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Interface Specification for Antenna Units (RT-500-M / RT-600 / RT-800)

valid for Variants [A] & [L]

Change Log

Rev	Date	Remark	Changes
1.00	11.12.2017	Official Version	

Index

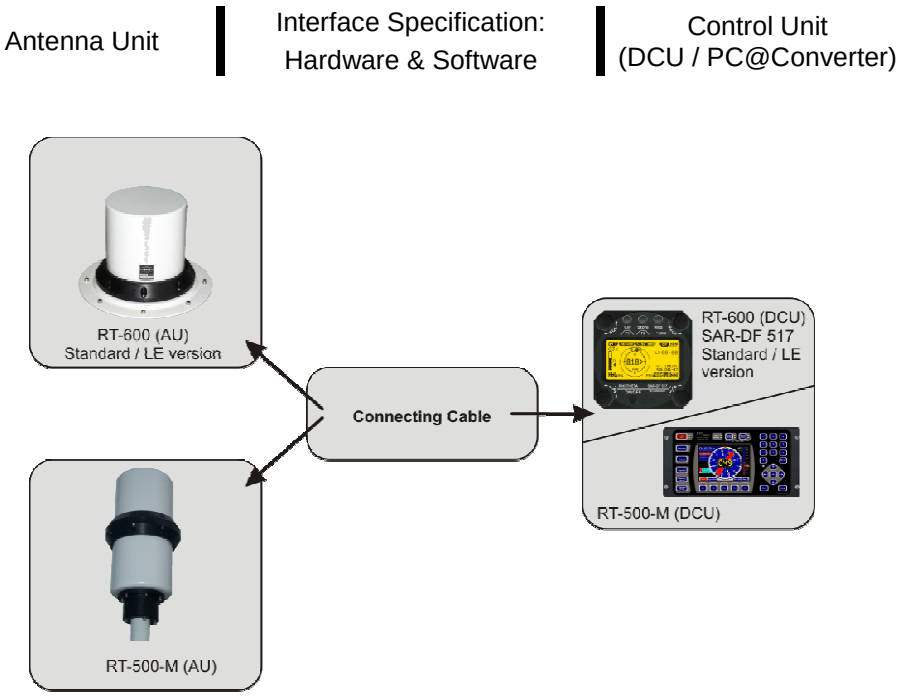
Abbildungsverzeichniss

1 General

This document (specification) describes the Interface (Hardware & serial Data protocol) of the RHOTHETA Direction Finder System RT-600 (SAR-DF 517 / Standard or LE airborne version), RT-500-M (Maritime), RT-800 and RT-600 Light between:

- Antenna Unit (AU)
- Control Unit (DCU / PC @ Converter)

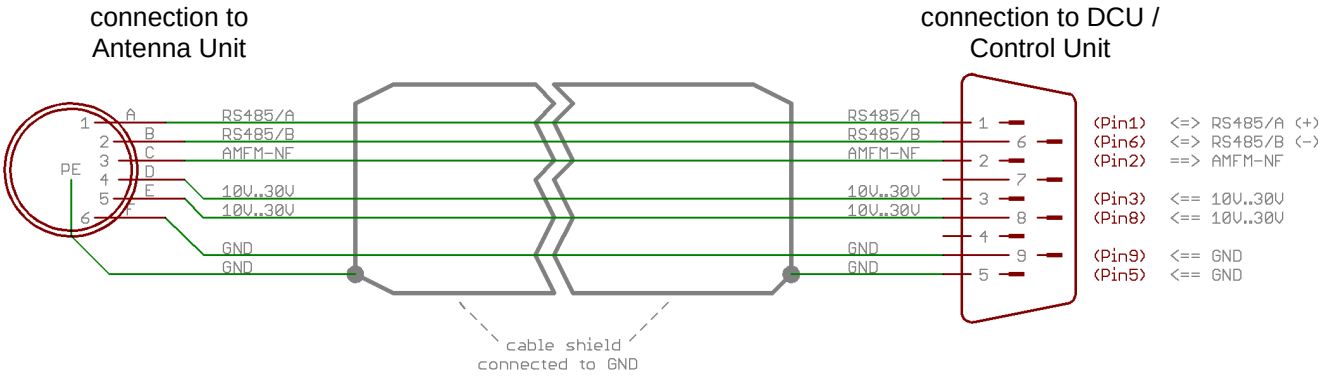
The complete Direction Finder (Antenna, RF-Commutator, Receiver and CPU) is located inside the Antenna Unit. So in principle any Hardware, which is conform with this specification, can be used to communicate with the Direction Finder Antenna Unit. The Hardware (Control Unit) has to provide the power supply lines, the RS-485 serial data connection and optional one analog signal line for the audio signal.



graphical Hardware Overview

2 Hardware

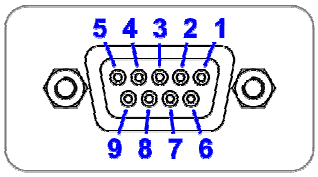
2.1 Connection Cable between Antenna Unit and DCU (or any other Control Unit)



Connection Cable AU ⇔ DCU (RHOTHETA DCU Devices)

Note: RT-600 Light System contains only the AU (for detailed information please s. User Manual of RT-600 Light).

