrees or degrees/second depending on yaw input).		
4: Altitude	altitude depending on mount mode.		m
5: Latitude	latitude, set if appropriate mount mode.		
6: Longitude	longitude, set if appropriate mount mode.		
7: Mode	Mount mode.	<a href="#">MAV_MOUNT_MODE</a>	

#### MAV\_CMD\_DO\_SET\_CAM\_TRIGG\_DIST (206)

)

[Command] Mission command to set camera trigger distance for this flight. The camera is triggered each time this distance is exceeded. This command can also be used to set the shutter integration time for the camera.

Param (:Label)	Description	Values	Units
1: Distance	Camera trigger distance. 0 to stop triggering.	*min:*0	m
2: Shutter	Camera shutter integration time. -1 or 0 to ignore	min:	
-1			
*increment:*1	ms		
3: Trigger	Trigger camera once immediately. (0 = no trigger, 1 = trigger)	*min:*0 *max:*1 *increment:*1	
4	Empty		
5	Empty		
6	Empty		
7	Empty		

#### MAV\_CMD\_DO\_FENCE\_ENABLE (207)

)

[Command] Mission command to enable the geofence

Param (:Label)	Description	Values
1: Enable	enable? (0=disable, 1=enable, 2=disable_floor_only)	*min:*0 *max:*2 *increment:*1
2	Empty	
3	Empty	
4	Empty	
5	Empty	
6	Empty	
7	Empty	

#### MAV\_CMD\_DO\_PARACHUTE (208)

)

[Command] Mission item/command to release a parachute or enable/disable auto release.

Param (:Label)	Description	Values
1: Action	Action	<a href="#">PARACHUTE_ACTION</a>
2	Empty	

3	Empty
4	Empty
5	Empty
6	Empty
7	Empty

#### MAV\_CMD\_DO\_MOTOR\_TEST (209)

)

[Command] Command to perform motor test.

Param (:Label)	Description	Values	Units
1: Instance	Motor instance number (from 1 to max number of motors on the vehicle).	*min:*1 *increment:*1	
2: Throttle Type	Throttle type (whether the Throttle Value in param3 is a percentage, PWM value, etc.)	<a href="#">MOTOR_TEST_THROTTLE_TYPE</a>	
3: Throttle	Throttle value.		
4: Timeout	Timeout between tests that are run in sequence.	*min:*0	s
5: Motor Count	Motor count. Number of motors to test in sequence: 0/1=one motor, 2= two motors, etc. The Timeout (param4) is used between tests.	*min:*0 *increment:*1	
6: Test Order	Motor test order.	<a href="#">MOTOR_TEST_ORDER</a>	
7	Empty		

#### MAV\_CMD\_DO\_INVERTED\_FLIGHT (210)

)

[Command] Change to/from inverted flight.

Param (:Label)	Description	Values
1: Inverted	Inverted flight. (0=normal, 1=inverted)	*min:*0 *max:*1 *increment:*1
2	Empty	
3	Empty	
4	Empty	
5	Empty	
6	Empty	
7	Empty	

#### MAV\_CMD\_DO\_GRIPPER (211)

)

[Command] Mission command to operate a gripper.

Param (:Label)	Description	Values
1: Instance	Gripper instance number.	*min:*1 *increment:*1
2: Action	Gripper action to perform.	<a href="#">GRIPPER_ACTIONS</a>
3	Empty	
4	Empty	
5	Empty	
6	Empty	
7	Empty	

#### MAV\_CMD\_DO\_AUTOTUNE\_ENABLE (212)

)

[Command] Enable/disable autotune.

Param (:Label)	Description	Values
1: Enable	Enable (1: enable, 0:disable).	*min:*0 *max:*1 *increment:*1
2: Axis	Specify which axis are autotuned. 0 indicates autopilot default settings.	<a href="#">AUTOTUNE_AXIS</a>
3	Empty.	
4	Empty.	
5	Empty.	
6	Empty.	
7	Empty.	

#### MAV\_CMD\_NAV\_SET\_YAW\_SPEED (213)

)

[Command] Sets a desired vehicle turn angle and speed change.

Param (:Label)	Description	Values	Units
1: Yaw	Yaw angle to adjust steering by.		deg
2: Speed	Speed.		m/s
3: Angle	Final angle. (0=absolute, 1=relative)	*min:*0 *max:*1 *increment:*1	
4	Empty		
5	Empty		
6	Empty		
7	Empty		

#### MAV\_CMD\_DO\_SET\_CAM\_TRIGG\_INTERVAL (214)

)

[\[Command\]](#) Mission command to set camera trigger interval for this flight. If triggering is enabled, the camera is triggered each time this interval expires. This command can also be used to set the shutter integration time for the camera.

Param (:Label)	Description	Values	Units
1: Trigger Cycle	Camera trigger cycle time. -1 or 0 to ignore.	<i>min:</i>	
-1			
*increment:*1	ms		
2: Shutter Integration	Camera shutter integration time. Should be less than trigger cycle time. -1 or 0 to ignore.	<i>min:</i>	
-1			
*increment:*1	ms		
3	Empty		
4	Empty		
5	Empty		
6	Empty		
7	Empty		

## MAV\_CMD\_DO\_MOUNT\_CONTROL\_QUAT (220)

)

**DEPRECATED:** Replaced by [MAV\\_CMD\\_DO\\_GIMBAL\\_MANAGER\\_PITCHYAW](#) (2020-01).

[\[Command\]](#) Mission command to control a camera or antenna mount, using a quaternion as reference.

Param (:Label)	Description
1: Q1	quaternion param q1, w (1 in null-rotation)
2: Q2	quaternion param q2, x (0 in null-rotation)
3: Q3	quaternion param q3, y (0 in null-rotation)
4: Q4	quaternion param q4, z (0 in null-rotation)
5	Empty
6	Empty
7	Empty

## MAV\_CMD\_DO\_GUIDED\_MASTER (221)

)

[\[Command\]](#) set id of master controller

Param (:Label)	Description	Values
1: System ID	System ID	*min:*0 *max:*255 *increment:*1
2: Component ID	Component ID	*min:*0 *max:*255 *increment:*1
3	Empty	
4	Empty	
5	Empty	
6	Empty	
7	Empty	

## MAV\_CMD\_DO\_GUIDED\_LIMITS (222)

)

[\[Command\]](#) Set limits for external control

Param (:Label)	Description	Values	Units
1: Timeout	Timeout - maximum time that external controller will be allowed to control vehicle. 0 means no timeout.	*min:*0	s
2: Min Altitude	Altitude (MSL) min - if vehicle moves below this alt, the command will be aborted and the mission will continue. 0 means no lower altitude limit.		m
3: Max Altitude	Altitude (MSL) max - if vehicle moves above this alt, the command will be aborted and the mission will continue. 0 means no upper altitude limit.		m
4: Horiz. Move Limit	Horizontal move limit - if vehicle moves more than this distance from its location at the moment the command was executed, the command will be aborted and the mission will continue. 0 means no horizontal move limit.	*min:*0	m
5	Empty		
6	Empty		
7	Empty		

## MAV\_CMD\_DO\_ENGINE\_CONTROL (223)

)

[\[Command\]](#) Control vehicle engine. This is interpreted by the vehicles engine controller to change the target engine state. It is intended for vehicles with internal combustion engines

Param (:Label)	Description	Values	Units
1: Start Engine	0: Stop engine, 1:Start Engine	*min:*0 *max:*1 *increment:*1	
2: Cold Start	0: Warm start, 1:Cold start. Controls use of choke where applicable	*min:*0 *max:*1 *increment:*1	
3: Height	Height delay. This is for commanding engine start only after the vehicle has gained the specified height. Used in VTOL vehicles during takeoff to start engine after the aircraft is off the ground. Zero for no	*min:*0	m

Delay	delay.
4	Empty
5	Empty
5	Empty
6	Empty
7	Empty

## MAV\_CMD\_DO\_SET\_MISSION\_CURRENT (224)

)

[\[Command\]](#) Set the mission item with sequence number seq as current item. This means that the MAV will continue to this mission item on the shortest path (not following the mission items in-between).

Param (:Label)	Description	Values
1: Number	Mission sequence value to set	*min:*0 *increment:*1
2	Empty	
3	Empty	
4	Empty	
5	Empty	
5	Empty	
6	Empty	
7	Empty	

## MAV\_CMD\_DO\_LAST (240)

)

[\[Command\]](#) NOP - This command is only used to mark the upper limit of the DO commands in the enumeration

Param (:Label)	Description
1	Empty
2	Empty
3	Empty
4	Empty
5	Empty
6	Empty
7	Empty

## MAV\_CMD\_PREFLIGHT\_CALIBRATION (241)

)

[\[Command\]](#) Trigger calibration. This command will be only accepted if in pre-flight mode. Except for Temperature Calibration, only one sensor should be set in a single message and all others should be zero.

Param (:Label)	Description	Values
1: Gyro Temperature	1: gyro calibration, 3: gyro temperature calibration	*min:*0 *max:*3 *increment:*1
2: Magnetometer	1: magnetometer calibration	*min:*0 *max:*1 *increment:*1
3: Ground Pressure	1: ground pressure calibration	*min:*0 *max:*1 *increment:*1
4: Remote Control	1: radio RC calibration, 2: RC trim calibration	*min:*0 *max:*1 *increment:*1
5: Accelerometer	1: accelerometer calibration, 2: board level calibration, 3: accelerometer temperature calibration, 4: simple accelerometer calibration	*min:*0 *max:*4 *increment:*1
6: Compmot or Airspeed	1: APM: compass/motor interference calibration (PX4: airspeed calibration, deprecated), 2: airspeed calibration	*min:*0 *max:*2 *increment:*1
7: ESC or Baro	1: ESC calibration, 3: barometer temperature calibration	*min:*0 *max:*3 *increment:*1

## MAV\_CMD\_PREFLIGHT\_SET\_SENSOR\_OFFSETS (242)

)

[\[Command\]](#) Set sensor offsets. This command will be only accepted if in pre-flight mode.

Param (:Label)	Description	Values
1: Sensor Type	Sensor to adjust the offsets for: 0: gyros, 1: accelerometer, 2: magnetometer, 3: barometer, 4: optical flow, 5: second magnetometer, 6: third magnetometer	*min:*0 *max:*6 *increment:*1
2: X Offset	X axis offset (or generic dimension 1), in the sensor's raw units	
3: Y Offset	Y axis offset (or generic dimension 2), in the sensor's raw units	
4: Z Offset	Z axis offset (or generic dimension 3), in the sensor's raw units	
5: 4th Dimension	Generic dimension 4, in the sensor's raw units	
6: 5th Dimension	Generic dimension 5, in the sensor's raw units	
7: 6th Dimension	Generic dimension 6, in the sensor's raw units	

## MAV\_CMD\_PREFLIGHT\_UAVCAN (243)

)

[\[Command\]](#) Trigger UAVCAN configuration (actuator ID assignment and direction mapping). Note that this maps to the legacy UAVCAN

v0 function [UAVCAN\\_ENUMERATE](#), which is intended to be executed just once during initial vehicle configuration (it is not a normal pre-flight command and has been poorly named).

Param (:Label)	Description
1: Actuator ID	1: Trigger actuator ID assignment and direction mapping. 0: Cancel command.
2	Reserved
3	Reserved
4	Reserved
5	Reserved
6	Reserved
7	Reserved

#### MAV\_CMD\_PREFLIGHT\_STORAGE (245)

)

[[Command](#)] Request storage of different parameter values and logs. This command will be only accepted if in pre-flight mode.

Param (:Label)	Description	Values	Units
1: Parameter Storage	Action to perform on the persistent parameter storage	<a href="#">PREFLIGHT_STORAGE_PARAMETER_ACTION</a>	
2: Mission Storage	Action to perform on the persistent mission storage	<a href="#">PREFLIGHT_STORAGE_MISSION_ACTION</a>	
3: Logging Rate	Onboard logging: 0: Ignore, 1: Start default rate logging, -1: Stop logging, > 1: logging rate (e.g. set to 1000 for 1000 Hz logging)	<i>min:</i>	
-1			
*increment:*1 Hz			
4	Reserved		
5	Empty		
6	Empty		
7	Empty		

#### MAV\_CMD\_PREFLIGHT\_REBOOT\_SHUTDOWN (246)

)

[[Command](#)] Request the reboot or shutdown of system components.

Param (:Label)	Description	Values
1: Autopilot	0: Do nothing for autopilot, 1: Reboot autopilot, 2: Shutdown autopilot, 3: Reboot autopilot and keep it in the bootloader until upgraded.	*min:*0 *max:*3 *increment:*1
2: Companion	0: Do nothing for onboard computer, 1: Reboot onboard computer, 2: Shutdown onboard computer, 3: Reboot onboard computer and keep it in the bootloader until upgraded.	*min:*0 *max:*3 *increment:*1
3: Component action	0: Do nothing for component, 1: Reboot component, 2: Shutdown component, 3: Reboot component and keep it in the bootloader until upgraded	*min:*0 *max:*3 *increment:*1
4: Component ID	MAVLink Component ID targeted in param3 (0 for all components).	*min:*0 *max:*255 *increment:*1
5	Reserved (set to 0)	
6	Reserved (set to 0)	
7	WIP: ID (e.g. camera ID -1 for all IDs)	

#### MAV\_CMD\_OVERRIDE\_GOTO (252)

)

[[Command](#)] Override current mission with command to pause mission, pause mission and move to position, continue/resume mission. When param 1 indicates that the mission is paused ([MAV\\_GOTO\\_DO\\_HOLD](#)), param 2 defines whether it holds in place or moves to another position.

Param (:Label)	Description	Values	Units
1: Continue	MAV_GOTO_DO_HOLD: pause mission and either hold or move to specified position (depending on param2), <a href="#">MAV_GOTO_DO_CONTINUE</a> : resume mission.	<a href="#">MAV_GOTO</a>	
2: Position	MAV_GOTO_HOLD_AT_CURRENT_POSITION: hold at current position, <a href="#">MAV_GOTO_HOLD_AT_SPECIFIED_POSITION</a> : hold at specified position.	<a href="#">MAV_GOTO</a>	
3: Frame	Coordinate frame of hold point.	<a href="#">MAV_FRAME</a>	
4: Yaw	Desired yaw angle.		deg
5: Latitude/X	Latitude/X position.		
6: Longitude/Y	Longitude/Y position.		
7: Altitude/Z	Altitude/Z position.		

#### MAV\_CMD\_OBLIQUE\_SURVEY (260)

)

[[Command](#)] Mission command to set a Camera Auto Mount Pivoting Oblique Survey (Replaces [CAM\\_TRIGG\\_DIST](#) for this purpose). The camera is triggered each time this distance is exceeded, then the mount moves to the next position. Params 4~6 set-up the angle limits and number of positions for oblique survey, where mount-enabled vehicles automatically roll the camera between shots to emulate an oblique camera setup (providing an increased HFOV). This command can also be used to set the shutter integration time for the camera.

**Param**

(:Label)	Description	Values	Units
1: Distance	Camera trigger distance. 0 to stop triggering.	*min:*0	m
2: Shutter	Camera shutter integration time. 0 to ignore	*min:*0 *increment:*1	ms
3: Min Interval	The minimum interval in which the camera is capable of taking subsequent pictures repeatedly. 0 to ignore.	*min:*0 *max:*10000 *increment:*1	ms
4: Positions	Total number of roll positions at which the camera will capture photos (images captures spread evenly across the limits defined by param5).	*min:*2 *increment:*1	
5: Roll Angle	Angle limits that the camera can be rolled to left and right of center.	*min:*0	deg
6: Pitch Angle	Fixed pitch angle that the camera will hold in oblique mode if the mount is actuated in the pitch axis.	<i>min:</i>	
-180			
*max:*180	deg		
7	Empty		

### MAV\_CMD\_MISSION\_START (300)

)

[[Command](#)] start running a mission

Param (:Label)	Description	Values
1: First Item	first_item: the first mission item to run	*min:*0 *increment:*1
2: Last Item	last_item: the last mission item to run (after this item is run, the mission ends)	*min:*0 *increment:*1

### MAV\_CMD\_ACTUATOR\_TEST (310)

)

[[Command](#)] Actuator testing command. This is similar to [MAV\\_CMD\\_DO\\_MOTOR\\_TEST](#) but operates on the level of output functions, i.e. it is possible to test Motor1 independent from which output it is configured on. Autopilots typically refuse this command while armed.

Param (:Label)	Description	Values	Units
1: Value	Output value: 1 means maximum positive output, 0 to center servos or minimum motor thrust (expected to spin), -1 for maximum negative (if not supported by the motors, i.e. motor is not reversible, smaller than 0 maps to NaN). And NaN maps to disarmed (stop the motors).	<i>min:</i>	
-1			
*max:*1			
2: Timeout	Timeout after which the test command expires and the output is restored to the previous value. A timeout has to be set for safety reasons. A timeout of 0 means to restore the previous value immediately.	*min:*0 *max:*3	s
3	Reserved (set to 0)		
4	Reserved (set to 0)		
5: Output Function	Actuator Output function	<a href="#">ACTUATOR_OUTPUT_FUNCTION</a>	
6	Reserved (set to 0)		
7	Reserved (set to 0)		

### MAV\_CMD\_CONFIGURE\_ACTUATOR (311)

)

[[Command](#)] Actuator configuration command.

Param (:Label)	Description	Values
1: Configuration	Actuator configuration action	<a href="#">ACTUATOR_CONFIGURATION</a>
2	Reserved (set to 0)	
3	Reserved (set to 0)	
4	Reserved (set to 0)	
5: Output Function	Actuator Output function	<a href="#">ACTUATOR_OUTPUT_FUNCTION</a>
6	Reserved (set to 0)	
7	Reserved (set to 0)	

### MAV\_CMD\_COMPONENT\_ARM\_DISARM (400)

)

[[Command](#)] Arms / Disarms a component

Param (:Label)	Description	Values
1: Arm	0: disarm, 1: arm	*min:*0 *max:*1 *increment:*1
2: Force	0: arm-disarm unless prevented by safety checks (i.e. when landed), 21196: force arming/disarming (e.g. allow arming to override preflight checks and disarming in flight)	*min:*0 *max:*21196 *increment:*21196

### MAV\_CMD\_RUN\_PREARM\_CHECKS (401)

)

[[Command](#)] Instructs a target system to run pre-arm checks. This allows preflight checks to be run on demand, which may be useful on systems that normally run them at low rate, or which do not trigger checks when the armable state might have changed. This command should return [MAV\\_RESULT\\_ACCEPTED](#) if it will run the checks. The results of the checks are usually then reported in [SYS\\_STATUS](#)



messages (this is system-specific). The command should return [MAV\\_RESULT\\_TEMPORARILY\\_REJECTED](#) if the system is already armed.

**Param (:Label) Description**

#### MAV\_CMD\_ILLUMINATOR\_ON\_OFF ([405](#))

)

**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[\[Command\]](#) Turns illuminators ON/OFF. An illuminator is a light source that is used for lighting up dark areas external to the system: e.g. a torch or searchlight (as opposed to a light source for illuminating the system itself, e.g. an indicator light).

Param (:Label)	Description	Values
1: Enable	0: Illuminators OFF, 1: Illuminators ON	*min:*0 *max:*1 *increment:*1

#### MAV\_CMD\_GET\_HOME\_POSITION ([410](#))

)

**DEPRECATED:** Replaced by [MAV\\_CMD\\_REQUEST\\_MESSAGE](#) (2022-04).

[\[Command\]](#) Request the home position from the vehicle. The vehicle will ACK the command and then emit the [HOME\\_POSITION](#) message.

**Param (:Label) Description**

1	Reserved
2	Reserved
3	Reserved
4	Reserved
5	Reserved
6	Reserved
7	Reserved

#### MAV\_CMD\_INJECT\_FAILURE ([420](#))

)

[\[Command\]](#) Inject artificial failure for testing purposes. Note that autopilots should implement an additional protection before accepting this command such as a specific param setting.

Param (:Label)	Description	Values
1: Failure unit	The unit which is affected by the failure.	<a href="#">FAILURE_UNIT</a>
2: Failure type	The type how the failure manifests itself.	<a href="#">FAILURE_TYPE</a>
3: Instance	Instance affected by failure (0 to signal all).	

#### MAV\_CMD\_START\_RX\_PAIR ([500](#))

)

[\[Command\]](#) Starts receiver pairing.

Param (:Label)	Description	Values
1: Spektrum	0: Spektrum.	
2: RC Type	RC type.	<a href="#">RC_TYPE</a>

#### MAV\_CMD\_GET\_MESSAGE\_INTERVAL ([510](#))

)

**DEPRECATED:** Replaced by [MAV\\_CMD\\_REQUEST\\_MESSAGE](#) (2022-04).

[\[Command\]](#) Request the interval between messages for a particular MAVLink message ID. The receiver should ACK the command and then emit its response in a [MESSAGE\\_INTERVAL](#) message.

Param (:Label)	Description	Values
1: Message ID	The MAVLink message ID	*min:*0 *max:*16777215 *increment:*1

#### MAV\_CMD\_SET\_MESSAGE\_INTERVAL ([511](#))

)

[\[Command\]](#) Set the interval between messages for a particular MAVLink message ID. This interface replaces [REQUEST\\_DATA\\_STREAM](#).

Param (:Label)	Description	Values	Units
1: Message ID	The MAVLink message ID	*min:*0 *max:*16777215 *increment:*1	
2: Interval	The interval between two messages. Set to -1 to disable and 0 to request default rate.	min:	
-1			
	*increment:*1 us		
7: Response Target	Target address of message stream (if message has target address fields). 0: Flight-stack default (recommended), 1: address of requestor, 2: broadcast.	*min:*0 *max:*2 *increment:*1	

#### MAV\_CMD\_REQUEST\_MESSAGE ([512](#))

)

[\[Command\]](#) Request the target system(s) emit a single instance of a specified message (i.e. a "one-shot" version of [MAV\\_CMD\\_SET\\_MESSAGE\\_INTERVAL](#)).

Param (:Label)	Description	Values
1: Message ID	The MAVLink message ID of the requested message.	*min:*0 *max:*16777215 *increment:*1
2: Req Param 1	Use for index ID, if required. Otherwise, the use of this parameter (if any) must be defined in the requested message. By default assumed not used (0).	
3: Req Param 2	The use of this parameter (if any), must be defined in the requested message. By default assumed not used (0).	
4: Req Param 3	The use of this parameter (if any), must be defined in the requested message. By default assumed not used (0).	
5: Req Param 4	The use of this parameter (if any), must be defined in the requested message. By default assumed not used (0).	
6: Req Param 5	The use of this parameter (if any), must be defined in the requested message. By default assumed not used (0).	
7: Response Target	Target address for requested message (if message has target address fields). 0: Flight-stack default, 1: address of requestor, 2: broadcast.	*min:*0 *max:*2 *increment:*1

#### MAV\_CMD\_REQUEST\_PROTOCOL\_VERSION ([519](#))

)

**DEPRECATED:** Replaced by [MAV\\_CMD\\_REQUEST\\_MESSAGE](#) (2019-08).

[\[Command\]](#) Request MAVLink protocol version compatibility. All receivers should ACK the command and then emit their capabilities in an [PROTOCOL\\_VERSION](#) message

Param (:Label)	Description	Values
1: Protocol	1: Request supported protocol versions by all nodes on the network	*min:*0 *max:*1 *increment:*1
2	Reserved (all remaining params)	

#### MAV\_CMD\_REQUEST\_AUTOPILOT\_CAPABILITIES ([520](#))

)

**DEPRECATED:** Replaced by [MAV\\_CMD\\_REQUEST\\_MESSAGE](#) (2019-08).

[\[Command\]](#) Request autopilot capabilities. The receiver should ACK the command and then emit its capabilities in an [AUTOPILOT\\_VERSION](#) message

Param (:Label)	Description	Values
1: Version	1: Request autopilot version	*min:*0 *max:*1 *increment:*1
2	Reserved (all remaining params)	

#### MAV\_CMD\_REQUEST\_CAMERA\_INFORMATION ([521](#))

)

**DEPRECATED:** Replaced by [MAV\\_CMD\\_REQUEST\\_MESSAGE](#) (2019-08).

[\[Command\]](#) Request camera information ([CAMERA\\_INFORMATION](#)).

Param (:Label)	Description	Values
1: Capabilities	0: No action 1: Request camera capabilities	*min:*0 *max:*1 *increment:*1
2	Reserved (all remaining params)	

#### MAV\_CMD\_REQUEST\_CAMERA\_SETTINGS ([522](#))

)

**DEPRECATED:** Replaced by [MAV\\_CMD\\_REQUEST\\_MESSAGE](#) (2019-08).

[\[Command\]](#) Request camera settings ([CAMERA\\_SETTINGS](#)).

Param (:Label)	Description	Values
1: Settings	0: No Action 1: Request camera settings	*min:*0 *max:*1 *increment:*1
2	Reserved (all remaining params)	

#### MAV\_CMD\_REQUEST\_STORAGE\_INFORMATION ([525](#))

)

**DEPRECATED:** Replaced by [MAV\\_CMD\\_REQUEST\\_MESSAGE](#) (2019-08).

[\[Command\]](#) Request storage information ([STORAGE\\_INFORMATION](#)). Use the command's target\_component to target a specific component's storage.

Param (:Label)	Description	Values
1: Storage ID	Storage ID (0 for all, 1 for first, 2 for second, etc.)	*min:*0 *increment:*1
2: Information	0: No Action 1: Request storage information	*min:*0 *max:*1 *increment:*1
3	Reserved (all remaining params)	

#### MAV\_CMD\_STORAGE\_FORMAT ([526](#))

)

[\[Command\]](#) Format a storage medium. Once format is complete, a [STORAGE\\_INFORMATION](#) message is sent. Use the command's target\_component to target a specific component's storage.

Param (:Label)	Description	Values
1: Storage ID	Storage ID (1 for first, 2 for second, etc.)	*min:*0 *increment:*1
2: Format	Format storage (and reset image log). 0: No action 1: Format storage	*min:*0 *max:*1 *increment:*1
3: Reset Image Log	Reset Image Log (without formatting storage medium). This will reset <a href="#">CAMERA_CAPTURE_STATUS</a> .image_count and <a href="#">CAMERA_IMAGE_CAPTURED</a> .image_index. 0: No action 1: Reset Image Log	*min:*0 *max:*1 *increment:*1
4	Reserved (all remaining params)	

#### MAV\_CMD\_REQUEST\_CAMERA\_CAPTURE\_STATUS (527)

)

**DEPRECATED:** Replaced by [MAV\\_CMD\\_REQUEST\\_MESSAGE](#) (2019-08).

[Command] Request camera capture status ([CAMERA\\_CAPTURE\\_STATUS](#))

Param (:Label)	Description	Values
1: Capture Status 0: No Action 1: Request camera capture status		*min:*0 *max:*1 *increment:*1
2	Reserved (all remaining params)	

#### MAV\_CMD\_REQUEST\_FLIGHT\_INFORMATION (528)

)

**DEPRECATED:** Replaced by [MAV\\_CMD\\_REQUEST\\_MESSAGE](#) (2019-08).

[Command] Request flight information ([FLIGHT\\_INFORMATION](#))

Param (:Label)	Description	Values
1: Flight Information 1: Request flight information		*min:*0 *max:*1 *increment:*1
2	Reserved (all remaining params)	

#### MAV\_CMD\_RESET\_CAMERA\_SETTINGS (529)

)

[Command] Reset all camera settings to Factory Default

Param (:Label)	Description	Values
1: Reset	0: No Action 1: Reset all settings	*min:*0 *max:*1 *increment:*1
2	Reserved (all remaining params)	

#### MAV\_CMD\_SET\_CAMERA\_MODE (530)

)

[Command] Set camera running mode. Use NaN for reserved values. GCS will send a [MAV\\_CMD\\_REQUEST\\_VIDEO\\_STREAM\\_STATUS](#) command after a mode change if the camera supports video streaming.

Param (:Label)	Description	Values
1	Reserved (Set to 0)	
2: Camera Mode	Camera mode	<a href="#">CAMERA_MODE</a>
3	Reserved (set to NaN)	
4	Reserved (set to NaN)	
7	Reserved (set to NaN)	

#### MAV\_CMD\_SET\_CAMERA\_ZOOM (531)

)

[Command] Set camera zoom. Camera must respond with a [CAMERA\\_SETTINGS](#) message (on success).

Param (:Label)	Description	Values
1: Zoom Type	Zoom type	<a href="#">CAMERA_ZOOM_TYPE</a>
2: Zoom Value	Zoom value. The range of valid values depend on the zoom type.	
3	Reserved (set to NaN)	
4	Reserved (set to NaN)	
7	Reserved (set to NaN)	

#### MAV\_CMD\_SET\_CAMERA\_FOCUS (532)

)

[Command] Set camera focus. Camera must respond with a [CAMERA\\_SETTINGS](#) message (on success).

Param (:Label)	Description	Values
1: Focus Type	Focus type	<a href="#">SET_FOCUS_TYPE</a>
2: Focus Value	Focus value	
3	Reserved (set to NaN)	
4	Reserved (set to NaN)	
7	Reserved (set to NaN)	

#### MAV\_CMD\_SET\_STORAGE\_USAGE (533)

)

[\[Command\]](#) Set that a particular storage is the preferred location for saving photos, videos, and/or other media (e.g. to set that an SD card is used for storing videos). There can only be one preferred save location for each particular media type: setting a media usage flag will clear/reset that same flag if set on any other storage. If no flag is set the system should use its default storage. A target system can choose to always use default storage, in which case it should ACK the command with [MAV\\_RESULT\\_UNSUPPORTED](#). A target system can choose to not allow a particular storage to be set as preferred storage, in which case it should ACK the command with [MAV\\_RESULT\\_DENIED](#).

Param (:Label)	Description	Values
1: Storage ID	Storage ID (1 for first, 2 for second, etc.)	*min:*0 *increment:*1
2: Usage	Usage flags	<a href="#">STORAGE_USAGE_FLAG</a>

## MAV\_CMD\_JUMP\_TAG (600)

)

[\[Command\]](#) Tagged jump target. Can be jumped to with [MAV\\_CMD\\_DO\\_JUMP\\_TAG](#).

Param (:Label)	Description	Values
1: Tag	Tag.	*min:*0 *increment:*1

## MAV\_CMD\_DO\_JUMP\_TAG (601)

)

[\[Command\]](#) Jump to the matching tag in the mission list. Repeat this action for the specified number of times. A mission should contain a single matching tag for each jump. If this is not the case then a jump to a missing tag should complete the mission, and a jump where there are multiple matching tags should always select the one with the lowest mission sequence number.

Param (:Label)	Description	Values
1: Tag	Target tag to jump to.	*min:*0 *increment:*1
2: Repeat	Repeat count.	*min:*0 *increment:*1

## MAV\_CMD\_DO\_GIMBAL\_MANAGER\_PITCHYAW (1000)

)

**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[\[Command\]](#) High level setpoint to be sent to a gimbal manager to set a gimbal attitude. It is possible to set combinations of the values below. E.g. an angle as well as a desired angular rate can be used to get to this angle at a certain angular rate, or an angular rate only will result in continuous turning. NaN is to be used to signal unset. Note: a gimbal is never to react to this command but only the gimbal manager.

Param (:Label)	Description	Values	Units
1: Pitch angle	Pitch angle (positive to pitch up, relative to vehicle for FOLLOW mode, relative to world horizon for LOCK mode).	<i>min</i>	
-180			
*max:*180	deg		
2: Yaw angle	Yaw angle (positive to yaw to the right, relative to vehicle for FOLLOW mode, absolute to North for LOCK mode).	<i>min</i>	
-180			
*max:*180	deg		
3: Pitch rate	Pitch rate (positive to pitch up).		deg/s
4: Yaw rate	Yaw rate (positive to yaw to the right).		deg/s
5: Gimbal manager flags	Gimbal manager flags to use.	<a href="#">GIMBAL_MANAGER_FLAGS</a>	
7: Gimbal device ID	Component ID of gimbal device to address (or 1-6 for non-MAVLink gimbal), 0 for all gimbal device components. Send command multiple times for more than one gimbal (but not all gimbals).		

## MAV\_CMD\_DO\_GIMBAL\_MANAGER\_CONFIGURE (1001)

)

**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[\[Command\]](#) Gimbal configuration to set which sysid/compid is in primary and secondary control.

Param (:Label)	Description
1: sysid primary control	Sysid for primary control (0: no one in control, -1: leave unchanged, -2: set itself in control (for missions where the own sysid is still unknown), -3: remove control if currently in control).
2: compid primary control	Compid for primary control (0: no one in control, -1: leave unchanged, -2: set itself in control (for missions where the own sysid is still unknown), -3: remove control if currently in control).
3: sysid secondary control	Sysid for secondary control (0: no one in control, -1: leave unchanged, -2: set itself in control (for missions where the own sysid is still unknown), -3: remove control if currently in control).
4: compid secondary control	Compid for secondary control (0: no one in control, -1: leave unchanged, -2: set itself in control (for missions where the own sysid is still unknown), -3: remove control if currently in control).
7: Gimbal device ID	Component ID of gimbal device to address (or 1-6 for non-MAVLink gimbal), 0 for all gimbal device components. Send command multiple times for more than one gimbal (but not all gimbals).

## MAV\_CMD\_IMAGE\_START\_CAPTURE (2000)

)

[\[Command\]](#) Start image capture sequence. Sends [CAMERA\\_IMAGE\\_CAPTURED](#) after each capture. Use NaN for reserved values.

Param (:Label)	Description	Values	Units
1	Reserved (Set to 0)		
2: Interval	Desired elapsed time between two consecutive pictures (in seconds). Minimum values depend on hardware (typically greater than 2 seconds).	*min:*0	s
3: Total Images	Total number of images to capture. 0 to capture forever/until <a href="#">MAV_CMD_IMAGE_STOP_CAPTURE</a> .	*min:*0 *increment:*1	
4: Sequence Number	Capture sequence number starting from 1. This is only valid for single-capture (param3 == 1), otherwise set to 0. Increment the capture ID for each capture command to prevent double captures when a command is re-transmitted.	*min:*1 *increment:*1	
5	Reserved (set to NaN)		
6	Reserved (set to NaN)		
7	Reserved (set to NaN)		

## MAV\_CMD\_IMAGE\_STOP\_CAPTURE (2001)

)

[\[Command\]](#) Stop image capture sequence Use NaN for reserved values.

