# 文档目的

提供无人机到地面管控模块的通信协议，以及具体通信数据格式、通信内容。

# 文档内容

## 认证流程

无人机管控模块在与地面站进行认证时需要完成以下工作：

首先由无人机管控模块发送12 Bytes数据 'H' 'E' 'L' 'L' 'O' 'I' 'T' 'I' 'S' 'M' 'E' '!'

地面站返回倒序数组为认证成功，即返回 '!' 'E' 'M' 'S' 'I' 'T' 'I' 'O' 'L' 'L' 'E' 'H'

### GPRS协议

负责（地面站）服务器和安全管理模块网络通信协议，详见《GPRS\_Protocol》和《GPRS\_Protocol2》《GPRS\_Protocol3》。

从服务器发送到安全管理模块：

**@@<**Data ***identifier*><*Data length*>,<*IMEI*>,<*Command type*>,<*Command*><\**Checksum*>\r\n**

从安全管理模块发送到服务器：

**$$<*Data identifier*><*Data length*>,<*IMEI*>,<*Command type*>,<*Command*><\**Checksum*>\r\n**

由于在北航给定的GPRS中没有相符的命令，在和北航商量后，自己拟定以下命令用于管控模块与地面站的通信：

1. 管控模块主动上报事件：AAA,140,

Tracker report：AAA, 140,latitude, longitude, altitude, Speed ,roll, pitch, yaw, time\_boot\_ms, voltage\_battery, battery\_remaining, type, system\_status

|  |  |  |  |
| --- | --- | --- | --- |
| Field Name | Type | Description |  |
| Latitude | float | Unit: degree  Decimal  22.756325  -23.256438  GPRS Protocol  When a minus (-) exists, the tracker is in the southern hemisphere.  When no minus (-) exists, the tracker is in the northern hemisphere. | %f |
| Longitude | float | Unit: degree  Decimal  When a minus (-) exists, the tracker is in the western hemisphere.  When no minus (-) exists, the tracker is in the eastern hemisphere. | %f |
| Altitude | int | Unit: meter | %d |
| Speed | float | External Gps provides speed data | %.1f |
| roll | float | Roll angle (rad, -pi..+pi) | %f |
| pitch | float | Pitch angle (rad, -pi..+pi) | %f |
| yaw | float | Yaw angle (rad, -pi..+pi) | %f |
| time\_boot\_ms | uint32\_t | Timestamp (milliseconds since system boot) | %u |
| Battery\_status | int8\_t | Battery\_status<0, low battery; Battery\_status>0 normal status | %d |
| Uav\_type | Int8\_t | UAV type  {  helicopter???  Quadrotor???  …data from flash  } | %d |
| Vendor | Char[4] | Manufacture ；HWA type defined "HW" | %s |
| system\_status | uint8\_t | Device status  bit 0 = 1:sensors ok!  bit 1 = 1:comunication to flying control system ok!  bit 2 = 1:???  bit 3 = 1:???  bit 4 = 1:???  bit 5 = 1:???  bit 6 = 1:???  bit 7 = 1:??? | %u |

1. 地面站控制命令:S01（请求控制权）；（暂定 地面站只发送数据到管控模块，但管控模块不转发到飞控）

Ground send: S01, target\_system, control\_request, version, passkey

Srv reply: S01,OK或者S01,ERROR（OK 表示管控模块收到数据并做了相应的处理，ERROR 表示管控模块收到的数据不对或者在做处理时失败）

| Field Name | Type | Description |  |
| --- | --- | --- | --- |
| target\_system | uint8\_t | System the GCS requests control for | %u |
| control\_request | uint8\_t | 0: request control of this MAV, 1: Release control of this MAV | %u |
| version | uint8\_t | 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. | %u |
| 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 "!?,.-" | %s |

1. 地面站控制命令:S02（地面站取代遥控器的控制）；（暂定 地面站只发送数据到管控模块，但管控模块不转发到飞控）

Ground send: S02, target\_system,target\_component,chan1\_raw,chan2\_raw, chan3\_raw, chan4\_raw, chan5\_raw, chan6\_raw, chan7\_raw, chan8\_raw,

Srv reply: S02,OK 或者S02,ERROR （OK 表示管控模块收到数据并做了相应的处理，ERROR 表示管控模块收到的数据不对或者在做处理时失败）

| Field Name | Type | Description |  |
| --- | --- | --- | --- |
| target\_system | uint8\_t | System ID | %u |
| target\_component | uint8\_t | Component ID | %u |
| chan1\_raw | uint16\_t | RC channel 1 value, in microseconds. A value of UINT16\_MAX means to ignore this field. | %u |
| chan2\_raw | uint16\_t | RC channel 2 value, in microseconds. A value of UINT16\_MAX means to ignore this field. | %u |
| chan3\_raw | uint16\_t | RC channel 3 value, in microseconds. A value of UINT16\_MAX means to ignore this field. | %u |
| chan4\_raw | uint16\_t | RC channel 4 value, in microseconds. A value of UINT16\_MAX means to ignore this field. | %u |
| chan5\_raw | uint16\_t | RC channel 5 value, in microseconds. A value of UINT16\_MAX means to ignore this field. | %u |
| chan6\_raw | uint16\_t | RC channel 6 value, in microseconds. A value of UINT16\_MAX means to ignore this field. | %u |
| chan7\_raw | uint16\_t | RC channel 7 value, in microseconds. A value of UINT16\_MAX means to ignore this field. | %u |
| chan8\_raw | uint16\_t | RC channel 8 value, in microseconds. A value of UINT16\_MAX means to ignore this field. | %u |

1. S03（没有找到起飞命令 悬停指令、返航命令、指定位置悬停）（悬停指令MAV\_CMD\_OVERRIDE\_GOTO、返航命令MAV\_CMD\_NAV\_RETURN\_TO\_LAUNCH、指定位置悬停MAV\_CMD\_NAV\_LOITER\_UNLIM）

Ground send: S03, target\_system,target\_component,command,confirmation,param1,param2,param3,param4,param5,param6, param7

Srv reply: S03,OK 或者S03,ERROR （OK 表示管控模块收到数据并做了相应的处理，ERROR 表示管控模块收到的数据不对或者在做处理时失败）

| Field Name | Type | Description |  |
| --- | --- | --- | --- |
| target\_system | uint8\_t | System which should execute the command | %u |
| target\_component | uint8\_t | Component which should execute the command, 0 for all components | %u |
| command | uint16\_t | Command ID, as defined by MAV\_CMD enum. | %u |
| confirmation | uint8\_t | 0: First transmission of this command. 1-255: Confirmation transmissions (e.g. for kill command) | %u |
| param1 | float | Parameter 1, as defined by MAV\_CMD enum. | %f |
| param2 | float | Parameter 2, as defined by MAV\_CMD enum. | %f |
| param3 | float | Parameter 3, as defined by MAV\_CMD enum. | %f |
| param4 | float | Parameter 4, as defined by MAV\_CMD enum. | %f |
| param5 | float | Parameter 5, as defined by MAV\_CMD enum. | %f |
| param6 | float | Parameter 6, as defined by MAV\_CMD enum. | %f |
| param7 | float | Parameter 7, as defined by MAV\_CMD enum. | %f |