Connector at DCU / Control Unit
D-Sub 9-pins female



Contact / Pin	Signal	
3 8	+10 ... +30 V_{DC}	Power Supply for Antenna Unit At 12 V_{DC}: Power consumption = 200mA / 2.4 Watt At 24 V_{DC}: Power consumption = 100mA / 2.4 Watt
5 9	GND	
1	RS 485 A / +	Serial data connection AU ⇔ DCU Max Voltage Range: [0 V_{DC} … +5 V_{DC}]
6	RS 485 B / -	
2	AMFM-NF	Audio signal & analog Test/Service line Max. 50 mA output current Output Voltage Range max. [0V … +5V] DC opposite GND **Output Voltage:** 121,500 MHz / 100% AM / 800 Hz AF → 1.4V_{PP} / 2.5V Bias 156,800 MHz / 3kHz FM / 800 Hz AF → 1.4V_{PP} / 2.5V Bias

3 Serial Data Protocol (via RS-485)

The data protocol between the Control Unit and the Antenna Unit is very simple. The Control Unit operates as the Master, the Antenna Unit only answers.

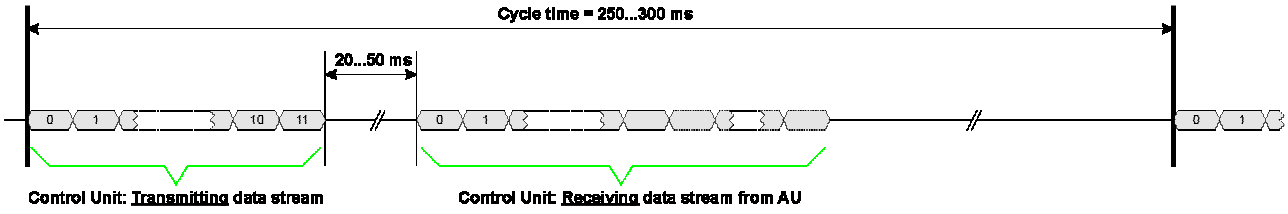
3.1 Serial Settings

- Communication Line with RS-485 Signal Levels
- Half-Duplex Mode (sending & receiving at the same lines, 2-wire)
  any industrial RS-485 interface converter has configured to: 2-wire auto mode
- 9600 Baud, 8 Databits, 1 Stopbit, No parity, (LSB send first)
- Used Terminating Resistors: 120 Ohm

3.2 Timing of serial data stream

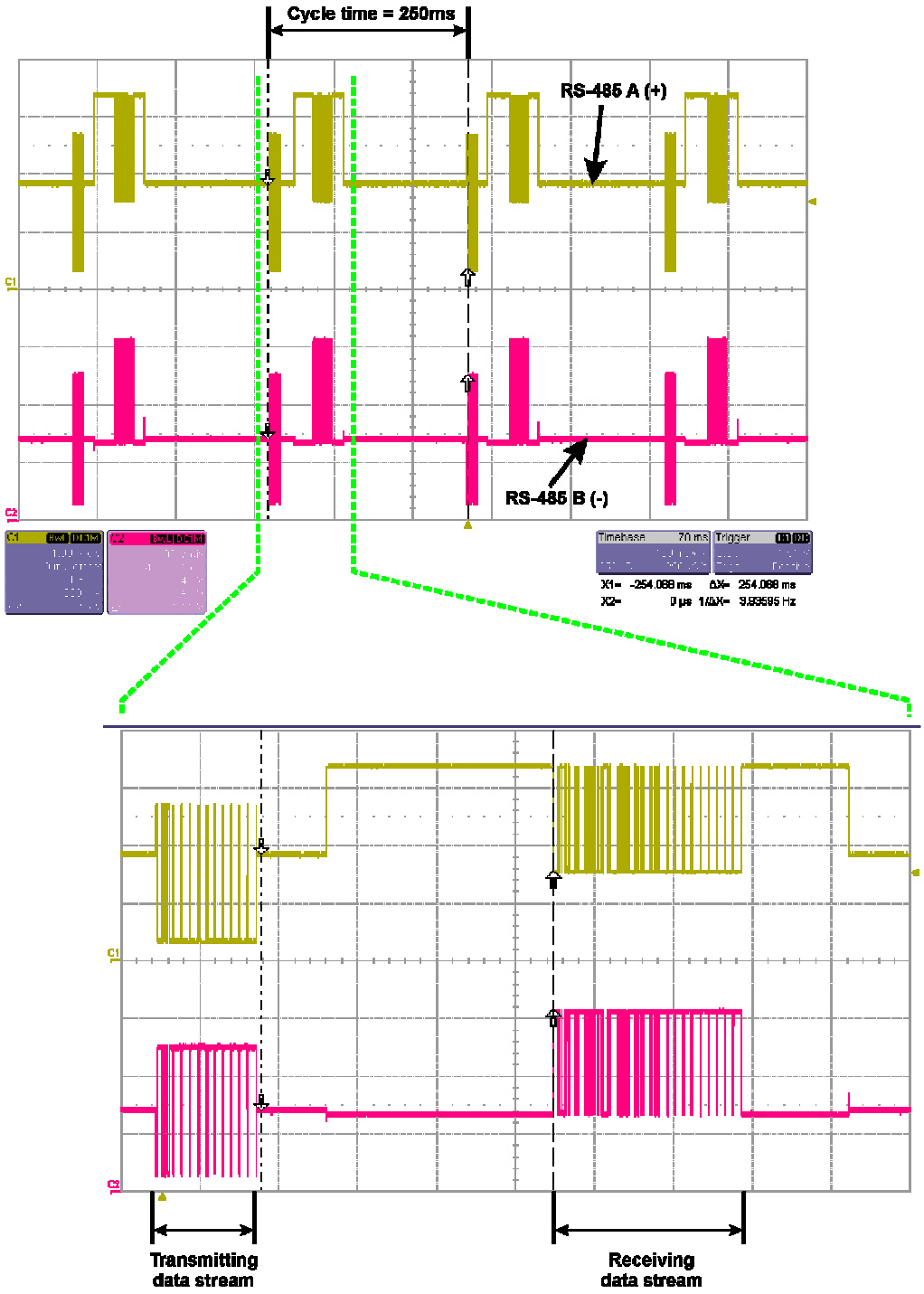
The connected Control Unit serves as Master. The Control Unit sends out cyclic one datastream to the Antenna Unit. This datastream contains the commanding bytes for controlling all Direction Finder functions inside the Antenna Unit.

