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| **Projektbezeichnung** | Unmanned Surface Vehicle (USV) | |
| **Projektleiter** | Jörg Grabow | |
| **Verantwortlich** | Jörg Grabow | |
| **Erstellt am** | 10.02.2020 | |
| **Zuletzt geändert** | 21.12.2023 | |
| **Bearbeitungsstand** | i.B. | in Bearbeitung  vorgelegt  fertig gestellt |
| **Dokumentenablage** | https://github.com/Joe-Grabow/USV | |

**Änderungsverzeichnis**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Änderung** | | | **geänderte**  **Kapitel** | **Beschreibung** | **Autor** | **neuer**  **Zustand** |
| **Nr.** | **Datum** | **Version** |
| 1 | 18.12.23 | 1.00 | - | Startversion | Gr. | f.g. |
| 2 | 21.12.23 | 1.01 | 1 | APRS-Datenpaket | Gr. | f.g. |

in Bearbeitung (i.B.)

Vorlage (Vg.)

fertig gestellt (f.g.)

|  |  |  |
| --- | --- | --- |
| Inhaltsverzeichnis | | |
|  | Kapitel | Verweise auf andere Dokumente |
| APRS-Daten | 1.0 | APRS\_Format.docx |
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1.0 APRS-Daten pro Sendedurchgang

In jedem Sendedurchgang (Timeslot) werden alle relevanten Daten des USV per APRS gesendet. Der Datensatz setzt sich aus 4 APRS-Datenframes zusammen, welche hintereinander ohne Pause gesendet werden. Tabelle 1 listet alle relevanten Daten und ihre Codierung auf.

**Tab. 1:** USV-Datensatz für APRS-Aussendung

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***Position*** | | | | | |
|  |  |  |  | **POSITION AND DF REPORT** | |
| **Sign** | **Funktion** | **Beschreibung** | **Bytes** | **APRS-Block** | **Data Extension** |
| SB2 | Längengrad | GPS-Koordinate in Grad, Minute, 1/100 Sekunde  *(01342.57E)* | 9 | Position Reports | Course/Speed |
| SB3 | Breitengrad | GPS-Koordinate in Grad, Minute, 1/100 Sekunde  *(5416.83N)* | 8 | Position Reports | Course/Speed |
| SB5 | Geschwindigkeit | GPS-Geschwindigkeitsangabe in kn  *(006)* | 3 | Position Reports | Course/Speed |
| SB6 | Kurswinkel | Kurswinkel in Grad (Nordrichtung im Uhrzeigersinn)  *(293)* | 3 | Position Reports | Course/Speed |
|  |  |  |  |  |  |
| ***Antrieb*** | | | | | |
|  |  |  |  | **TELEMETRY DATA** | |
| **Sign** | **Funktion** | **Beschreibung** | **Bytes** | **Analog** | **Digital** |
| AS1 | Schub | Stellgröße Schub *(-/+ 1) -> (0 – 100 - 200)* | 3 | Analog 3 | 02 |
| AS2 | Ruderausschlag | Stellgröße Ruderausschlag *(-/+ 1) -> (0 – 100 – 200)* | 3 | Analog 4 | 02 |
|  |  |  |  |  |  |
| **Energiemanagement** | | | | | |
|  |  |  |  | **TELEMETRY DATA** | |
| **Sign** | **Funktion** | **Beschreibung** | **Bytes** | **Analog** | **Digital** |
| EM1 | Akku 1 | Spannung in Volt *(24.2) -> (242)* | 3 | Analog 1 | 01 |
| EM2 | Akku 1 | Strom in Ampere *(55.4) -> 55.4/2 -> (277)* | 3 | Analog 1 | 02 |
| EM3 | Akku 1 | Restkapazität in Ah *(55) -> (055)* | 3 | Analog 1 | 03 |
| EM4 | Akku 2 | Spannung in Volt *(19.3) -> (193)* | 3 | Analog 2 | 01 |
| EM5 | Akku 2 | Strom in Ampere *(51.7) -> 51.7/2 -> (258)* | 3 | Analog 2 | 02 |
| EM6 | Akku 2 | Restkapazität in Ah *(52) -> (052)* | 3 | Analog 2 | 03 |
| EM7 | Solar | Solarladespannung Antriebsakku *(24.6) -> (246)* | 3 | Analog 4 | 01 |
| EM9 | ULidar | Spannung Lidar (24V) *(24.1) -> (241)* | 3 | Analog 3 | 01 |
|  |  |  |  |  |  |
| ***System*** | | | | | |
|  |  |  |  | **TELEMETRY DATA** | |
| **Sign** | **Funktion** | **Beschreibung** | **Bytes** | **Analog** | **Digital** |
| EM8 | BTemp | Board-Temperatur in °C *(18.6) -> 18.6/2 -> (093)* | 3 | Analog 5 | 01 |
|  |  |  |  |  |  |
| ***Status*** | | | | | |
|  |  |  |  | **TELEMETRY DATA** | |
| **Sign** | **Funktion** | **Beschreibung** | **Bytes** | **Analog** | **Digital** |
| SB1 | GESB | globales Error Status Byte (GESB) *(0011)* | 4 | - | 01 |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

