



## **Bluebox User Manual**

### **Retrieving Transponder-IDs**

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# 1 Introduction

## 1.1 Commands for Transponder-IDs

There are 3 commands to retrieve transponder-IDs from the Bluebox:

- Inventory (retrieve transponders in the read range of the antenna)
- Data Request (retrieve filtered list)
- Queue Request (retrieve unfiltered list)

### 1.1.1 Inventory

This command scans for transponders in the read range of the antennas. The result is the UUIDs (EPCs) of the discovered transponders. With passive RFID it is quite common, that a single inventory does not discover all transponder-IDs. Therefore, it is best to use several inventory commands in a row to ensure that all transponders have been discovered. The inventory command can be used together with the automatic mode (Continuous Mode).

### 1.1.2 Data Request

This command delivers transponder-IDs from the filtered list. If “Continuous Mode” (Automatic Mode) is active, this data is taken from the filtered list and immediately send. If the device is not in automatic mode, the device does an inventory and returns the result of this action.

Filtered means:

- Transponder-IDs that have been discovered several times are combined in a single entry.
- Transponder-IDs expire after a filter time and are deleted from the filtered list; this means the list can run empty.

The contents of the filtered list are automatically deleted after this command.

### 1.1.3 Queue Data Request

This command delivers the oldest transponder-ID from the unfiltered list.

Unfiltered means:

- Transponder-IDs that have been discovered several times are also stored several times in the list.
- Transponder-IDs remain in the list. The list can contain up to 100 transponder-IDs.

The retrieved entry from the unfiltered list is not deleted. It should be deleted with the delete command; otherwise, the same entry will be delivered for the next Queue Data Request.

## 2 Operation Modes

### 2.1 Manual Operation

The screenshot shows the 'Configuration' window in the BLUEBOX Show software. On the left, a 'Commands' tree has 'Configuration' selected. The main area contains the following settings:

- Address: 255
- Baud rate: 19200
- Data bits: 8
- Stop bits: 1
- Parity: None
- Filter time: 1 seconds (radio button selected)
- Flags:
  - ☒ Buzzer activation on new tag event
  - ☐ Output 1 activation on tag present
  - ☐ Send antenna information
  - ☐ Send tag information
  - ☐ Spontaneous mode activation
  - ☐ Continuous mode triggered by input 1
  - ☐ Continuous mode activation

At the bottom are three buttons: 'Read', 'Write', and 'Default'.

Abbildung 1: BLUEBOX Show Screen Section: Configuration without automatic modes

If you need to request the tag UIDs, you can either use the command “Inventory” or “Data Request”. With the above settings, “Data Request” will not find data in the unfiltered list and no data from automatic operation, hence it will send an “Inventory” command internally.

### 2.2 Automatic Mode (Continuous Mode, Auto-Read)

This screenshot is identical to the previous one, but with the 'Continuous mode activation' checkbox under the 'Flags' section checked. This checkbox is highlighted with a red rectangle.

Abbildung 2: BLUEBOX Show Screen Section: Configuration with automatic mode

With the above settings, the Bluebox now steadily executes the “Inventory” command, detects transponders and stores their UID in the unfiltered list. This list can be retrieved with the command “Queue Data Request” or filtered with “Data Request”.

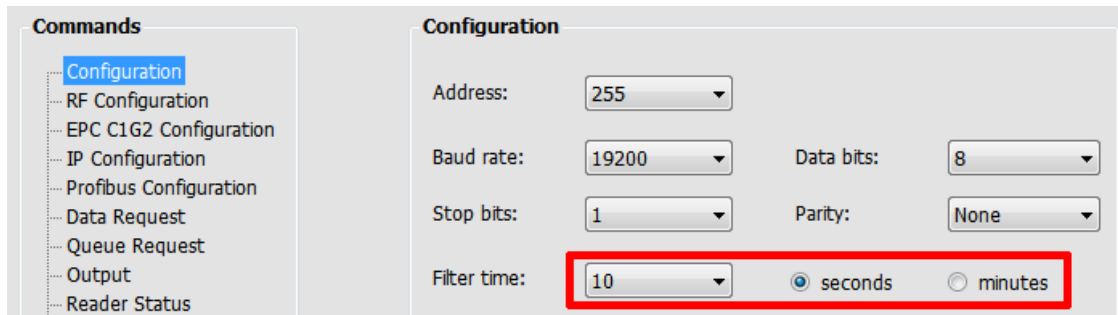


Abbildung 3: BLUEBOX Show Screen Section: configuratoin of Filter Time

With the above settings you will receive transponder-IDs that have been discovered during the last 10 seconds using the “Data Request” command.