Param (:Label)	Description
1	Reserved (Set to 0)
2	Reserved (set to NaN)
3	Reserved (set to NaN)
4	Reserved (set to NaN)
7	Reserved (set to NaN)

## MAV\_CMD\_REQUEST\_CAMERA\_IMAGE\_CAPTURE (2002)

)

**DEPRECATED:** Replaced by [MAV\\_CMD\\_REQUEST\\_MESSAGE](#) (2019-08).

[\[Command\]](#) Re-request a [CAMERA\\_IMAGE\\_CAPTURED](#) message.

Param (:Label)	Description	Values
1: Number	Sequence number for missing <a href="#">CAMERA_IMAGE_CAPTURED</a> message	*min:*0 *increment:*1
2	Reserved (set to NaN)	
3	Reserved (set to NaN)	
4	Reserved (set to NaN)	
7	Reserved (set to NaN)	

## MAV\_CMD\_DO\_TRIGGER\_CONTROL (2003)

)

[\[Command\]](#) Enable or disable on-board camera triggering system.

Param (:Label)	Description	Values
1: Enable	Trigger enable/disable (0 for disable, 1 for start), -1 to ignore	<i>min:</i>
-1		
*max:*1 *increment:*1		
2: Reset	1 to reset the trigger sequence, -1 or 0 to ignore	<i>min:</i>
-1		
*max:*1 *increment:*1		
3: Pause	1 to pause triggering, but without switching the camera off or retracting it. -1 to ignore	<i>min:</i>
-1		
*max:*1 *increment:*2		

## MAV\_CMD\_CAMERA\_TRACK\_POINT (2004)

)

**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[\[Command\]](#) If the camera supports point visual tracking ([CAMERA\\_CAP\\_FLAGS\\_HAS\\_TRACKING\\_POINT](#) is set), this command allows to initiate the tracking.

Param (:Label)	Description	Values
1: Point x	Point to track x value (normalized 0..1, 0 is left, 1 is right).	*min:*0 *max:*1
2: Point y	Point to track y value (normalized 0..1, 0 is top, 1 is bottom).	*min:*0 *max:*1
3: Radius	Point radius (normalized 0..1, 0 is image left, 1 is image right).	*min:*0 *max:*1

## MAV\_CMD\_CAMERA\_TRACK\_RECTANGLE (2005)

)

**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[\[Command\]](#) If the camera supports rectangle visual tracking ([CAMERA\\_CAP\\_FLAGS\\_HAS\\_TRACKING\\_RECTANGLE](#) is set), this command allows to initiate the tracking.

Param (:Label)	Description	Values
1: Top left corner x	Top left corner of rectangle x value (normalized 0..1, 0 is left, 1 is right).	*min:*0 *max:*1
2: Top left corner y	Top left corner of rectangle y value (normalized 0..1, 0 is top, 1 is bottom).	*min:*0 *max:*1
3: Bottom right corner x	Bottom right corner of rectangle x value (normalized 0..1, 0 is left, 1 is right).	*min:*0 *max:*1
4: Bottom right corner y	Bottom right corner of rectangle y value (normalized 0..1, 0 is top, 1 is bottom).	*min:*0 *max:*1

## MAV\_CMD\_CAMERA\_STOP\_TRACKING (2010)

)

**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[\[Command\]](#) Stops ongoing tracking.

**Param (:Label) Description**

## MAV\_CMD\_VIDEO\_START\_CAPTURE (2500)

)

[\[Command\]](#) Starts video capture (recording).

Param (:Label)	Description	Values	Units
1: Stream ID	Video Stream ID (0 for all streams)	*min:*0 *increment:*1	
2: Status Frequency	Frequency <a href="#">CAMERA_CAPTURE_STATUS</a> messages should be sent while recording (0 for no messages, otherwise frequency)	*min:*0	Hz
3	Reserved (set to NaN)		
4	Reserved (set to NaN)		
5	Reserved (set to NaN)		
6	Reserved (set to NaN)		
7	Reserved (set to NaN)		

## MAV\_CMD\_VIDEO\_STOP\_CAPTURE (2501)

)

[\[Command\]](#) Stop the current video capture (recording).

Param (:Label)	Description	Values
1: Stream ID	Video Stream ID (0 for all streams)	*min:*0 *increment:*1
2	Reserved (set to NaN)	
3	Reserved (set to NaN)	
4	Reserved (set to NaN)	
5	Reserved (set to NaN)	
6	Reserved (set to NaN)	
7	Reserved (set to NaN)	

## MAV\_CMD\_VIDEO\_START\_STREAMING (2502)

)

[\[Command\]](#) Start video streaming

Param (:Label)	Description	Values
1: Stream ID	Video Stream ID (0 for all streams, 1 for first, 2 for second, etc.)	*min:*0 *increment:*1

## MAV\_CMD\_VIDEO\_STOP\_STREAMING (2503)

)

[\[Command\]](#) Stop the given video stream

Param (:Label)	Description	Values
1: Stream ID	Video Stream ID (0 for all streams, 1 for first, 2 for second, etc.)	*min:*0 *increment:*1

## MAV\_CMD\_REQUEST\_VIDEO\_STREAM\_INFORMATION (2504)

)

**DEPRECATED:** Replaced by [MAV\\_CMD\\_REQUEST\\_MESSAGE](#) (2019-08).

[\[Command\]](#) Request video stream information ([VIDEO\\_STREAM\\_INFORMATION](#))

Param (:Label)	Description	Values
1: Stream ID	Video Stream ID (0 for all streams, 1 for first, 2 for second, etc.)	*min:*0 *increment:*1

## MAV\_CMD\_REQUEST\_VIDEO\_STREAM\_STATUS (2505)

)

**DEPRECATED:** Replaced by [MAV\\_CMD\\_REQUEST\\_MESSAGE](#) (2019-08).

[\[Command\]](#) Request video stream status ([VIDEO\\_STREAM\\_STATUS](#))

Param (:Label)	Description	Values
1: Stream ID	Video Stream ID (0 for all streams, 1 for first, 2 for second, etc.)	*min:*0 *increment:*1

## MAV\_CMD\_LOGGING\_START (2510)

)

[\[Command\]](#) Request to start streaming logging data over MAVLink (see also [LOGGING\\_DATA](#) message)

Param (:Label)	Description	Values
----------------	-------------	--------

1: Format	Format: 0: ULog *min:*0 *increment:*1
2	Reserved (set to 0)
3	Reserved (set to 0)
4	Reserved (set to 0)
5	Reserved (set to 0)
6	Reserved (set to 0)
7	Reserved (set to 0)

### MAV\_CMD\_LOGGING\_STOP (2511)

)

[Command] Request to stop streaming log data over MAVLink

Param (:Label)	Description
1	Reserved (set to 0)
2	Reserved (set to 0)
3	Reserved (set to 0)
4	Reserved (set to 0)
5	Reserved (set to 0)
6	Reserved (set to 0)
7	Reserved (set to 0)

### MAV\_CMD\_AIRFRAME\_CONFIGURATION (2520)

)

[Command]

Param (:Label)	Description	Values
1: Landing Gear ID	Landing gear ID (default: 0, -1 for all)	min:
-1		
*increment:*1		
2: Landing Gear Position	Landing gear position (Down: 0, Up: 1, NaN for no change)	
3	Reserved (set to NaN)	
4	Reserved (set to NaN)	
5	Reserved (set to NaN)	
6	Reserved (set to NaN)	
7	Reserved (set to NaN)	

### MAV\_CMD\_CONTROL\_HIGH\_LATENCY (2600)

)

[Command] Request to start/stop transmitting over the high latency telemetry

Param (:Label)	Description	Values
1: Enable	Control transmission over high latency telemetry (0: stop, 1: start) *min:*0 *max:*1 *increment:*1	
2	Empty	
3	Empty	
4	Empty	
5	Empty	
6	Empty	
7	Empty	

### MAV\_CMD\_PANORAMA\_CREATE (2800)

)

[Command] Create a panorama at the current position

Param (:Label)	Description	Units
1: Horizontal Angle	Viewing angle horizontal of the panorama (+- 0.5 the total angle)	deg
2: Vertical Angle	Viewing angle vertical of panorama.	deg
3: Horizontal Speed	Speed of the horizontal rotation.	deg/s
4: Vertical Speed	Speed of the vertical rotation.	deg/s

### MAV\_CMD\_DO\_VTOL\_TRANSITION (3000)

)

[Command] Request VTOL transition

Param (:Label)	Description	Values
1: State	The target VTOL state. For normal transitions, only <a href="#">MAV_VTOL_STATE_MC</a> and <a href="#">MAV_VTOL_STATE_FW</a> can be used.	<a href="#">MAV_VTOL_STATE</a>
2: Immediate	Force immediate transition to the specified <a href="#">MAV_VTOL_STATE</a> . 1: Force immediate, 0: normal transition. Can be used, for example, to trigger an emergency "Quadchute". Caution: Can be dangerous/damage vehicle, depending on autopilot implementation of this command.	

### MAV\_CMD\_ARM\_AUTHORIZATION\_REQUEST (3001)

)

[Command] Request authorization to arm the vehicle to a external entity, the arm authorizer is responsible to request all data that is needs from the vehicle before authorize or deny the request. If approved the progress of command\_ack message should be set with

period of time that this authorization is valid in seconds or in case it was denied it should be set with one of the reasons in [ARM\\_AUTH\\_DENIED\\_REASON](#).

Param (:Label)	Description	Values
1: System ID	Vehicle system id, this way ground station can request arm authorization on behalf of any vehicle	*min:*0 *max:*255 *increment:*1

#### MAV\_CMD\_SET\_GUIDED\_SUBMODE\_STANDARD ([4000](#))

)

[\[Command\]](#) This command sets the submode to standard guided when vehicle is in guided mode. The vehicle holds position and altitude and the user can input the desired velocities along all three axes.

**Param (:Label) Description**

#### MAV\_CMD\_SET\_GUIDED\_SUBMODE\_CIRCLE ([4001](#))

)

[\[Command\]](#) This command sets submode circle when vehicle is in guided mode. Vehicle flies along a circle facing the center of the circle. The user can input the velocity along the circle and change the radius. If no input is given the vehicle will hold position.

Param (:Label)	Description	Units
1: Radius	Radius of desired circle in CIRCLE_MODE	m
2	User defined	
3	User defined	
4	User defined	
5: Latitude	Target latitude of center of circle in CIRCLE_MODE	degE7
6: Longitude	Target longitude of center of circle in CIRCLE_MODE	degE7

#### MAV\_CMD\_CONDITION\_GATE ([4501](#))

)

**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[\[Command\]](#) Delay mission state machine until gate has been reached.

Param (:Label)	Description	Values	Units
1: Geometry	Geometry: 0: orthogonal to path between previous and next waypoint.	*min:*0 *increment:*1	
2: UseAltitude	Altitude: 0: ignore altitude	*min:*0 *max:*1 *increment:*1	
3	Empty		
4	Empty		
5: Latitude	Latitude		
6: Longitude	Longitude		
7: Altitude	Altitude		m

#### MAV\_CMD\_NAV\_FENCE\_RETURN\_POINT ([5000](#))

)

[\[Command\]](#) Fence return point (there can only be one such point in a geofence definition). If rally points are supported they should be used instead.

**Param (:Label) Description Units**

1	Reserved	
2	Reserved	
3	Reserved	
4	Reserved	
5: Latitude	Latitude	
6: Longitude	Longitude	
7: Altitude	Altitude	m

#### MAV\_CMD\_NAV\_FENCE\_POLYGON\_VERTEX\_INCLUSION ([5001](#))

)

[\[Command\]](#) Fence vertex for an inclusion polygon (the polygon must not be self-intersecting). The vehicle must stay within this area. Minimum of 3 vertices required.

Param (:Label)	Description	Values
1: Vertex Count	Polygon vertex count	*min:*3 *increment:*1
2: Inclusion Group	Vehicle must be inside ALL inclusion zones in a single group, vehicle must be inside at least one group, must be the same for all points in each polygon	*min:*0 *increment:*1
3	Reserved	
4	Reserved	
5: Latitude	Latitude	
6: Longitude	Longitude	
7	Reserved	

#### MAV\_CMD\_NAV\_FENCE\_POLYGON\_VERTEX\_EXCLUSION ([5002](#))

)



[\[Command\]](#) Fence vertex for an exclusion polygon (the polygon must not be self-intersecting). The vehicle must stay outside this area. Minimum of 3 vertices required.

Param (:Label)	Description	Values
1: Vertex Count	Polygon vertex count	*min:*3 *increment:*1
2	Reserved	
3	Reserved	
4	Reserved	
5: Latitude	Latitude	
6: Longitude	Longitude	
7	Reserved	

#### MAV\_CMD\_NAV\_FENCE\_CIRCLE\_INCLUSION (5003)

)

[\[Command\]](#) Circular fence area. The vehicle must stay inside this area.

Param (:Label)	Description	Values	Units
1: Radius	Radius.		m
2: Inclusion Group	Vehicle must be inside ALL inclusion zones in a single group, vehicle must be inside at least one group	*min:*0 *increment:*1	
3	Reserved		
4	Reserved		
5: Latitude	Latitude		
6: Longitude	Longitude		
7	Reserved		

#### MAV\_CMD\_NAV\_FENCE\_CIRCLE\_EXCLUSION (5004)

)

[\[Command\]](#) Circular fence area. The vehicle must stay outside this area.

Param (:Label)	Description	Units
1: Radius	Radius.	m
2	Reserved	
3	Reserved	
4	Reserved	
5: Latitude	Latitude	
6: Longitude	Longitude	
7	Reserved	

#### MAV\_CMD\_NAV\_RALLY\_POINT (5100)

)

[\[Command\]](#) Rally point. You can have multiple rally points defined.

Param (:Label)	Description	Units
1	Reserved	
2	Reserved	
3	Reserved	
4	Reserved	
5: Latitude	Latitude	
6: Longitude	Longitude	
7: Altitude	Altitude	m

#### MAV\_CMD\_UAVCAN\_GET\_NODE\_INFO (5200)

)

[\[Command\]](#) Commands the vehicle to respond with a sequence of messages [UAVCAN\\_NODE\\_INFO](#), one message per every UAVCAN node that is online. Note that some of the response messages can be lost, which the receiver can detect easily by checking whether every received [UAVCAN\\_NODE\\_STATUS](#) has a matching message [UAVCAN\\_NODE\\_INFO](#) received earlier; if not, this command should be sent again in order to request re-transmission of the node information messages.

Param (:Label)	Description
1	Reserved (set to 0)
2	Reserved (set to 0)
3	Reserved (set to 0)
4	Reserved (set to 0)
5	Reserved (set to 0)
6	Reserved (set to 0)
7	Reserved (set to 0)

#### MAV\_CMD\_DO\_ADSB\_OUT\_IDENT (10001)

)

[\[Command\]](#) Trigger the start of an ADSB-out IDENT. This should only be used when requested to do so by an Air Traffic Controller in controlled airspace. This starts the IDENT which is then typically held for 18 seconds by the hardware per the Mode A, C, and S transponder spec.

Param (:Label)	Description
1	Reserved (set to 0)
2	Reserved (set to 0)

3	Reserved (set to 0)
4	Reserved (set to 0)
5	Reserved (set to 0)
6	Reserved (set to 0)
7	Reserved (set to 0)

#### MAV\_CMD\_PAYLOAD\_PREPARE\_DEPLOY (30001

)

**DEPRECATED:** Replaced by (2021-06).

[\[Command\]](#) Deploy payload on a Lat / Lon / Alt position. This includes the navigation to reach the required release position and velocity.

Param (:Label)	Description	Values	Units
1: Operation Mode	Operation mode. 0: prepare single payload deploy (overwriting previous requests), but do not execute it. 1: execute payload deploy immediately (rejecting further deploy commands during execution, but allowing abort). 2: add payload deploy to existing deployment list.	*min:*0 *max:*2 *increment:*1	
2: Approach Vector	Desired approach vector in compass heading. A negative value indicates the system can define the approach vector at will.	min:	
-1			
	*max:*360 deg		
3: Ground Speed	Desired ground speed at release time. This can be overridden by the airframe in case it needs to meet minimum airspeed. A negative value indicates the system can define the ground speed at will.	min:	
-1			
4: Altitude Clearance	Minimum altitude clearance to the release position. A negative value indicates the system can define the clearance at will.	min:	
-1			
m			
5: Latitude	Latitude. Note, if used in <a href="#">MISSION_ITEM</a> (deprecated) the units are degrees (unscaled)		degE7
6: Longitude	Longitude. Note, if used in <a href="#">MISSION_ITEM</a> (deprecated) the units are degrees (unscaled)		degE7
7: Altitude	Altitude (MSL)		m

#### MAV\_CMD\_PAYLOAD\_CONTROL\_DEPLOY (30002

)

**DEPRECATED:** Replaced by (2021-06).

[\[Command\]](#) Control the payload deployment.

Param (:Label)	Description	Values
1: Operation Mode	Operation mode. 0: Abort deployment, continue normal mission. 1: switch to payload deployment mode. 100: delete first payload deployment request. 101: delete all payload deployment requests.	*min:*0 *max:*101 *increment:*1
2	Reserved	
3	Reserved	
4	Reserved	
5	Reserved	
6	Reserved	
7	Reserved	

#### MAV\_CMD\_FIXED\_MAG\_CAL\_YAW (42006

)

[\[Command\]](#) Magnetometer calibration based on provided known yaw. This allows for fast calibration using WMM field tables in the vehicle, given only the known yaw of the vehicle. If Latitude and longitude are both zero then use the current vehicle location.

Param (:Label)	Description	Units
1: Yaw	Yaw of vehicle in earth frame.	deg
2: CompassMask	CompassMask, 0 for all.	
3: Latitude	Latitude.	deg
4: Longitude	Longitude.	deg
5	Empty.	
6	Empty.	
7	Empty.	

#### MAV\_CMD\_DO\_WINCH (42600

)

[\[Command\]](#) Command to operate winch.

Param (:Label)	Description	Values	Units
1: Instance	Winch instance number.	*min:*1 *increment:*1	
2: Action	Action to perform.	<a href="#">WINCH_ACTIONS</a>	
3: Length	Length of line to release (negative to wind).		m
4: Rate	Release rate (negative to wind).		m/s
5	Empty.		
6	Empty.		

7 Empty.

#### MAV\_CMD\_WAYPOINT\_USER\_1 (31000)

)

[Command] User defined waypoint item. Ground Station will show the Vehicle as flying through this item.

Param (:Label)	Description	Units
1	User defined	
2	User defined	
3	User defined	
4	User defined	
5: Latitude	Latitude unscaled	
6: Longitude	Longitude unscaled	
7: Altitude	Altitude (MSL)	m

#### MAV\_CMD\_WAYPOINT\_USER\_2 (31001)

)

[Command] User defined waypoint item. Ground Station will show the Vehicle as flying through this item.

Param (:Label)	Description	Units
1	User defined	
2	User defined	
3	User defined	
4	User defined	
5: Latitude	Latitude unscaled	
6: Longitude	Longitude unscaled	
7: Altitude	Altitude (MSL)	m

#### MAV\_CMD\_WAYPOINT\_USER\_3 (31002)

)

[Command] User defined waypoint item. Ground Station will show the Vehicle as flying through this item.

Param (:Label)	Description	Units
1	User defined	
2	User defined	
3	User defined	
4	User defined	
5: Latitude	Latitude unscaled	
6: Longitude	Longitude unscaled	
7: Altitude	Altitude (MSL)	m

#### MAV\_CMD\_WAYPOINT\_USER\_4 (31003)

)

[Command] User defined waypoint item. Ground Station will show the Vehicle as flying through this item.

Param (:Label)	Description	Units
1	User defined	
2	User defined	
3	User defined	
4	User defined	
5: Latitude	Latitude unscaled	
6: Longitude	Longitude unscaled	
7: Altitude	Altitude (MSL)	m

#### MAV\_CMD\_WAYPOINT\_USER\_5 (31004)

)

[Command] User defined waypoint item. Ground Station will show the Vehicle as flying through this item.

Param (:Label)	Description	Units
1	User defined	
2	User defined	
3	User defined	
4	User defined	
5: Latitude	Latitude unscaled	
6: Longitude	Longitude unscaled	
7: Altitude	Altitude (MSL)	m

#### MAV\_CMD\_SPATIAL\_USER\_1 (31005)

)

[Command] User defined spatial item. Ground Station will not show the Vehicle as flying through this item. Example: ROI item.

Param (:Label)	Description	Units
1	User defined	
2	User defined	

3	User defined	
4	User defined	
5: Latitude	Latitude unscaled	
6: Longitude	Longitude unscaled	
7: Altitude	Altitude (MSL)	m

#### MAV\_CMD\_SPATIAL\_USER\_2 ([31006](#))

)

[\[Command\]](#) User defined spatial item. Ground Station will not show the Vehicle as flying through this item. Example: ROI item.

Param (:Label)	Description	Units
1	User defined	
2	User defined	
3	User defined	
4	User defined	
5: Latitude	Latitude unscaled	
6: Longitude	Longitude unscaled	
7: Altitude	Altitude (MSL)	m

#### MAV\_CMD\_SPATIAL\_USER\_3 ([31007](#))

)

[\[Command\]](#) User defined spatial item. Ground Station will not show the Vehicle as flying through this item. Example: ROI item.

Param (:Label)	Description	Units
1	User defined	
2	User defined	
3	User defined	
4	User defined	
5: Latitude	Latitude unscaled	
6: Longitude	Longitude unscaled	
7: Altitude	Altitude (MSL)	m

#### MAV\_CMD\_SPATIAL\_USER\_4 ([31008](#))

)

[\[Command\]](#) User defined spatial item. Ground Station will not show the Vehicle as flying through this item. Example: ROI item.

Param (:Label)	Description	Units
1	User defined	
2	User defined	
3	User defined	
4	User defined	
5: Latitude	Latitude unscaled	
6: Longitude	Longitude unscaled	
7: Altitude	Altitude (MSL)	m

#### MAV\_CMD\_SPATIAL\_USER\_5 ([31009](#))

)

[\[Command\]](#) User defined spatial item. Ground Station will not show the Vehicle as flying through this item. Example: ROI item.

Param (:Label)	Description	Units
1	User defined	
2	User defined	
3	User defined	
4	User defined	
5: Latitude	Latitude unscaled	
6: Longitude	Longitude unscaled	
7: Altitude	Altitude (MSL)	m

#### MAV\_CMD\_USER\_1 ([31010](#))

)

[\[Command\]](#) User defined command. Ground Station will not show the Vehicle as flying through this item. Example: [MAV\\_CMD\\_DO\\_SET\\_PARAMETER](#) item.

Param (:Label)	Description
1	User defined
2	User defined
3	User defined
4	User defined
5	User defined
6	User defined
7	User defined

#### MAV\_CMD\_USER\_2 ([31011](#))

)

[\[Command\]](#) User defined command. Ground Station will not show the Vehicle as flying through this item. Example: [MAV\\_CMD\\_DO\\_SET\\_PARAMETER](#) item.

Param (:Label)	Description
1	User defined
2	User defined
3	User defined
4	User defined
5	User defined
6	User defined
7	User defined

#### MAV\_CMD\_USER\_3 ([31012](#))

)

[\[Command\]](#) User defined command. Ground Station will not show the Vehicle as flying through this item. Example: [MAV\\_CMD\\_DO\\_SET\\_PARAMETER](#) item.

Param (:Label)	Description
1	User defined
2	User defined
3	User defined
4	User defined
5	User defined
6	User defined
7	User defined

#### MAV\_CMD\_USER\_4 ([31013](#))

)

[\[Command\]](#) User defined command. Ground Station will not show the Vehicle as flying through this item. Example: [MAV\\_CMD\\_DO\\_SET\\_PARAMETER](#) item.

Param (:Label)	Description
1	User defined
2	User defined
3	User defined
4	User defined
5	User defined
6	User defined
7	User defined

#### MAV\_CMD\_USER\_5 ([31014](#))

)

[\[Command\]](#) User defined command. Ground Station will not show the Vehicle as flying through this item. Example: [MAV\\_CMD\\_DO\\_SET\\_PARAMETER](#) item.

Param (:Label)	Description
1	User defined
2	User defined
3	User defined
4	User defined
5	User defined
6	User defined
7	User defined

#### MAV\_CMD\_CAN\_FORWARD ([32000](#))

)

[\[Command\]](#) Request forwarding of CAN packets from the given CAN bus to this component. CAN Frames are sent using [CAN\\_FRAME](#) and [CANFD\\_FRAME](#) messages

Param (:Label)	Description
1: bus	Bus number (0 to disable forwarding, 1 for first bus, 2 for 2nd bus, 3 for 3rd bus).
2	Empty.
3	Empty.
4	Empty.
5	Empty.
6	Empty.
7	Empty.

## MAVLink Messages

### SYS\_STATUS ([#1](#))

)

[\[Message\]](#) The general system state. If the system is following the MAVLink standard, the system state is mainly defined by three orthogonal states/modes: The system mode, which is either LOCKED (motors shut down and locked), MANUAL (system under RC control), GUIDED (system with autonomous position control, position setpoint controlled manually) or AUTO (system guided by path/waypoint planner). The [NAV\\_MODE](#) defined the current flight state: LIFTOFF (often an open-loop maneuver), LANDING,

WAYPOINTS or VECTOR. This represents the internal navigation state machine. The system status shows whether the system is currently active or not and if an emergency occurred. During the CRITICAL and EMERGENCY states the MAV is still considered to be active, but should start emergency procedures autonomously. After a failure occurred it should first move from active to critical to allow manual intervention and then move to emergency after a certain timeout.

Field Name	Type	Units	Values	Description
onboard_control_sensors_present	uint32_t		<a href="#">MAV_SYS_STATUS_SENSOR</a>	Bitmap showing which onboard controllers and sensors are present. Value of 0: not present. Value of 1: present.
onboard_control_sensors_enabled	uint32_t		<a href="#">MAV_SYS_STATUS_SENSOR</a>	Bitmap showing which onboard controllers and sensors are enabled: Value of 0: not enabled. Value of 1: enabled.
onboard_control_sensors_health	uint32_t		<a href="#">MAV_SYS_STATUS_SENSOR</a>	Bitmap showing which onboard controllers and sensors have an error (or are operational). Value of 0: error. Value of 1: healthy.
load	uint16_t	d%		Maximum usage in percent of the mainloop time. Values: [0-1000] - should always be below 1000
voltage_battery	uint16_t	mV		Battery voltage, UINT16_MAX: Voltage not sent by autopilot
current_battery	int16_t	cA		Battery current, -1: Current not sent by autopilot
battery_remaining %	int8_t			Battery energy remaining, -1: Battery remaining energy not sent by autopilot
drop_rate_comm	uint16_t	c%		Communication drop rate, (UART, I2C, SPI, CAN), dropped packets on all links (packets that were corrupted on reception on the MAV)
errors_comm	uint16_t			Communication errors (UART, I2C, SPI, CAN), dropped packets on all links (packets that were corrupted on reception on the MAV)
errors_count1	uint16_t			Autopilot-specific errors
errors_count2	uint16_t			Autopilot-specific errors
errors_count3	uint16_t			Autopilot-specific errors
errors_count4	uint16_t			Autopilot-specific errors
				Bitmap showing which onboard

onboard_control_sensors_present_extended** uint32_t	<a href="#">MAV_SYS_STATUS_SENSOR_EXTENDED</a>	controllers and sensors are present. Value of 0: not present. Value of 1: present. Bitmap showing which onboard controllers and sensors are enabled: Value of 0: not enabled. Value of 1: enabled. Bitmap showing which onboard controllers and sensors have an error (or are operational). Value of 0: error. Value of 1: healthy.
onboard_control_sensors_enabled_extended** uint32_t	<a href="#">MAV_SYS_STATUS_SENSOR_EXTENDED</a>	
onboard_control_sensors_health_extended** uint32_t	<a href="#">MAV_SYS_STATUS_SENSOR_EXTENDED</a>	

## SYSTEM\_TIME (#2)

)

[Message] The system time is the time of the master clock, typically the computer clock of the main onboard computer.

Field Name	Type	Units	Description
time_unix_usec	uint64_t	us	Timestamp (UNIX epoch time).
time_boot_ms	uint32_t	ms	Timestamp (time since system boot).

## PING (#4)

)

**DEPRECATED:** Replaced by [SYSTEM\\_TIME](#) (2011-08).

to be removed / merged with SYSTEM\_TIME

[Message] A ping message either requesting or responding to a ping. This allows to measure the system latencies, including serial port, radio modem and UDP connections. The ping microservice is documented at <https://mavlink.io/en/services/ping.html>

Field Name	Type	Units	Description
time_usec	uint64_t	us	Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
seq	uint32_t		PING sequence
target_system	uint8_t		0: request ping from all receiving systems. If greater than 0: message is a ping response and number is the system id of the requesting system
target_component	uint8_t		0: request ping from all receiving components. If greater than 0: message is a ping response and number is the component id of the requesting component.

## CHANGE\_OPERATOR\_CONTROL (#5)

)

[Message] Request to control this MAV

Field Name	Type	Units	Description
target_system	uint8_t		System the GCS requests control for
control_request	uint8_t		0: request control of this MAV, 1: Release control of this MAV
version	uint8_t	rad	0: key as plaintext, 1-255: future, different hashing/encryption variants. The GCS should in general use the safest mode possible initially and then gradually move down the encryption level if it gets a NACK message indicating an encryption mismatch.
passkey	char[25]		Password / Key, depending on version plaintext or encrypted. 25 or less characters, NULL terminated. The characters may involve A-Z, a-z, 0-9, and "!,,.."

## CHANGE\_OPERATOR\_CONTROL\_ACK (#6)

)

[Message] Accept / deny control of this MAV

Field Name	Type	Description
gcs_system_id	uint8_t	ID of the GCS this message
control_request	uint8_t	0: request control of this MAV, 1: Release control of this MAV
ack	uint8_t	0: ACK, 1: NACK: Wrong passkey, 2: NACK: Unsupported passkey encryption method, 3: NACK: Already under control

## AUTH\_KEY (#7)

)

[Message] Emit an encrypted signature / key identifying this system. PLEASE NOTE: This protocol has been kept simple, so transmitting the key requires an encrypted channel for true safety.

Field Name	Type	Description
------------	------	-------------

key char[32] key

## LINK\_NODE\_STATUS (#8)

)

**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[Message] Status generated in each node in the communication chain and injected into MAVLink stream.

Field Name	Type	Units	Description
timestamp	uint64_t	ms	Timestamp (time since system boot).
tx_buf	uint8_t		
%			
Remaining free transmit buffer space			
rx_buf	uint8_t		
%			
Remaining free receive buffer space			
tx_rate	uint32_t	bytes/s	Transmit rate
rx_rate	uint32_t	bytes/s	Receive rate
rx_parse_err	uint16_t	bytes	Number of bytes that could not be parsed correctly.
tx_overflows	uint16_t	bytes	Transmit buffer overflows. This number wraps around as it reaches UINT16_MAX
rx_overflows	uint16_t	bytes	Receive buffer overflows. This number wraps around as it reaches UINT16_MAX
messages_sent	uint32_t		Messages sent
messages_received	uint32_t		Messages received (estimated from counting seq)
messages_lost	uint32_t		Messages lost (estimated from counting seq)

## SET\_MODE (#11)

)

**DEPRECATED:** Replaced by [MAV\\_CMD\\_DO\\_SET\\_MODE](#) (2015-12).

Use [COMMAND\\_LONG](#) with [MAV\\_CMD\\_DO\\_SET\\_MODE](#) instead

[Message] Set the system mode, as defined by enum [MAV\\_MODE](#). There is no target component id as the mode is by definition for the overall aircraft, not only for one component.

Field Name	Type	Values	Description
target_system	uint8_t		The system setting the mode
base_mode	uint8_t	<a href="#">MAV_MODE</a>	The new base mode.
custom_mode	uint32_t		The new autopilot-specific mode. This field can be ignored by an autopilot.

## PARAM\_REQUEST\_READ (#20)

)

[Message] Request to read the onboard parameter with the param\_id string id. Onboard parameters are stored as key[const char\*] -> value[float]. This allows to send a parameter to any other component (such as the GCS) without the need of previous knowledge of possible parameter names. Thus the same GCS can store different parameters for different autopilots. See also <https://mavlink.io/en/services/parameter.html> for a full documentation of QGroundControl and IMU code.

Field Name	Type	Description
target_system	uint8_t	System ID
target_component	uint8_t	Component ID
param_id	char[16]	Onboard parameter id, terminated by NULL if the length is less than 16 human-readable chars and WITHOUT null termination (NULL) byte if the length is exactly 16 chars - applications have to provide 16+1 bytes storage if the ID is stored as string
param_index	int16_t	Parameter index. Send -1 to use the param ID field as identifier (else the param id will be ignored)

## PARAM\_REQUEST\_LIST (#21)

)

[Message] Request all parameters of this component. After this request, all parameters are emitted. The parameter microservice is documented at <https://mavlink.io/en/services/parameter.html>

Field Name	Type	Description
target_system	uint8_t	System ID
target_component	uint8_t	Component ID

## PARAM\_VALUE (#22)

)

[Message] Emit the value of an onboard parameter. The inclusion of param\_count and param\_index in the message allows the recipient to keep track of received parameters and allows him to re-request missing parameters after a loss or timeout. The parameter microservice is documented at <https://mavlink.io/en/services/parameter.html>

Field Name	Type	Values	Description
param_id	char[16]		Onboard parameter id, terminated by NULL if the length is less than 16 human-readable chars and WITHOUT null termination (NULL) byte if the length is exactly 16 chars - applications have to provide 16+1 bytes storage if the ID is stored as string
param_value	float		Onboard parameter value
param_type	uint8_t	<a href="#">MAV_PARAM_TYPE</a>	Onboard parameter type.
param_count	uint16_t		Total number of onboard parameters
param_index	uint16_t		Index of this onboard parameter



## PARAM\_SET (#23)

)

[Message] Set a parameter value (write new value to permanent storage). The receiving component should acknowledge the new parameter value by broadcasting a [PARAM\\_VALUE](#) message (broadcasting ensures that multiple GCS all have an up-to-date list of all parameters). If the sending GCS did not receive a [PARAM\\_VALUE](#) within its timeout time, it should re-send the [PARAM\\_SET](#) message. The parameter microservice is documented at <https://mavlink.io/en/services/parameter.html>. [PARAM\\_SET](#) may also be called within the context of a transaction (started with [MAV\\_CMD\\_PARAM\\_TRANSACTION](#)). Within a transaction the receiving component should respond with [PARAM\\_ACK\\_TRANSACTION](#) to the setter component (instead of broadcasting [PARAM\\_VALUE](#)), and [PARAM\\_SET](#) should be re-sent if this is ACK not received.