*(blaue Einträge)* sind Muster

Datenframemuster (Frame 1) für ein POSITIONS AND DF REPORT

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Kennung** | **SB3** | **-** | **SB2** | **-** | **SB6** | **-** | **SB5** |
| **Funktion** | Breitengrad | Trenner | Längengrad | ship | Kurswinkel | Trenner | Geschwindigkeit |
| **Byte** | 8 | 1 | 9 | 1 | 3 | 1 | 3 |
| **Muster** | 5416.83N | / | 01342.57E | s | 293 | / | 006 |

Bsp.: 5416.83N/01342.57Es293/006

Latitude 54° 16.63´Nord, Longitude 13° 42.57´Ost, Kurswinkel 293°, Geschwindigkeit 6 Knoten

Datenframemuster (Frame 2) für eine TELEMETRY DATA Aussendung (Report 1)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Kennung** | **-** | **-** | **-** | **-** | **EM1** | **-** | **EM2** | **-** | **EM9** | **-** | **EM7** | **-** | **EM8** | **-** | **GSB|0001** |
| **Funktion** | Telemetry | Tr | Nummer | Tr | A1 | Tr | A2 | Tr | A3 | Tr | A4 | Tr | A5 | Tr | Digital |
| **Byte** | 1 | 1 | 3 | 1 | 3 | 1 | 3 | 1 | 3 | 1 |  | 1 |  | 1 | 8 |
| **Muster** | T | # | 000 | , | 242 | , | 277 | , | 241 | , | 246 | , | 093 | , | 00110001 |

Bsp.: T#000,242,277,241,246,093,0011001

Telemetrie-Paket: 001 (fortlaufende Nummer)

Spannung Akku1: 24.2V

Strom Akku1: 27.7x2 -> 55.4A

Spannung Lidar: 24.1V

Solar-Landespannung: 24.6V

Board-Temperatur: 9.3 x2 -> 18.6°C

globales Error-Statusbyte: 0011

Report 1: 0001

Datenframemuster (Frame 3) für eine TELEMETRY DATA Aussendung (Report 2)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Kennung** | **-** | **-** | **-** | **-** | **EM4** | **-** | **EM5** | **-** | **AS1** | **-** | **AS2** | **-** | **frei** | **-** | **GSB|0010** |
| **Funktion** | Telemetry | Tr | Nummer | Tr | A1 | Tr | A2 | Tr | A3 | Tr | A4 | Tr | A5 | Tr | Digital |
| **Byte** | 1 | 1 | 3 | 1 | 3 | 1 | 3 | 1 | 3 | 1 |  | 1 |  | 1 | 8 |
| **Muster** | T | # | 001 | , | 193 | , | 258 | , | 100 | , | 150 | , | 000 | , | 00110010 |

Bsp.: T#001,193,258,100,150,000,0011000

Telemetrie-Paket: 002 (fortlaufende Nummer)

Spannung Akku2: 19.3V

Strom Akku2: 25.8x2 -> 51.6A

Schub: 0

Ruder: 0.5

frei: 000

globales Error-Statusbyte: 0011

Report 2: 0010

Datenframemuster (Frame 4) für eine TELEMETRY DATA Aussendung (Report 3)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Kennung** | **-** | **-** | **-** | **-** | **EM3** | **-** | **EM6** | **-** | **frei** | **-** | **frei** | **-** | **frei** | **-** | **GSB|0011** |
| **Funktion** | Telemetry | Tr | Nummer | Tr | A1 | Tr | A2 | Tr | A3 | Tr | A4 | Tr | A5 | Tr | Digital |
| **Byte** | 1 | 1 | 3 | 1 | 3 | 1 | 3 | 1 | 3 | 1 |  | 1 |  | 1 | 8 |
| **Muster** | T | # | 002 | , | 055 | , | 052 | , | 000 | , | 000 | , | 000 | , | 00110011 |

Bsp.: T#002,055,052,000,000,000,0011000

Telemetrie-Paket: 003 (fortlaufende Nummer)