This datastream has to be send out (transmitted) each 250 ms. After this transmitting process and a break of 20…50ms, the Antenna Unit sends the Answer. The Control Unit has to receive this datastream which contains all available Direction Finder information.



Main Cycle Timing of serial Data

Example of recorded RS-485 Lines with oscilloscope



RS-485 Lines

3.3 Transmitting data protocol

This datastream has to be send out by the Control Unit (transmitted) each 250 ... 300 ms and contains the following Control Bytes:

Byte No.	Variant [A]=Standard / [L]=LawEnforcement; / [V]=VTS
[0]	**Header** — **Variant** [A|L|V] - 0xA0 = Bearing Standard Direction Finder Mode ... X X X - 0xA1 = Cospas/Sarsat Decoding Mode ... X X X - 0xA2 = Cospas/Sarsat Scanning Mode (Auto AU scanning of CospasSarsat Ch. A…S / 406.022…406.076 MHz ... X X X - 0xA3 = LoJack Decoding & Bearing Mode with [Filter=VLU] ... X - 0xA4 = LoJack Decoding & Bearing Mode with [Filter=ID] ... X - 0xA5 = Fast Band Scanning Mode ... X X X - 0xA6 = Bearing Testmode (PS-RAM right rotation / only for RHOTHETA internal use) ... X X X - 0xA7 = Bearing Testmode (PS-RAM left rotation) / only for RHOTHETA internal use) ... X X X - 0xA8 = Calibration for Bearing Mode (only for RHOTHETA internal use) ... X - 0xA9 = Fast Channel Scanning Mode (fast scanning of up to 8 frequencies) ... X - 0xAF = AU Info & AutoErrorSend Mode ... X X X
[1]	**Number of bytes** in the complete data stream (including header) - decimal 12 = default value - decimal 17 = Variant[L] only: LoJack Mode with Filter=ID - decimal 20 = Fast Band Scanning Mode - decimal 23 = special Service mode / only for RHOTHETA internal use
[2..5]	**Actual Frequency** of Direction Finder [Hz] Byte [2][3][4][5] MSB LSB Variant [A/V]: - [118000000 .. 123975000] (VHF-Airband @ 8.333 kHz) - [155000000 .. 162995000] (VHF-Sea Band @ 5.000 kHz) - [240000000 .. 245975000] (UHF-Airband @ 8.333 kHz) - [400000000 .. 410000000] (CpSarSatBand @ 8.333 kHz) Variant [L]: - [118000000 .. 123975000] (VHF-Airband @ 8.333 kHz) - [164000000 .. 174000000] (LoJack @ 12.500 kHz) - [201000000 .. 215995000] (MedTrack @ 5.000 kHz) - [216000000 .. 218995000] (ETS new @ 12.500 kHz) - [219000000 .. 220000000] (ETS old @ 10.000 kHz) - [400000000 .. 410000000] (CpSarSatBand @ 8.333 kHz) Example: 156.800MHz => Byte[2..5] = [0x09][0x58][0x94][0x00]
[6]	**Squelchlevel** / Threshold [%] if signal level (from receiver) > Squelchlevel => Receiving; Bearing, Decoding ... On if signal level (from receiver) < Squelchlevel => No Receiving; Bearing Off Remark: It is very important to adjust the squelchlevel correct. (a little bit over the noise signal level) The noise level can vary about the different bands and even the frequencies. Valid range: [0..60] (%, decimal for normal Squelchsetting) [-1] Autosquelch active; WARNING: works only with pulsed signals < [5..10]sec Example: 35% Squelchlevel => Value=[0x23] (DF is only bearing if signal level > 35 %) Autosquelch active => Value=[0xFF] (as example for CospasSarsat Frequencies)
[7]	**Bit[3..0]: SignalOff Timehold** Valid range of Value: - [0] => recommended DEFAULT VALUE: value automatically set (frequency-band dependent) by AU - [1 .. 10] = 1..10 sec => WARNING, only for experts: manual setting of Timehold value; - [11] = 20 sec => " " - [12] = 30 sec => " " - [13] = 60 sec => " " - [14] = 10 min => " " - [15] = 60 min => " " **Bit[7..4]: Signal-to-Noise ratio** [% DF Level] for Autosquelch & Scanning functions Valid range of Value: - [0] => recommended DEFAULT VALUE: value set by AU - [1 .. 15] % => necessary level difference (Noise min. <> Level max.) for signal detection conversion [1% .. 15%] = [1.5dB .. 22.5dB]
[8..9]	**Offset** of Bearing [Deg] only optional value for compensation of contorted Antenna mounting - Default Value = [0x00][0x00] MSB LSB Valid range: [0 .. 359] (cw, Deg)