Field Name	Type	Values	Description
target_system	uint8_t		System ID
target_component	uint8_t		Component ID
param_id	char[16]		Onboard parameter id, terminated by NULL if the length is less than 16 human-readable chars and WITHOUT null termination (NULL) byte if the length is exactly 16 chars - applications have to provide 16+1 bytes storage if the ID is stored as string
param_value	float		Onboard parameter value
param_type	uint8_t	<a href="#">MAV_PARAM_TYPE</a>	Onboard parameter type.

## GPS\_RAW\_INT (#24)

)

[Message] The global position, as returned by the Global Positioning System (GPS). This is NOT the global position estimate of the system, but rather a RAW sensor value. See message [GLOBAL\\_POSITION\\_INT](#) for the global position estimate.

Field Name	Type	Units	Values	Description
time_usec	uint64_t	us		Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
fix_type	uint8_t		<a href="#">GPS_FIX_TYPE</a>	GPS fix type.
lat	int32_t	degE7		Latitude (WGS84, EGM96 ellipsoid)
lon	int32_t	degE7		Longitude (WGS84, EGM96 ellipsoid)
alt	int32_t	mm		Altitude (MSL). Positive for up. Note that virtually all GPS modules provide the MSL altitude in addition to the WGS84 altitude.
eph	uint16_t			GPS HDOP horizontal dilution of position (unitless * 100). If unknown, set to: UINT16_MAX
epv	uint16_t			GPS VDOP vertical dilution of position (unitless * 100). If unknown, set to: UINT16_MAX
vel	uint16_t	cm/s		GPS ground speed. If unknown, set to: UINT16_MAX
cog	uint16_t	cdeg		Course over ground (NOT heading, but direction of movement) in degrees * 100, 0.0..359.99 degrees. If unknown, set to: UINT16_MAX
satellites_visible	uint8_t			Number of satellites visible. If unknown, set to: UINT8_MAX
alt_ellipsoid**	int32_t	mm		Altitude (above WGS84, EGM96 ellipsoid). Positive for up.
h_acc**	uint32_t	mm		Position uncertainty.
v_acc**	uint32_t	mm		Altitude uncertainty.
vel_acc**	uint32_t	mm		Speed uncertainty.
hdg_acc**	uint32_t	degE5		Heading / track uncertainty
yaw**	uint16_t	cdeg		Yaw in earth frame from north. Use 0 if this GPS does not provide yaw. Use UINT16_MAX if this GPS is configured to provide yaw and is currently unable to provide it. Use 36000 for north.

## GPS\_STATUS (#25)

)

[Message] The positioning status, as reported by GPS. This message is intended to display status information about each satellite visible to the receiver. See message [GLOBAL\\_POSITION\\_INT](#) for the global position estimate. This message can contain information for up to 20 satellites.

Field Name	Type	Units	Description
satellites_visible	uint8_t		Number of satellites visible
satellite_prn	uint8_t[20]		Global satellite ID
satellite_used	uint8_t[20]		0: Satellite not used, 1: used for localization
satellite_elevation	uint8_t[20]	deg	Elevation (0: right on top of receiver, 90: on the horizon) of satellite
satellite_azimuth	uint8_t[20]	deg	Direction of satellite, 0: 0 deg, 255: 360 deg.
satellite_snr	uint8_t[20]	dB	Signal to noise ratio of satellite

## SCALED\_IMU (#26)

)

[Message] The RAW IMU readings for the usual 9DOF sensor setup. This message should contain the scaled values to the described units

Field Name	Type	Units	Description
time_boot_ms	uint32_t	ms	Timestamp (time since system boot).
xacc	int16_t	mG	X acceleration
yacc	int16_t	mG	Y acceleration
zacc	int16_t	mG	Z acceleration
xgyro	int16_t	mrads	Angular speed around X axis
ygyro	int16_t	mrads	Angular speed around Y axis
zgyro	int16_t	mrads	Angular speed around Z axis
xmag	int16_t	mgauss	X Magnetic field
ymag	int16_t	mgauss	Y Magnetic field
zmag	int16_t	mgauss	Z Magnetic field

temperature\*\*int16\_t cdegC Temperature, 0: IMU does not provide temperature values. If the IMU is at 0C it must send 1 (0.01C).

## RAW\_IMU (#27)

)

[Message] The RAW IMU readings for a 9DOF sensor, which is identified by the id (default IMU1). This message should always contain the true raw values without any scaling to allow data capture and system debugging.

Field Name	Type	Units	Description
time_usec	uint64_t	us	Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
xacc	int16_t		X acceleration (raw)
yacc	int16_t		Y acceleration (raw)
zacc	int16_t		Z acceleration (raw)
xgyro	int16_t		Angular speed around X axis (raw)
ygyro	int16_t		Angular speed around Y axis (raw)
zgyro	int16_t		Angular speed around Z axis (raw)
xmag	int16_t		X Magnetic field (raw)
ymag	int16_t		Y Magnetic field (raw)
zmag	int16_t		Z Magnetic field (raw)
id**	uint8_t		Id. Ids are numbered from 0 and map to IMUs numbered from 1 (e.g. IMU1 will have a message with id=0)

temperature\*\*int16\_t cdegC Temperature, 0: IMU does not provide temperature values. If the IMU is at 0C it must send 1 (0.01C).

## RAW\_PRESSURE (#28)

)

[Message] The RAW pressure readings for the typical setup of one absolute pressure and one differential pressure sensor. The sensor values should be the raw, UNSCALED ADC values.

Field Name	Type	Units	Description
time_usec	uint64_t	us	Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
press_abs	int16_t		Absolute pressure (raw)
press_diff1	int16_t		Differential pressure 1 (raw, 0 if nonexistent)
press_diff2	int16_t		Differential pressure 2 (raw, 0 if nonexistent)
temperature	int16_t		Raw Temperature measurement (raw)

## SCALED\_PRESSURE (#29)

)

[Message] The pressure readings for the typical setup of one absolute and differential pressure sensor. The units are as specified in each field.

Field Name	Type	Units	Description
time_boot_ms	uint32_t	ms	Timestamp (time since system boot).
press_abs	float	hPa	Absolute pressure
press_diff	float	hPa	Differential pressure 1
temperature	int16_t	cdegC	Absolute pressure temperature
temperature_press_diff**	int16_t	cdegC	Differential pressure temperature (0, if not available). Report values of 0 (or 1) as 1 cdegC.

## ATTITUDE (#30)

)

[Message] The attitude in the aeronautical frame (right-handed, Z-down, X-front, Y-right).

Field Name	Type	Units	Description
time_boot_ms	uint32_t	ms	Timestamp (time since system boot).
roll	float	rad	Roll angle (-pi..+pi)
pitch	float	rad	Pitch angle (-pi..+pi)
yaw	float	rad	Yaw angle (-pi..+pi)
rollspeed	float	rad/s	Roll angular speed
pitchspeed	float	rad/s	Pitch angular speed
yawspeed	float	rad/s	Yaw angular speed

## ATTITUDE\_QUATERNION (#31)

)

[Message] The attitude in the aeronautical frame (right-handed, Z-down, X-front, Y-right), expressed as quaternion. Quaternion order is w, x, y, z and a zero rotation would be expressed as (1 0 0 0).

Field Name	Type	Units	Description
time_boot_ms	uint32_t	ms	Timestamp (time since system boot).
q1	float		Quaternion component 1, w (1 in null-rotation)
q2	float		Quaternion component 2, x (0 in null-rotation)
q3	float		Quaternion component 3, y (0 in null-rotation)
q4	float		Quaternion component 4, z (0 in null-rotation)
rollspeed	float	rad/s	Roll angular speed
pitchspeed	float	rad/s	Pitch angular speed
yawspeed	float	rad/s	Yaw angular speed

repr\_offset\_q\*\*float[4]

Rotation offset by which the attitude quaternion and angular speed vector should be rotated for user display (quaternion with [w, x, y, z] order, zero-rotation is [1, 0, 0, 0], send [0, 0, 0, 0] if field not supported). This field is intended for systems in which the reference attitude may change during flight. For example, tailsitters VTOLs rotate their reference attitude by 90 degrees between hover mode and fixed wing mode, thus repr\_offset\_q is equal to [1, 0, 0, 0] in hover mode and equal to [0.7071, 0, 0.7071, 0] in fixed wing mode.

## LOCAL\_POSITION\_NED (#32)

)

[\[Message\]](#) The filtered local position (e.g. fused computer vision and accelerometers). Coordinate frame is right-handed, Z-axis down (aeronautical frame, NED / north-east-down convention)

Field Name	Type	Units	Description
time_boot_ms	uint32_t	ms	Timestamp (time since system boot).
x	float	m	X Position
y	float	m	Y Position
z	float	m	Z Position
vx	float	m/s	X Speed
vy	float	m/s	Y Speed
vz	float	m/s	Z Speed

## GLOBAL\_POSITION\_INT (#33)

)

[\[Message\]](#) The filtered global position (e.g. fused GPS and accelerometers). The position is in GPS-frame (right-handed, Z-up). It is designed as scaled integer message since the resolution of float is not sufficient.

Field Name	Type	Units	Description
time_boot_ms	uint32_t	ms	Timestamp (time since system boot).
lat	int32_t	degE7	Latitude, expressed
lon	int32_t	degE7	Longitude, expressed
alt	int32_t	mm	Altitude (MSL). Note that virtually all GPS modules provide both WGS84 and MSL.
relative_alt	int32_t	mm	Altitude above ground
vx	int16_t	cm/s	Ground X Speed (Latitude, positive north)
vy	int16_t	cm/s	Ground Y Speed (Longitude, positive east)
vz	int16_t	cm/s	Ground Z Speed (Altitude, positive down)
hdg	uint16_t	cdeg	Vehicle heading (yaw angle), 0.0..359.99 degrees. If unknown, set to: UINT16_MAX

## RC\_CHANNELS\_SCALED (#34)

)

[\[Message\]](#) The scaled values of the RC channels received: (-100%) -10000, (0%) 0, (100%) 10000. Channels that are inactive should be set to UINT16\_MAX.

Field Name	Type	Units	Description
time_boot_ms	uint32_t	ms	Timestamp (time since system boot).
port	uint8_t		Servo output port (set of 8 outputs = 1 port). Flight stacks running on Pixhawk should use: 0 = MAIN, 1 = AUX.
chan1_scaled	int16_t		RC channel 1 value scaled.
chan2_scaled	int16_t		RC channel 2 value scaled.
chan3_scaled	int16_t		RC channel 3 value scaled.
chan4_scaled	int16_t		RC channel 4 value scaled.
chan5_scaled	int16_t		RC channel 5 value scaled.
chan6_scaled	int16_t		RC channel 6 value scaled.
chan7_scaled	int16_t		RC channel 7 value scaled.
chan8_scaled	int16_t		RC channel 8 value scaled.
rsqi	uint8_t		Receive signal strength indicator in device-dependent units/scale. Values: [0-254], UINT8_MAX: invalid/unknown.

## RC\_CHANNELS\_RAW (#35)

)

[\[Message\]](#) The RAW values of the RC channels received. The standard PPM modulation is as follows: 1000 microseconds: 0%, 2000 microseconds: 100%. A value of UINT16\_MAX implies the channel is unused. Individual receivers/transmitters might violate this specification.

Field Name	Type	Units	Description
time_boot_ms	uint32_t	ms	Timestamp (time since system boot).
port	uint8_t		Servo output port (set of 8 outputs = 1 port). Flight stacks running on Pixhawk should use: 0 = MAIN, 1 = AUX.
chan1_raw	uint16_t	us	RC channel 1 value.
chan2_raw	uint16_t	us	RC channel 2 value.
chan3_raw	uint16_t	us	RC channel 3 value.
chan4_raw	uint16_t	us	RC channel 4 value.
chan5_raw	uint16_t	us	RC channel 5 value.
chan6_raw	uint16_t	us	RC channel 6 value.
chan7_raw	uint16_t	us	RC channel 7 value.
chan8_raw	uint16_t	us	RC channel 8 value.
rsqi	uint8_t		Receive signal strength indicator in device-dependent units/scale. Values: [0-254], UINT8_MAX: invalid/unknown.

## SERVO\_OUTPUT\_RAW (#36)

)

[Message] Superseded by [ACTUATOR\\_OUTPUT\\_STATUS](#). The RAW values of the servo outputs (for RC input from the remote, use the [RC\\_CHANNELS](#) messages). The standard PPM modulation is as follows: 1000 microseconds: 0%, 2000 microseconds: 100%.

Field Name	Type	Units	Description
time_usec	uint32_t	us	Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
port	uint8_t		Servo output port (set of 8 outputs = 1 port). Flight stacks running on Pixhawk should use: 0 = MAIN, 1 = AUX.
servo1_raw	uint16_t	us	Servo output 1 value
servo2_raw	uint16_t	us	Servo output 2 value
servo3_raw	uint16_t	us	Servo output 3 value
servo4_raw	uint16_t	us	Servo output 4 value
servo5_raw	uint16_t	us	Servo output 5 value
servo6_raw	uint16_t	us	Servo output 6 value
servo7_raw	uint16_t	us	Servo output 7 value
servo8_raw	uint16_t	us	Servo output 8 value
servo9_raw**	uint16_t	us	Servo output 9 value
servo10_raw**	uint16_t	us	Servo output 10 value
servo11_raw**	uint16_t	us	Servo output 11 value
servo12_raw**	uint16_t	us	Servo output 12 value
servo13_raw**	uint16_t	us	Servo output 13 value
servo14_raw**	uint16_t	us	Servo output 14 value
servo15_raw**	uint16_t	us	Servo output 15 value
servo16_raw**	uint16_t	us	Servo output 16 value

## MISSION\_REQUEST\_PARTIAL\_LIST (#37)

)

[Message] Request a partial list of mission items from the system/component. <https://mavlink.io/en/services/mission.html>. If start and end index are the same, just send one waypoint.

Field Name	Type	Values	Description
target_system	uint8_t		System ID
target_component	uint8_t		Component ID
start_index	int16_t		Start index
end_index	int16_t		End index, -1 by default (-1: send list to end). Else a valid index of the list
mission_type**	uint8_t	<a href="#">MAV_MISSION_TYPE</a>	Mission type.

## MISSION\_WRITE\_PARTIAL\_LIST (#38)

)

[Message] This message is sent to the MAV to write a partial list. If start index == end index, only one item will be transmitted / updated. If the start index is NOT 0 and above the current list size, this request should be REJECTED!

Field Name	Type	Values	Description
target_system	uint8_t		System ID
target_component	uint8_t		Component ID
start_index	int16_t		Start index. Must be smaller / equal to the largest index of the current onboard list.
end_index	int16_t		End index, equal or greater than start index.
mission_type**	uint8_t	<a href="#">MAV_MISSION_TYPE</a>	Mission type.

## MISSION\_ITEM (#39)

)

**DEPRECATED:** Replaced by [MISSION\\_ITEM\\_INT](#) (2020-06).

[Message] Message encoding a mission item. This message is emitted to announce the presence of a mission item and to set a mission item on the system. The mission item can be either in x, y, z meters (type: LOCAL) or x:lat, y:lon, z:altitude. Local frame is Z-down, right handed (NED), global frame is Z-up, right handed (ENU). NaN may be used to indicate an optional/default value (e.g. to use the system's current latitude or yaw rather than a specific value). See also <https://mavlink.io/en/services/mission.html>.

Field Name	Type	Values	Description
target_system	uint8_t		System ID
target_component	uint8_t		Component ID
seq	uint16_t		Sequence
frame	uint8_t	<a href="#">MAV_FRAME</a>	The coordinate system of the waypoint.
command	uint16_t	<a href="#">MAV_CMD</a>	The scheduled action for the waypoint.
current	uint8_t		false:0, true:1
autocontinue	uint8_t		Autocontinue to next waypoint
param1	float		PARAM1, see <a href="#">MAV_CMD</a> enum
param2	float		PARAM2, see <a href="#">MAV_CMD</a> enum
param3	float		PARAM3, see <a href="#">MAV_CMD</a> enum
param4	float		PARAM4, see <a href="#">MAV_CMD</a> enum
x	float		PARAM5 / local: X coordinate, global: latitude
y	float		PARAM6 / local: Y coordinate, global: longitude
z	float		PARAM7 / local: Z coordinate, global: altitude (relative or absolute, depending on frame).
mission_type**	uint8_t	<a href="#">MAV_MISSION_TYPE</a>	Mission type.

## MISSION\_REQUEST (#40)

)

**DEPRECATED:** Replaced by [MISSION\\_REQUEST\\_INT](#) (2020-06).

A system that gets this request should respond with [MISSION\\_ITEM\\_INT](#) (as though [MISSION\\_REQUEST\\_INT](#) was received).

[Message] Request the information of the mission item with the sequence number seq. The response of the system to this message should be a [MISSION\\_ITEM](#) message. <https://mavlink.io/en/services/mission.html>

Field Name	Type	Values	Description
target_system	uint8_t		System ID
target_component	uint8_t		Component ID
seq	uint16_t		Sequence
mission_type**	uint8_t	<a href="#">MAV_MISSION_TYPE</a>	Mission type.

## MISSION\_SET\_CURRENT (#41)

)

[Message] Set the mission item with sequence number seq as current item. This means that the MAV will continue to this mission item on the shortest path (not following the mission items in-between).

Field Name	Type	Description
target_system	uint8_t	System ID
target_component	uint8_t	Component ID
seq	uint16_t	Sequence

## MISSION\_CURRENT (#42)

)

[Message] Message that announces the sequence number of the current active mission item. The MAV will fly towards this mission item.

Field Name	Type	Description
seq	uint16_t	Sequence

## MISSION\_REQUEST\_LIST (#43)

)

[Message] Request the overall list of mission items from the system/component.

Field Name	Type	Values	Description
target_system	uint8_t		System ID
target_component	uint8_t		Component ID
mission_type**	uint8_t	<a href="#">MAV_MISSION_TYPE</a>	Mission type.

## MISSION\_COUNT (#44)

)

[Message] This message is emitted as response to [MISSION\\_REQUEST\\_LIST](#) by the MAV and to initiate a write transaction. The GCS can then request the individual mission item based on the knowledge of the total number of waypoints.

Field Name	Type	Values	Description
target_system	uint8_t		System ID
target_component	uint8_t		Component ID
count	uint16_t		Number of mission items in the sequence
mission_type**	uint8_t	<a href="#">MAV_MISSION_TYPE</a>	Mission type.

## MISSION\_CLEAR\_ALL (#45)

)

[Message] Delete all mission items at once.

Field Name	Type	Values	Description
target_system	uint8_t		System ID
target_component	uint8_t		Component ID
mission_type**	uint8_t	<a href="#">MAV_MISSION_TYPE</a>	Mission type.

## MISSION\_ITEM\_REACHED (#46)

)

[Message] A certain mission item has been reached. The system will either hold this position (or circle on the orbit) or (if the autocontinue on the WP was set) continue to the next waypoint.

Field Name	Type	Description
seq	uint16_t	Sequence

## MISSION\_ACK (#47)

)

[Message] Acknowledgment message during waypoint handling. The type field states if this message is a positive ack (type=0) or if an error happened (type=non-zero).

Field Name	Type	Values	Description
target_system	uint8_t		System ID
target_component	uint8_t		Component ID
type	uint8_t	<a href="#">MAV_MISSION_RESULT</a>	Mission result.
mission_type**	uint8_t	<a href="#">MAV_MISSION_TYPE</a>	Mission type.

#### SET\_GPS\_GLOBAL\_ORIGIN (#48)

)

[Message] Sets the GPS coordinates of the vehicle local origin (0,0,0) position. Vehicle should emit [GPS\\_GLOBAL\\_ORIGIN](#) irrespective of whether the origin is changed. This enables transform between the local coordinate frame and the global (GPS) coordinate frame, which may be necessary when (for example) indoor and outdoor settings are connected and the MAV should move from in- to outdoor.

Field Name	Type	Units	Description
target_system	uint8_t		System ID
latitude	int32_t	degE7	Latitude (WGS84)
longitude	int32_t	degE7	Longitude (WGS84)
altitude	int32_t	mm	Altitude (MSL). Positive for up.
time_usec**	uint64_t	us	Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.

#### GPS\_GLOBAL\_ORIGIN (#49)

)

[Message] Publishes the GPS coordinates of the vehicle local origin (0,0,0) position. Emitted whenever a new GPS-Local position mapping is requested or set - e.g. following [SET\\_GPS\\_GLOBAL\\_ORIGIN](#) message.

Field Name	Type	Units	Description
latitude	int32_t	degE7	Latitude (WGS84)
longitude	int32_t	degE7	Longitude (WGS84)
altitude	int32_t	mm	Altitude (MSL). Positive for up.
time_usec**	uint64_t	us	Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.

#### PARAM\_MAP\_RC (#50)

)

[Message] Bind a RC channel to a parameter. The parameter should change according to the RC channel value.

Field Name	Type	Description
target_system	uint8_t	System ID
target_component	uint8_t	Component ID
param_id	char[16]	Onboard parameter id, terminated by NULL if the length is less than 16 human-readable chars and WITHOUT null termination (NULL) byte if the length is exactly 16 chars - applications have to provide 16+1 bytes storage if the ID is stored as string
param_index	int16_t	Parameter index. Send -1 to use the param ID field as identifier (else the param id will be ignored), send -2 to disable any existing map for this rc_channel_index.
parameter_rc_channel_index	uint8_t	Index of parameter RC channel. Not equal to the RC channel id. Typically corresponds to a potentiometer-knob on the RC.
param_value0	float	Initial parameter value
scale	float	Scale, maps the RC range [-1, 1] to a parameter value
param_value_min	float	Minimum param value. The protocol does not define if this overwrites an onboard minimum value. (Depends on implementation)
param_value_max	float	Maximum param value. The protocol does not define if this overwrites an onboard maximum value. (Depends on implementation)

#### MISSION\_REQUEST\_INT (#51)

)

[Message] Request the information of the mission item with the sequence number seq. The response of the system to this message should be a [MISSION\\_ITEM\\_INT](#) message. <https://mavlink.io/en/services/mission.html>

Field Name	Type	Values	Description
target_system	uint8_t		System ID
target_component	uint8_t		Component ID
seq	uint16_t		Sequence
mission_type**	uint8_t	<a href="#">MAV_MISSION_TYPE</a>	Mission type.

#### SAFETY\_SET\_ALLOWED\_AREA (#54)

)

[Message] Set a safety zone (volume), which is defined by two corners of a cube. This message can be used to tell the MAV which setpoints/waypoints to accept and which to reject. Safety areas are often enforced by national or competition regulations.

Field Name	Type	Units	Values	Description
target_system	uint8_t			System ID
target_component	uint8_t			Component ID
frame	uint8_t		<a href="#">MAV_FRAME</a>	Coordinate frame. Can be either global, GPS, right-handed with Z axis up or local, right handed, Z axis down.
p1x	float	m		x position 1 / Latitude 1
p1y	float	m		y position 1 / Longitude 1
p1z	float	m		z position 1 / Altitude 1

p2x	float	m	x position 2 / Latitude 2
p2y	float	m	y position 2 / Longitude 2
p2z	float	m	z position 2 / Altitude 2

## SAFETY\_ALLOWED\_AREA (#55)

)

[Message] Read out the safety zone the MAV currently assumes.

Field Name	Type	Units	Values	Description
frame	uint8_t		<a href="#">MAV_FRAME</a>	Coordinate frame. Can be either global, GPS, right-handed with Z axis up or local, right handed, Z axis down.
p1x	float	m		x position 1 / Latitude 1
p1y	float	m		y position 1 / Longitude 1
p1z	float	m		z position 1 / Altitude 1
p2x	float	m		x position 2 / Latitude 2
p2y	float	m		y position 2 / Longitude 2
p2z	float	m		z position 2 / Altitude 2

## ATTITUDE\_QUATERNION\_COV (#61)

)

[Message] The attitude in the aeronautical frame (right-handed, Z-down, X-front, Y-right), expressed as quaternion. Quaternion order is w, x, y, z and a zero rotation would be expressed as (1 0 0 0).

Field Name	Type	Units	Description
time_usec	uint64_t	us	Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
q	float[4]		Quaternion components, w, x, y, z (1 0 0 0 is the null-rotation)
rollspeed	float	rad/s	Roll angular speed
pitchspeed	float	rad/s	Pitch angular speed
yawspeed	float	rad/s	Yaw angular speed
covariance	float[9]		Row-major representation of a 3x3 attitude covariance matrix (states: roll, pitch, yaw; first three entries are the first ROW, next three entries are the second row, etc.). If unknown, assign NaN value to first element in the array.

## NAV\_CONTROLLER\_OUTPUT (#62)

)

[Message] The state of the navigation and position controller.

Field Name	Type	Units	Description
nav_roll	float	deg	Current desired roll
nav_pitch	float	deg	Current desired pitch
nav_bearing	int16_t	deg	Current desired heading
target_bearing	int16_t	deg	Bearing to current waypoint/target
wp_dist	uint16_t	m	Distance to active waypoint
alt_error	float	m	Current altitude error
aspd_error	float	m/s	Current airspeed error
xtrack_error	float	m	Current crosstrack error on x-y plane

## GLOBAL\_POSITION\_INT\_COV (#63)

)

[Message] The filtered global position (e.g. fused GPS and accelerometers). The position is in GPS-frame (right-handed, Z-up). It is designed as scaled integer message since the resolution of float is not sufficient. NOTE: This message is intended for onboard networks / companion computers and higher-bandwidth links and optimized for accuracy and completeness. Please use the [GLOBAL\\_POSITION\\_INT](#) message for a minimal subset.

Field Name	Type	Units	Values	Description
time_usec	uint64_t	us		Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
estimator_type	uint8_t		<a href="#">MAV_ESTIMATOR_TYPE</a>	Class id of the estimator this estimate originated from.
lat	int32_t	degE7		Latitude
lon	int32_t	degE7		Longitude
alt	int32_t	mm		Altitude in meters above MSL
relative_alt	int32_t	mm		Altitude above ground
vx	float	m/s		Ground X Speed (Latitude)
vy	float	m/s		Ground Y Speed (Longitude)
vz	float	m/s		Ground Z Speed (Altitude)
covariance	float[36]			Row-major representation of a 6x6 position and velocity 6x6 cross-covariance matrix (states: lat, lon, alt, vx, vy, vz; first six entries are the first ROW, next six entries are the second row, etc.). If unknown, assign NaN value to first element in the array.

## LOCAL\_POSITION\_NED\_COV (#64)

)

[Message] The filtered local position (e.g. fused computer vision and accelerometers). Coordinate frame is right-handed, Z-axis down (aeronautical frame, NED / north-east-down convention)

Field Name	Type	Units	Values	Description
time_usec	uint64_t	us		Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
estimator_type	uint8_t		<a href="#">MAV_ESTIMATOR_TYPE</a>	Class id of the estimator this estimate originated from.
x	float	m		X Position
y	float	m		Y Position
z	float	m		Z Position
vx	float	m/s		X Speed
vy	float	m/s		Y Speed
vz	float	m/s		Z Speed
ax	float	m/s/s		X Acceleration
ay	float	m/s/s		Y Acceleration
az	float	m/s/s		Z Acceleration
covariance	float[45]			Row-major representation of position, velocity and acceleration 9x9 cross-covariance matrix upper right triangle (states: x, y, z, vx, vy, vz, ax, ay, az; first nine entries are the first ROW, next eight entries are the second row, etc.). If unknown, assign NaN value to first element in the array.

## RC\_CHANNELS (#65

)

[Message] The PPM values of the RC channels received. The standard PPM modulation is as follows: 1000 microseconds: 0%, 2000 microseconds: 100%. A value of UINT16\_MAX implies the channel is unused. Individual receivers/transmitters might violate this specification.

Field Name	Type	Units	Description
time_boot_ms	uint32_t	ms	Timestamp (time since system boot).
chancount	uint8_t		Total number of RC channels being received. This can be larger than 18, indicating that more channels are available but not given in this message. This value should be 0 when no RC channels are available.
chan1_raw	uint16_t	us	RC channel 1 value.
chan2_raw	uint16_t	us	RC channel 2 value.
chan3_raw	uint16_t	us	RC channel 3 value.
chan4_raw	uint16_t	us	RC channel 4 value.
chan5_raw	uint16_t	us	RC channel 5 value.
chan6_raw	uint16_t	us	RC channel 6 value.
chan7_raw	uint16_t	us	RC channel 7 value.
chan8_raw	uint16_t	us	RC channel 8 value.
chan9_raw	uint16_t	us	RC channel 9 value.
chan10_raw	uint16_t	us	RC channel 10 value.
chan11_raw	uint16_t	us	RC channel 11 value.
chan12_raw	uint16_t	us	RC channel 12 value.
chan13_raw	uint16_t	us	RC channel 13 value.
chan14_raw	uint16_t	us	RC channel 14 value.
chan15_raw	uint16_t	us	RC channel 15 value.
chan16_raw	uint16_t	us	RC channel 16 value.
chan17_raw	uint16_t	us	RC channel 17 value.
chan18_raw	uint16_t	us	RC channel 18 value.
rss	uint8_t		Receive signal strength indicator in device-dependent units/scale. Values: [0-254], UINT8_MAX: invalid/unknown.

## REQUEST\_DATA\_STREAM (#66

)

**DEPRECATED:** Replaced by [SET\\_MESSAGE\\_INTERVAL](#) (2015-08).

[Message] Request a data stream.

Field Name	Type	Units	Description
target_system	uint8_t		The target requested to send the message stream.
target_component	uint8_t		The target requested to send the message stream.
req_stream_id	uint8_t		The ID of the requested data stream
req_message_rate	uint16_t	Hz	The requested message rate
start_stop	uint8_t		1 to start sending, 0 to stop sending.

## DATA\_STREAM (#67

)

**DEPRECATED:** Replaced by [MESSAGE\\_INTERVAL](#) (2015-08).

[Message] Data stream status information.

Field Name	Type	Units	Description
stream_id	uint8_t		The ID of the requested data stream
message_rate	uint16_t	Hz	The message rate
on_off	uint8_t		1 stream is enabled, 0 stream is stopped.

## MANUAL\_CONTROL (#69

)



[\[Message\]](#) This message provides an API for manually controlling the vehicle using standard joystick axes nomenclature, along with a joystick-like input device. Unused axes can be disabled and buttons states are transmitted as individual on/off bits of a bitmask

Field Name	Type	Description
target	uint8_t	The system to be controlled.
x	int16_t	X-axis, normalized to the range [-1000,1000]. A value of INT16_MAX indicates that this axis is invalid. Generally corresponds to forward(1000)-backward(-1000) movement on a joystick and the pitch of a vehicle.
y	int16_t	Y-axis, normalized to the range [-1000,1000]. A value of INT16_MAX indicates that this axis is invalid. Generally corresponds to left(-1000)-right(1000) movement on a joystick and the roll of a vehicle.
z	int16_t	Z-axis, normalized to the range [-1000,1000]. A value of INT16_MAX indicates that this axis is invalid. Generally corresponds to a separate slider movement with maximum being 1000 and minimum being -1000 on a joystick and the thrust of a vehicle. Positive values are positive thrust, negative values are negative thrust.
r	int16_t	R-axis, normalized to the range [-1000,1000]. A value of INT16_MAX indicates that this axis is invalid. Generally corresponds to a twisting of the joystick, with counter-clockwise being 1000 and clockwise being -1000, and the yaw of a vehicle.
buttons	uint16_t	A bitfield corresponding to the joystick buttons' 0-15 current state, 1 for pressed, 0 for released. The lowest bit corresponds to Button 1.
buttons2**	uint16_t	A bitfield corresponding to the joystick buttons' 16-31 current state, 1 for pressed, 0 for released. The lowest bit corresponds to Button 16.
enabled_extensions**	uint8_t	Set bits to 1 to indicate which of the following extension fields contain valid data: bit 0: pitch, bit 1: roll.
s**	int16_t	Pitch-only-axis, normalized to the range [-1000,1000]. Generally corresponds to pitch on vehicles with additional degrees of freedom. Valid if bit 0 of enabled_extensions field is set. Set to 0 if invalid.
t**	int16_t	Roll-only-axis, normalized to the range [-1000,1000]. Generally corresponds to roll on vehicles with additional degrees of freedom. Valid if bit 1 of enabled_extensions field is set. Set to 0 if invalid.