Restkapazität Akku 1: 55Ah

Restkapazität Akku 2: 52Ah

frei: 000

frei: 000

frei: 000

globales Error-Statusbyte: 0011

Report 3: 0011

Aussendungen pro Timeslot

5416.83N/01342.57Es293/006

T#001,242,277,241,246,093,0011001

T#002,193,259,100,150,000,0011010

T#003,055,052,000,000,000,0011011

reales Protokoll

2023-12-21 17:12:27 CET: [**DL3AKB-5**](https://aprs.fi/?c=raw&limit=&call=DL3AKB-5)>APE,TCPIP\*,qAS,DL3AKB:=5417.12N/01342.22Es334/007sUSV Nordwind  
2023-12-21 17:12:33 CET: [**DL3AKB-5**](https://aprs.fi/?c=raw&limit=&call=DL3AKB-5)>APRS,qAS,DL3AKB:T#033,242,277,241,246,093,00000001  
2023-12-21 17:12:39 CET: [**DL3AKB-5**](https://aprs.fi/?c=raw&limit=&call=DL3AKB-5)>APRS,qAS,DL3AKB:T#034,193,258,100,150,000,00000010  
2023-12-21 17:12:45 CET: [**DL3AKB-5**](https://aprs.fi/?c=raw&limit=&call=DL3AKB-5)>APRS,qAS,DL3AKB:T#035,055,052,000,000,000,00000011  
2023-12-21 17:13:15 CET: [**DL3AKB-5**](https://aprs.fi/?c=raw&limit=&call=DL3AKB-5)>APE,TCPIP\*,qAS,DL3AKB:=5417.18N/01342.18Es315/007sUSV Nordwind  
2023-12-21 17:13:22 CET: [**DL3AKB-5**](https://aprs.fi/?c=raw&limit=&call=DL3AKB-5)>APRS,qAS,DL3AKB:T#036,242,277,241,246,093,00000001  
2023-12-21 17:13:28 CET: [**DL3AKB-5**](https://aprs.fi/?c=raw&limit=&call=DL3AKB-5)>APRS,qAS,DL3AKB:T#037,193,258,100,150,000,00000010  
2023-12-21 17:13:34 CET: [**DL3AKB-5**](https://aprs.fi/?c=raw&limit=&call=DL3AKB-5)>APRS,qAS,DL3AKB:T#038,055,052,000,000,000,00000011  
2023-12-21 17:14:04 CET: [**DL3AKB-5**](https://aprs.fi/?c=raw&limit=&call=DL3AKB-5)>APE,TCPIP\*,qAS,DL3AKB:=5417.22N/01342.10Es305/007sUSV Nordwind  
2023-12-21 17:14:10 CET: [**DL3AKB-5**](https://aprs.fi/?c=raw&limit=&call=DL3AKB-5)>APRS,qAS,DL3AKB:T#039,242,277,241,246,093,00000001  
2023-12-21 17:14:16 CET: [**DL3AKB-5**](https://aprs.fi/?c=raw&limit=&call=DL3AKB-5)>APRS,qAS,DL3AKB:T#040,193,258,100,150,000,00000010  
2023-12-21 17:14:22 CET: [**DL3AKB-5**](https://aprs.fi/?c=raw&limit=&call=DL3AKB-5)>APRS,qAS,DL3AKB:T#041,055,052,000,000,000,00000011  
2023-12-21 17:14:52 CET: [**DL3AKB-5**](https://aprs.fi/?c=raw&limit=&call=DL3AKB-5)>APE,TCPIP\*,qAS,DL3AKB:=5417.25N/01342.02Es295/008sUSV Nordwind  
2023-12-21 17:14:58 CET: [**DL3AKB-5**](https://aprs.fi/?c=raw&limit=&call=DL3AKB-5)>APRS,qAS,DL3AKB:T#042,242,277,241,246,093,00000001  
2023-12-21 17:15:04 CET: [**DL3AKB-5**](https://aprs.fi/?c=raw&limit=&call=DL3AKB-5)>APRS,qAS,DL3AKB:T#043,193,258,100,150,000,00000010  
2023-12-21 17:15:10 CET: [**DL3AKB-5**](https://aprs.fi/?c=raw&limit=&call=DL3AKB-5)>APRS,qAS,DL3AKB:T#044,055,052,000,000,000,00000011  
2023-12-21 17:15:41 CET: [**DL3AKB-5**](https://aprs.fi/?c=raw&limit=&call=DL3AKB-5)>APE,TCPIP\*,qAS,DL3AKB:=5417.28N/01341.91Es293/006sUSV Nordwind  
2023-12-21 17:15:47 CET: [**DL3AKB-5**](https://aprs.fi/?c=raw&limit=&call=DL3AKB-5)>APRS,qAS,DL3AKB:T#045,242,277,241,246,093,00000001  
2023-12-21 17:15:53 CET: [**DL3AKB-5**](https://aprs.fi/?c=raw&limit=&call=DL3AKB-5)>APRS,qAS,DL3AKB:T#046,193,258,100,150,000,00000010  
2023-12-21 17:15:59 CET: [**DL3AKB-5**](https://aprs.fi/?c=raw&limit=&call=DL3AKB-5)>APRS,qAS,DL3AKB:T#047,055,052,000,000,000,00000011  
2023-12-21 17:16:29 CET: [**DL3AKB-5**](https://aprs.fi/?c=raw&limit=&call=DL3AKB-5)>APE,TCPIP\*,qAS,DL3AKB:=5417.30N/01341.82Es279/008sUSV Nordwind  
2023-12-21 17:16:35 CET: [**DL3AKB-5**](https://aprs.fi/?c=raw&limit=&call=DL3AKB-5)>APRS,qAS,DL3AKB:T#048,242,277,241,246,093,00000001  
2023-12-21 17:16:41 CET: [**DL3AKB-5**](https://aprs.fi/?c=raw&limit=&call=DL3AKB-5)>APRS,qAS,DL3AKB:T#049,193,258,100,150,000,00000010