Byte No.	Variant [A]=Standard / [L]=LawEnforcement; / [V]=VTS
[10]	**Status** Bits HSB [x|x|x|x|x|x|x|x] LSB Bit0: CLR-Function (reset mode-dependent values) Bit2: Permission RL-Calibration Bit4: Antenna mounted Top (0=mounted upside down) Bit5: PTT (Bearing Suppression) Bit6: Service Test Flag Bit7: (optional) Bearing Calibration Off (=Disabled) The most Status/Control Bits are for RHOTHETA internal use only. The important Bits are: - Bit4 (Antenna mounted Top) : Default Value for RT-600 = 0 (Monopol Antenna mounted upside down helicopter) Default Value for RT-500-M = 1 (Dipol Antenna) - Bit5 (PTT) : while BitValue=1, the Bearing Indication is suppresed

[11]	**AMFM-LF Control** (this value controls the output of Audio signal & analog Test/Service line) Values: - 0x00 = Off - 0x01 = FM Modulation - 0x02 = AM Modulation - 0x03 = PM Modulation (Digital) - 0x04 = TEST FM-Rec \ - 0x05 = TEST FM-Filter \ only for RHOTHETA - 0x06 = TEST FM-LowPass / internal use - 0x07 = TEST FMDigitalBeep / - 0x17 = BeepTone Modulation /

Additional optional Values (only necessary for special modes):

3.3.1 LoJack Decoding & Bearing Mode [Filter=ID/VLU] (Header byte = 0xA4/0xA5)

Variant [L] only

[12..16]	**Lojack Reply Code ID** 5 x valid Lojack ASCII character set ID (No BIOZ set) Valid Reply Code mandatory when header == 0xA4 (LoJack Filter=ID) / otherwise no signal will be received Reply Code optional when header = 0xA3 (LoJack Filter=VLU) (when received VLU code == Lojack Reply Code ID): → Audio = Off (used for LoJack Scan mode / only new VLUs are interesting)

3.3.2 Fast Scanning Mode of one Band (Header byte = 0xA5)

Important:

- The actual frequency (byte[2..5]) has always to be inside the frequency band range of [lower limit … upper limit]
- When the scan mode is started, then the first scan frequency is the actual frequency (byte[2..5])
- The scan is executed continuously from lower to higher frequency [start…stop]
- If the start or the stop frequencies == 0, then the scan is executed automatically within the complete frequency band of the actual frequency (byte[2..5]) / depending on available options.)
- A minimum frequency span of 100 kHz is required.

As example, it is correct if the actual frequency (byte[2..5]) = frequency of lower limit (byte[12..15]).

[12..15]	**Frequency Start [Hz], lower Limit of band scanrange band) or 0xFFFFFFFF**
[16..19]	**Frequency Stop [Hz], upper Limit of band scanrange band) or 0xFFFFFFFF**

3.3.3 AU Info & AutoErrorSend Mode (Header byte = 0xAF)

For RHOTHETA internal use only.
Bytes [12 … 22] are used in this mode.

See also 3.4 Receiving data protocol (3.4.8 Antenna Unit Info & Auto Error Send mode).

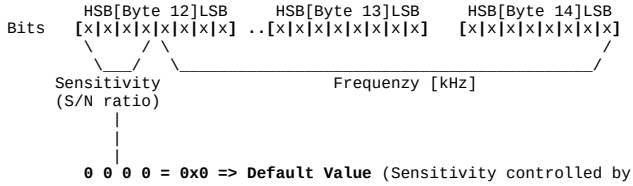
3.3.4 Calibration for Bearing Mode (Header byte = 0xA8)

For RHOTHETA internal use only.
Bytes [12 … 35] are used in this mode.