## RC\_CHANNELS\_OVERRIDE (#70)

)

[\[Message\]](#) The RAW values of the RC channels sent to the MAV to override info received from the RC radio. The standard PPM modulation is as follows: 1000 microseconds: 0%, 2000 microseconds: 100%. Individual receivers/transmitters might violate this specification. Note carefully the semantic differences between the first 8 channels and the subsequent channels

Field Name	Type	Units	Description
target_system	uint8_t		System ID
target_component	uint8_t		Component ID
chan1_raw	uint16_t	us	RC channel 1 value. A value of UINT16_MAX means to ignore this field. A value of 0 means to release this channel back to the RC radio.
chan2_raw	uint16_t	us	RC channel 2 value. A value of UINT16_MAX means to ignore this field. A value of 0 means to release this channel back to the RC radio.
chan3_raw	uint16_t	us	RC channel 3 value. A value of UINT16_MAX means to ignore this field. A value of 0 means to release this channel back to the RC radio.
chan4_raw	uint16_t	us	RC channel 4 value. A value of UINT16_MAX means to ignore this field. A value of 0 means to release this channel back to the RC radio.
chan5_raw	uint16_t	us	RC channel 5 value. A value of UINT16_MAX means to ignore this field. A value of 0 means to release this channel back to the RC radio.
chan6_raw	uint16_t	us	RC channel 6 value. A value of UINT16_MAX means to ignore this field. A value of 0 means to release this channel back to the RC radio.
chan7_raw	uint16_t	us	RC channel 7 value. A value of UINT16_MAX means to ignore this field. A value of 0 means to release this channel back to the RC radio.
chan8_raw	uint16_t	us	RC channel 8 value. A value of UINT16_MAX means to ignore this field. A value of 0 means to release this channel back to the RC radio.
chan9_raw**	uint16_t	us	RC channel 9 value. A value of 0 or UINT16_MAX means to ignore this field. A value of UINT16_MAX-1 means to release this channel back to the RC radio.
chan10_raw**	uint16_t	us	RC channel 10 value. A value of 0 or UINT16_MAX means to ignore this field. A value of UINT16_MAX-1 means to release this channel back to the RC radio.
chan11_raw**	uint16_t	us	RC channel 11 value. A value of 0 or UINT16_MAX means to ignore this field. A value of UINT16_MAX-1 means to release this channel back to the RC radio.
chan12_raw**	uint16_t	us	RC channel 12 value. A value of 0 or UINT16_MAX means to ignore this field. A value of UINT16_MAX-1 means to release this channel back to the RC radio.
chan13_raw**	uint16_t	us	RC channel 13 value. A value of 0 or UINT16_MAX means to ignore this field. A value of UINT16_MAX-1 means to release this channel back to the RC radio.
chan14_raw**	uint16_t	us	RC channel 14 value. A value of 0 or UINT16_MAX means to ignore this field. A value of UINT16_MAX-1 means to release this channel back to the RC radio.
chan15_raw**	uint16_t	us	RC channel 15 value. A value of 0 or UINT16_MAX means to ignore this field. A value of UINT16_MAX-1 means to release this channel back to the RC radio.
chan16_raw**	uint16_t	us	RC channel 16 value. A value of 0 or UINT16_MAX means to ignore this field. A value of UINT16_MAX-1 means to release this channel back to the RC radio.
chan17_raw**	uint16_t	us	RC channel 17 value. A value of 0 or UINT16_MAX means to ignore this field. A value of UINT16_MAX-1 means to release this channel back to the RC radio.
chan18_raw**	uint16_t	us	RC channel 18 value. A value of 0 or UINT16_MAX means to ignore this field. A value of UINT16_MAX-1 means to release this channel back to the RC radio.

## MISSION\_ITEM\_INT (#73)

)

[\[Message\]](#) Message encoding a mission item. This message is emitted to announce the presence of a mission item and to set a mission item on the system. The mission item can be either in x, y, z meters (type: LOCAL) or x:lat, y:lon, z:altitude. Local frame is Z-down, right handed (NED), global frame is Z-up, right handed (ENU). NaN or INT32\_MAX may be used in float/integer params (respectively) to indicate optional/default values (e.g. to use the component's current latitude, yaw rather than a specific value). See also <https://mavlink.io/en/services/mission.html>.

Field Name	Type	Values	Description
target_system	uint8_t		System ID
target_component	uint8_t		Component ID

seq	uint16_t	Waypoint ID (sequence number). Starts at zero. Increases monotonically for each waypoint, no gaps in the sequence (0,1,2,3,4).
frame	uint8_t	<a href="#">MAV_FRAME</a> The coordinate system of the waypoint.
command	uint16_t	<a href="#">MAV_CMD</a> The scheduled action for the waypoint.
current	uint8_t	false:0, true:1
autocontinue	uint8_t	Autocontinue to next waypoint
param1	float	PARAM1, see <a href="#">MAV_CMD</a> enum
param2	float	PARAM2, see <a href="#">MAV_CMD</a> enum
param3	float	PARAM3, see <a href="#">MAV_CMD</a> enum
param4	float	PARAM4, see <a href="#">MAV_CMD</a> enum
x	int32_t	PARAM5 / local: x position in meters * 1e4, global: latitude in degrees * 10 <sup>7</sup>
y	int32_t	PARAM6 / y position: local: x position in meters * 1e4, global: longitude in degrees * 10 <sup>7</sup>
z	float	PARAM7 / z position: global: altitude in meters (relative or absolute, depending on frame).
mission_type**	uint8_t	<a href="#">MAV_MISSION_TYPE</a> Mission type.

## VFR\_HUD (#74)

)

[\[Message\]](#) Metrics typically displayed on a HUD for fixed wing aircraft.

Field Name	Type	Units	Description
airspeed	float	m/s	Vehicle speed in form appropriate for vehicle type. For standard aircraft this is typically calibrated airspeed (CAS) or indicated airspeed (IAS) - either of which can be used by a pilot to estimate stall speed.
groundspeed	float	m/s	Current ground speed.
heading	int16_t	deg	Current heading in compass units (0-360, 0=north).
throttle	uint16_t	%	Current throttle setting (0 to 100).
alt	float	m	Current altitude (MSL).
climb	float	m/s	Current climb rate.

## COMMAND\_INT (#75)

)

[\[Message\]](#) Message encoding a command with parameters as scaled integers. Scaling depends on the actual command value. NaN or INT32\_MAX may be used in float/integer params (respectively) to indicate optional/default values (e.g. to use the component's current latitude, yaw rather than a specific value). The command microservice is documented at <https://mavlink.io/en/services/command.html>

Field Name	Type	Values	Description
target_system	uint8_t		System ID
target_component	uint8_t		Component ID
frame	uint8_t	<a href="#">MAV_FRAME</a>	The coordinate system of the COMMAND.
command	uint16_t	<a href="#">MAV_CMD</a>	The scheduled action for the mission item.
current	uint8_t		Not used.
autocontinue	uint8_t		Not used (set 0).
param1	float		PARAM1, see <a href="#">MAV_CMD</a> enum
param2	float		PARAM2, see <a href="#">MAV_CMD</a> enum
param3	float		PARAM3, see <a href="#">MAV_CMD</a> enum
param4	float		PARAM4, see <a href="#">MAV_CMD</a> enum
x	int32_t		PARAM5 / local: x position in meters * 1e4, global: latitude in degrees * 10 <sup>7</sup>
y	int32_t		PARAM6 / local: y position in meters * 1e4, global: longitude in degrees * 10 <sup>7</sup>
z	float		PARAM7 / z position: global: altitude in meters (relative or absolute, depending on frame).

## COMMAND\_LONG (#76)

)

[\[Message\]](#) Send a command with up to seven parameters to the MAV. The command microservice is documented at <https://mavlink.io/en/services/command.html>

Field Name	Type	Values	Description
target_system	uint8_t		System which should execute the command
target_component	uint8_t		Component which should execute the command, 0 for all components
command	uint16_t	<a href="#">MAV_CMD</a>	Command ID (of command to send).
confirmation	uint8_t		0: First transmission of this command. 1-255: Confirmation transmissions (e.g. for kill command)
param1	float		Parameter 1 (for the specific command).
param2	float		Parameter 2 (for the specific command).
param3	float		Parameter 3 (for the specific command).
param4	float		Parameter 4 (for the specific command).
param5	float		Parameter 5 (for the specific command).
param6	float		Parameter 6 (for the specific command).
param7	float		Parameter 7 (for the specific command).

## COMMAND\_ACK (#77)

)

[\[Message\]](#) Report status of a command. Includes feedback whether the command was executed. The command microservice is documented at <https://mavlink.io/en/services/command.html>

Field Name	Type	Values	Description
command	uint16_t	<a href="#">MAV_CMD</a>	Command ID (of acknowledged command).
result	uint8_t	<a href="#">MAV_RESULT</a>	Result of command.
progress**	uint8_t		Also used as result_param1, it can be set with an enum containing the errors reasons of why the command was denied, or the progress percentage when result is <a href="#">MAV_RESULT_IN_PROGRESS</a> (UINT8_MAX if the progress is unknown).
result_param2**	int32_t		Additional parameter of the result, example: which parameter of <a href="#">MAV_CMD_NAV_WAYPOINT</a> caused it to be denied.
target_system**	uint8_t		System ID of the target recipient. This is the ID of the system that sent the command for which this <a href="#">COMMAND_ACK</a> is an acknowledgement.
target_component**	uint8_t		Component ID of the target recipient. This is the ID of the system that sent the command for which this <a href="#">COMMAND_ACK</a> is an acknowledgement.

## COMMAND\_CANCEL (#80)

)

**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[Message] Cancel a long running command. The target system should respond with a [COMMAND\\_ACK](#) to the original command with result=MAV\_RESULT\_CANCELLED if the long running process was cancelled. If it has already completed, the cancel action can be ignored. The cancel action can be retried until some sort of acknowledgement to the original command has been received. The command microservice is documented at <https://mavlink.io/en/services/command.html>

Field Name	Type	Values	Description
target_system	uint8_t		System executing long running command. Should not be broadcast (0).
target_component	uint8_t		Component executing long running command.
command	uint16_t	<a href="#">MAV_CMD</a>	Command ID (of command to cancel).

## MANUAL\_SETPOINT (#81)

)

[Message] Setpoint in roll, pitch, yaw and thrust from the operator

Field Name	Type	Units	Description
time_boot_ms	uint32_t	ms	Timestamp (time since system boot).
roll	float	rad/s	Desired roll rate
pitch	float	rad/s	Desired pitch rate
yaw	float	rad/s	Desired yaw rate
thrust	float		Collective thrust, normalized to 0 .. 1
mode_switch	uint8_t		Flight mode switch position, 0.. 255
manual_override_switch	uint8_t		Override mode switch position, 0.. 255

## SET\_ATTITUDE\_TARGET (#82)

)

[Message] Sets a desired vehicle attitude. Used by an external controller to command the vehicle (manual controller or other system).

Field Name	Type	Units	Values	Description
time_boot_ms	uint32_t	ms		Timestamp (time since system boot).
target_system	uint8_t			System ID
target_component	uint8_t			Component ID
type_mask	uint8_t		<a href="#">ATTITUDE_TARGET_TYPEMASK</a>	Bitmap to indicate which dimensions should be ignored by the vehicle.
q	float[4]			Attitude quaternion (w, x, y, z order, zero-rotation is 1, 0, 0, 0)
body_roll_rate	float	rad/s		Body roll rate
body_pitch_rate	float	rad/s		Body pitch rate
body_yaw_rate	float	rad/s		Body yaw rate
thrust	float			Collective thrust, normalized to 0 .. 1 (-1 .. 1 for vehicles capable of reverse thrust)
thrust_body**	float[3]			3D thrust setpoint in the body NED frame, normalized to -1 .. 1

## ATTITUDE\_TARGET (#83)

)

[Message] Reports the current commanded attitude of the vehicle as specified by the autopilot. This should match the commands sent in a [SET\\_ATTITUDE\\_TARGET](#) message if the vehicle is being controlled this way.

Field Name	Type	Units	Values	Description
time_boot_ms	uint32_t	ms		Timestamp (time since system boot).
type_mask	uint8_t		<a href="#">ATTITUDE_TARGET_TYPEMASK</a>	Bitmap to indicate which dimensions should be ignored by the vehicle.
q	float[4]			Attitude quaternion (w, x, y, z order, zero-rotation is 1, 0, 0, 0)
body_roll_rate	float	rad/s		Body roll rate
body_pitch_rate	float	rad/s		Body pitch rate
body_yaw_rate	float	rad/s		Body yaw rate
thrust	float			Collective thrust, normalized to 0 .. 1 (-1 .. 1 for vehicles capable of reverse thrust)

## SET\_POSITION\_TARGET\_LOCAL\_NED (#84)

)

[Message] Sets a desired vehicle position in a local north-east-down coordinate frame. Used by an external controller to command the vehicle (manual controller or other system).

Field Name	Type	Units	Values	Description
time_boot_ms	uint32_t	ms		Timestamp (time since system boot).
target_system	uint8_t			System ID
target_component	uint8_t			Component ID
coordinate_frame	uint8_t		<a href="#">MAV_FRAME</a>	Valid options are: <a href="#">MAV_FRAME_LOCAL_NED</a> = 1, <a href="#">MAV_FRAME_LOCAL_OFFSET_NED</a> = 7, <a href="#">MAV_FRAME_BODY_NED</a> = 8, <a href="#">MAV_FRAME_BODY_OFFSET_NED</a> = 9
type_mask	uint16_t		<a href="#">POSITION_TARGET_TYPEMASK</a>	Bitmap to indicate which dimensions should be ignored by the vehicle.
x	float	m		X Position in NED frame
y	float	m		Y Position in NED frame
z	float	m		Z Position in NED frame (note, altitude is negative in NED)
vx	float	m/s		X velocity in NED frame
vy	float	m/s		Y velocity in NED frame
vz	float	m/s		Z velocity in NED frame
afx	float	m/s/s		X acceleration or force (if bit 10 of type_mask is set) in NED frame in meter / s <sup>2</sup> or N
afy	float	m/s/s		Y acceleration or force (if bit 10 of type_mask is set) in NED frame in meter / s <sup>2</sup> or N
afz	float	m/s/s		Z acceleration or force (if bit 10 of type_mask is set) in NED frame in meter / s <sup>2</sup> or N
yaw	float	rad		yaw setpoint
yaw_rate	float	rad/s		yaw rate setpoint

### POSITION\_TARGET\_LOCAL\_NED (#85)

)

[Message] Reports the current commanded vehicle position, velocity, and acceleration as specified by the autopilot. This should match the commands sent in [SET\\_POSITION\\_TARGET\\_LOCAL\\_NED](#) if the vehicle is being controlled this way.

Field Name	Type	Units	Values	Description
time_boot_ms	uint32_t	ms		Timestamp (time since system boot).
coordinate_frame	uint8_t		<a href="#">MAV_FRAME</a>	Valid options are: <a href="#">MAV_FRAME_LOCAL_NED</a> = 1, <a href="#">MAV_FRAME_LOCAL_OFFSET_NED</a> = 7, <a href="#">MAV_FRAME_BODY_NED</a> = 8, <a href="#">MAV_FRAME_BODY_OFFSET_NED</a> = 9
type_mask	uint16_t		<a href="#">POSITION_TARGET_TYPEMASK</a>	Bitmap to indicate which dimensions should be ignored by the vehicle.
x	float	m		X Position in NED frame
y	float	m		Y Position in NED frame
z	float	m		Z Position in NED frame (note, altitude is negative in NED)
vx	float	m/s		X velocity in NED frame
vy	float	m/s		Y velocity in NED frame
vz	float	m/s		Z velocity in NED frame
afx	float	m/s/s		X acceleration or force (if bit 10 of type_mask is set) in NED frame in meter / s <sup>2</sup> or N
afy	float	m/s/s		Y acceleration or force (if bit 10 of type_mask is set) in NED frame in meter / s <sup>2</sup> or N
afz	float	m/s/s		Z acceleration or force (if bit 10 of type_mask is set) in NED frame in meter / s <sup>2</sup> or N
yaw	float	rad		yaw setpoint
yaw_rate	float	rad/s		yaw rate setpoint

### SET\_POSITION\_TARGET\_GLOBAL\_INT (#86)

)

[Message] Sets a desired vehicle position, velocity, and/or acceleration in a global coordinate system (WGS84). Used by an external controller to command the vehicle (manual controller or other system).

Field Name	Type	Units	Values	Description
time_boot_ms	uint32_t	ms		Timestamp (time since system boot). The rationale for the timestamp in the setpoint is to allow the system to compensate for the transport delay of the setpoint. This allows the system to compensate processing latency.
target_system	uint8_t			System ID
target_component	uint8_t			Component ID
coordinate_frame	uint8_t		<a href="#">MAV_FRAME</a>	Valid options are: <a href="#">MAV_FRAME_GLOBAL_INT</a> = 5, <a href="#">MAV_FRAME_GLOBAL_RELATIVE_ALT_INT</a> = 6, <a href="#">MAV_FRAME_GLOBAL_TERRAIN_ALT_INT</a> = 11
type_mask	uint16_t		<a href="#">POSITION_TARGET_TYPEMASK</a>	Bitmap to indicate which dimensions should be ignored by the vehicle.
lat_int	int32_t	degE7		X Position in WGS84 frame
lon_int	int32_t	degE7		Y Position in WGS84 frame
alt	float	m		Altitude (MSL, Relative to home, or AGL - depending on frame)
vx	float	m/s		X velocity in NED frame
vy	float	m/s		Y velocity in NED frame
vz	float	m/s		Z velocity in NED frame
afx	float	m/s/s		X acceleration or force (if bit 10 of type_mask is set) in NED frame in meter / s <sup>2</sup> or N
afy	float	m/s/s		Y acceleration or force (if bit 10 of type_mask is set) in NED frame in meter / s <sup>2</sup> or N
afz	float	m/s/s		Z acceleration or force (if bit 10 of type_mask is set) in NED frame in meter / s <sup>2</sup> or N
yaw	float	rad		yaw setpoint
yaw_rate	float	rad/s		yaw rate setpoint

## POSITION\_TARGET\_GLOBAL\_INT (#87)

)

[Message] Reports the current commanded vehicle position, velocity, and acceleration as specified by the autopilot. This should match the commands sent in [SET\\_POSITION\\_TARGET\\_GLOBAL\\_INT](#) if the vehicle is being controlled this way.

Field Name	Type	Units	Values	Description
time_boot_ms	uint32_t	ms		Timestamp (time since system boot). The rationale for the timestamp in the setpoint is to allow the system to compensate for the transport delay of the setpoint. This allows the system to compensate processing latency.
coordinate_frame	uint8_t		<a href="#">MAV_FRAME</a>	Valid options are: <a href="#">MAV_FRAME_GLOBAL_INT</a> = 5, <a href="#">MAV_FRAME_GLOBAL_RELATIVE_ALT_INT</a> = 6, <a href="#">MAV_FRAME_GLOBAL_TERRAIN_ALT_INT</a> = 11
type_mask	uint16_t		<a href="#">POSITION_TARGET_TYPEMASK</a>	Bitmap to indicate which dimensions should be ignored by the vehicle.
lat_int	int32_t	degE7		X Position in WGS84 frame
lon_int	int32_t	degE7		Y Position in WGS84 frame
alt	float	m		Altitude (MSL, AGL or relative to home altitude, depending on frame)
vx	float	m/s		X velocity in NED frame
vy	float	m/s		Y velocity in NED frame
vz	float	m/s		Z velocity in NED frame
afx	float	m/s/s		X acceleration or force (if bit 10 of type_mask is set) in NED frame in meter / s <sup>2</sup> or N
afy	float	m/s/s		Y acceleration or force (if bit 10 of type_mask is set) in NED frame in meter / s <sup>2</sup> or N
afz	float	m/s/s		Z acceleration or force (if bit 10 of type_mask is set) in NED frame in meter / s <sup>2</sup> or N
yaw	float	rad		yaw setpoint
yaw_rate	float	rad/s		yaw rate setpoint

## LOCAL\_POSITION\_NED\_SYSTEM\_GLOBAL\_OFFSET (#89)

)

[Message] The offset in X, Y, Z and yaw between the [LOCAL\\_POSITION\\_NED](#) messages of MAV X and the global coordinate frame in NED coordinates. Coordinate frame is right-handed, Z-axis down (aeronautical frame, NED / north-east-down convention)

Field Name	Type	Units	Description
time_boot_ms	uint32_t	ms	Timestamp (time since system boot).
x	float	m	X Position
y	float	m	Y Position
z	float	m	Z Position
roll	float	rad	Roll
pitch	float	rad	Pitch
yaw	float	rad	Yaw

## HIL\_STATE (#90)

)

**DEPRECATED:** Replaced by [HIL\\_STATE\\_QUATERNION](#) (2013-07).

Suffers from missing airspeed fields and singularities due to Euler angles

[Message] Sent from simulation to autopilot. This packet is useful for high throughput applications such as hardware in the loop simulations.

Field Name	Type	Units	Description
time_usec	uint64_t	us	Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
roll	float	rad	Roll angle
pitch	float	rad	Pitch angle
yaw	float	rad	Yaw angle
rollspeed	float	rad/s	Body frame roll / phi angular speed
pitchspeed	float	rad/s	Body frame pitch / theta angular speed
yawspeed	float	rad/s	Body frame yaw / psi angular speed
lat	int32_t	degE7	Latitude
lon	int32_t	degE7	Longitude
alt	int32_t	mm	Altitude
vx	int16_t	cm/s	Ground X Speed (Latitude)
vy	int16_t	cm/s	Ground Y Speed (Longitude)
vz	int16_t	cm/s	Ground Z Speed (Altitude)
xacc	int16_t	mG	X acceleration
yacc	int16_t	mG	Y acceleration
zacc	int16_t	mG	Z acceleration

## HIL\_CONTROLS (#91)

)

[Message] Sent from autopilot to simulation. Hardware in the loop control outputs

Field Name	Type	Units	Values	Description
				Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer

time_usec	uint64_t	us	timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
roll_ailerons	float		Control output -1 .. 1
pitch_elevator	float		Control output -1 .. 1
yaw_rudder	float		Control output -1 .. 1
throttle	float		Throttle 0 .. 1
aux1	float		Aux 1, -1 .. 1
aux2	float		Aux 2, -1 .. 1
aux3	float		Aux 3, -1 .. 1
aux4	float		Aux 4, -1 .. 1
mode	uint8_t		<a href="#">MAV_MODE</a> System mode.
nav_mode	uint8_t		Navigation mode ( <a href="#">MAV_NAV_MODE</a> )

## HIL\_RC\_INPUTS\_RAW (#92)

)

[\[Message\]](#) Sent from simulation to autopilot. The RAW values of the RC channels received. The standard PPM modulation is as follows: 1000 microseconds: 0%, 2000 microseconds: 100%. Individual receivers/transmitters might violate this specification.

Field Name	Type	Units	Description
time_usec	uint64_t	us	Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
chan1_raw	uint16_t	us	RC channel 1 value
chan2_raw	uint16_t	us	RC channel 2 value
chan3_raw	uint16_t	us	RC channel 3 value
chan4_raw	uint16_t	us	RC channel 4 value
chan5_raw	uint16_t	us	RC channel 5 value
chan6_raw	uint16_t	us	RC channel 6 value
chan7_raw	uint16_t	us	RC channel 7 value
chan8_raw	uint16_t	us	RC channel 8 value
chan9_raw	uint16_t	us	RC channel 9 value
chan10_raw	uint16_t	us	RC channel 10 value
chan11_raw	uint16_t	us	RC channel 11 value
chan12_raw	uint16_t	us	RC channel 12 value
rsqi	uint8_t		Receive signal strength indicator in device-dependent units/scale. Values: [0-254], UINT8_MAX: invalid/unknown.

## HIL\_ACTUATOR\_CONTROLS (#93)

)

[\[Message\]](#) Sent from autopilot to simulation. Hardware in the loop control outputs (replacement for [HIL\\_CONTROLS](#))

Field Name	Type	Units	Values	Description
time_usec	uint64_t	us		Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
controls	float[16]			Control outputs -1 .. 1. Channel assignment depends on the simulated hardware.
mode	uint8_t		<a href="#">MAV_MODE_FLAG</a>	System mode. Includes arming state.
flags	uint64_t			Flags as bitfield, 1: indicate simulation using lockstep.

## OPTICAL\_FLOW (#100)

)

[\[Message\]](#) Optical flow from a flow sensor (e.g. optical mouse sensor)

Field Name	Type	Units	Description
time_usec	uint64_t	us	Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
sensor_id	uint8_t		Sensor ID
flow_x	int16_t	dpix	Flow in x-sensor direction
flow_y	int16_t	dpix	Flow in y-sensor direction
flow_comp_m_x	float	m/s	Flow in x-sensor direction, angular-speed compensated
flow_comp_m_y	float	m/s	Flow in y-sensor direction, angular-speed compensated
quality	uint8_t		Optical flow quality / confidence. 0: bad, 255: maximum quality
ground_distance	float	m	Ground distance. Positive value: distance known. Negative value: Unknown distance
flow_rate_x**	float	rad/s	Flow rate about X axis
flow_rate_y**	float	rad/s	Flow rate about Y axis

## GLOBAL\_VISION\_POSITION\_ESTIMATE (#101)

)

[\[Message\]](#) Global position/attitude estimate from a vision source.

Field Name	Type	Units	Description
usec	uint64_t	us	Timestamp (UNIX time or since system boot)
x	float	m	Global X position
y	float	m	Global Y position
z	float	m	Global Z position
roll	float	rad	Roll angle

pitch	float	rad	Pitch angle
yaw	float	rad	Yaw angle
covariance**	float[21]		Row-major representation of pose 6x6 cross-covariance matrix upper right triangle (states: x_global, y_global, z_global, roll, pitch, yaw; first six entries are the first ROW, next five entries are the second ROW, etc.). If unknown, assign NaN value to first element in the array.
reset_counter**	uint8_t		Estimate reset counter. This should be incremented when the estimate resets in any of the dimensions (position, velocity, attitude, angular speed). This is designed to be used when e.g an external SLAM system detects a loop-closure and the estimate jumps.

## VISION\_POSITION\_ESTIMATE (#102)

)

[Message] Local position/attitude estimate from a vision source.

Field Name	Type	Units	Description
usec	uint64_t	us	Timestamp (UNIX time or time since system boot)
x	float	m	Local X position
y	float	m	Local Y position
z	float	m	Local Z position
roll	float	rad	Roll angle
pitch	float	rad	Pitch angle
yaw	float	rad	Yaw angle
covariance**	float[21]		Row-major representation of pose 6x6 cross-covariance matrix upper right triangle (states: x, y, z, roll, pitch, yaw; first six entries are the first ROW, next five entries are the second ROW, etc.). If unknown, assign NaN value to first element in the array.
reset_counter**	uint8_t		Estimate reset counter. This should be incremented when the estimate resets in any of the dimensions (position, velocity, attitude, angular speed). This is designed to be used when e.g an external SLAM system detects a loop-closure and the estimate jumps.

## VISION\_SPEED\_ESTIMATE (#103)

)

[Message] Speed estimate from a vision source.

Field Name	Type	Units	Description
usec	uint64_t	us	Timestamp (UNIX time or time since system boot)
x	float	m/s	Global X speed
y	float	m/s	Global Y speed
z	float	m/s	Global Z speed
covariance**	float[9]		Row-major representation of 3x3 linear velocity covariance matrix (states: vx, vy, vz; 1st three entries - 1st row, etc.). If unknown, assign NaN value to first element in the array.
reset_counter**	uint8_t		Estimate reset counter. This should be incremented when the estimate resets in any of the dimensions (position, velocity, attitude, angular speed). This is designed to be used when e.g an external SLAM system detects a loop-closure and the estimate jumps.

## VICON\_POSITION\_ESTIMATE (#104)

)

[Message] Global position estimate from a Vicon motion system source.

Field Name	Type	Units	Description
usec	uint64_t	us	Timestamp (UNIX time or time since system boot)
x	float	m	Global X position
y	float	m	Global Y position
z	float	m	Global Z position
roll	float	rad	Roll angle
pitch	float	rad	Pitch angle
yaw	float	rad	Yaw angle
covariance**	float[21]		Row-major representation of 6x6 pose cross-covariance matrix upper right triangle (states: x, y, z, roll, pitch, yaw; first six entries are the first ROW, next five entries are the second ROW, etc.). If unknown, assign NaN value to first element in the array.

## HIGHRES\_IMU (#105)

)

[Message] The IMU readings in SI units in NED body frame

Field Name	Type	Units	Values	Description
time_usec	uint64_t	us		Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
xacc	float	m/s/s		X acceleration
yacc	float	m/s/s		Y acceleration
zacc	float	m/s/s		Z acceleration
xgyro	float	rad/s		Angular speed around X axis
ygyro	float	rad/s		Angular speed around Y axis
zgyro	float	rad/s		Angular speed around Z axis
xmag	float	gauss		X Magnetic field
ymag	float	gauss		Y Magnetic field
zmag	float	gauss		Z Magnetic field
abs_pressure	float	hPa		Absolute pressure
diff_pressure	float	hPa		Differential pressure

pressure_alt	float		Altitude calculated from pressure
temperature	float	degC	Temperature
fields_updated	uint16	t	<a href="#">HIGHRES_IMU_UPDATED_FLAGS</a> Bitmap for fields that have updated since last message
id**	uint8	t	Id. Ids are numbered from 0 and map to IMUs numbered from 1 (e.g. IMU1 will have a message with id=0)

## OPTICAL\_FLOW\_RAD (#106)

)

[Message] Optical flow from an angular rate flow sensor (e.g. PX4FLOW or mouse sensor)

Field Name	Type	Units	Description
time_usec	uint64_t	us	Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
sensor_id	uint8_t		Sensor ID
integration_time_us	uint32_t	us	Integration time. Divide integrated_x and integrated_y by the integration time to obtain average flow. The integration time also indicates the.
integrated_x	float	rad	Flow around X axis (Sensor RH rotation about the X axis induces a positive flow. Sensor linear motion along the positive Y axis induces a negative flow.)
integrated_y	float	rad	Flow around Y axis (Sensor RH rotation about the Y axis induces a positive flow. Sensor linear motion along the positive X axis induces a positive flow.)
integrated_xgyro	float	rad	RH rotation around X axis
integrated_ygyro	float	rad	RH rotation around Y axis
integrated_zgyro	float	rad	RH rotation around Z axis
temperature	int16_t	cdegC	Temperature
quality	uint8_t		Optical flow quality / confidence. 0: no valid flow, 255: maximum quality
time_delta_distance_us	uint32_t	us	Time since the distance was sampled.
distance	float	m	Distance to the center of the flow field. Positive value (including zero): distance known. Negative value: Unknown distance.

## HIL\_SENSOR (#107)

)

[Message] The IMU readings in SI units in NED body frame

Field Name	Type	Units	Values	Description
time_usec	uint64_t	us		Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
xacc	float	m/s/s		X acceleration
yacc	float	m/s/s		Y acceleration
zacc	float	m/s/s		Z acceleration
xgyro	float	rad/s		Angular speed around X axis in body frame
ygyro	float	rad/s		Angular speed around Y axis in body frame
zgyro	float	rad/s		Angular speed around Z axis in body frame
xmag	float	gauss		X Magnetic field
ymag	float	gauss		Y Magnetic field
zmag	float	gauss		Z Magnetic field
abs_pressure	float	hPa		Absolute pressure
diff_pressure	float	hPa		Differential pressure (airspeed)
pressure_alt	float			Altitude calculated from pressure
temperature	float	degC		Temperature
fields_updated	uint32_t			<a href="#">HIL_SENSOR_UPDATED_FLAGS</a> Bitmap for fields that have updated since last message
id**	uint8_t			Sensor ID (zero indexed). Used for multiple sensor inputs

## SIM\_STATE (#108)

)

[Message] Status of simulation environment, if used

Field Name	Type	Units	Description
q1	float		True attitude quaternion component 1, w (1 in null-rotation)
q2	float		True attitude quaternion component 2, x (0 in null-rotation)
q3	float		True attitude quaternion component 3, y (0 in null-rotation)
q4	float		True attitude quaternion component 4, z (0 in null-rotation)
roll	float		Attitude roll expressed as Euler angles, not recommended except for human-readable outputs
pitch	float		Attitude pitch expressed as Euler angles, not recommended except for human-readable outputs
yaw	float		Attitude yaw expressed as Euler angles, not recommended except for human-readable outputs
xacc	float	m/s/s	X acceleration
yacc	float	m/s/s	Y acceleration
zacc	float	m/s/s	Z acceleration
xgyro	float	rad/s	Angular speed around X axis
ygyro	float	rad/s	Angular speed around Y axis
zgyro	float	rad/s	Angular speed around Z axis
lat	float	deg	Latitude
lon	float	deg	Longitude
alt	float	m	Altitude
std_dev_horz	float		Horizontal position standard deviation
std_dev_vert	float		Vertical position standard deviation
vn	float	m/s	True velocity in north direction in earth-fixed NED frame
ve	float	m/s	True velocity in east direction in earth-fixed NED frame



vd float m/s True velocity in down direction in earth-fixed NED frame

## RADIO\_STATUS (#109)

)

[Message] Status generated by radio and injected into MAVLink stream.

Field Name	Type	Units	Description
rss	uint8_t		Local (message sender) received signal strength indication in device-dependent units/scale. Values: [0-254], UINT8_MAX: invalid/unknown.
remrss	uint8_t		Remote (message receiver) signal strength indication in device-dependent units/scale. Values: [0-254], UINT8_MAX: invalid/unknown.
txbuf %	uint8_t		
Remaining free transmitter buffer space.			
noise	uint8_t		Local background noise level. These are device dependent RSSI values (scale as approx 2x dB on SiK radios). Values: [0-254], UINT8_MAX: invalid/unknown.
remnoise	uint8_t		Remote background noise level. These are device dependent RSSI values (scale as approx 2x dB on SiK radios). Values: [0-254], UINT8_MAX: invalid/unknown.
rxerrors	uint16_t		Count of radio packet receive errors (since boot).
fixed	uint16_t		Count of error corrected radio packets (since boot).

## FILE\_TRANSFER\_PROTOCOL (#110)

)

[Message] File transfer protocol message: <https://mavlink.io/en/services/ftp.html>.

Field Name	Type	Description
target_network	uint8_t	Network ID (0 for broadcast)
target_system	uint8_t	System ID (0 for broadcast)
target_component	uint8_t	Component ID (0 for broadcast)
Variable length payload. The length is defined by the remaining message length when subtracting the header and other fields. The content/format of this block is defined in <a href="https://mavlink.io/en/services/ftp.html">https://mavlink.io/en/services/ftp.html</a> .		
payload	uint8_t[251]	

## TIMESYNC (#111)

)

[Message] Time synchronization message.