3.3.5 Fast Scanning Mode of up to 8 frequencies (Header byte = 0xA9)

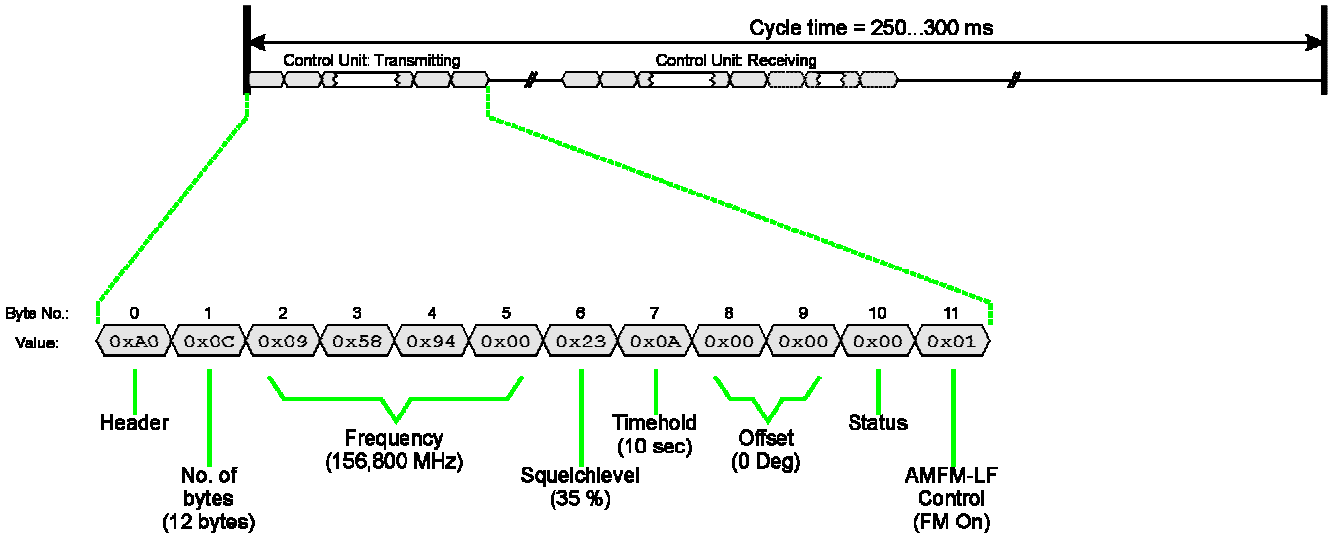
Variant [V] only

Remark:
Bytes[2..5] (actual Frequency) without Function
Byte6 (Squelchlevel) without Function

[12..14]	**Scan-Frequency No.1 [kHz] respective relative Sensitivity**  **0 0 0 0 = 0x0 => Default Value** (Sensitivity controlled by AU) 0 0 0 1 = 0x1 ... ... => [1%..15%] necessary level difference (Noise min. <> Level max.) for signal detection 1 1 1 1 = 0xF conversion [1% .. 15%] = [1.5dB .. 22.5dB] Example 1: 0x026480 => Byte12=0x02; Byte13=64; Byte14=0x80 => Sensitivity = 0x0 (= Default Value) => Frequency = 0x26480 = 156800 dezimal = 156.800 MHz Example 2: 0xA1DB3A => Byte12=0xA1; Byte13=DB; Byte14=0x3A => Sensitivity = 0xA (= 10% over Noise) => Frequency = 0x1DB3A = 121658 dezimal = 121.658333 MHz
[15..17]	**Scan-Frequency No.2 [kHz] respective relative Sensitivity**
[18..20]	**Scan-Frequency No.3 [kHz] respective relative Sensitivity**
[21..23]	**Scan-Frequency No.4 [kHz] respective relative Sensitivity**
[24..26]	**Scan-Frequency No.5 [kHz] respective relative Sensitivity**
[27..29]	**Scan-Frequency No.6 [kHz] respective relative Sensitivity**
[30..32]	**Scan-Frequency No.7 [kHz] respective relative Sensitivity**
[33..35]	**Scan-Frequency No.8 [kHz] respective relative Sensitivity**

If as Example only 3 Scan-Frequencies are used, then the remaining 5 Frequencies have to be defined as 0x000000.

3.3.6 Example of Transmitting data protocol



Example of Transmitting data stream from Control Unit

3.4 Receiving data protocol

The Antenna Unit serves as slave. After the transmit data stream from the Control Unit, the Antenna Unit sends out the answer to the Control Unit (Control Unit Receiving).

There are different Data protocols possible (dependent of controlled Direction Finder mode).

3.4.1 Bearing Mode (Standard and also with active Lojack Filter)

To activate the standard Bearing mode, use Header=0xA0 by the Transmitting data protocol.

Byte No.	
[0]	**Header** = 0x90 Identification for Standard Bearing Mode = 0x93 Variant [L] only: (Lojack Decode & Bearing Mode with Filter = VLU) = 0x94 Variant [L] only: (Lojack Decode & Bearing Mode with Filter = ID)
[1]	**Number of bytes** in the complete data stream - decimal 34 = default value
[2]	**Error** Bits HSB [x|x|x|x|x|x|x|x] LSB Bit0: No Receiver (Receiver modul of the Antenna Unit is defective) Bit1: Data Range (transmitting data values out of range, or variant incompability) Bit2: Decoding Error Bit3: Frequency Offset of received Transmitter (Frequency deviation < -8 kHz) Bit4: Frequency Offset of received Transmitter (Frequency deviation > +8 kHz) Bit5: Receiver PLL Oscillator not locked Bit6: No serial Data from Control Unit (Master) available (Timeout = 1000 ms) Bit7: Bad serial Data from Control Unit (wrong protocol or byte error)
[3]	**Bit[0]: Receiving On/Off** - 0 => No Receiving, no bearing (Signal level < Squelchlevel) - 1 => Receiving Signal, bearing (Signal level > Squelchlevel) **Bit[6..1]: AutoSquelch Level** valid range: [0..60] (%, decimal) **Bit[7]: Squelch AU controlled** - 0 => Standard, Squelchlevel is controlled by DCU - 1 **=>** Squelchlevel is controlled only by AU (= Autosquelch = On, Autosquelch disable is blocked)
[4]	**Signallevel** of received signal valid range: [0..99] (%, decimal)
[5]	**Voltage** of Antenna Unit Power Supply input valid range: [80..255] (decimal, = 8.0 .. 25.5 V DC)
[6]	**Temperature** inside Antenna Unit valid range: [-50..+100] (°C, signed byte value)
[7..8]	**Relative Bearing (averaged)** valid range: [0..359] (decimal Deg, value=0xFFFF => bearing unvalid)
[9..10]	**Min. Live value of relative Bearing** valid range: [0..359] (Deg)
[11..12]	**Max. Live Value of relative Bearing** valid range: [0..359] (Deg)

The relative live bearing field contains the max/min bearing in degrees without averaging. The relative live bearing reacts faster than the normal relative bearing, but it has not the precision of the averaged bearing.
The Min/Max Bearing Values are calculated within a time period of aprox. 250ms. If they are very close together (as example “124” and “128”) degrees, then the signal quality is quit good. A wide span of the min/max values (as example “97” and “162”) shows very noisy, but nevertheless bearable signal quality.

		Variant [L] only: Mode Filter = VLU (=0x93) oder ID (=0x94) and Receiving=On	
		Byte No.	
[13..22]	**Up to 10 x LF Values** of modulated (AM or FM) audio receiving signal - the values are generated as a continous datastream of the audio frequency - each value is measured within a timespan of 40 ms in the Antenna Unit - if the duty cycle of this receiving data protocol has a timespan of 250ms => approx. 6 valid values are calculated. - each value != 0 is valid - the resolution of the value = 25 Hz (as Example a audio frequency of 800Hz => value = 32 decimal) This values are used as example for identification of typicaly ELT modulated signals (sweep tone)	**[13..17]**	Lojack ID Replay Code 5 x ASCII Chars “No BIOZ” set
		18	Receiver Level Out Max [0..99]%
		19	LoJack Decoder Status: [0..7] - 0 : Off - 1 : Wait for Preamble - 2 : Preamble Ok - 3 : FlagPattern Ok - 4 : Data BitError > 1 - 5 : Data Ok (No VLU) - 6 : VLU Ok - 7 : ID Ok (1 corrected bit) - 8 : ID Ok (no error)
		[20..21]	Not used
		22	Not used
[23]	**Frequency Offset** of received Transmitter (service value for RHOTHETA internal use) valid range: [-99..+99], [-111]=unvalid; (depends on AFC On/Off Mode)		
[24]	**PsRam Bearing Value Right** (service value for RHOTHETA internal use) valid range: [0..179] (2° quant); [0xFF]=unvalid		
[25]	**PsRam Bearing Value Left** (service value for RHOTHETA internal use) valid range: [0..179] (2° quant); [0xFF]=unvalid		

[26..29]	**Minimum valid frequency** of the actual band (based on the actual frequency / transmit protocol byte [2..5])
[30..33]	**Maximum valid frequency** of the actual band (based on the actual frequency / transmit protocol byte [2..5])

3.4.2 CP/Sarsat decoding mode

To activate this mode, use Header=0xA1 by the Transmitting data protocol.
This mode is only for decoding the Cospas/Sarsat Pulses. While this mode is activated, no more bearing is available.

Byte No.		
[0]	**Header** = 0x91 (Identification for CP/Sarsat decoding mode)	
[1]	**Number of bytes** - 7 if no decoded pulse is available - 33 if new pulse is available	
[2]	**Error**	For details, see Receiving data protocol / Bearing Mode
[3]	**Bit[0]:** - 0 => No 406 MSG available - 1 => New valid 406 MSG available (Sync & Frame Ok) Check Error Status for Bit-Errors **Bit[6..1]: AutoSquelch Level** **Bit[7] = 1: Squelch controlled by AU**	
[4]	**Signallevel**	
[5]	**Voltage**	
[6]	**Temperature**	
The following databytes are only available, if a correct CP/Sarsat puls gets received and decoded with correct checksum		
[7..24]	**18 x Databytes** complete orginal CP/Sarsat 406 decoded message (144 bit) Databyte Nr: [Byte 7] [Byte 8] [Byte9 .. .. Byte24] 406 MSG Bit Nr: [1 2 3 4 5 6 7 8] [9 10 11 12 13 14 15 16] [17 .. .. 144]	
[25]	**S/N-Flag** valid values: 0x53='S'; 0x4E='N'; 0x2D='-' if no GPS data available	GPS-Position Latitude
[26]	**Deg** valid values: [0..90] (decimal, Deg) 0xFF if no GPS data available	
[27]	**Min** valid values: [0..59] (decimal, Deg) 0xFF if no GPS data available	
[28]	**Sec** valid values: [0..59] (decimal, Deg) 0xFF if no GPS data available	
[29]	**W/E-Flag** valid values: 0x57='W'; 0x45='E'; 0x2D='-' if no GPS data available	GPS-Position Longitude
[30]	**Deg** valid values: [0..180] (decimal, Deg) 0xFF if no GPS data available	
[31]	**Min** valid values: [0..59] (decimal, Deg) 0xFF if no GPS data available	
[32]	**Sec** valid values: [0..59] (decimal, Deg) 0xFF if no GPS data available	

3.4.3 CP/Sarsat scanning mode

To activate this mode, use Header=0xA2 by the Transmitting data protocol.
Antenna Unit / receiver works at auto scanning Cospas Sarsat mode.

While this mode is activated, no more bearing is available.