Field Name	Type	Description
tc1	int64_t	Time sync timestamp 1
ts1	int64_t	Time sync timestamp 2

## CAMERA\_TRIGGER (#112)

)

[Message] Camera-IMU triggering and synchronisation message.

Field Name	Type	Units	Description
time_usec	uint64_t	us	Timestamp for image frame (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
seq	uint32_t		Image frame sequence

## HIL\_GPS (#113)

)

[Message] The global position, as returned by the Global Positioning System (GPS). This is NOT the global position estimate of the system, but rather a RAW sensor value. See message [GLOBAL\\_POSITION\\_INT](#) for the global position estimate.

Field Name	Type	Units	Description
time_usec	uint64_t	us	Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
fix_type	uint8_t		0-1: no fix, 2: 2D fix, 3: 3D fix. Some applications will not use the value of this field unless it is at least two, so always correctly fill in the fix.
lat	int32_t	degE7	Latitude (WGS84)
lon	int32_t	degE7	Longitude (WGS84)
alt	int32_t	mm	Altitude (MSL). Positive for up.
eph	uint16_t		GPS HDOP horizontal dilution of position (unitless * 100). If unknown, set to: UINT16_MAX
epv	uint16_t		GPS VDOP vertical dilution of position (unitless * 100). If unknown, set to: UINT16_MAX
vel	uint16_t	cm/s	GPS ground speed. If unknown, set to: UINT16_MAX
vn	int16_t	cm/s	GPS velocity in north direction in earth-fixed NED frame
ve	int16_t	cm/s	GPS velocity in east direction in earth-fixed NED frame
vd	int16_t	cm/s	GPS velocity in down direction in earth-fixed NED frame
cog	uint16_t	cdeg	Course over ground (NOT heading, but direction of movement), 0.0..359.99 degrees. If unknown, set to: UINT16_MAX
satellites_visible	uint8_t		Number of satellites visible. If unknown, set to UINT8_MAX
id**	uint8_t		GPS ID (zero indexed). Used for multiple GPS inputs
yaw**	uint16_t	cdeg	Yaw of vehicle relative to Earth's North, zero means not available, use 36000 for north

## HIL\_OPTICAL\_FLOW (#114)

)

[Message] Simulated optical flow from a flow sensor (e.g. PX4FLOW or optical mouse sensor)

Field Name	Type	Units	Description
time_usec	uint64_t	us	Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
sensor_id	uint8_t		Sensor ID
integration_time_us	uint32_t	us	Integration time. Divide integrated_x and integrated_y by the integration time to obtain average flow. The integration time also indicates the.
integrated_x	float	rad	Flow in radians around X axis (Sensor RH rotation about the X axis induces a positive flow. Sensor linear motion along the positive Y axis induces a negative flow.)
integrated_y	float	rad	Flow in radians around Y axis (Sensor RH rotation about the Y axis induces a positive flow. Sensor linear motion along the positive X axis induces a positive flow.)
integrated_xgyro	float	rad	RH rotation around X axis
integrated_ygyro	float	rad	RH rotation around Y axis
integrated_zgyro	float	rad	RH rotation around Z axis
temperature	int16_t	cdegC	Temperature
quality	uint8_t		Optical flow quality / confidence. 0: no valid flow, 255: maximum quality
time_delta_distance_us	uint32_t	us	Time since the distance was sampled.
distance	float	m	Distance to the center of the flow field. Positive value (including zero): distance known. Negative value: Unknown distance.

## HIL\_STATE\_QUATERNION (#115)

)

[Message] Sent from simulation to autopilot, avoids in contrast to [HIL\\_STATE](#) singularities. This packet is useful for high throughput applications such as hardware in the loop simulations.

Field Name	Type	Units	Description
time_usec	uint64_t	us	Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
attitude_quaternion	float[4]		Vehicle attitude expressed as normalized quaternion in w, x, y, z order (with 1 0 0 0 being the null-rotation)
rollspeed	float	rad/s	Body frame roll / phi angular speed
pitchspeed	float	rad/s	Body frame pitch / theta angular speed
yawspeed	float	rad/s	Body frame yaw / psi angular speed
lat	int32_t	degE7	Latitude
lon	int32_t	degE7	Longitude
alt	int32_t	mm	Altitude
vx	int16_t	cm/s	Ground X Speed (Latitude)
vy	int16_t	cm/s	Ground Y Speed (Longitude)
vz	int16_t	cm/s	Ground Z Speed (Altitude)
ind_airspeed	uint16_t	cm/s	Indicated airspeed
true_airspeed	uint16_t	cm/s	True airspeed
xacc	int16_t	mG	X acceleration
yacc	int16_t	mG	Y acceleration
zacc	int16_t	mG	Z acceleration

## SCALED\_IMU2 (#116)

)

[Message] The RAW IMU readings for secondary 9DOF sensor setup. This message should contain the scaled values to the described units

Field Name	Type	Units	Description
time_boot_ms	uint32_t	ms	Timestamp (time since system boot).
xacc	int16_t	mG	X acceleration
yacc	int16_t	mG	Y acceleration
zacc	int16_t	mG	Z acceleration
xgyro	int16_t	mrads	Angular speed around X axis
ygyro	int16_t	mrads	Angular speed around Y axis
zgyro	int16_t	mrads	Angular speed around Z axis
xmag	int16_t	mgauss	X Magnetic field
ymag	int16_t	mgauss	Y Magnetic field
zmag	int16_t	mgauss	Z Magnetic field
temperature**	int16_t	cdegC	Temperature, 0: IMU does not provide temperature values. If the IMU is at 0C it must send 1 (0.01C).

## LOG\_REQUEST\_LIST (#117)

)

[Message] Request a list of available logs. On some systems calling this may stop on-board logging until [LOG\\_REQUEST\\_END](#) is called. If there are no log files available this request shall be answered with one [LOG\\_ENTRY](#) message with id = 0 and num\_logs = 0.

Field Name	Type	Description
target_system	uint8_t	System ID
target_component	uint8_t	Component ID
start	uint16_t	First log id (0 for first available)
end	uint16_t	Last log id (0xffff for last available)

### LOG\_ENTRY (#118)

)

[Message] Reply to LOG\_REQUEST\_LIST

Field Name	Type	Units	Description
id	uint16_t		Log id
num_logs	uint16_t		Total number of logs
last_log_num	uint16_t		High log number
time_utc	uint32_t	s	UTC timestamp of log since 1970, or 0 if not available
size	uint32_t	bytes	Size of the log (may be approximate)

### LOG\_REQUEST\_DATA (#119)

)

[Message] Request a chunk of a log

Field Name	Type	Units	Description
target_system	uint8_t		System ID
target_component	uint8_t		Component ID
id	uint16_t		Log id (from <a href="#">LOG_ENTRY</a> reply)
ofs	uint32_t		Offset into the log
count	uint32_t	bytes	Number of bytes

### LOG\_DATA (#120)

)

[Message] Reply to LOG\_REQUEST\_DATA

Field Name	Type	Units	Description
id	uint16_t		Log id (from <a href="#">LOG_ENTRY</a> reply)
ofs	uint32_t		Offset into the log
count	uint8_t	bytes	Number of bytes (zero for end of log)
data	uint8_t[90]		log data

### LOG\_ERASE (#121)

)

[Message] Erase all logs

Field Name	Type	Description
target_system	uint8_t	System ID
target_component	uint8_t	Component ID

### LOG\_REQUEST\_END (#122)

)

[Message] Stop log transfer and resume normal logging

Field Name	Type	Description
target_system	uint8_t	System ID
target_component	uint8_t	Component ID

### GPS\_INJECT\_DATA (#123)

)

**DEPRECATED:** Replaced by [GPS\\_RTCM\\_DATA](#) (2022-05).

[Message] Data for injecting into the onboard GPS (used for DGPS)

Field Name	Type	Units	Description
target_system	uint8_t		System ID
target_component	uint8_t		Component ID
len	uint8_t	bytes	Data length
data	uint8_t[110]		Raw data (110 is enough for 12 satellites of RTCMv2)

### GPS2\_RAW (#124)

)

[Message] Second GPS data.

Field Name	Type	Units	Values	Description
time_usec	uint64_t	us		Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
fix_type	uint8_t		<a href="#">GPS_FIX_TYPE</a>	GPS fix type.
lat	int32_t	degE7		Latitude (WGS84)
lon	int32_t	degE7		Longitude (WGS84)
alt	int32_t	mm		Altitude (MSL). Positive for up.
eph	uint16_t			GPS HDOP horizontal dilution of position (unitless * 100). If unknown, set to: UINT16_MAX

epv	uint16_t	GPS VDOP vertical dilution of position (unitless * 100). If unknown, set to: UINT16_MAX
vel	uint16_t cm/s	GPS ground speed. If unknown, set to: UINT16_MAX
cog	uint16_t cdeg	Course over ground (NOT heading, but direction of movement): 0.0..359.99 degrees. If unknown, set to: UINT16_MAX
satellites_visible	uint8_t	Number of satellites visible. If unknown, set to UINT8_MAX
dgps_numch	uint8_t	Number of DGPS satellites
dgps_age	uint32_t ms	Age of DGPS info
yaw**	uint16_t cdeg	Yaw in earth frame from north. Use 0 if this GPS does not provide yaw. Use UINT16_MAX if this GPS is configured to provide yaw and is currently unable to provide it. Use 36000 for north.
alt_ellipsoid**	int32_t mm	Altitude (above WGS84, EGM96 ellipsoid). Positive for up.
h_acc**	uint32_t mm	Position uncertainty.
v_acc**	uint32_t mm	Altitude uncertainty.
vel_acc**	uint32_t mm	Speed uncertainty.
hdg_acc**	uint32_t degE5	Heading / track uncertainty

## POWER\_STATUS (#125)

)

[Message] Power supply status

Field Name	Type	Units	Values	Description
Vcc	uint16_t	mV		5V rail voltage.
Vservo	uint16_t	mV		Servo rail voltage.
flags	uint16_t		<a href="#">MAV_POWER_STATUS</a>	Bitmap of power supply status flags.

## SERIAL\_CONTROL (#126)

)

[Message] Control a serial port. This can be used for raw access to an onboard serial peripheral such as a GPS or telemetry radio. It is designed to make it possible to update the devices firmware via MAVLink messages or change the devices settings. A message with zero bytes can be used to change just the baudrate.

Field Name	Type	Units	Values	Description
device	uint8_t		<a href="#">SERIAL_CONTROL_DEV</a>	Serial control device type.
flags	uint8_t		<a href="#">SERIAL_CONTROL_FLAG</a>	Bitmap of serial control flags.
timeout	uint16_t	ms		Timeout for reply data
baudrate	uint32_t	bits/s		Baudrate of transfer. Zero means no change.
count	uint8_t	bytes		how many bytes in this transfer
data	uint8_t[70]			serial data
target_system**	uint8_t			System ID
target_component**	uint8_t			Component ID

## GPS\_RTK (#127)

)

[Message] RTK GPS data. Gives information on the relative baseline calculation the GPS is reporting

Field Name	Type	Units	Values	Description
time_last_baseline_ms	uint32_t	ms		Time since boot of last baseline message received.
rtk_receiver_id	uint8_t			Identification of connected RTK receiver.
wn	uint16_t			GPS Week Number of last baseline
tow	uint32_t	ms		GPS Time of Week of last baseline
rtk_health	uint8_t			GPS-specific health report for RTK data.
rtk_rate	uint8_t	Hz		Rate of baseline messages being received by GPS
nsats	uint8_t			Current number of sats used for RTK calculation.
baseline_coords_type	uint8_t		<a href="#">RTK_BASELINE_COORDINATE_SYSTEM</a>	Coordinate system of baseline
baseline_a_mm	int32_t	mm		Current baseline in ECEF x or NED north component.
baseline_b_mm	int32_t	mm		Current baseline in ECEF y or NED east component.
baseline_c_mm	int32_t	mm		Current baseline in ECEF z or NED down component.
accuracy	uint32_t			Current estimate of baseline accuracy.
iar_num_hypotheses	int32_t			Current number of integer ambiguity hypotheses.

## GPS2\_RTK (#128)

)

[Message] RTK GPS data. Gives information on the relative baseline calculation the GPS is reporting

Field Name	Type	Units	Values	Description
time_last_baseline_ms	uint32_t	ms		Time since boot of last baseline message received.
rtk_receiver_id	uint8_t			Identification of connected RTK receiver.
wn	uint16_t			GPS Week Number of last baseline
tow	uint32_t	ms		GPS Time of Week of last baseline
rtk_health	uint8_t			GPS-specific health report for RTK data.
rtk_rate	uint8_t	Hz		Rate of baseline messages being received by GPS
nsats	uint8_t			Current number of sats used for RTK calculation.
baseline_coords_type	uint8_t		<a href="#">RTK_BASELINE_COORDINATE_SYSTEM</a>	Coordinate system of baseline
baseline_a_mm	int32_t	mm		Current baseline in ECEF x or NED north component.
baseline_b_mm	int32_t	mm		Current baseline in ECEF y or NED east component.
baseline_c_mm	int32_t	mm		Current baseline in ECEF z or NED down component.

accuracy	uint32_t	Current estimate of baseline accuracy.
iar_num_hypotheses	int32_t	Current number of integer ambiguity hypotheses.

### SCALED\_IMU3 (#129)

)

[Message] The RAW IMU readings for 3rd 9DOF sensor setup. This message should contain the scaled values to the described units

Field Name	Type	Units	Description
time_boot_ms	uint32_t	ms	Timestamp (time since system boot).
xacc	int16_t	mG	X acceleration
yacc	int16_t	mG	Y acceleration
zacc	int16_t	mG	Z acceleration
xgyro	int16_t	mrads	Angular speed around X axis
ygyro	int16_t	mrads	Angular speed around Y axis
zgyro	int16_t	mrads	Angular speed around Z axis
xmag	int16_t	mgauss	X Magnetic field
ymag	int16_t	mgauss	Y Magnetic field
zmag	int16_t	mgauss	Z Magnetic field
temperature**	int16_t	cdegC	Temperature, 0: IMU does not provide temperature values. If the IMU is at 0C it must send 1 (0.01C).

### DATA\_TRANSMISSION\_HANDSHAKE (#130)

)

[Message] Handshake message to initiate, control and stop image streaming when using the Image Transmission Protocol:  
[https://mavlink.io/en/services/image\\_transmission.html](https://mavlink.io/en/services/image_transmission.html).

Field Name	Type	Units	Values	Description
type	uint8_t		<a href="#">MAVLINK_DATA_STREAM_TYPE</a>	Type of requested/acknowledged data.
size	uint32_t	bytes		total data size (set on ACK only).
width	uint16_t			Width of a matrix or image.
height	uint16_t			Height of a matrix or image.
packets	uint16_t			Number of packets being sent (set on ACK only).
payload	uint8_t	bytes		Payload size per packet (normally 253 byte, see DATA field size in message <a href="#">ENCAPSULATED_DATA</a> ) (set on ACK only).
jpg_quality	uint8_t			
%				JPEG quality. Values: [1-100].

### ENCAPSULATED\_DATA (#131)

)

[Message] Data packet for images sent using the Image Transmission Protocol: [https://mavlink.io/en/services/image\\_transmission.html](https://mavlink.io/en/services/image_transmission.html).

Field Name	Type	Description
seqnr	uint16_t	sequence number (starting with 0 on every transmission)
data	uint8_t[253]	image data bytes

### DISTANCE\_SENSOR (#132)

)

[Message] Distance sensor information for an onboard rangefinder.

Field Name	Type	Units	Values	Description
time_boot_ms	uint32_t	ms		Timestamp (time since system boot).
min_distance	uint16_t	cm		Minimum distance the sensor can measure
max_distance	uint16_t	cm		Maximum distance the sensor can measure
current_distance	uint16_t	cm		Current distance reading
type	uint8_t		<a href="#">MAV_DISTANCE_SENSOR</a>	Type of distance sensor.
id	uint8_t			Onboard ID of the sensor
				Direction the sensor faces. downward-facing: <a href="#">ROTATION_PITCH_270</a> , upward-facing: <a href="#">ROTATION_PITCH_90</a> ,
orientation	uint8_t		<a href="#">MAV_SENSOR_ORIENTATION</a>	backward-facing: <a href="#">ROTATION_PITCH_180</a> , forward-facing: <a href="#">ROTATION_NONE</a> , left-facing: <a href="#">ROTATION_YAW_90</a> , right-facing: <a href="#">ROTATION_YAW_270</a>
covariance	uint8_t	cm^2		Measurement variance. Max standard deviation is 6cm. UINT8_MAX if unknown.
horizontal_fov**	float	rad		Horizontal Field of View (angle) where the distance measurement is valid and the field of view is known. Otherwise this is set to 0.
vertical_fov**	float	rad		Vertical Field of View (angle) where the distance measurement is valid and the field of view is known. Otherwise this is set to 0.

<p>quaternion** float[4]</p> <p>signal_quality** uint8_t %</p> <p>Signal quality of the sensor. Specific to each sensor type, representing the relation of the signal strength with the target reflectivity, distance, size or aspect, but normalised as a percentage. 0 = unknown/unset signal quality, 1 = invalid signal, 100 = perfect signal.</p>	<p>Quaternion of the sensor orientation in vehicle body frame (w, x, y, z order, zero-rotation is 1, 0, 0, 0). Zero-rotation is along the vehicle body x-axis. This field is required if the orientation is set to <a href="#">MAV_SENSOR_ROTATION_CUSTOM</a>. Set it to 0 if invalid."</p>
---	---

## TERRAIN\_REQUEST (#133)

)

[Message] Request for terrain data and terrain status. See terrain protocol docs: <https://mavlink.io/en/services/terrain.html>

Field Name	Type	Units	Description
lat	int32_t	degE7	Latitude of SW corner of first grid
lon	int32_t	degE7	Longitude of SW corner of first grid
grid_spacing	uint16_t	m	Grid spacing
mask	uint64_t		Bitmask of requested 4x4 grids (row major 8x7 array of grids, 56 bits)

## TERRAIN\_DATA (#134)

)

[Message] Terrain data sent from GCS. The lat/lon and grid\_spacing must be the same as a lat/lon from a [TERRAIN\\_REQUEST](#). See terrain protocol docs: <https://mavlink.io/en/services/terrain.html>

Field Name	Type	Units	Description
lat	int32_t	degE7	Latitude of SW corner of first grid
lon	int32_t	degE7	Longitude of SW corner of first grid
grid_spacing	uint16_t	m	Grid spacing
gridbit	uint8_t		bit within the terrain request mask
data	int16_t[16]	m	Terrain data MSL

## TERRAIN\_CHECK (#135)

)

[Message] Request that the vehicle report terrain height at the given location (expected response is a [TERRAIN\\_REPORT](#)). Used by GCS to check if vehicle has all terrain data needed for a mission.

Field Name	Type	Units	Description
lat	int32_t	degE7	Latitude
lon	int32_t	degE7	Longitude

## TERRAIN\_REPORT (#136)

)

[Message] Streamed from drone to report progress of terrain map download (initiated by [TERRAIN\\_REQUEST](#)), or sent as a response to a [TERRAIN\\_CHECK](#) request. See terrain protocol docs: <https://mavlink.io/en/services/terrain.html>

Field Name	Type	Units	Description
lat	int32_t	degE7	Latitude
lon	int32_t	degE7	Longitude
spacing	uint16_t		grid spacing (zero if terrain at this location unavailable)
terrain_height	float	m	Terrain height MSL
current_height	float	m	Current vehicle height above lat/lon terrain height
pending	uint16_t		Number of 4x4 terrain blocks waiting to be received or read from disk
loaded	uint16_t		Number of 4x4 terrain blocks in memory

## SCALED\_PRESSURE2 (#137)

)

[Message] Barometer readings for 2nd barometer

Field Name	Type	Units	Description
time_boot_ms	uint32_t	ms	Timestamp (time since system boot).
press_abs	float	hPa	Absolute pressure
press_diff	float	hPa	Differential pressure
temperature	int16_t	cdegC	Absolute pressure temperature
temperature_press_diff**	int16_t	cdegC	Differential pressure temperature (0, if not available). Report values of 0 (or 1) as 1 cdegC.

## ATT\_POS\_MOCAP (#138)

)

[Message] Motion capture attitude and position

Field Name	Type	Units	Description
time_usec	uint64_t	us	Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
q	float[4]		Attitude quaternion (w, x, y, z order, zero-rotation is 1, 0, 0, 0)
x	float	m	X position (NED)
y	float	m	Y position (NED)
z	float	m	Z position (NED)
covariance**	float[21]		Row-major representation of a pose 6x6 cross-covariance matrix upper right triangle (states: x, y, z, roll, pitch, yaw; first six entries are the first ROW, next five entries are the second ROW, etc.). If unknown, assign NaN value to first element in the array.

## SET\_ACTUATOR\_CONTROL\_TARGET (#139)

)

[Message] Set the vehicle attitude and body angular rates.

Field Name	Type	Units	Description
time_usec	uint64_t	us	Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
group_mlx	uint8_t		Actuator group. The " _mlx" indicates this is a multi-instance message and a MAVLink parser should use this field to difference between instances.
target_system	uint8_t		System ID
target_component	uint8_t		Component ID
controls	float[8]		Actuator controls. Normed to -1..+1 where 0 is neutral position. Throttle for single rotation direction motors is 0..1, negative range for reverse direction. Standard mapping for attitude controls (group 0): (index 0-7): roll, pitch, yaw, throttle, flaps, spoilers, airbrakes, landing gear. Load a pass-through mixer to repurpose them as generic outputs.

## ACTUATOR\_CONTROL\_TARGET (#140)

)

[Message] Set the vehicle attitude and body angular rates.

Field Name	Type	Units	Description
time_usec	uint64_t	us	Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
group_mlx	uint8_t		Actuator group. The " _mlx" indicates this is a multi-instance message and a MAVLink parser should use this field to difference between instances.
controls	float[8]		Actuator controls. Normed to -1..+1 where 0 is neutral position. Throttle for single rotation direction motors is 0..1, negative range for reverse direction. Standard mapping for attitude controls (group 0): (index 0-7): roll, pitch, yaw, throttle, flaps, spoilers, airbrakes, landing gear. Load a pass-through mixer to repurpose them as generic outputs.

## ALTITUDE (#141)

)

[Message] The current system altitude.

Field Name	Type	Units	Description
time_usec	uint64_t	us	Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
altitude_monotonic	float	m	This altitude measure is initialized on system boot and monotonic (it is never reset, but represents the local altitude change). The only guarantee on this field is that it will never be reset and is consistent within a flight. The recommended value for this field is the uncorrected barometric altitude at boot time. This altitude will also drift and vary between flights.
altitude_amsl	float	m	This altitude measure is strictly above mean sea level and might be non-monotonic (it might reset on events like GPS lock or when a new QNH value is set). It should be the altitude to which global altitude waypoints are compared to. Note that it is *not* the GPS altitude, however, most GPS modules already output MSL by default and not the WGS84 altitude.
altitude_local	float	m	This is the local altitude in the local coordinate frame. It is not the altitude above home, but in reference to the coordinate origin (0, 0, 0). It is up-positive.
altitude_relative	float	m	This is the altitude above the home position. It resets on each change of the current home position.
altitude_terrain	float	m	This is the altitude above terrain. It might be fed by a terrain database or an altimeter. Values smaller than -1000 should be interpreted as unknown.
bottom_clearance	float	m	This is not the altitude, but the clear space below the system according to the fused clearance estimate. It generally should max out at the maximum range of e.g. the laser altimeter. It is generally a moving target. A negative value indicates no measurement available.

## RESOURCE\_REQUEST (#142)

)

[Message] The autopilot is requesting a resource (file, binary, other type of data)

Field Name	Type	Description
request_id	uint8_t	Request ID. This ID should be re-used when sending back URI contents
uri_type	uint8_t	The type of requested URI. 0 = a file via URL. 1 = a UAVCAN binary
uri	uint8_t[120]	The requested unique resource identifier (URI). It is not necessarily a straight domain name (depends on the URI type enum)
transfer_type	uint8_t	The way the autopilot wants to receive the URI. 0 = MAVLink FTP. 1 = binary stream.
storage	uint8_t[120]	The storage path the autopilot wants the URI to be stored in. Will only be valid if the transfer_type has a storage associated (e.g. MAVLink FTP).

### SCALED\_PRESSURE3 (#143)

)

[Message] Barometer readings for 3rd barometer

Field Name	Type	Units	Description
time_boot_ms	uint32_t	ms	Timestamp (time since system boot).
press_abs	float	hPa	Absolute pressure
press_diff	float	hPa	Differential pressure
temperature	int16_t	cdegC	Absolute pressure temperature
temperature_press_diff	int16_t	cdegC	Differential pressure temperature (0, if not available). Report values of 0 (or 1) as 1 cdegC.

### FOLLOW\_TARGET (#144)

)

[Message] Current motion information from a designated system

Field Name	Type	Units	Description
timestamp	uint64_t	ms	Timestamp (time since system boot).
est_capabilities	uint8_t		bit positions for tracker reporting capabilities (POS = 0, VEL = 1, ACCEL = 2, ATT + RATES = 3)
lat	int32_t	degE7	Latitude (WGS84)
lon	int32_t	degE7	Longitude (WGS84)
alt	float	m	Altitude (MSL)
vel	float[3]	m/s	target velocity (0,0,0) for unknown
acc	float[3]	m/s/s	linear target acceleration (0,0,0) for unknown
attitude_q	float[4]		
(0 0 0 0 for unknown)			

|| rates | float[3] | | (0 0 0 for unknown) | | position\_cov | float[3] | | eph epv | | custom\_state | uint64\_t | | button states or switches of a tracker device |

### CONTROL\_SYSTEM\_STATE (#146)

)

[Message] The smoothed, monotonic system state used to feed the control loops of the system.

Field Name	Type	Units	Description
time_usec	uint64_t	us	Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
x_acc	float	m/s/s	X acceleration in body frame
y_acc	float	m/s/s	Y acceleration in body frame
z_acc	float	m/s/s	Z acceleration in body frame
x_vel	float	m/s	X velocity in body frame
y_vel	float	m/s	Y velocity in body frame
z_vel	float	m/s	Z velocity in body frame
x_pos	float	m	X position in local frame
y_pos	float	m	Y position in local frame
z_pos	float	m	Z position in local frame
airspeed	float	m/s	Airspeed, set to -1 if unknown
vel_variance	float[3]		Variance of body velocity estimate
pos_variance	float[3]		Variance in local position
q	float[4]		The attitude, represented as Quaternion
roll_rate	float	rad/s	Angular rate in roll axis
pitch_rate	float	rad/s	Angular rate in pitch axis
yaw_rate	float	rad/s	Angular rate in yaw axis

### BATTERY\_STATUS (#147)

)

[Message] Battery information. Updates GCS with flight controller battery status. Smart batteries also use this message, but may additionally send [SMART\\_BATTERY\\_INFO](#).

Field Name	Type	Units	Values	Description
id	uint8_t			Battery ID
battery_function	uint8_t		<a href="#">MAV_BATTERY_FUNCTION</a>	Function of the battery
type	uint8_t		<a href="#">MAV_BATTERY_TYPE</a>	Type (chemistry) of the battery
temperature	int16_t	cdegC		Temperature of the battery. INT16_MAX for unknown temperature.
				Battery voltage of cells 1 to 10 (see voltages_ext for cells 11-14). Cells in this field above the valid cell count for this battery should have the UINT16_MAX value. If individual cell voltages are unknown or not measured for this battery, then the overall battery voltage should be filled in cell 0, with all others set to UINT16_MAX. If the voltage of the battery is greater than (UINT16_MAX - 1), then cell 0 should be set to (UINT16_MAX - 1), and cell 1 to the remaining voltage. This can be extended to multiple cells if the total voltage is greater than 2 * (UINT16_MAX - 1).
voltages	uint16_t[10]	mV		
current_battery	int16_t	mA		Battery current, -1: autopilot does not measure the current
current_consumed	int32_t	mAh		Consumed charge, -1: autopilot does not provide consumption estimate
energy_consumed	int32_t	hJ		Consumed energy, -1: autopilot does not provide energy consumption estimate



battery_remaining	int8_t	%	Remaining battery energy. Values: [0-100], -1: autopilot does not estimate the remaining battery.	
time_remaining	int32_t	s	Remaining battery time, 0: autopilot does not provide remaining battery time estimate	
charge_state	uint8_t		State for extent of discharge, provided by autopilot for warning or external reactions	<a href="#">MAV_BATTERY_CHARGE_STATE</a>
voltages_ext	uint16_t[4]	mV	Battery voltages for cells 11 to 14. Cells above the valid cell count for this battery should have a value of 0, where zero indicates not supported (note, this is different than for the voltages field and allows empty byte truncation). If the measured value is 0 then 1 should be sent instead.	
mode	uint8_t		Battery mode. Default (0) is that battery mode reporting is not supported or battery is in normal-use mode.	<a href="#">MAV_BATTERY_MODE</a>
fault_bitmask	uint32_t		Fault/health indications. These should be set when charge_state is <a href="#">MAV_BATTERY_CHARGE_STATE_FAILED</a> or <a href="#">MAV_BATTERY_CHARGE_STATE_UNHEALTHY</a> (if not, fault reporting is not supported).	<a href="#">MAV_BATTERY_FAULT</a>

## AUTOPILOT\_VERSION (#148)

)

[Message] Version and capability of autopilot software. This should be emitted in response to a request with [MAV\\_CMD\\_REQUEST\\_MESSAGE](#).

Field Name	Type	Values	Description
capabilities	uint64_t	<a href="#">MAV_PROTOCOL_CAPABILITY</a>	Bitmap of capabilities
flight_sw_version	uint32_t		Firmware version number
middleware_sw_version	uint32_t		Middleware version number
os_sw_version	uint32_t		Operating system version number
board_version	uint32_t		HW / board version (last 8 bits should be silicon ID, if any). The first 16 bits of this field specify <a href="https://github.com/PX4/PX4-Bootloader/blob/master/board_types.txt">https://github.com/PX4/PX4-Bootloader/blob/master/board_types.txt</a>
flight_custom_version	uint8_t[8]		Custom version field, commonly the first 8 bytes of the git hash. This is not an unique identifier, but should allow to identify the commit using the main version number even for very large code bases.
middleware_custom_version	uint8_t[8]		Custom version field, commonly the first 8 bytes of the git hash. This is not an unique identifier, but should allow to identify the commit using the main version number even for very large code bases.
os_custom_version	uint8_t[8]		Custom version field, commonly the first 8 bytes of the git hash. This is not an unique identifier, but should allow to identify the commit using the main version number even for very large code bases.
vendor_id	uint16_t		ID of the board vendor
product_id	uint16_t		ID of the product
uid	uint64_t		UID if provided by hardware (see uid2)
uid2	uint8_t[18]		UID if provided by hardware (supersedes the uid field. If this is non-zero, use this field, otherwise use uid)

## LANDING\_TARGET (#149)

)

[Message] The location of a landing target. See: [https://mavlink.io/en/services/landing\\_target.html](https://mavlink.io/en/services/landing_target.html)

Field Name	Type	Units	Values	Description
time_usec	uint64_t	us		Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
target_num	uint8_t			The ID of the target if multiple targets are present
frame	uint8_t		<a href="#">MAV_FRAME</a>	Coordinate frame used for following fields.
angle_x	float	rad		X-axis angular offset of the target from the center of the image
angle_y	float	rad		Y-axis angular offset of the target from the center of the image
distance	float	m		Distance to the target from the vehicle
size_x	float	rad		Size of target along x-axis
size_y	float	rad		Size of target along y-axis
x	float	m		X Position of the landing target in MAV_FRAME
y	float	m		Y Position of the landing target in MAV_FRAME
z	float	m		Z Position of the landing target in MAV_FRAME
q	float[4]			Quaternion of landing target orientation (w, x, y, z order, zero-rotation is 1, 0, 0, 0)
type	uint8_t		<a href="#">LANDING_TARGET_TYPE</a>	Type of landing target
position_valid	uint8_t			Boolean indicating whether the position fields (x, y, z, q, type) contain valid target position information (valid: 1, invalid: 0). Default is 0 (invalid).

## FENCE\_STATUS (#162)

)

[Message] Status of geo-fencing. Sent in extended status stream when fencing enabled.

Field Name	Type	Units	Values	Description
breach_status	uint8_t			Breach status (0 if currently inside fence, 1 if outside).
breach_count	uint16_t			Number of fence breaches.
breach_type	uint8_t		<a href="#">FENCE_BREACH</a>	Last breach type.
breach_time	uint32_t	ms		Time (since boot) of last breach.
breach_mitigation**	uint8_t		<a href="#">FENCE_MITIGATE</a>	Active action to prevent fence breach

## MAG\_CAL\_REPORT (#192)

)

[Message] Reports results of completed compass calibration. Sent until [MAG\\_CAL\\_ACK](#) received.

Field Name	Type	Units	Values	Description
compass_id	uint8_t			Compass being calibrated.
cal_mask	uint8_t			Bitmask of compasses being calibrated.
cal_status	uint8_t		<a href="#">MAG_CAL_STATUS</a>	Calibration Status.
autosaved	uint8_t			0=requires a <a href="#">MAV_CMD_DO_ACCEPT_MAG_CAL</a> , 1=saved to parameters.
fitness	float	mgauss		RMS milligauss residuals.
ofs_x	float			X offset.
ofs_y	float			Y offset.
ofs_z	float			Z offset.
diag_x	float			X diagonal (matrix 11).
diag_y	float			Y diagonal (matrix 22).
diag_z	float			Z diagonal (matrix 33).
offdiag_x	float			X off-diagonal (matrix 12 and 21).
offdiag_y	float			Y off-diagonal (matrix 13 and 31).
offdiag_z	float			Z off-diagonal (matrix 32 and 23).
orientation_confidence**	float			Confidence in orientation (higher is better).
old_orientation**	uint8_t		<a href="#">MAV_SENSOR_ORIENTATION</a>	orientation before calibration.
new_orientation**	uint8_t		<a href="#">MAV_SENSOR_ORIENTATION</a>	orientation after calibration.
scale_factor**	float			field radius correction factor

## EFI\_STATUS (#225)

)

[Message] EFI status output

Field Name	Type	Units	Description
health	uint8_t		EFI health status
ecu_index	float		ECU index
rpm	float		RPM
fuel_consumed	float	cm <sup>3</sup>	Fuel consumed
fuel_flow	float	cm <sup>3</sup> /min	Fuel flow rate
engine_load	float		
% Engine load			
throttle_position	float		
% Throttle position			
spark_dwell_time	float	ms	Spark dwell time
barometric_pressure	float	kPa	Barometric pressure
intake_manifold_pressure	float	kPa	Intake manifold pressure(
intake_manifold_temperature	float	degC	Intake manifold temperature
cylinder_head_temperature	float	degC	Cylinder head temperature
ignition_timing	float	deg	Ignition timing (Crank angle degrees)
injection_time	float	ms	Injection time
exhaust_gas_temperature	float	degC	Exhaust gas temperature
throttle_out	float		
% Output throttle			
pt_compensation	float		Pressure/temperature compensation
ignition_voltage**	float	V	Supply voltage to EFI sparking system. Zero in this value means "unknown", so if the supply voltage really is zero volts use 0.0001 instead.

## ESTIMATOR\_STATUS (#230)

)

[Message] Estimator status message including flags, innovation test ratios and estimated accuracies. The flags message is an integer bitmask containing information on which EKF outputs are valid. See the [ESTIMATOR\\_STATUS\\_FLAGS](#) enum definition for further information. The innovation test ratios show the magnitude of the sensor innovation divided by the innovation check threshold. Under normal operation the innovation test ratios should be below 0.5 with occasional values up to 1.0. Values greater than 1.0 should be rare under normal operation and indicate that a measurement has been rejected by the filter. The user should be notified if an innovation test ratio greater than 1.0 is recorded. Notifications for values in the range between 0.5 and 1.0 should be optional and controllable by the user.

Field Name	Type	Units	Values	Description
time_usec	uint64_t	us		Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.

flags	uint16_t	<a href="#">ESTIMATOR_STATUS_FLAGS</a>	Bitmap indicating which EKF outputs are valid.
vel_ratio	float		Velocity innovation test ratio
pos_horiz_ratio	float		Horizontal position innovation test ratio
pos_vert_ratio	float		Vertical position innovation test ratio
mag_ratio	float		Magnetometer innovation test ratio
hagl_ratio	float		Height above terrain innovation test ratio
tas_ratio	float		True airspeed innovation test ratio
pos_horiz_accuracy	float	m	Horizontal position 1-STD accuracy relative to the EKF local origin
pos_vert_accuracy	float	m	Vertical position 1-STD accuracy relative to the EKF local origin

## WIND\_COV ([#231](#))

)

[\[Message\]](#) Wind estimate from vehicle. Note that despite the name, this message does not actually contain any covariances but instead variability and accuracy fields in terms of standard deviation (1-STD).

Field Name	Type	Units	Description
time_usec	uint64_t	us	Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
wind_x	float	m/s	Wind in North (NED) direction (NAN if unknown)
wind_y	float	m/s	Wind in East (NED) direction (NAN if unknown)
wind_z	float	m/s	Wind in down (NED) direction (NAN if unknown)
var_horiz	float	m/s	Variability of wind in XY, 1-STD estimated from a 1 Hz lowpassed wind estimate (NAN if unknown)
var_vert	float	m/s	Variability of wind in Z, 1-STD estimated from a 1 Hz lowpassed wind estimate (NAN if unknown)
wind_alt	float	m	Altitude (MSL) that this measurement was taken at (NAN if unknown)
horiz_accuracy	float	m/s	Horizontal speed 1-STD accuracy (0 if unknown)
vert_accuracy	float	m/s	Vertical speed 1-STD accuracy (0 if unknown)

## GPS\_INPUT ([#232](#))

)

[\[Message\]](#) GPS sensor input message. This is a raw sensor value sent by the GPS. This is NOT the global position estimate of the system.

Field Name	Type	Units	Values	Description
time_usec	uint64_t	us		Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
gps_id	uint8_t			ID of the GPS for multiple GPS inputs
ignore_flags	uint16_t		<a href="#">GPS_INPUT_IGNORE_FLAGS</a>	Bitmap indicating which GPS input flags fields to ignore. All other fields must be provided.
time_week_ms	uint32_t	ms		GPS time (from start of GPS week)
time_week	uint16_t			GPS week number
fix_type	uint8_t			0-1: no fix, 2: 2D fix, 3: 3D fix, 4: 3D with DGPS, 5: 3D with RTK
lat	int32_t	degE7		Latitude (WGS84)
lon	int32_t	degE7		Longitude (WGS84)
alt	float	m		Altitude (MSL). Positive for up.
hdop	float			GPS HDOP horizontal dilution of position (unitless). If unknown, set to: UINT16_MAX
vdop	float			GPS VDOP vertical dilution of position (unitless). If unknown, set to: UINT16_MAX
vn	float	m/s		GPS velocity in north direction in earth-fixed NED frame
ve	float	m/s		GPS velocity in east direction in earth-fixed NED frame
vd	float	m/s		GPS velocity in down direction in earth-fixed NED frame
speed_accuracy	float	m/s		GPS speed accuracy
horiz_accuracy	float	m		GPS horizontal accuracy
vert_accuracy	float	m		GPS vertical accuracy
satellites_visible	uint8_t			Number of satellites visible.
yaw**	uint16_t	cdeg		Yaw of vehicle relative to Earth's North, zero means not available, use 36000 for north

## GPS\_RTCM\_DATA ([#233](#))

)

[\[Message\]](#) RTCM message for injecting into the onboard GPS (used for DGPS)

Field Name	Type	Units	Description
flags	uint8_t		LSB: 1 means message is fragmented, next 2 bits are the fragment ID, the remaining 5 bits are used for the sequence ID. Messages are only to be flushed to the GPS when the entire message has been reconstructed on the autopilot. The fragment ID specifies which order the fragments should be assembled into a buffer, while the sequence ID is used to detect a mismatch between different buffers. The buffer is considered fully reconstructed when either all 4 fragments are present, or all the fragments before the first fragment with a non full payload is received. This management is used to ensure that normal GPS operation doesn't corrupt RTCM data, and to recover from a unreliable transport delivery order.
len	uint8_t	bytes	data length
data	uint8_t[180]		RTCM message (may be fragmented)

## HIGH\_LATENCY ([#234](#))

)

**DEPRECATED:** Replaced by [HIGH\\_LATENCY2](#) (2020-10).

[Message] Message appropriate for high latency connections like Iridium

Field Name	Type	Units	Values	Description
base_mode	uint8_t		<a href="#">MAV_MODE_FLAG</a>	Bitmap of enabled system modes.
custom_mode	uint32_t			A bitfield for use for autopilot-specific flags.
landed_state	uint8_t		<a href="#">MAV_LANDED_STATE</a>	The landed state. Is set to <a href="#">MAV_LANDED_STATE_UNDEFINED</a> if landed state is unknown.
roll	int16_t	cdeg		roll
pitch	int16_t	cdeg		pitch
heading	uint16_t	cdeg		heading
throttle	int8_t			
%	throttle (percentage)			
heading_sp	int16_t	cdeg		heading setpoint
latitude	int32_t	degE7		Latitude
longitude	int32_t	degE7		Longitude
altitude_amsl	int16_t	m		Altitude above mean sea level
altitude_sp	int16_t	m		Altitude setpoint relative to the home position
airspeed	uint8_t	m/s		airspeed
airspeed_sp	uint8_t	m/s		airspeed setpoint
groundspeed	uint8_t	m/s		groundspeed
climb_rate	int8_t	m/s		climb rate
gps_nsat	uint8_t			Number of satellites visible. If unknown, set to UINT8_MAX
gps_fix_type	uint8_t		<a href="#">GPS_FIX_TYPE</a>	GPS Fix type.
battery_remaining	uint8_t			
%	Remaining battery (percentage)			
temperature	int8_t	degC		Autopilot temperature (degrees C)
temperature_air	int8_t	degC		Air temperature (degrees C) from airspeed sensor
failsafe	uint8_t			failsafe (each bit represents a failsafe where 0=ok, 1=failsafe active (bit0:RC, bit1:batt, bit2:GPS, bit3:GCS, bit4:fence))
wp_num	uint8_t			current waypoint number
wp_distance	uint16_t	m		distance to target

## HIGH\_LATENCY2 (#235)

)

[Message] Message appropriate for high latency connections like Iridium (version 2)

Field Name	Type	Units	Values	Description
timestamp	uint32_t	ms		Timestamp (milliseconds since boot or Unix epoch)
type	uint8_t		<a href="#">MAV_TYPE</a>	Type of the MAV (quadrotor, helicopter, etc.)
autopilot	uint8_t		<a href="#">MAV_AUTOPILOT</a>	Autopilot type / class. Use <a href="#">MAV_AUTOPILOT_INVALID</a> for components that are not flight controllers.
custom_mode	uint16_t			A bitfield for use for autopilot-specific flags (2 byte version).
latitude	int32_t	degE7		Latitude
longitude	int32_t	degE7		Longitude
altitude	int16_t	m		Altitude above mean sea level
target_altitude	int16_t	m		Altitude setpoint
heading	uint8_t	deg/2		Heading
target_heading	uint8_t	deg/2		Heading setpoint
target_distance	uint16_t	dam		Distance to target waypoint or position
throttle	uint8_t			
%	Throttle			
airspeed	uint8_t	m/s*5		Airspeed
airspeed_sp	uint8_t	m/s*5		Airspeed setpoint
groundspeed	uint8_t	m/s*5		Groundspeed
windspeed	uint8_t	m/s*5		Windspeed
wind_heading	uint8_t	deg/2		Wind heading
eph	uint8_t	dm		Maximum error horizontal position since last message
epv	uint8_t	dm		Maximum error vertical position since last message
temperature_air	int8_t	degC		Air temperature from airspeed sensor
climb_rate	int8_t	dm/s		Maximum climb rate magnitude since last message
battery	int8_t			
%	Battery level (-1 if field not provided).			
wp_num	uint16_t			Current waypoint number
failure_flags	uint16_t		<a href="#">HL_FAILURE_FLAG</a>	Bitmap of failure flags.
custom0	int8_t			Field for custom payload.
custom1	int8_t			Field for custom payload.
custom2	int8_t			Field for custom payload.

## VIBRATION (#241)

)

[Message] Vibration levels and accelerometer clipping

Field Name	Type	Units	Description
time_usec	uint64_t	us	Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
vibration_x	float		Vibration levels on X-axis
vibration_y	float		Vibration levels on Y-axis
vibration_z	float		Vibration levels on Z-axis
clipping_0	uint32_t		first accelerometer clipping count
clipping_1	uint32_t		second accelerometer clipping count
clipping_2	uint32_t		third accelerometer clipping count

## HOME\_POSITION (#242)

)

[Message] Contains the home position. The home position is the default position that the system will return to and land on. The position must be set automatically by the system during the takeoff, and may also be explicitly set using [MAV\\_CMD\\_DO\\_SET\\_HOME](#). The global and local positions encode the position in the respective coordinate frames, while the q parameter encodes the orientation of the surface. Under normal conditions it describes the heading and terrain slope, which can be used by the aircraft to adjust the approach. The approach 3D vector describes the point to which the system should fly in normal flight mode and then perform a landing sequence along the vector. Note: this message can be requested by sending the [MAV\\_CMD\\_REQUEST\\_MESSAGE](#) with param1=242 (or the deprecated [MAV\\_CMD\\_GET\\_HOME\\_POSITION](#) command).

Field Name	Type	Units	Description
latitude	int32_t	degE7	Latitude (WGS84)
longitude	int32_t	degE7	Longitude (WGS84)
altitude	int32_t	mm	Altitude (MSL). Positive for up.
x	float	m	Local X position of this position in the local coordinate frame
y	float	m	Local Y position of this position in the local coordinate frame
z	float	m	Local Z position of this position in the local coordinate frame
q	float[4]		World to surface normal and heading transformation of the takeoff position. Used to indicate the heading and slope of the ground
approach_x	float	m	Local X position of the end of the approach vector. Multicopters should set this position based on their takeoff path. Grass-landing fixed wing aircraft should set it the same way as multicopters. Runway-landing fixed wing aircraft should set it to the opposite direction of the takeoff, assuming the takeoff happened from the threshold / touchdown zone.
approach_y	float	m	Local Y position of the end of the approach vector. Multicopters should set this position based on their takeoff path. Grass-landing fixed wing aircraft should set it the same way as multicopters. Runway-landing fixed wing aircraft should set it to the opposite direction of the takeoff, assuming the takeoff happened from the threshold / touchdown zone.
approach_z	float	m	Local Z position of the end of the approach vector. Multicopters should set this position based on their takeoff path. Grass-landing fixed wing aircraft should set it the same way as multicopters. Runway-landing fixed wing aircraft should set it to the opposite direction of the takeoff, assuming the takeoff happened from the threshold / touchdown zone.
time_usec**	uint64_t	us	Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.

## SET\_HOME\_POSITION (#243)

)

**DEPRECATED:** Replaced by [MAV\\_CMD\\_DO\\_SET\\_HOME](#) (2022-02).

The command protocol version ([MAV\\_CMD\\_DO\\_SET\\_HOME](#)) allows a GCS to detect when setting the home position has failed.

[Message] Sets the home position. The home position is the default position that the system will return to and land on. The position is set automatically by the system during the takeoff (and may also be set using this message). The global and local positions encode the position in the respective coordinate frames, while the q parameter encodes the orientation of the surface. Under normal conditions it describes the heading and terrain slope, which can be used by the aircraft to adjust the approach. The approach 3D vector describes the point to which the system should fly in normal flight mode and then perform a landing sequence along the vector. Note: the current home position may be emitted in a [HOME\\_POSITION](#) message on request (using [MAV\\_CMD\\_REQUEST\\_MESSAGE](#) with param1=242).

Field Name	Type	Units	Description
target_system	uint8_t		System ID.
latitude	int32_t	degE7	Latitude (WGS84)
longitude	int32_t	degE7	Longitude (WGS84)
altitude	int32_t	mm	Altitude (MSL). Positive for up.
x	float	m	Local X position of this position in the local coordinate frame
y	float	m	Local Y position of this position in the local coordinate frame
z	float	m	Local Z position of this position in the local coordinate frame
q	float[4]		World to surface normal and heading transformation of the takeoff position. Used to indicate the heading and slope of the ground
approach_x	float	m	Local X position of the end of the approach vector. Multicopters should set this position based on their takeoff path. Grass-landing fixed wing aircraft should set it the same way as multicopters. Runway-landing fixed wing aircraft should set it to the opposite direction of the takeoff, assuming the takeoff happened from the threshold / touchdown zone.
approach_y	float	m	Local Y position of the end of the approach vector. Multicopters should set this position based on their takeoff path. Grass-landing fixed wing aircraft should set it the same way as multicopters. Runway-landing fixed wing aircraft should set it to the opposite direction of the takeoff, assuming the takeoff happened from the threshold / touchdown zone.
approach_z	float	m	Local Z position of the end of the approach vector. Multicopters should set this position based on their takeoff path. Grass-landing fixed wing aircraft should set it the same way as multicopters. Runway-landing fixed wing aircraft should set it to the opposite direction of the takeoff, assuming the takeoff happened from the threshold / touchdown zone.
time_usec**	uint64_t	us	Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.

## MESSAGE\_INTERVAL (#244)

)

[Message] The interval between messages for a particular MAVLink message ID. This message is sent in response to the [MAV\\_CMD\\_REQUEST\\_MESSAGE](#) command with param1=244 (this message) and param2=message\_id (the id of the message for which the interval is required). It may also be sent in response to [MAV\\_CMD\\_GET\\_MESSAGE\\_INTERVAL](#). This interface replaces [DATA\\_STREAM](#).

Field Name	Type	Units	Description
message_id	uint16_t		The ID of the requested MAVLink message. v1.0 is limited to 254 messages.
interval_us	int32_t	us	The interval between two messages. A value of -1 indicates this stream is disabled, 0 indicates it is not available, > 0 indicates the interval at which it is sent.

## EXTENDED\_SYS\_STATE (#245)

)

[Message] Provides state for additional features

Field Name	Type	Values	Description
vtol_state	uint8_t	<a href="#">MAV_VTOL_STATE</a>	The VTOL state if applicable. Is set to <a href="#">MAV_VTOL_STATE_UNDEFINED</a> if UAV is not in VTOL configuration.
landed_state	uint8_t	<a href="#">MAV_LANDED_STATE</a>	The landed state. Is set to <a href="#">MAV_LANDED_STATE_UNDEFINED</a> if landed state is unknown.

## ADSB\_VEHICLE (#246)

)

[Message] The location and information of an ADSB vehicle

Field Name	Type	Units	Values	Description
ICAO_address	uint32_t			ICAO address
lat	int32_t	degE7		Latitude
lon	int32_t	degE7		Longitude
altitude_type	uint8_t		<a href="#">ADSB_ALTITUDE_TYPE</a>	ADSB altitude type.
altitude	int32_t	mm		Altitude(ASL)
heading	uint16_t	cdeg		Course over ground
hor_velocity	uint16_t	cm/s		The horizontal velocity
ver_velocity	int16_t	cm/s		The vertical velocity. Positive is up
callsign	char[9]			The callsign, 8+null
emitter_type	uint8_t		<a href="#">ADSB_EMITTER_TYPE</a>	ADSB emitter type.
tslc	uint8_t	s		Time since last communication in seconds
flags	uint16_t		<a href="#">ADSB_FLAGS</a>	Bitmap to indicate various statuses including valid data fields
squawk	uint16_t			Squawk code

## COLLISION (#247)

)

[Message] Information about a potential collision

Field Name	Type	Units	Values	Description
src	uint8_t		<a href="#">MAV_COLLISION_SRC</a>	Collision data source
id	uint32_t			Unique identifier, domain based on src field
action	uint8_t		<a href="#">MAV_COLLISION_ACTION</a>	Action that is being taken to avoid this collision
threat_level	uint8_t		<a href="#">MAV_COLLISION_THREAT_LEVEL</a>	How concerned the aircraft is about this collision
time_to_minimum_delta	float	s		Estimated time until collision occurs
altitude_minimum_delta	float	m		Closest vertical distance between vehicle and object
horizontal_minimum_delta	float	m		Closest horizontal distance between vehicle and object

## V2\_EXTENSION (#248)

)

[Message] Message implementing parts of the V2 payload specs in V1 frames for transitional support.

Field Name	Type	Description
target_network	uint8_t	Network ID (0 for broadcast)
target_system	uint8_t	System ID (0 for broadcast)
target_component	uint8_t	Component ID (0 for broadcast)
message_type	uint16_t	A code that identifies the software component that understands this message (analogous to USB device classes or mime type strings). If this code is less than 32768, it is considered a 'registered' protocol extension and the corresponding entry should be added to <a href="https://github.com/mavlink/mavlink/definition_files/extension_message_ids.xml">https://github.com/mavlink/mavlink/definition_files/extension_message_ids.xml</a> . Software creators can register blocks of message IDs as needed (useful for GCS specific metadata, etc...). Message types greater than 32767 are considered local experiments and should not be checked in to any widely distributed codebase.
payload	uint8_t[249]	Variable length payload. The length must be encoded in the payload as part of the message_type protocol, e.g. by including the length as payload data, or by terminating the payload data with a non-zero marker. This is required in order to reconstruct zero-terminated payloads that are (or otherwise would be) trimmed by MAVLink 2 empty-byte truncation. The entire content of the payload block is opaque unless you understand the encoding message_type. The particular encoding used can be extension specific and might not always be documented as part of the MAVLink specification.

## MEMORY\_VECT (#249)

)

[Message] Send raw controller memory. The use of this message is discouraged for normal packets, but a quite efficient way for testing new messages and getting experimental debug output.

Field Name	Type	Description
address	uint16_t	Starting address of the debug variables
ver	uint8_t	Version code of the type variable. 0=unknown, type ignored and assumed int16_t. 1=as below
type	uint8_t	Type code of the memory variables. for ver = 1: 0=16 x int16_t, 1=16 x uint16_t, 2=16 x Q15, 3=16 x Q14
value	int8_t[32]	Memory contents at specified address

#### DEBUG\_VECT (#250)

)

[Message] To debug something using a named 3D vector.

Field Name	Type	Units	Description
name	char[10]	Name	
time_usec	uint64_t	us	Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
x	float	x	
y	float	y	
z	float	z	

#### NAMED\_VALUE\_FLOAT (#251)

)

[Message] Send a key-value pair as float. The use of this message is discouraged for normal packets, but a quite efficient way for testing new messages and getting experimental debug output.

Field Name	Type	Units	Description
time_boot_ms	uint32_t	ms	Timestamp (time since system boot).
name	char[10]		Name of the debug variable
value	float		Floating point value

#### NAMED\_VALUE\_INT (#252)

)

[Message] Send a key-value pair as integer. The use of this message is discouraged for normal packets, but a quite efficient way for testing new messages and getting experimental debug output.

Field Name	Type	Units	Description
time_boot_ms	uint32_t	ms	Timestamp (time since system boot).
name	char[10]		Name of the debug variable
value	int32_t		Signed integer value

#### STATUSTEXT (#253)

)

[Message] Status text message. These messages are printed in yellow in the COMM console of QGroundControl. WARNING: They consume quite some bandwidth, so use only for important status and error messages. If implemented wisely, these messages are buffered on the MCU and sent only at a limited rate (e.g. 10 Hz).

Field Name	Type	Values	Description
severity	uint8_t	<a href="#">MAV_SEVERITY</a>	Severity of status. Relies on the definitions within RFC-5424.
text	char[50]		Status text message, without null termination character
id**	uint16_t		Unique (opaque) identifier for this statustext message. May be used to reassemble a logical long-statustext message from a sequence of chunks. A value of zero indicates this is the only chunk in the sequence and the message can be emitted immediately.
chunk_seq**	uint8_t		This chunk's sequence number; indexing is from zero. Any null character in the text field is taken to mean this was the last chunk.

#### DEBUG (#254)

)

[Message] Send a debug value. The index is used to discriminate between values. These values show up in the plot of QGroundControl as DEBUG N.

Field Name	Type	Units	Description
time_boot_ms	uint32_t	ms	Timestamp (time since system boot).
ind	uint8_t		index of debug variable
value	float		DEBUG value

#### SETUP\_SIGNING (#256)

)

[Message] (MAVLink 2) Setup a MAVLink2 signing key. If called with secret\_key of all zero and zero initial\_timestamp will disable signing

Field Name	Type	Description
target_system	uint8_t	system id of the target
target_component	uint8_t	component ID of the target
secret_key	uint8_t[32]	signing key

initial\_timestamp uint64\_t initial timestamp

## BUTTON\_CHANGE (#257)

)

[Message] (MAVLink 2) Report button state change.

Field Name	Type	Units	Description
time_boot_ms	uint32_t	ms	Timestamp (time since system boot).
last_change_ms	uint32_t	ms	Time of last change of button state.
state	uint8_t		Bitmap for state of buttons.

## PLAY\_TUNE (#258)

)

**DEPRECATED:** Replaced by [PLAY\\_TUNE\\_V2](#) (2019-10).

New version explicitly defines format. More interoperable.

[Message] (MAVLink 2) Control vehicle tone generation (buzzer).

Field Name	Type	Description
target_system	uint8_t	System ID
target_component	uint8_t	Component ID
tune	char[30]	tune in board specific format
tune2**	char[200]	tune extension (appended to tune)

## CAMERA\_INFORMATION (#259)

)

[Message] (MAVLink 2) Information about a camera. Can be requested with a [MAV\\_CMD\\_REQUEST\\_MESSAGE](#) command.

Field Name	Type	Units	Values	Description
time_boot_ms	uint32_t	ms		Timestamp (time since system boot).
vendor_name	uint8_t[32]			Name of the camera vendor
model_name	uint8_t[32]			Name of the camera model
firmware_version	uint32_t			Version of the camera firmware, encoded as: (Dev & 0xff) << 24
focal_length	float	mm		Focal length
sensor_size_h	float	mm		Image sensor size horizontal
sensor_size_v	float	mm		Image sensor size vertical
resolution_h	uint16_t	pix		Horizontal image resolution
resolution_v	uint16_t	pix		Vertical image resolution
lens_id	uint8_t			Reserved for a lens ID
flags	uint32_t		<a href="#">CAMERA_CAP_FLAGS</a>	Bitmap of camera capability flags.
cam_definition_version	uint16_t			Camera definition version (iteration)
cam_definition_uri	char[140]			Camera definition URI (if any, otherwise only basic functions will be available). HTTP- (http://) and MAVLink FTP- (mavlinkftp://) formatted URIs are allowed (and both must be supported by any GCS that implements the Camera Protocol). The definition file may be xz compressed, which will be indicated by the file extension .xml.xz (a GCS that implements the protocol must support decompressing the file). The string needs to be zero terminated.

## CAMERA\_SETTINGS (#260)

)

[Message] (MAVLink 2) Settings of a camera. Can be requested with a [MAV\\_CMD\\_REQUEST\\_MESSAGE](#) command.

Field Name	Type	Units	Values	Description
time_boot_ms	uint32_t	ms		Timestamp (time since system boot).
mode_id	uint8_t		<a href="#">CAMERA_MODE</a>	Camera mode
zoomLevel**	float			Current zoom level (0.0 to 100.0, NaN if not known)
focusLevel**	float			Current focus level (0.0 to 100.0, NaN if not known)

## STORAGE\_INFORMATION (#261)

)

[Message] (MAVLink 2) Information about a storage medium. This message is sent in response to a request with [MAV\\_CMD\\_REQUEST\\_MESSAGE](#) and whenever the status of the storage changes ([STORAGE\\_STATUS](#)). Use [MAV\\_CMD\\_REQUEST\\_MESSAGE](#).param2 to indicate the index/id of requested storage: 0 for all, 1 for first, 2 for second, etc.

Field Name	Type	Units	Values	Description
time_boot_ms	uint32_t	ms		Timestamp (time since system boot).
storage_id	uint8_t			Storage ID (1 for first, 2 for second, etc.)
storage_count	uint8_t			Number of storage devices
status	uint8_t		<a href="#">STORAGE_STATUS</a>	Status of storage
total_capacity	float	MiB		Total capacity. If storage is not ready ( <a href="#">STORAGE_STATUS_READY</a> ) value will be ignored.
used_capacity	float	MiB		Used capacity. If storage is not ready ( <a href="#">STORAGE_STATUS_READY</a> ) value will be ignored.



available_capacity	float	MiB	Available storage capacity. If storage is not ready ( <a href="#">STORAGE_STATUS_READY</a> ) value will be ignored.
read_speed	float	MiB/s	Read speed.
write_speed	float	MiB/s	Write speed.
type**	uint8_t	<a href="#">STORAGE_TYPE</a>	Type of storage
name**	char[32]		Textual storage name to be used in UI (microSD 1, Internal Memory, etc.) This is a NULL terminated string. If it is exactly 32 characters long, add a terminating NULL. If this string is empty, the generic type is shown to the user.
storage_usage**	uint8_t	<a href="#">STORAGE_USAGE_FLAG</a>	Flags indicating whether this instance is preferred storage for photos, videos, etc.

Note: Implementations should initially set the flags on the system-default storage id used for saving media (if possible/supported).  
This setting can then be overridden using [MAV\\_CMD\\_SET\\_STORAGE\\_USAGE](#).  
If the media usage flags are not set, a GCS may assume storage ID 1 is the default storage for all media types.

## CAMERA\_CAPTURE\_STATUS (#262)

)

[Message] (MAVLink 2) Information about the status of a capture. Can be requested with a [MAV\\_CMD\\_REQUEST\\_MESSAGE](#) command.

Field Name	Type	Units	Description
time_boot_ms	uint32_t	ms	Timestamp (time since system boot).
image_status	uint8_t		Current status of image capturing (0: idle, 1: capture in progress, 2: interval set but idle, 3: interval set and capture in progress)
video_status	uint8_t		Current status of video capturing (0: idle, 1: capture in progress)
image_interval	float	s	Image capture interval
recording_time_ms	uint32_t	ms	Elapsed time since recording started (0: Not supported/available). A GCS should compute recording time and use non-zero values of this field to correct any discrepancy.
available_capacity	float	MiB	Available storage capacity.
image_count**	int32_t		Total number of images captured ('forever', or until reset using <a href="#">MAV_CMD_STORAGE_FORMAT</a> ).

## CAMERA\_IMAGE\_CAPTURED (#263)

)

[Message] (MAVLink 2) Information about a captured image. This is emitted every time a message is captured. [MAV\\_CMD\\_REQUEST\\_MESSAGE](#) can be used to (re)request this message for a specific sequence number or range of sequence numbers: [MAV\\_CMD\\_REQUEST\\_MESSAGE](#).param2 indicates the sequence number the first image to send, or set to -1 to send the message for all sequence numbers. [MAV\\_CMD\\_REQUEST\\_MESSAGE](#).param3 is used to specify a range of messages to send: set to 0 (default) to send just the message for the sequence number in param 2, set to -1 to send the message for the sequence number in param 2 and all the following sequence numbers, set to the sequence number of the final message in the range.

Field Name	Type	Units	Description
time_boot_ms	uint32_t	ms	Timestamp (time since system boot).
time_utc	uint64_t	us	Timestamp (time since UNIX epoch) in UTC. 0 for unknown.
camera_id	uint8_t		Deprecated/unused. Component IDs are used to differentiate multiple cameras.
lat	int32_t	degE7	Latitude where image was taken
lon	int32_t	degE7	Longitude where capture was taken
alt	int32_t	mm	Altitude (MSL) where image was taken
relative_alt	int32_t	mm	Altitude above ground
q	float[4]		Quaternion of camera orientation (w, x, y, z order, zero-rotation is 1, 0, 0, 0)
image_index	int32_t		Zero based index of this image (i.e. a new image will have index <a href="#">CAMERA_CAPTURE_STATUS</a> .image count -1)
capture_result	int8_t		Boolean indicating success (1) or failure (0) while capturing this image.
file_url	char[205]		URL of image taken. Either local storage or <a href="http://foo.jpg">http://foo.jpg</a> if camera provides an HTTP interface.

## FLIGHT\_INFORMATION (#264)

)

[Message] (MAVLink 2) Information about flight since last arming. This can be requested using [MAV\\_CMD\\_REQUEST\\_MESSAGE](#).

Field Name	Type	Units	Description
time_boot_ms	uint32_t	ms	Timestamp (time since system boot).
arming_time_utc	uint64_t	us	Timestamp at arming (time since UNIX epoch) in UTC, 0 for unknown
takeoff_time_utc	uint64_t	us	Timestamp at takeoff (time since UNIX epoch) in UTC, 0 for unknown
flight_uuid	uint64_t		Universally unique identifier (UUID) of flight, should correspond to name of log files

## MOUNT\_ORIENTATION (#265)

)

**DEPRECATED:** Replaced by [MAV\\_CMD\\_DO\\_GIMBAL\\_MANAGER\\_PITCHYAW](#) (2020-01).

This message is being superseded by [MAV\\_CMD\\_DO\\_GIMBAL\\_MANAGER\\_PITCHYAW](#). The message can still be used to communicate with legacy gimbals implementing it.

[Message] (MAVLink 2) Orientation of a mount

Field Name	Type	Units	Description
time_boot_ms	uint32_t	ms	Timestamp (time since system boot).
roll	float	deg	Roll in global frame (set to NaN for invalid).
pitch	float	deg	Pitch in global frame (set to NaN for invalid).
yaw	float	deg	Yaw relative to vehicle (set to NaN for invalid).
yaw_absolute**	float	deg	Yaw in absolute frame relative to Earth's North, north is 0 (set to NaN for invalid).

## LOGGING\_DATA (#266)

)

[Message] (MAVLink 2) A message containing logged data (see also [MAV\\_CMD\\_LOGGING\\_START](#))

Field Name	Type	Units	Description
target_system	uint8_t		system ID of the target
target_component	uint8_t		component ID of the target
sequence	uint16_t		sequence number (can wrap)
length	uint8_t	bytes	data length
first_message_offset	uint8_t	bytes	offset into data where first message starts. This can be used for recovery, when a previous message got lost (set to UINT8_MAX if no start exists).
data	uint8_t[249]		logged data

## LOGGING\_DATA\_ACKED (#267)

)

[Message] (MAVLink 2) A message containing logged data which requires a [LOGGING\\_ACK](#) to be sent back

Field Name	Type	Units	Description
target_system	uint8_t		system ID of the target
target_component	uint8_t		component ID of the target
sequence	uint16_t		sequence number (can wrap)
length	uint8_t	bytes	data length
first_message_offset	uint8_t	bytes	offset into data where first message starts. This can be used for recovery, when a previous message got lost (set to UINT8_MAX if no start exists).
data	uint8_t[249]		logged data

## LOGGING\_ACK (#268)

)

[Message] (MAVLink 2) An ack for a [LOGGING\\_DATA\\_ACKED](#) message

Field Name	Type	Description
target_system	uint8_t	system ID of the target
target_component	uint8_t	component ID of the target
sequence	uint16_t	sequence number (must match the one in <a href="#">LOGGING_DATA_ACKED</a> )

## VIDEO\_STREAM\_INFORMATION (#269)

)

[Message] (MAVLink 2) Information about video stream. It may be requested using [MAV\\_CMD\\_REQUEST\\_MESSAGE](#), where param2 indicates the video stream id: 0 for all streams, 1 for first, 2 for second, etc.