Byte No.	
[0]	**Header** = 0x92 (Identification for CP/Sarsat scanning mode)
[1]	**Number of bytes** in the complete data stream = 0x0B (11 bytes)
[2]	**Error** Bits (see Error Bits Bearing Mode)
[3]	**Bit[0]: Receiving On/Off** - 0 => No puls received - 1 => Cospas Sarsat Puls received (see enclosed Frequency Byte[7..10]) **Bit[6..1]: AutoSquelchLevel** valid range: [0..60] (%, decimal) **Bit[7] = 1: Squelch controlled by AU**
[4]	**Signallevel** of received signal valid range: [0..99] (%, decimal)
[5]	**Voltage** of Antenna Unit Power Supply input valid range: [80..255] (decimal, = 8.0 .. 25.5 V DC)
[6]	**Temperature** inside Antenna Unit valid range: [-50..+100] (°C, signed byte value)
[7..10]	**Actual Frequency** at CospasSarsat scanning mode [Hz] Byte [7][8][9][10] | | MSB LSB Value = [406025000 .. 406075000] (CpSarSatBand with 8.333kHz Grid) Example: Byte[7..10] = [0x18][0x33][0x93][0xB5] => CospasSarsat Frequency 406,033333 MHz

3.4.4 Fast Band Scanning Mode

To activate this mode, use Header=0xA5 by the Transmitting data protocol.
Antenna Unit / receiver works at auto scanning band mode.

While this mode is activated, no more bearing is available.

While a scan is running, the actual frequency (byte no. [7..10]) contains only “shnapshot” of the true receiver frequency because this receiver internal frequency changes faster than transmitted by this protocol.
If a signal is detected, the Receiving On/Off Bit is set, and the scanning is stopped for approx. 2 sec.
While this short time, the scanmode is usually aborted by the DCU (applicable for RT-600, RT-500-M, RT-800) and the mode is changed (by the DCU) to normal bearing Mode. The actual found scanning frequency with signal is available at Byte No. [7..10].

(Without mode change, the scanning is continued with the active start frequency: Byte No. [2..5] of actual Transmitting data protocol).

The sensitivity of the scanning process is controlled with static Squelchlevel (= 0..100%) or, if Autosquelch is On (Squelchlevel = -1) with S/N Ratio (1..15) (> see transmitting data protocol byte 7 Bit[7..4]).

Byte No.	
[0]	**Header** = 0x95 (Identification for Bearing Mode)
[1]	**Number of bytes** in the complete data stream = 0x0B (11 bytes)
[2]	**Error** Bits (see Error Bits Bearing Mode)
[3]	**Bit[0]: Receiving On/Off** - 0 => No signal received - 1 => Signal receiving (see enclosed Frequency Byte[7..10]) **Bit[6..1]: AutoSquelchLevel** valid range: [0..60] (%, decimal) **Bit[7] = 1: Squelch controlled by AU** **Bit[7]:=** 0 => Standard, Squelchlevel is controlled by DCU
[4]	**Signallevel** of received signal valid range: [0..99] (%, decimal)
[5]	**Voltage** of Antenna Unit Power Supply input valid range: [80..255] (decimal, = 8.0 .. 25.5 V DC)
[6]	**Temperature** inside Antenna Unit valid range: [-50..+100] (°C, signed byte value)
[7..10]	**Actual Frequency** at scanning mode [Hz] Byte [7][8][9][10] | | MSB LSB Only valid if != 0 Example: Byte[7..10] = [0x09][0x5B][0x66][0xA8] => Frequency 156,985 MHz

3.4.5 Fast Channel Scanning Mode

Variant [V] only

To activate this mode, use Header=0xA9 by the Transmitting data protocol.
Antenna Unit / receiver works at fast channel scanning mode.

While this mode is activated, no more bearing is available.
If a signal is detected, the Receiving On/Off Bit is set, and the scanning is stopped for 1 sec.
While this short time, the fast channel scanmode is usually aborted by the DCU (applicable for RT-600, RT-500-M, RT-800) and the mode is changed (by the DCU) to normal bearing Mode
(Without mode change, the scanning is continued with the next scan frequency).

Byte No.		
[0]	**Header** = 0x99 (Identification for Fast Channel Scanning Mode)	
[1]	**Number of bytes** in the complete data stream = 0x1B (27 bytes)	
[2]	**Error** Bits (see Error Bits Bearing Mode)	
[3]	**Bit[0]: Receiving On/Off** - 0 => No signal received - 1 => Signal receiving (see enclosed Frequency Byte[7..10]) **Bit[6..1]: AutoSquelchLevel** valid range: [0..60] (%, decimal) **Bit[7]: = 1: Squelch controlled by AU**	
[4]	**Signallevel** of received signal valid range: [0..99] (%, decimal)	
[5]	**Voltage** of Antenna Unit Power Supply input valid range: [80..255] (decimal, = 8.0 .. 25.5 V DC)	
[6]	**Temperature** inside Antenna Unit valid range: [-50..+100] (°C, signed byte value)	
[7..10]	**Actual Frequency** at scanning mode [Hz] Byte [7][8][9][10] | | MSB LSB Example: Byte[7..10] = [0x09][0x58][0x94][0x00] => Frequency 156,800 MHz	
[11]	**Max. Peak Level [%]** of Scan-Frequency No. 1	valid range: [0..99] %
[12]	**Max. Peak Level [%]** of Scan-Frequency No. 2	
[13]	**Max. Peak Level [%]** of Scan-Frequency No. 3	
[14]	**Max. Peak Level [%]** of Scan-Frequency No. 4	
[15]	**Max. Peak Level [%]** of Scan-Frequency No. 5	
[16]	**Max. Peak Level [%]** of Scan-Frequency No. 6	
[17]	**Max. Peak Level [%]** of Scan-Frequency No. 7	
[18]	**Max. Peak Level [%]** of Scan-Frequency No. 8	
[19]	**Noise Level [%]** of Scan-Frequency No. 1	valid range: [0..99] %
[20]	**Noise Level [%]** of Scan-Frequency No. 2	
[21]	**Noise Level [%]** of Scan-Frequency No. 3	
[22]	**Noise Level [%]** of Scan-Frequency No. 4	
[23]	**Noise Level [%]** of Scan-Frequency No. 5	
[24]	**Noise Level [%]** of Scan-Frequency No. 6	
[25]	**Noise Level [%]** of Scan-Frequency No. 7	
[26]	**Noise Level [%]** of Scan-Frequency No. 8	