Field Name	Type	Units	Values	Description
stream_id	uint8_t			Video Stream ID (1 for first, 2 for second, etc.)
count	uint8_t			Number of streams available.
type	uint8_t		<a href="#">VIDEO_STREAM_TYPE</a>	Type of stream.
flags	uint16_t		<a href="#">VIDEO_STREAM_STATUS_FLAGS</a>	Bitmap of stream status flags.
framerate	float	Hz		Frame rate.
resolution_h	uint16_t	pix		Horizontal resolution.
resolution_v	uint16_t	pix		Vertical resolution.
bitrate	uint32_t	bits/s		Bit rate.
rotation	uint16_t	deg		Video image rotation clockwise.
hfov	uint16_t	deg		Horizontal Field of view.
name	char[32]			Stream name.
uri	char[160]			Video stream URI (TCP or RTSP URI ground station should connect to) or port number (UDP port ground station should listen to).

## VIDEO\_STREAM\_STATUS (#270)

)

[Message] (MAVLink 2) Information about the status of a video stream. It may be requested using [MAV\\_CMD\\_REQUEST\\_MESSAGE](#).

Field Name	Type	Units	Values	Description
stream_id	uint8_t			Video Stream ID (1 for first, 2 for second, etc.)
flags	uint16_t		<a href="#">VIDEO_STREAM_STATUS_FLAGS</a>	Bitmap of stream status flags
framerate	float	Hz		Frame rate
resolution_h	uint16_t	pix		Horizontal resolution
resolution_v	uint16_t	pix		Vertical resolution
bitrate	uint32_t	bits/s		Bit rate
rotation	uint16_t	deg		Video image rotation clockwise

CAMERA FOV STATUS (#271

**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

Field Name	Type	Units	Description
time_boot_ms	uint32_t	ms	Timestamp (time since system boot).
lat_camera	int32_t	degE7	Latitude of camera (INT32_MAX if unknown).
lon_camera	int32_t	degE7	Longitude of camera (INT32_MAX if unknown).
alt_camera	int32_t	mm	Altitude (MSL) of camera (INT32_MAX if unknown).
lat_image	int32_t	degE7	Latitude of center of image (INT32_MAX if unknown, INT32_MIN if at infinity, not intersecting with horizon).
lon_image	int32_t	degE7	Longitude of center of image (INT32_MAX if unknown, INT32_MIN if at infinity, not intersecting with horizon).
alt_image	int32_t	mm	Altitude (MSL) of center of image (INT32_MAX if unknown, INT32_MIN if at infinity, not intersecting with horizon).
q	float[4]		Quaternion of camera orientation (w, x, y, z order, zero-rotation is 1, 0, 0, 0)
hfov	float	deg	Horizontal field of view (NaN if unknown).
vfov	float	deg	Vertical field of view (NaN if unknown).

## )

**[Message] (MAVLink 2)** Camera tracking status, sent while in active tracking. Use [MAV\\_CMD\\_SET\\_MESSAGE\\_INTERVAL](#) to define message interval.

Field Name	Type	Values	Description
tracking_status	uint8_t	<a href="#">CAMERA_TRACKING_STATUS_FLAGS</a>	Current tracking status
tracking_mode	uint8_t	<a href="#">CAMERA_TRACKING_MODE</a>	Current tracking mode
target_data	uint8_t	<a href="#">CAMERA_TRACKING_TARGET_DATA</a>	Defines location of target data
point_x	float		Current tracked point x value if <a href="#">CAMERA_TRACKING_MODE_POINT</a> (normalized 0..1, 0 is left, 1 is right), NAN if unknown
point_y	float		Current tracked point y value if <a href="#">CAMERA_TRACKING_MODE_POINT</a> (normalized 0..1, 0 is top, 1 is bottom), NAN if unknown
radius	float		Current tracked radius if <a href="#">CAMERA_TRACKING_MODE_POINT</a> (normalized 0..1, 0 is image left, 1 is image right), NAN if unknown
rec_top_x	float		Current tracked rectangle top x value if <a href="#">CAMERA_TRACKING_MODE_RECTANGLE</a> (normalized 0..1, 0 is left, 1 is right), NAN if unknown
rec_top_y	float		Current tracked rectangle top y value if <a href="#">CAMERA_TRACKING_MODE_RECTANGLE</a> (normalized 0..1, 0 is top, 1 is bottom), NAN if unknown
rec_bottom_x	float		Current tracked rectangle bottom x value if <a href="#">CAMERA_TRACKING_MODE_RECTANGLE</a> (normalized 0..1, 0 is left, 1 is right), NAN if unknown
rec_bottom_y	float		Current tracked rectangle bottom y value if <a href="#">CAMERA_TRACKING_MODE_RECTANGLE</a> (normalized 0..1, 0 is top, 1 is bottom), NAN if unknown

## )

[\[Message\]](#) (**MAVLink 2**) Camera tracking status, sent while in active tracking. Use [MAV\\_CMD\\_SET\\_MESSAGE\\_INTERVAL](#) to define message interval.

Field Name	Type	Units	Values	Description
tracking_status	uint8_t		<a href="#">CAMERA_TRACKING_STATUS_FLAGS</a>	Current tracking status
lat	int32_t	degE7		Latitude of tracked object
lon	int32_t	degE7		Longitude of tracked object
alt	float	m		Altitude of tracked object(AMSL, WGS84)
h_acc	float	m		Horizontal accuracy. NAN if unknown
v_acc	float	m		Vertical accuracy. NAN if unknown
vel_n	float	m/s		North velocity of tracked object. NAN if unknown
vel_e	float	m/s		East velocity of tracked object. NAN if unknown
vel_d	float	m/s		Down velocity of tracked object. NAN if unknown
vel_acc	float	m/s		Velocity accuracy. NAN if unknown
dist	float	m		Distance between camera and tracked object. NAN if unknown
hdg	float	rad		Heading in radians, in NED. NAN if unknown
hdg_acc	float	rad		Accuracy of heading, in NED. NAN if unknown

## )

**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[\[Message\]](#) (**MAVLink 2**) Information about a high level gimbal manager. This message should be requested by a ground station using [MAV\\_CMD\\_REQUEST\\_MESSAGE](#).

Field Name	Type	Units	Values	Description
time_boot_ms	uint32_t	ms		Timestamp (time since system boot).
cap_flags	uint32_t		<a href="#">GIMBAL_MANAGER_CAP_FLAGS</a>	Bitmap of gimbal capability flags.
gimbal_device_id	uint8_t			Gimbal device ID that this gimbal manager is responsible for.
roll_min	float	rad		Minimum hardware roll angle (positive: rolling to the right, negative: rolling to the left)
roll_max	float	rad		Maximum hardware roll angle (positive: rolling to the right, negative: rolling to the left)
pitch_min	float	rad		Minimum pitch angle (positive: up, negative: down)
pitch_max	float	rad		Maximum pitch angle (positive: up, negative: down)
yaw_min	float	rad		Minimum yaw angle (positive: to the right, negative: to the left)
yaw_max	float	rad		Maximum yaw angle (positive: to the right, negative: to the left)

#### GIMBAL\_MANAGER\_STATUS (#281)

)

**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[\[Message\]](#) (**MAVLink 2**) Current status about a high level gimbal manager. This message should be broadcast at a low regular rate (e.g. 5Hz).

Field Name	Type	Units	Values	Description
time_boot_ms	uint32_t	ms		Timestamp (time since system boot).
flags	uint32_t		<a href="#">GIMBAL_MANAGER_FLAGS</a>	High level gimbal manager flags currently applied.
gimbal_device_id	uint8_t			Gimbal device ID that this gimbal manager is responsible for.
primary_control_sysid	uint8_t			System ID of MAVLink component with primary control, 0 for none.
primary_control_compid	uint8_t			Component ID of MAVLink component with primary control, 0 for none.
secondary_control_sysid	uint8_t			System ID of MAVLink component with secondary control, 0 for none.
secondary_control_compid	uint8_t			Component ID of MAVLink component with secondary control, 0 for none.

#### GIMBAL\_MANAGER\_SET\_ATTITUDE (#282)

)

**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[\[Message\]](#) (**MAVLink 2**) High level message to control a gimbal's attitude. This message is to be sent to the gimbal manager (e.g. from a ground station). Angles and rates can be set to NaN according to use case.

Field Name	Type	Units	Values	Description
target_system	uint8_t			System ID
target_component	uint8_t			Component ID
flags	uint32_t		<a href="#">GIMBAL_MANAGER_FLAGS</a>	High level gimbal manager flags to use.
gimbal_device_id	uint8_t			Component ID of gimbal device to address (or 1-6 for non-MAVLink gimbal), 0 for all gimbal device components. Send command multiple times for more than one gimbal (but not all gimbals).
q	float[4]			Quaternion components, w, x, y, z (1 0 0 0 is the null-rotation, the frame is depends on whether the flag <a href="#">GIMBAL_MANAGER_FLAGS_YAW_LOCK</a> is set)
angular_velocity_x	float	rad/s		X component of angular velocity, positive is rolling to the right, NaN to be ignored.
angular_velocity_y	float	rad/s		Y component of angular velocity, positive is pitching up, NaN to be ignored.
angular_velocity_z	float	rad/s		Z component of angular velocity, positive is yawing to the right, NaN to be ignored.

#### GIMBAL\_DEVICE\_INFORMATION (#283)

)

**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[\[Message\]](#) (**MAVLink 2**) Information about a low level gimbal. This message should be requested by the gimbal manager or a ground station using [MAV\\_CMD\\_REQUEST\\_MESSAGE](#). The maximum angles and rates are the limits by hardware. However, the limits by software used are likely different/smaller and dependent on mode/settings/etc..

Field Name	Type	Units	Values	Description
time_boot_ms	uint32_t	ms		Timestamp (time since system boot).
vendor_name	char[32]			Name of the gimbal vendor.
model_name	char[32]			Name of the gimbal model.
custom_name	char[32]			Custom name of the gimbal given to it by the user.
firmware_version	uint32_t			Version of the gimbal firmware, encoded as: (Dev & 0xff) << 24
hardware_version	uint32_t			Version of the gimbal hardware, encoded as: (Dev & 0xff) << 24
uid	uint64_t			UID of gimbal hardware (0 if unknown).
cap_flags	uint16_t		<a href="#">GIMBAL_DEVICE_CAP_FLAGS</a>	Bitmap of gimbal capability flags.
custom_cap_flags	uint16_t			Bitmap for use for gimbal-specific capability flags.
roll_min	float	rad		Minimum hardware roll angle (positive: rolling to the right, negative: rolling to the left)
roll_max	float	rad		Maximum hardware roll angle (positive: rolling to the right, negative: rolling to the left)

			rolling to the left)
pitch_min	float	rad	Minimum hardware pitch angle (positive: up, negative: down)
pitch_max	float	rad	Maximum hardware pitch angle (positive: up, negative: down)
yaw_min	float	rad	Minimum hardware yaw angle (positive: to the right, negative: to the left)
yaw_max	float	rad	Maximum hardware yaw angle (positive: to the right, negative: to the left)

## GIMBAL\_DEVICE\_SET\_ATTITUDE (#284)

)

**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[Message] (MAVLink 2) Low level message to control a gimbal device's attitude. This message is to be sent from the gimbal manager to the gimbal device component. Angles and rates can be set to NaN according to use case.

Field Name	Type	Units	Values	Description
target_system	uint8_t			System ID
target_component	uint8_t			Component ID
flags	uint16_t		<a href="#">GIMBAL_DEVICE_FLAGS</a>	Low level gimbal flags.
q	float[4]			Quaternion components, w, x, y, z (1 0 0 0 is the null-rotation, the frame is depends on whether the flag <a href="#">GIMBAL_DEVICE_FLAGS_YAW_LOCK</a> is set, set all fields to NaN if only angular velocity should be used)
angular_velocity_x	float	rad/s		X component of angular velocity, positive is rolling to the right, NaN to be ignored.
angular_velocity_y	float	rad/s		Y component of angular velocity, positive is pitching up, NaN to be ignored.
angular_velocity_z	float	rad/s		Z component of angular velocity, positive is yawing to the right, NaN to be ignored.

## GIMBAL\_DEVICE\_ATTITUDE\_STATUS (#285)

)

**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[Message] (MAVLink 2) Message reporting the status of a gimbal device. This message should be broadcasted by a gimbal device component. The angles encoded in the quaternion are relative to absolute North if the flag [GIMBAL\\_DEVICE\\_FLAGS\\_YAW\\_LOCK](#) is set (roll: positive is rolling to the right, pitch: positive is pitching up, yaw is turn to the right) or relative to the vehicle heading if the flag is not set. This message should be broadcast at a low regular rate (e.g. 10Hz).

Field Name	Type	Units	Values	Description
target_system	uint8_t			System ID
target_component	uint8_t			Component ID
time_boot_ms	uint32_t	ms		Timestamp (time since system boot).
flags	uint16_t		<a href="#">GIMBAL_DEVICE_FLAGS</a>	Current gimbal flags set.
q	float[4]			Quaternion components, w, x, y, z (1 0 0 0 is the null-rotation, the frame is depends on whether the flag <a href="#">GIMBAL_DEVICE_FLAGS_YAW_LOCK</a> is set)
angular_velocity_x	float	rad/s		X component of angular velocity (NaN if unknown)
angular_velocity_y	float	rad/s		Y component of angular velocity (NaN if unknown)
angular_velocity_z	float	rad/s		Z component of angular velocity (NaN if unknown)
failure_flags	uint32_t		<a href="#">GIMBAL_DEVICE_ERROR_FLAGS</a>	Failure flags (0 for no failure)

## AUTOPILOT\_STATE\_FOR\_GIMBAL\_DEVICE (#286)

)

**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[Message] (MAVLink 2) Low level message containing autopilot state relevant for a gimbal device. This message is to be sent from the gimbal manager to the gimbal device component. The data of this message server for the gimbal's estimator corrections in particular horizon compensation, as well as the autopilot's control intention e.g. feed forward angular control in z-axis.

Field Name	Type	Units	Values	Description
target_system	uint8_t			System ID
target_component	uint8_t			Component ID
time_boot_us	uint64_t	us		Timestamp (time since system boot).
q	float[4]			Quaternion components of autopilot attitude: w, x, y, z (1 0 0 0 is the null-rotation, Hamilton convention).
q_estimated_delay_us	uint32_t	us		Estimated delay of the attitude data.
vx	float	m/s		X Speed in NED (North, East, Down).
vy	float	m/s		Y Speed in NED (North, East, Down).
vz	float	m/s		Z Speed in NED (North, East, Down).
v_estimated_delay_us	uint32_t	us		Estimated delay of the speed data.
feed_forward_angular_velocity_z	float	rad/s		Feed forward Z component of angular velocity, positive is yawing to the right, NaN to be ignored. This is to indicate if the autopilot is actively yawing.
estimator_status	uint16_t		<a href="#">ESTIMATOR_STATUS_FLAGS</a>	Bitmap indicating which estimator outputs are valid.
landed_state	uint8_t		<a href="#">MAV_LANDED_STATE</a>	The landed state. Is set to <a href="#">MAV_LANDED_STATE_UNDEFINED</a> if landed state is unknown.

## GIMBAL\_MANAGER\_SET\_PITCHYAW (#287)

)

**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[Message] (MAVLink 2) High level message to control a gimbal's pitch and yaw angles. This message is to be sent to the gimbal manager (e.g. from a ground station). Angles and rates can be set to NaN according to use case.

Field Name	Type	Units	Values	Description
target_system	uint8_t			System ID
target_component	uint8_t			Component ID
flags	uint32_t		<a href="#">GIMBAL_MANAGER_FLAGS</a>	High level gimbal manager flags to use.
gimbal_device_id	uint8_t			Component ID of gimbal device to address (or 1-6 for non-MAVLink gimbal), 0 for all gimbal device components. Send command multiple times for more than one gimbal (but not all gimbals).
pitch	float	rad		Pitch angle (positive: up, negative: down, NaN to be ignored).
yaw	float	rad		Yaw angle (positive: to the right, negative: to the left, NaN to be ignored).
pitch_rate	float	rad/s		Pitch angular rate (positive: up, negative: down, NaN to be ignored).
yaw_rate	float	rad/s		Yaw angular rate (positive: to the right, negative: to the left, NaN to be ignored).

#### GIMBAL\_MANAGER\_SET\_MANUAL\_CONTROL (#288)

)

**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[Message] (MAVLink 2) High level message to control a gimbal manually. The angles or angular rates are unitless; the actual rates will depend on internal gimbal manager settings/configuration (e.g. set by parameters). This message is to be sent to the gimbal manager (e.g. from a ground station). Angles and rates can be set to NaN according to use case.

Field Name	Type	Units	Values	Description
target_system	uint8_t			System ID
target_component	uint8_t			Component ID
flags	uint32_t		<a href="#">GIMBAL_MANAGER_FLAGS</a>	High level gimbal manager flags.
gimbal_device_id	uint8_t			Component ID of gimbal device to address (or 1-6 for non-MAVLink gimbal), 0 for all gimbal device components. Send command multiple times for more than one gimbal (but not all gimbals).
pitch	float			Pitch angle unitless (-1..1, positive: up, negative: down, NaN to be ignored).
yaw	float			Yaw angle unitless (-1..1, positive: to the right, negative: to the left, NaN to be ignored).
pitch_rate	float			Pitch angular rate unitless (-1..1, positive: up, negative: down, NaN to be ignored).
yaw_rate	float			Yaw angular rate unitless (-1..1, positive: to the right, negative: to the left, NaN to be ignored).

#### ESC\_INFO (#290)

)

**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[Message] (MAVLink 2) ESC information for lower rate streaming. Recommended streaming rate 1Hz. See [ESC\\_STATUS](#) for higher-rate ESC data.

Field Name	Type	Units	Values	Description
index	uint8_t			Index of the first ESC in this message. minValue = 0, maxValue = 60, increment = 4.
time_usec	uint64_t	us		Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude the number.
counter	uint16_t			Counter of data packets received.
count	uint8_t			Total number of ESCs in all messages of this type. Message fields with an index higher than this should be ignored because they contain invalid data.
connection_type	uint8_t		<a href="#">ESC_CONNECTION_TYPE</a>	Connection type protocol for all ESC.
info	uint8_t			Information regarding online/offline status of each ESC.
failure_flags	uint16_t[4]		<a href="#">ESC_FAILURE_FLAGS</a>	Bitmap of ESC failure flags.
error_count	uint32_t[4]			Number of reported errors by each ESC since boot.
temperature	int16_t[4]	cdegC		Temperature of each ESC. INT16_MAX: if data not supplied by ESC.

#### ESC\_STATUS (#291)

)

**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[Message] (MAVLink 2) ESC information for higher rate streaming. Recommended streaming rate is ~10 Hz. Information that changes more slowly is sent in [ESC\\_INFO](#). It should typically only be streamed on high-bandwidth links (i.e. to a companion computer).

Field Name	Type	Units	Description
index	uint8_t		Index of the first ESC in this message. minValue = 0, maxValue = 60, increment = 4.
time_usec	uint64_t	us	Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude the number.
rpm	int32_t[4]	rpm	Reported motor RPM from each ESC (negative for reverse rotation).
voltage	float[4]	V	Voltage measured from each ESC.
current	float[4]	A	Current measured from each ESC.

#### WIFI\_CONFIG\_AP (#299)

)

[Message] (MAVLink 2) Configure WiFi AP SSID, password, and mode. This message is re-emitted as an acknowledgement by the AP. The message may also be explicitly requested using MAV\_CMD\_REQUEST\_MESSAGE

Field Name	Type	Values	Description
ssid	char[32]		Name of Wi-Fi network (SSID). Blank to leave it unchanged when setting. Current SSID when sent back as a response.
password	char[64]		Password. Blank for an open AP. MD5 hash when message is sent back as a response.
mode**	int8_t	<a href="#">WIFI_CONFIG_AP_MODE</a>	WiFi Mode.
response**	int8_t	<a href="#">WIFI_CONFIG_AP_RESPONSE</a>	Message acceptance response (sent back to GS).

### AIS\_VESSEL (#301)

)

[Message] (MAVLink 2) The location and information of an AIS vessel

Field Name	Type	Units	Values	Description
MMSI	uint32_t			Mobile Marine Service Identifier, 9 decimal digits
lat	int32_t	degE7		Latitude
lon	int32_t	degE7		Longitude
COG	uint16_t	cdeg		Course over ground
heading	uint16_t	cdeg		True heading
velocity	uint16_t	cm/s		Speed over ground
turn_rate	int8_t	cdeg/s		Turn rate
navigational_status	uint8_t		<a href="#">AIS_NAV_STATUS</a>	Navigational status
type	uint8_t		<a href="#">AIS_TYPE</a>	Type of vessels
dimension_bow	uint16_t	m		Distance from lat/lon location to bow
dimension_stern	uint16_t	m		Distance from lat/lon location to stern
dimension_port	uint8_t	m		Distance from lat/lon location to port side
dimension_starboard	uint8_t	m		Distance from lat/lon location to starboard side
callsign	char[7]			The vessel callsign
name	char[20]			The vessel name
tslc	uint16_t	s		Time since last communication in seconds
flags	uint16_t		<a href="#">AIS_FLAGS</a>	Bitmask to indicate various statuses including valid data fields

### UAVCAN\_NODE\_STATUS (#310)

)

[Message] (MAVLink 2) General status information of an UAVCAN node. Please refer to the definition of the UAVCAN message "uavcan.protocol.NodeStatus" for the background information. The UAVCAN specification is available at <http://uavcan.org>.

Field Name	Type	Units	Values	Description
time_usec	uint64_t	us		Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
uptime_sec	uint32_t	s		Time since the start-up of the node.
health	uint8_t		<a href="#">UAVCAN_NODE_HEALTH</a>	Generalized node health status.
mode	uint8_t		<a href="#">UAVCAN_NODE_MODE</a>	Generalized operating mode.
sub_mode	uint8_t			Not used currently.
vendor_specific_status_code	uint16_t			Vendor-specific status information.

### UAVCAN\_NODE\_INFO (#311)

)

[Message] (MAVLink 2) General information describing a particular UAVCAN node. Please refer to the definition of the UAVCAN service "uavcan.protocol.GetNodeInfo" for the background information. This message should be emitted by the system whenever a new node appears online, or an existing node reboots. Additionally, it can be emitted upon request from the other end of the MAVLink channel (see [MAV\\_CMD\\_UAVCAN\\_GET\\_NODE\\_INFO](#)). It is also not prohibited to emit this message unconditionally at a low frequency. The UAVCAN specification is available at <http://uavcan.org>.

Field Name	Type	Units	Description
time_usec	uint64_t	us	Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
uptime_sec	uint32_t	s	Time since the start-up of the node.
name	char[80]		Node name string. For example, "sapog.px4.io".
hw_version_major	uint8_t		Hardware major version number.
hw_version_minor	uint8_t		Hardware minor version number.
hw_unique_id	uint8_t[16]		Hardware unique 128-bit ID.
sw_version_major	uint8_t		Software major version number.
sw_version_minor	uint8_t		Software minor version number.
sw_vcs_commit	uint32_t		Version control system (VCS) revision identifier (e.g. git short commit hash). 0 if unknown.

### PARAM\_EXT\_REQUEST\_READ (#320)

)

[Message] (MAVLink 2) Request to read the value of a parameter with either the param\_id string id or param\_index. [PARAM\\_EXT\\_VALUE](#) should be emitted in response.

Field Name	Type	Description
target_system	uint8_t	System ID

target_component	uint8_t	Component ID
param_id	char[16]	Parameter id, terminated by NULL if the length is less than 16 human-readable chars and WITHOUT null termination (NULL) byte if the length is exactly 16 chars - applications have to provide 16+1 bytes storage if the ID is stored as string
param_index	int16_t	Parameter index. Set to -1 to use the Parameter ID field as identifier (else param_id will be ignored)

### PARAM\_EXT\_REQUEST\_LIST (#321)

)

[Message] (MAVLink 2) Request all parameters of this component. All parameters should be emitted in response as [PARAM\\_EXT\\_VALUE](#).

Field Name	Type	Description
target_system	uint8_t	System ID
target_component	uint8_t	Component ID

### PARAM\_EXT\_VALUE (#322)

)

[Message] (MAVLink 2) Emit the value of a parameter. The inclusion of param\_count and param\_index in the message allows the recipient to keep track of received parameters and allows them to re-request missing parameters after a loss or timeout.

Field Name	Type	Values	Description
param_id	char[16]		Parameter id, terminated by NULL if the length is less than 16 human-readable chars and WITHOUT null termination (NULL) byte if the length is exactly 16 chars - applications have to provide 16+1 bytes storage if the ID is stored as string
param_value	char[128]		Parameter value
param_type	uint8_t	<a href="#">MAV_PARAM_EXT_TYPE</a>	Parameter type.
param_count	uint16_t		Total number of parameters
param_index	uint16_t		Index of this parameter

### PARAM\_EXT\_SET (#323)

)

[Message] (MAVLink 2) Set a parameter value. In order to deal with message loss (and retransmission of [PARAM\\_EXT\\_SET](#)), when setting a parameter value and the new value is the same as the current value, you will immediately get a [PARAM\\_ACK\\_ACCEPTED](#) response. If the current state is [PARAM\\_ACK\\_IN\\_PROGRESS](#), you will accordingly receive a [PARAM\\_ACK\\_IN\\_PROGRESS](#) in response.

Field Name	Type	Values	Description
target_system	uint8_t		System ID
target_component	uint8_t		Component ID
param_id	char[16]		Parameter id, terminated by NULL if the length is less than 16 human-readable chars and WITHOUT null termination (NULL) byte if the length is exactly 16 chars - applications have to provide 16+1 bytes storage if the ID is stored as string
param_value	char[128]		Parameter value
param_type	uint8_t	<a href="#">MAV_PARAM_EXT_TYPE</a>	Parameter type.

### PARAM\_EXT\_ACK (#324)

)

[Message] (MAVLink 2) Response from a [PARAM\\_EXT\\_SET](#) message.

Field Name	Type	Values	Description
param_id	char[16]		Parameter id, terminated by NULL if the length is less than 16 human-readable chars and WITHOUT null termination (NULL) byte if the length is exactly 16 chars - applications have to provide 16+1 bytes storage if the ID is stored as string
param_value	char[128]		Parameter value (new value if <a href="#">PARAM_ACK_ACCEPTED</a> , current value otherwise)
param_type	uint8_t	<a href="#">MAV_PARAM_EXT_TYPE</a>	Parameter type.
param_result	uint8_t	<a href="#">PARAM_ACK</a>	Result code.

### OBSTACLE\_DISTANCE (#330)

)

[Message] (MAVLink 2) Obstacle distances in front of the sensor, starting from the left in increment degrees to the right

Field Name	Type	Units	Values	Description
time_usec	uint64_t	us		Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
sensor_type	uint8_t		<a href="#">MAV_DISTANCE_SENSOR</a>	Class id of the distance sensor type.
distances	uint16_t[72]	cm		Distance of obstacles around the vehicle with index 0 corresponding to north + angle_offset, unless otherwise specified in the frame. A value of 0 is valid and means that the obstacle is practically touching the sensor. A value of max_distance + 1 means no obstacle is present. A value of UINT16_MAX for unknown/not used. In a array element, one unit corresponds to 1cm.
increment	uint8_t	deg		Angular width in degrees of each array element. Increment direction is clockwise. This field is ignored if increment_f is non-zero.
min_distance	uint16_t	cm		Minimum distance the sensor can measure.
max_distance	uint16_t	cm		Maximum distance the sensor can measure.
increment_f	float	deg		Angular width in degrees of each array element as a float. If non-zero then this value is used instead of the uint8_t increment field. Positive is clockwise direction, negative is counter-clockwise.
				Relative angle offset of the 0-index element in the distances array. Value of



angle_offset**	float	deg	0 corresponds to forward. Positive is clockwise direction, negative is counter-clockwise.
frame**	uint8_t	<a href="#">MAV_FRAME</a>	Coordinate frame of reference for the yaw rotation and offset of the sensor data. Defaults to <a href="#">MAV_FRAME_GLOBAL</a> , which is north aligned. For body-mounted sensors use <a href="#">MAV_FRAME_BODY_FRD</a> , which is vehicle front aligned.

## ODOMETRY (#331)

)

[Message] (MAVLink 2) Odometry message to communicate odometry information with an external interface. Fits ROS REP 147 standard for aerial vehicles (<http://www.ros.org/reps/rep-0147.html>).

Field Name	Type	Units	Values	Description
time_usec	uint64_t	us		Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
frame_id	uint8_t		<a href="#">MAV_FRAME</a>	Coordinate frame of reference for the pose data.
child_frame_id	uint8_t		<a href="#">MAV_FRAME</a>	Coordinate frame of reference for the velocity in free space (twist) data.
x	float	m		X Position
y	float	m		Y Position
z	float	m		Z Position
q	float[4]			Quaternion components, w, x, y, z (1 0 0 0 is the null-rotation)
vx	float	m/s		X linear speed
vy	float	m/s		Y linear speed
vz	float	m/s		Z linear speed
rollspeed	float	rad/s		Roll angular speed
pitchspeed	float	rad/s		Pitch angular speed
yawspeed	float	rad/s		Yaw angular speed
pose_covariance	float[21]			Row-major representation of a 6x6 pose cross-covariance matrix upper right triangle (states: x, y, z, roll, pitch, yaw; first six entries are the first ROW, next five entries are the second ROW, etc.). If unknown, assign NaN value to first element in the array.
velocity_covariance	float[21]			Row-major representation of a 6x6 velocity cross-covariance matrix upper right triangle (states: vx, vy, vz, rollspeed, pitchspeed, yawspeed; first six entries are the first ROW, next five entries are the second ROW, etc.). If unknown, assign NaN value to first element in the array.
reset_counter**	uint8_t			Estimate reset counter. This should be incremented when the estimate resets in any of the dimensions (position, velocity, attitude, angular speed). This is designed to be used when e.g an external SLAM system detects a loop-closure and the estimate jumps.
estimator_type**	uint8_t		<a href="#">MAV_ESTIMATOR_TYPE</a>	Type of estimator that is providing the odometry.
quality**	int8_t			
%				Optional odometry quality metric as a percentage. -1 = odometry has failed, 0 = unknown/unset quality, 1 = worst quality, 100 = best quality

## TRAJECTORY\_REPRESENTATION\_WAYPOINTS (#332)

)

[Message] (MAVLink 2) Describe a trajectory using an array of up-to 5 waypoints in the local frame ([MAV\\_FRAME\\_LOCAL\\_NED](#)).

Field Name	Type	Units	Values	Description
time_usec	uint64_t	us		Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
valid_points	uint8_t			Number of valid points (up-to 5 waypoints are possible)
pos_x	float[5]	m		X-coordinate of waypoint, set to NaN if not being used
pos_y	float[5]	m		Y-coordinate of waypoint, set to NaN if not being used
pos_z	float[5]	m		Z-coordinate of waypoint, set to NaN if not being used
vel_x	float[5]	m/s		X-velocity of waypoint, set to NaN if not being used
vel_y	float[5]	m/s		Y-velocity of waypoint, set to NaN if not being used
vel_z	float[5]	m/s		Z-velocity of waypoint, set to NaN if not being used
acc_x	float[5]	m/s/s		X-acceleration of waypoint, set to NaN if not being used
acc_y	float[5]	m/s/s		Y-acceleration of waypoint, set to NaN if not being used
acc_z	float[5]	m/s/s		Z-acceleration of waypoint, set to NaN if not being used
pos_yaw	float[5]	rad		Yaw angle, set to NaN if not being used
vel_yaw	float[5]	rad/s		Yaw rate, set to NaN if not being used
command	uint16_t[5]		<a href="#">MAV_CMD</a>	MAV_CMD command id of waypoint, set to UINT16_MAX if not being used.

## TRAJECTORY\_REPRESENTATION\_BEZIER (#333)

)

[Message] (MAVLink 2) Describe a trajectory using an array of up-to 5 bezier control points in the local frame (MAV\_FRAME\_LOCAL\_NED).

Field Name	Type	Units	Description
time_usec	uint64_t	us	Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
valid_points	uint8_t		Number of valid control points (up-to 5 points are possible)
pos_x	float[5]	m	X-coordinate of bezier control points. Set to NaN if not being used
pos_y	float[5]	m	Y-coordinate of bezier control points. Set to NaN if not being used
pos_z	float[5]	m	Z-coordinate of bezier control points. Set to NaN if not being used
delta	float[5]	s	Bezier time horizon. Set to NaN if velocity/acceleration should not be incorporated
pos_yaw	float[5]	rad	Yaw. Set to NaN for unchanged

## CELLULAR\_STATUS (#334)

)

[Message] (MAVLink 2) Report current used cellular network status

Field Name	Type	Values	Description
status	uint8_t	<a href="#">CELLULAR_STATUS_FLAG</a>	Cellular modem status
failure_reason	uint8_t	<a href="#">CELLULAR_NETWORK_FAILED_REASON</a>	Failure reason when status in CELLULAR_STATUS_FAILED
type	uint8_t	<a href="#">CELLULAR_NETWORK_RADIO_TYPE</a>	Cellular network radio type: gsm, cdma, lte...
quality	uint8_t		Signal quality in percent. If unknown, set to UINT8_MAX
mcc	uint16_t		Mobile country code. If unknown, set to UINT16_MAX
mnc	uint16_t		Mobile network code. If unknown, set to UINT16_MAX
lac	uint16_t		Location area code. If unknown, set to 0

## ISBD\_LINK\_STATUS (#335)

)

[Message] (MAVLink 2) Status of the Iridium SBD link.

Field Name	Type	Units	Description
timestamp	uint64_t	us	Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
last_heartbeat	uint64_t	us	Timestamp of the last successful sbd session. The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
failed_sessions	uint16_t		Number of failed SBD sessions.
successful_sessions	uint16_t		Number of successful SBD sessions.
signal_quality	uint8_t		Signal quality equal to the number of bars displayed on the ISU signal strength indicator. Range is 0 to 5, where 0 indicates no signal and 5 indicates maximum signal strength.
ring_pending	uint8_t		1: Ring call pending, 0: No call pending.
tx_session_pending	uint8_t		1: Transmission session pending, 0: No transmission session pending.
rx_session_pending	uint8_t		1: Receiving session pending, 0: No receiving session pending.

## CELLULAR\_CONFIG (#336)

)

[Message] (MAVLink 2) Configure cellular modems. This message is re-emitted as an acknowledgement by the modem. The message may also be explicitly requested using [MAV\\_CMD\\_REQUEST\\_MESSAGE](#).

Field Name	Type	Values	Description
enable_lte	uint8_t		Enable/disable LTE. 0: setting unchanged, 1: disabled, 2: enabled. Current setting when sent back as a response.
enable_pin	uint8_t		Enable/disable PIN on the SIM card. 0: setting unchanged, 1: disabled, 2: enabled. Current setting when sent back as a response.
pin	char[16]		PIN sent to the SIM card. Blank when PIN is disabled. Empty when message is sent back as a response.
new_pin	char[16]		New PIN when changing the PIN. Blank to leave it unchanged. Empty when message is sent back as a response.
apn	char[32]		Name of the cellular APN. Blank to leave it unchanged. Current APN when sent back as a response.
puk	char[16]		Required PUK code in case the user failed to authenticate 3 times with the PIN. Empty when message is sent back as a response.
roaming	uint8_t		Enable/disable roaming. 0: setting unchanged, 1: disabled, 2: enabled. Current setting when sent back as a response.
response	uint8_t	<a href="#">CELLULAR_CONFIG_RESPONSE</a>	Message acceptance response (sent back to GS).

## RAW\_RPM (#339)

)

[Message] (MAVLink 2) RPM sensor data message.

Field Name	Type	Units	Description
index	uint8_t		Index of this RPM sensor (0-indexed)
frequency	float	rpm	Indicated rate

## UTM\_GLOBAL\_POSITION (#340)

)

[Message] (MAVLink 2) The global position resulting from GPS and sensor fusion.

Field Name	Type	Units	Values	Description
time	uint64_t	us		Time of applicability of position (microseconds since UNIX epoch).
uas_id	uint8_t[18]			Unique UAS ID.
lat	int32_t	degE7		Latitude (WGS84)
lon	int32_t	degE7		Longitude (WGS84)
alt	int32_t	mm		Altitude (WGS84)
relative_alt	int32_t	mm		Altitude above ground
vx	int16_t	cm/s		Ground X speed (latitude, positive north)
vy	int16_t	cm/s		Ground Y speed (longitude, positive east)
vz	int16_t	cm/s		Ground Z speed (altitude, positive down)
h_acc	uint16_t	mm		Horizontal position uncertainty (standard deviation)
v_acc	uint16_t	mm		Altitude uncertainty (standard deviation)
vel_acc	uint16_t	cm/s		Speed uncertainty (standard deviation)
next_lat	int32_t	degE7		Next waypoint, latitude (WGS84)
next_lon	int32_t	degE7		Next waypoint, longitude (WGS84)
next_alt	int32_t	mm		Next waypoint, altitude (WGS84)
update_rate	uint16_t	cs		Time until next update. Set to 0 if unknown or in data driven mode.
flight_state	uint8_t		<a href="#">UTM_FLIGHT_STATE</a>	Flight state
flags	uint8_t		<a href="#">UTM_DATA_AVAIL_FLAGS</a>	Bitwise OR combination of the data available flags.

## DEBUG\_FLOAT\_ARRAY (#350)

)

[Message] (MAVLink 2) Large debug/prototyping array. The message uses the maximum available payload for data. The array\_id and name fields are used to discriminate between messages in code and in user interfaces (respectively). Do not use in production code.

Field Name	Type	Units	Description
time_usec	uint64_t	us	Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
name	char[10]		Name, for human-friendly display in a Ground Control Station
array_id	uint16_t		Unique ID used to discriminate between arrays
data**	float[58]		data

## ORBIT\_EXECUTION\_STATUS (#360)

)

**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[Message] (MAVLink 2) Vehicle status report that is sent out while orbit execution is in progress (see [MAV\\_CMD\\_DO\\_ORBIT](#)).

Field Name	Type	Units	Values	Description
time_usec	uint64_t	us		Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
radius	float	m		Radius of the orbit circle. Positive values orbit clockwise, negative values orbit counter-clockwise.
frame	uint8_t		<a href="#">MAV_FRAME</a>	The coordinate system of the fields: x, y, z.
x	int32_t			X coordinate of center point. Coordinate system depends on frame field: local = x position in meters * 1e4, global = latitude in degrees * 1e7.
y	int32_t			Y coordinate of center point. Coordinate system depends on frame field: local = x position in meters * 1e4, global = latitude in degrees * 1e7.
z	float	m		Altitude of center point. Coordinate system depends on frame field.

## SMART\_BATTERY\_INFO (#370)

)

[Message] (MAVLink 2) Smart Battery information (static/infrequent update). Use for updates from: smart battery to flight stack, flight stack to GCS. Use [BATTERY\\_STATUS](#) for smart battery frequent updates.

Field Name	Type	Units	Values	Description
id	uint8_t			Battery ID
battery_function	uint8_t		<a href="#">MAV_BATTERY_FUNCTION</a>	Function of the battery
type	uint8_t		<a href="#">MAV_BATTERY_TYPE</a>	Type (chemistry) of the battery
capacity_full_specification	int32_t	mAh		Capacity when full according to manufacturer, -1: field not provided.
capacity_full	int32_t	mAh		Capacity when full (accounting for battery degradation), -1: field not provided.
cycle_count	uint16_t			Charge/discharge cycle count. UINT16_MAX: field not provided.
serial_number	char[16]			Serial number in ASCII characters, 0 terminated. All 0: field not provided.
device_name	char[50]			Static device name in ASCII characters, 0 terminated. All 0: field not provided. Encode as manufacturer name then product name separated using an underscore.
weight	uint16_t	g		Battery weight. 0: field not provided.

discharge_minimum_voltage	uint16_t	mV	Minimum per-cell voltage when discharging. If not supplied set to UINT16_MAX value.
charging_minimum_voltage	uint16_t	mV	Minimum per-cell voltage when charging. If not supplied set to UINT16_MAX value.
resting_minimum_voltage	uint16_t	mV	Minimum per-cell voltage when resting. If not supplied set to UINT16_MAX value.
charging_maximum_voltage**	uint16_t	mV	Maximum per-cell voltage when charged. 0: field not provided.
cells_in_series**	uint8_t		Number of battery cells in series. 0: field not provided.
discharge_maximum_current**	uint32_t	mA	Maximum pack discharge current. 0: field not provided.
discharge_maximum_burst_current**	uint32_t	mA	Maximum pack discharge burst current. 0: field not provided.
manufacture_date**	char[11]		Manufacture date (DD/MM/YYYY) in ASCII characters, 0 terminated. All 0: field not provided.

## GENERATOR\_STATUS (#373)

)

[Message] (MAVLink 2) Telemetry of power generation system. Alternator or mechanical generator.

Field Name	Type	Units	Values	Description
status	uint64_t		MAV_GENERATOR_STATUS_FLAG	Status flags.
generator_speed	uint16_t	rpm		Speed of electrical generator or alternator. UINT16_MAX: field not provided.
battery_current	float	A		Current into/out of battery. Positive for out. Negative for in. NaN: field not provided.
load_current	float	A		Current going to the UAV. If battery current not available this is the DC current from the generator. Positive for out. Negative for in. NaN: field not provided
power_generated	float	W		The power being generated. NaN: field not provided
bus_voltage	float	V		Voltage of the bus seen at the generator, or battery bus if battery bus is controlled by generator and at a different voltage to main bus.
rectifier_temperature	int16_t	degC		The temperature of the rectifier or power converter. INT16_MAX: field not provided.
bat_current_setpoint	float	A		The target battery current. Positive for out. Negative for in. NaN: field not provided
generator_temperature	int16_t	degC		The temperature of the mechanical motor, fuel cell core or generator. INT16_MAX: field not provided.
runtime	uint32_t	s		Seconds this generator has run since it was rebooted. UINT32_MAX: field not provided.
time_until_maintenance	int32_t	s		Seconds until this generator requires maintenance. A negative value indicates maintenance is past-due. INT32_MAX: field not provided.

## ACTUATOR\_OUTPUT\_STATUS (#375)

)

[Message] (MAVLink 2) The raw values of the actuator outputs (e.g. on Pixhawk, from MAIN, AUX ports). This message supersedes SERVO\_OUTPUT\_RAW.

Field Name	Type	Units	Description
time_usec	uint64_t	us	Timestamp (since system boot).
active	uint32_t		Active outputs
actuator	float[32]		Servo / motor output array values. Zero values indicate unused channels.

## TIME\_ESTIMATE\_TO\_TARGET (#380)

)

**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[Message] (MAVLink 2) Time/duration estimates for various events and actions given the current vehicle state and position.

Field Name	Type	Units	Description
safe_return	int32_t	s	Estimated time to complete the vehicle's configured "safe return" action from its current position (e.g. RTL, Smart RTL, etc.). -1 indicates that the vehicle is landed, or that no time estimate available.
land	int32_t	s	Estimated time for vehicle to complete the LAND action from its current position. -1 indicates that the vehicle is landed, or that no time estimate available.
mission_next_item	int32_t	s	Estimated time for reaching/completing the currently active mission item. -1 means no time estimate available.
mission_end	int32_t	s	Estimated time for completing the current mission. -1 means no mission active and/or no estimate available.
commanded_action	int32_t	s	Estimated time for completing the current commanded action (i.e. Go To, Takeoff, Land, etc.). -1 means no action active and/or no estimate available.

## TUNNEL (#385)

)

[Message] (MAVLink 2) Message for transporting "arbitrary" variable-length data from one component to another (broadcast is not forbidden, but discouraged). The encoding of the data is usually extension specific, i.e. determined by the source, and is usually not documented as part of the MAVLink specification.

Field Name	Type	Values	Description
target_system	uint8_t		System ID (can be 0 for broadcast, but this is discouraged)

target_component	uint8_t		Component ID (can be 0 for broadcast, but this is discouraged) A code that identifies the content of the payload (0 for unknown, which is the default). If this code is less than 32768, it is a 'registered' payload type and the corresponding code should be added to the
payload_type	uint16_t	<a href="#">MAV_TUNNEL_PAYLOAD_TYPE</a>	<a href="#">MAV_TUNNEL_PAYLOAD_TYPE</a> enum. Software creators can register blocks of types as needed. Codes greater than 32767 are considered local experiments and should not be checked in to any widely distributed codebase.
payload_length	uint8_t		Length of the data transported in payload
payload	uint8_t[128]		Variable length payload. The payload length is defined by payload_length. The entire content of this block is opaque unless you understand the encoding specified by payload_type.

## CAN\_FRAME (#386)

)

[Message] (MAVLink 2) A forwarded CAN frame as requested by [MAV\\_CMD\\_CAN\\_FORWARD](#).

Field Name	Type	Description
target_system	uint8_t	System ID.
target_component	uint8_t	Component ID.
bus	uint8_t	Bus number
len	uint8_t	Frame length
id	uint32_t	Frame ID
data	uint8_t[8]	Frame data

## ONBOARD\_COMPUTER\_STATUS (#390)

)

**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[Message] (MAVLink 2) Hardware status sent by an onboard computer.

Field Name	Type	Units	Description
time_usec	uint64_t	us	Timestamp (UNIX Epoch time or time since system boot). The receiving end can infer timestamp format (since 1.1.1970 or since system boot) by checking for the magnitude of the number.
uptime	uint32_t	ms	Time since system boot.
type	uint8_t		Type of the onboard computer: 0: Mission computer primary, 1: Mission computer backup 1, 2: Mission computer backup 2, 3: Compute node, 4-5: Compute spares, 6-9: Payload computers.
cpu_cores	uint8_t[8]		CPU usage on the component in percent (100 - idle). A value of UINT8_MAX implies the field is unused.
cpu_combined	uint8_t[10]		Combined CPU usage as the last 10 slices of 100 MS (a histogram). This allows to identify spikes in load that max out the system, but only for a short amount of time. A value of UINT8_MAX implies the field is unused.
gpu_cores	uint8_t[4]		GPU usage on the component in percent (100 - idle). A value of UINT8_MAX implies the field is unused.
gpu_combined	uint8_t[10]		Combined GPU usage as the last 10 slices of 100 MS (a histogram). This allows to identify spikes in load that max out the system, but only for a short amount of time. A value of UINT8_MAX implies the field is unused.
temperature_board	int8_t	degC	Temperature of the board. A value of INT8_MAX implies the field is unused.
temperature_core	int8_t[8]	degC	Temperature of the CPU core. A value of INT8_MAX implies the field is unused.
fan_speed	int16_t[4]	rpm	Fan speeds. A value of INT16_MAX implies the field is unused.
ram_usage	uint32_t	MiB	Amount of used RAM on the component system. A value of UINT32_MAX implies the field is unused.
ram_total	uint32_t	MiB	Total amount of RAM on the component system. A value of UINT32_MAX implies the field is unused.
storage_type	uint32_t[4]		Storage type: 0: HDD, 1: SSD, 2: EMMC, 3: SD card (non-removable), 4: SD card (removable). A value of UINT32_MAX implies the field is unused.
storage_usage	uint32_t[4]	MiB	Amount of used storage space on the component system. A value of UINT32_MAX implies the field is unused.
storage_total	uint32_t[4]	MiB	Total amount of storage space on the component system. A value of UINT32_MAX implies the field is unused.
link_type	uint32_t[6]		Link type: 0-9: UART, 10-19: Wired network, 20-29: Wifi, 30-39: Point-to-point proprietary, 40-49: Mesh proprietary
link_tx_rate	uint32_t[6]	KiB/s	Network traffic from the component system. A value of UINT32_MAX implies the field is unused.
link_rx_rate	uint32_t[6]	KiB/s	Network traffic to the component system. A value of UINT32_MAX implies the field is unused.
link_tx_max	uint32_t[6]	KiB/s	Network capacity from the component system. A value of UINT32_MAX implies the field is unused.
link_rx_max	uint32_t[6]	KiB/s	Network capacity to the component system. A value of UINT32_MAX implies the field is unused.

## COMPONENT\_INFORMATION (#395)

)

**DEPRECATED:** Replaced by [COMPONENT\\_METADATA](#) (2022-04).

[Message] (MAVLink 2) Component information message, which may be requested using [MAV\\_CMD\\_REQUEST\\_MESSAGE](#).

Field Name	Type	Units	Description
time_boot_ms	uint32_t	ms	Timestamp (time since system boot).
general_metadata_file_crc	uint32_t		CRC32 of the general metadata file (general_metadata_uri). MAVLink FTP URI for the general metadata file ( <a href="#">COMP_METADATA_TYPE_GENERAL</a> ), which may be compressed with xz. The file contains general component metadata, and may contain URI links for
general_metadata_uri	char[100]		

peripherals_metadata_file_crc	uint32_t	additional metadata (see <a href="#">COMP_METADATA_TYPE</a> ). The information is static from boot, and may be generated at compile time. The string needs to be zero terminated.
peripherals_metadata_uri	char[100]	CRC32 of peripherals metadata file (peripherals_metadata_uri).

(Optional) MAVLink FTP URI for the peripherals metadata file ([COMP\\_METADATA\\_TYPE\\_PERIPHERALS](#)), which may be compressed with xz. This contains data about "attached components" such as UAVCAN nodes. The peripherals are in a separate file because the information must be generated dynamically at runtime. The string needs to be zero terminated.

## COMPONENT\_METADATA (#397)

**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[Message] (MAVLink 2) Component metadata message, which may be requested using [MAV\\_CMD\\_REQUEST\\_MESSAGE](#).

This contains the MAVLink FTP URI and CRC for the component's general metadata file. The file must be hosted on the component, and may be xz compressed. The file CRC can be used for file caching.

The general metadata file can be read to get the locations of other metadata files ([COMP\\_METADATA\\_TYPE](#)) and translations, which may be hosted either on the vehicle or the internet. For more information see: [https://mavlink.io/en/services/component\\_information.html](https://mavlink.io/en/services/component_information.html).

Note: Camera components should use [CAMERA\\_INFORMATION](#) instead, and autopilots may use both this message and [AUTOPILOT\\_VERSION](#).

Field Name	Type	Units	Description
time_boot_ms	uint32_t	ms	Timestamp (time since system boot).
file_crc	uint32_t		CRC32 of the general metadata file.
uri	char[100]		MAVLink FTP URI for the general metadata file ( <a href="#">COMP_METADATA_TYPE_GENERAL</a> ), which may be compressed with xz. The file contains general component metadata, and may contain URI links for additional metadata (see <a href="#">COMP_METADATA_TYPE</a> ). The information is static from boot, and may be generated at compile time. The string needs to be zero terminated.

## PLAY\_TUNE\_V2 (#400)

[Message] (MAVLink 2) Play vehicle tone/tune (buzzer). Supersedes message [PLAY\\_TUNE](#).

Field Name	Type	Values	Description
target_system	uint8_t		System ID
target_component	uint8_t		Component ID
format	uint32_t	<a href="#">TUNE_FORMAT</a>	Tune format
tune	char[248]		Tune definition as a NULL-terminated string.

## SUPPORTED\_TUNES (#401)

[Message] (MAVLink 2) Tune formats supported by vehicle. This should be emitted as response to [MAV\\_CMD\\_REQUEST\\_MESSAGE](#).

Field Name	Type	Values	Description
target_system	uint8_t		System ID
target_component	uint8_t		Component ID
format	uint32_t	<a href="#">TUNE_FORMAT</a>	Bitfield of supported tune formats.

## EVENT (#410)

**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[Message] (MAVLink 2) Event message. Each new event from a particular component gets a new sequence number. The same message might be sent multiple times if (re-)requested. Most events are broadcast, some can be specific to a target component (as receivers keep track of the sequence for missed events, all events need to be broadcast. Thus we use destination\_component instead of target\_component).

Field Name	Type	Units	Description
destination_component	uint8_t		Component ID
destination_system	uint8_t		System ID
id	uint32_t		Event ID (as defined in the component metadata)
event_time_boot_ms	uint32_t	ms	Timestamp (time since system boot when the event happened).
sequence	uint16_t		Sequence number.
log_levels	uint8_t		Log levels: 4 bits MSB: internal (for logging purposes), 4 bits LSB: external. Levels: Emergency = 0, Alert = 1, Critical = 2, Error = 3, Warning = 4, Notice = 5, Info = 6, Debug = 7, Protocol = 8, Disabled = 9
arguments	uint8_t[40]		Arguments (depend on event ID).

## CURRENT\_EVENT\_SEQUENCE (#411)

**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[Message] (MAVLink 2) Regular broadcast for the current latest event sequence number for a component. This is used to check for dropped events.

Field Name	Type	Values	Description
sequence	uint16_t		Sequence number.
flags	uint8_t	<a href="#">MAV_EVENT_CURRENT_SEQUENCE_FLAGS</a>	Flag bitset.

### REQUEST\_EVENT (#412)

)

**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[Message] (MAVLink 2) Request one or more events to be (re-)sent. If first\_sequence==last\_sequence, only a single event is requested. Note that first\_sequence can be larger than last\_sequence (because the sequence number can wrap). Each sequence will trigger an EVENT or [EVENT\\_ERROR](#) response.

Field Name	Type	Description
target_system	uint8_t	System ID
target_component	uint8_t	Component ID
first_sequence	uint16_t	First sequence number of the requested event.
last_sequence	uint16_t	Last sequence number of the requested event.

### RESPONSE\_EVENT\_ERROR (#413)

)

**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[Message] (MAVLink 2) Response to a [REQUEST\\_EVENT](#) in case of an error (e.g. the event is not available anymore).

Field Name	Type	Values	Description
target_system	uint8_t		System ID
target_component	uint8_t		Component ID
sequence	uint16_t		Sequence number.
sequence_oldest_available	uint16_t		Oldest Sequence number that is still available after the sequence set in <a href="#">REQUEST_EVENT</a> .
reason	uint8_t	<a href="#">MAV_EVENT_ERROR_REASON</a>	Error reason.

### CANFD\_FRAME (#387)

)

[Message] (MAVLink 2) A forwarded CANFD frame as requested by [MAV\\_CMD\\_CAN\\_FORWARD](#). These are separated from [CAN\\_FRAME](#) as they need different handling (eg. TAO handling)

Field Name	Type	Description
target_system	uint8_t	System ID.
target_component	uint8_t	Component ID.
bus	uint8_t	bus number
len	uint8_t	Frame length
id	uint32_t	Frame ID
data	uint8_t[64]	Frame data

### CAN\_FILTER\_MODIFY (#388)

)

[Message] (MAVLink 2) Modify the filter of what CAN messages to forward over the mavlink. This can be used to make CAN forwarding work well on low bandwidth links. The filtering is applied on bits 8 to 24 of the CAN id (2nd and 3rd bytes) which corresponds to the DroneCAN message ID for DroneCAN. Filters with more than 16 IDs can be constructed by sending multiple [CAN\\_FILTER\\_MODIFY](#) messages.

Field Name	Type	Values	Description
target_system	uint8_t		System ID.
target_component	uint8_t		Component ID.
bus	uint8_t		bus number
operation	uint8_t	<a href="#">CAN_FILTER_OP</a>	what operation to perform on the filter list. See <a href="#">CAN_FILTER_OP</a> enum.
num_ids	uint8_t		number of IDs in filter list
ids	uint16_t[16]		filter IDs, length num_ids

### WHEEL\_DISTANCE (#9000)

)

[Message] (MAVLink 2) Cumulative distance traveled for each reported wheel.

Field Name	Type	Units	Description
time_usec	uint64_t	us	Timestamp (synced to UNIX time or since system boot).
count	uint8_t		Number of wheels reported.
distance	double[16]	m	Distance reported by individual wheel encoders. Forward rotations increase values, reverse rotations decrease them. Not all wheels will necessarily have wheel encoders; the mapping of encoders to wheel positions must be agreed/understood by the endpoints.

### WINCH\_STATUS (#9005)

)

[Message] (MAVLink 2) Winch status.

Field Name	Type	Units	Values	Description
time_usec	uint64_t	us		Timestamp (syncd to UNIX time or since system boot).
line_length	float	m		Length of line released. NaN if unknown
speed	float	m/s		Speed line is being released or retracted. Positive values if being released, negative values if being retracted, NaN if unknown
tension	float	kg		Tension on the line. NaN if unknown
voltage	float	V		Voltage of the battery supplying the winch. NaN if unknown
current	float	A		Current draw from the winch. NaN if unknown
temperature	int16_t	degC		Temperature of the motor. INT16_MAX if unknown
status	uint32_t		MAV_WINCH_STATUS_FLAG	Status flags

## OPEN\_DRONE\_ID\_BASIC\_ID (#12900)

)

**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[Message] (MAVLink 2) Data for filling the OpenDroneID Basic ID message. This and the below messages are primarily meant for feeding data to/from an OpenDroneID implementation. E.g. <https://github.com/opendroneid/opendroneid-core-c>. These messages are compatible with the ASTM F3411 Remote ID standard and the ASD-STAN prEN 4709-002 Direct Remote ID standard. Additional information and usage of these messages is documented at <https://mavlink.io/en/services/opendroneid.html>.

Field Name	Type	Values	Description
target_system	uint8_t		System ID (0 for broadcast).
target_component	uint8_t		Component ID (0 for broadcast).
id_or_mac	uint8_t[20]		Only used for drone ID data received from other UAs. See detailed description at <a href="https://mavlink.io/en/services/opendroneid.html">https://mavlink.io/en/services/opendroneid.html</a> .
id_type	uint8_t	MAV_ODID_ID_TYPE	Indicates the format for the uas_id field of this message.
ua_type	uint8_t	MAV_ODID_UA_TYPE	Indicates the type of UA (Unmanned Aircraft).
uas_id	uint8_t[20]		UAS (Unmanned Aircraft System) ID following the format specified by id_type. Shall be filled with nulls in the unused portion of the field.

## OPEN\_DRONE\_ID\_LOCATION (#12901)

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**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[Message] (MAVLink 2) Data for filling the OpenDroneID Location message. The float data types are 32-bit IEEE 754. The Location message provides the location, altitude, direction and speed of the aircraft.

Field Name	Type	Units	Values	Description
target_system	uint8_t			System ID (0 for broadcast).
target_component	uint8_t			Component ID (0 for broadcast).
id_or_mac	uint8_t[20]			Only used for drone ID data received from other UAs. See detailed description at <a href="https://mavlink.io/en/services/opendroneid.html">https://mavlink.io/en/services/opendroneid.html</a> .
status	uint8_t		MAV_ODID_STATUS	Indicates whether the unmanned aircraft is on the ground or in the air.
direction	uint16_t	cdeg		Direction over ground (not heading, but direction of movement) measured clockwise from true North: 0 - 35999 centi-degrees. If unknown: 36100 centi-degrees.
speed_horizontal	uint16_t	cm/s		Ground speed. Positive only. If unknown: 25500 cm/s. If speed is larger than 25425 cm/s, use 25425 cm/s.
speed_vertical	int16_t	cm/s		The vertical speed. Up is positive. If unknown: 6300 cm/s. If speed is larger than 6200 cm/s, use 6200 cm/s. If lower than -6200 cm/s, use -6200 cm/s.
latitude	int32_t	degE7		Current latitude of the unmanned aircraft. If unknown: 0 (both Lat/Lon).
longitude	int32_t	degE7		Current longitude of the unmanned aircraft. If unknown: 0 (both Lat/Lon).
altitude_barometric	float	m		The altitude calculated from the barometric pressue. Reference is against 29.92inHg or 1013.2mb. If unknown: -1000 m.
altitude_geodetic	float	m		The geodetic altitude as defined by WGS84. If unknown: -1000 m.
height_reference	uint8_t		MAV_ODID_HEIGHT_REF	Indicates the reference point for the height field.
height	float	m		The current height of the unmanned aircraft above the take-off location or the ground as indicated by height_reference. If unknown: -1000 m.
horizontal_accuracy	uint8_t		MAV_ODID_HOR_ACC	The accuracy of the horizontal position.
vertical_accuracy	uint8_t		MAV_ODID_VER_ACC	The accuracy of the vertical position.
barometer_accuracy	uint8_t		MAV_ODID_VER_ACC	The accuracy of the barometric altitude.
speed_accuracy	uint8_t		MAV_ODID_SPEED_ACC	The accuracy of the horizontal and vertical speed.
timestamp	float	s		Seconds after the full hour with reference to UTC time. Typically the GPS outputs a time-of-week value in milliseconds. First convert that to UTC and then convert for this field using ((float) (time_week_ms % (60*60*1000))) / 1000. If unknown: 0xFFFF.
timestamp_accuracy	uint8_t		MAV_ODID_TIME_ACC	The accuracy of the timestamps.

## OPEN\_DRONE\_ID\_AUTHENTICATION (#12902)

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**WORK IN PROGRESS:** Do not use in stable production environments (it may change).



[Message] (MAVLink 2) Data for filling the OpenDroneID Authentication message. The Authentication Message defines a field that can provide a means of authenticity for the identity of the UAS (Unmanned Aircraft System). The Authentication message can have two different formats. For data page 0, the fields PageCount, Length and TimeStamp are present and AuthData is only 17 bytes. For data page 1 through 15, PageCount, Length and TimeStamp are not present and the size of AuthData is 23 bytes.

Field Name	Type	Units	Values	Description
target_system	uint8_t			System ID (0 for broadcast).
target_component	uint8_t			Component ID (0 for broadcast).
id_or_mac	uint8_t[20]			Only used for drone ID data received from other UAs. See detailed description at <a href="https://mavlink.io/en/services/opendroneid.html">https://mavlink.io/en/services/opendroneid.html</a> .
authentication_type	uint8_t		MAV_ODID_AUTH_TYPE	Indicates the type of authentication.
data_page	uint8_t			Allowed range is 0 - 15.
last_page_index	uint8_t			This field is only present for page 0. Allowed range is 0 - 15. See the description of struct ODID_Auth_data at <a href="https://github.com/opendroneid/opendroneid-core-c/blob/master/libopendroneid/opendroneid.h">https://github.com/opendroneid/opendroneid-core-c/blob/master/libopendroneid/opendroneid.h</a> .
length	uint8_t	bytes		This field is only present for page 0. Total bytes of authentication data from all data pages. See the description of struct ODID_Auth_data at <a href="https://github.com/opendroneid/opendroneid-core-c/blob/master/libopendroneid/opendroneid.h">https://github.com/opendroneid/opendroneid-core-c/blob/master/libopendroneid/opendroneid.h</a> .
timestamp	uint32_t	s		This field is only present for page 0. 32 bit Unix Timestamp in seconds since 00:00:00 01/01/2019.
authentication_data	uint8_t[23]			Opaque authentication data. For page 0, the size is only 17 bytes. For other pages, the size is 23 bytes. Shall be filled with nulls in the unused portion of the field.

## OPEN\_DRONE\_ID\_SELF\_ID (#12903)

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**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[Message] (MAVLink 2) Data for filling the OpenDroneID Self ID message. The Self ID Message is an opportunity for the operator to (optionally) declare their identity and purpose of the flight. This message can provide additional information that could reduce the threat profile of a UA (Unmanned Aircraft) flying in a particular area or manner. This message can also be used to provide optional additional clarification in an emergency/remote ID system failure situation.

Field Name	Type	Values	Description
target_system	uint8_t		System ID (0 for broadcast).
target_component	uint8_t		Component ID (0 for broadcast).
id_or_mac	uint8_t[20]		Only used for drone ID data received from other UAs. See detailed description at <a href="https://mavlink.io/en/services/opendroneid.html">https://mavlink.io/en/services/opendroneid.html</a> .
description_type	uint8_t	MAV_ODID_DESC_TYPE	Indicates the type of the description field.
description	char[23]		Text description or numeric value expressed as ASCII characters. Shall be filled with nulls in the unused portion of the field.

## OPEN\_DRONE\_ID\_SYSTEM (#12904)

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**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[Message] (MAVLink 2) Data for filling the OpenDroneID System message. The System Message contains general system information including the operator location/altitude and possible aircraft group and/or category/class information.

Field Name	Type	Units	Values	Description
target_system	uint8_t			System ID (0 for broadcast).
target_component	uint8_t			Component ID (0 for broadcast).
id_or_mac	uint8_t[20]			Only used for drone ID data received from other UAs. See detailed description at <a href="https://mavlink.io/en/services/opendroneid.html">https://mavlink.io/en/services/opendroneid.html</a> .
operator_location_type	uint8_t		MAV_ODID_OPERATOR_LOCATION_TYPE	Specifies the operator location type.
classification_type	uint8_t		MAV_ODID_CLASSIFICATION_TYPE	Specifies the classification type of the UA.
operator_latitude	int32_t	degE7		Latitude of the operator. If unknown: 0 (both Lat/Lon).
operator_longitude	int32_t	degE7		Longitude of the operator. If unknown: 0 (both Lat/Lon).
area_count	uint16_t			Number of aircraft in the area, group or formation (default 1).
area_radius	uint16_t	m		Radius of the cylindrical area of the group or formation (default 0).
area_ceiling	float	m		Area Operations Ceiling relative to WGS84. If unknown: -1000 m.
area_floor	float	m		Area Operations Floor relative to WGS84. If unknown: -1000 m.
category_eu	uint8_t		MAV_ODID_CATEGORY_EU	When classification type is MAV_ODID_CLASSIFICATION_TYPE_EU, specifies the category of the UA.
class_eu	uint8_t		MAV_ODID_CLASS_EU	When classification type is MAV_ODID_CLASSIFICATION_TYPE_EU, specifies the class of the UA.
operator_altitude_geo	float	m		Geodetic altitude of the operator relative to WGS84. If unknown: -1000 m.
timestamp	uint32_t	s		32 bit Unix Timestamp in seconds since 00:00:00 01/01/2019.

## OPEN\_DRONE\_ID\_OPERATOR\_ID (#12905)

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**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[Message] (MAVLink 2) Data for filling the OpenDroneID Operator ID message, which contains the CAA (Civil Aviation Authority) issued operator ID.

Field Name	Type	Values	Description
target_system	uint8_t		System ID (0 for broadcast).
target_component	uint8_t		Component ID (0 for broadcast).
id_or_mac	uint8_t[20]		Only used for drone ID data received from other UAs. See detailed description at <a href="https://mavlink.io/en/services/opendroneid.html">https://mavlink.io/en/services/opendroneid.html</a> .
operator_id_type	uint8_t	<a href="#">MAV_ODID_OPERATOR_ID_TYPE</a>	Indicates the type of the operator_id field.
operator_id	char[20]		Text description or numeric value expressed as ASCII characters. Shall be filled with nulls in the unused portion of the field.

#### OPEN\_DRONE\_ID\_MESSAGE\_PACK (#12915)

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**WORK IN PROGRESS:** Do not use in stable production environments (it may change).

[Message] (MAVLink 2) An OpenDroneID message pack is a container for multiple encoded OpenDroneID messages (i.e. not in the format given for the above message descriptions but after encoding into the compressed OpenDroneID byte format). Used e.g. when transmitting on Bluetooth 5.0 Long Range/Extended Advertising or on WiFi Neighbor Aware Networking or on WiFi Beacon.

Field Name	Type	Units	Description
target_system	uint8_t		System ID (0 for broadcast).
target_component	uint8_t		Component ID (0 for broadcast).
id_or_mac	uint8_t[20]		Only used for drone ID data received from other UAs. See detailed description at <a href="https://mavlink.io/en/services/opendroneid.html">https://mavlink.io/en/services/opendroneid.html</a> .
single_message_size	uint8_t	bytes	This field must currently always be equal to 25 (bytes), since all encoded OpenDroneID messages are specified to have this length.
msg_pack_size	uint8_t		Number of encoded messages in the pack (not the number of bytes). Allowed range is 1 - 9.
messages	uint8_t[225]		Concatenation of encoded OpenDroneID messages. Shall be filled with nulls in the unused portion of the field.

#### HYGROMETER\_SENSOR (#12920)

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[Message] (MAVLink 2) Temperature and humidity from hygrometer.

Field Name	Type	Units	Description
id	uint8_t		Hygrometer ID
temperature	int16_t	cdegC	Temperature
humidity	uint16_t	c%	Humidity