3.4.6 Testmode (Header byte = 0x96 or 0x97)

The Test modes are only for RHOTHETA internal use.
Bytes [1 … 24] are used in this mode.

3.4.7 Calibration for Bearing Mode (Header byte = 0x98)

Variant [V] only

The Calibration mode is only for RHOTHETA internal use.
Bytes [1 …20] are used in this mode.

3.4.8 Antenna Unit Info & Auto Error Send mode

The Antenna Unit always waits for an incoming data stream message from the Control Unit (Master). If there is no data available (Timeout after 500 ms, or data inconsistent) then the Antenna Unit switches to auto send mode and sends automatically without request from Control Unit this data protocol. In the moment of receiving valid data of the Control Unit this mode is disabled and the Antenna Unit operates in the standard modes.

Byte No.	
[0]	**Header** = 0x9F (Identification for auto send & error mode)
[1]	**Number of bytes** - 0x13 (19 bytes decimal)
[2]	**Error** Bits - 0x80 (Bit7 = Bad serial Data from Control Unit / wrong protocol or byte error) - 0x40 (Bit6 = No serial Data from Control Unit available / Timeout = 500 ms)
[3..18]	**Info String of 15 bytes/chars** the string contains Information about Unit, Variant, Software Version,Options and Serial No. Example: Byte [3..18] =

```
|--AU ID---||Var-||---Software Version---|      |-------------- Serial No.---------------|
[0x41][0x55][0x41][0x33][0x2E][0x32][0x35][0x3A][0x45][0x40][0x30][0x31][0x32][0x33][0x34][0x00]
  'A'   'U'   'A'   '3'   '.'   '2'   '5'   ':'   'E'   '@'   '0'   '1'   '2'   '3'   '4'  'END'
                |   \                 /          |     |   \                         /
                |    \_______________/           |     |    \_______________________/
                |           n . n n              |     |           n n n n n
                |     (Software Version)         |     |          (Serial No.)
                |                                |     |
                |                                |     |       Option Bits for Extra Functions:
                |                                |     |       [X1:        |X2:          ]
                |                                |     |       [AU Bearing |Fast Channel ]
                |                                |     |       [Calibration|Scan Mode    ]
                |                                |     └> '@'  [     -     |      -      ]
                |                                |     └> 'A'  [     X     |      -      ]
                |                                |     └> 'B'  [     -     |      X      ]
                |                                |     └> 'C'  [     X     |      X      ]
                |                                |
                |                                |
                |                                |       Option Bits for Extended Frequency Ranges:
                |                                |       [F1:        |F2:             |F3:        |F4:        ]
                |                                |       [VHF Airband|VHF Marineband  |UHF Airband|UHF FM band]
                |                                └> '@'  [     -     |       -        |     -     |     -     ]
                |                                └> 'A'  [     X     |       -        |     -     |     -     ]
                |                                └> 'B'  [     -     |       X        |     -     |     -     ]
                |                                └> 'C'  [     X     |       X        |     -     |     -     ]
                |                                └> 'D'  [     -     |       -        |     X     |     -     ]
                |                                └> 'E'  [     X     |       -        |     X     |     -     ]
                |                                └> 'F'  [     -     |       X        |     X     |     -     ]
                |                                └> 'G'  [     X     |       X        |     X     |     -     ]
                |                                └> 'H'  [     -     |       -        |     -     |     X     ]
                |                                └> 'I'  [     X     |       -        |     -     |     X     ]
                |                                └> 'J'  [     -     |       X        |     -     |     X     ]
                |                                └> 'K'  [     X     |       X        |     -     |     X     ]
                |                                └> 'L'  [     -     |       -        |     X     |     X     ]
                |                                └> 'M'  [     X     |       -        |     X     |     X     ]
                |                                └> 'N'  [     -     |       X        |     X     |     X     ]
                |                                └> 'O'  [     X     |       X        |     X     |     X     ]
                |
                └> 'A' => Variant "A" for RT-500-M and RT-600 Standard
                └> 'V' => Variant "V" with extended  VTS functionality (RT-800)
                └> 'L' => Variant "L" for RT-600 LawEnforcement


=> AU = Antenna Unit
=> A  = Standard Variant
=> Software Version 3.25
=> Frequency Options: F1 & F3 (Extended VHF & UHF Airband)
=> Extra Options: not activated
=> Serial No= 01234
```

See also [Transmitting data protocol] / [3.3.3] / [AU Info & AutoErrorSend Mode (Header byte = 0xAF)]