## 2.3 Automatic Telegram Transmission (Spontaneous Mode)

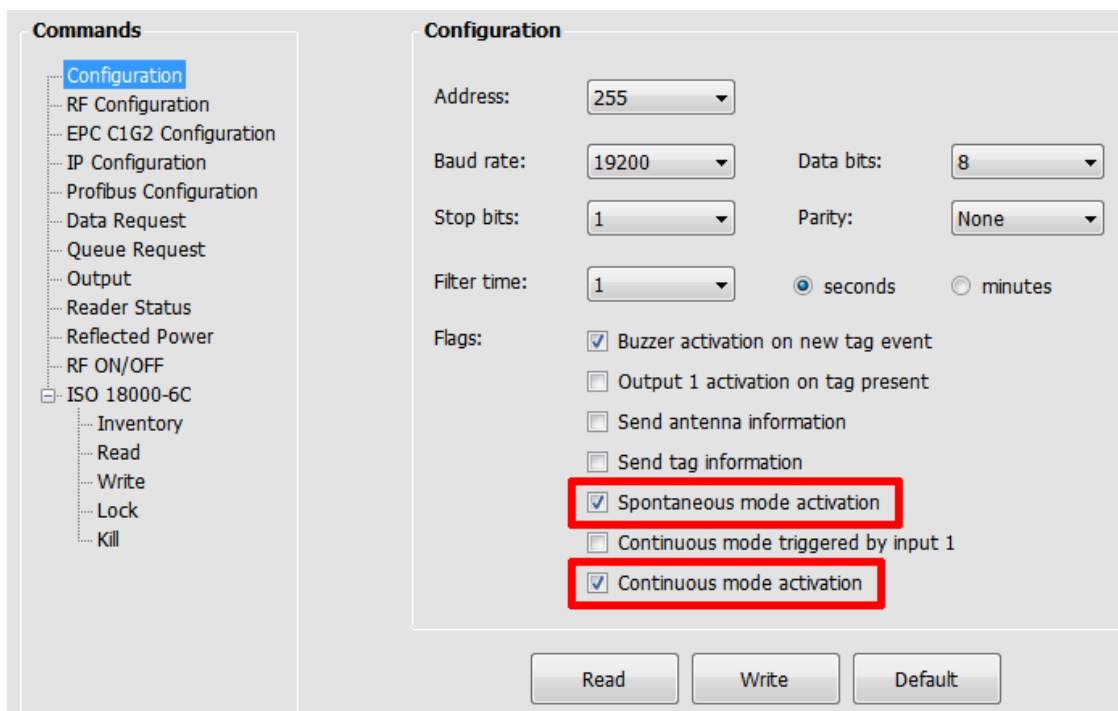


Abbildung 4: BLUEBOX Show Screen Section: Automatic operation and automatic telegram transmission

With the above settings, the Bluebox steadily executes “Inventory” commands, detects transponders and stores their UID in the unfiltered list. Furthermore, every newly discovered transponder ID will automatically be sent to your software. If you use “Spontaneous Mode” without “Continuous Mode”, you will get no automatic information on new transponders. Hence this combination is of no use.

## 2.4 Triggered Operation

The Bluebox can be triggered using different ways:

### Software-Trigger

- Sending the command “Inventory” triggers an acquisition process. Recommended are 3 inventories in a row.

- Sending the command "Data Request" without "Continuous Mode" has the same effect as Inventory.

#### Hardware-Trigger

- "Continuous Mode triggered by input 1": Trigger with signal on input 1 initiates Continuous Mode,
- in combination with Spontaneous Mode, the acquired transponder-IDs are sent automatically to the host.

## 2.5 Examples

Trucks stop before an entry (e.g. a barrier). The trucks trigger a sensor (light barrier, radar sensor, inductive loop, etc.):

- ⇒ No automatic operation, send several "Inventory" commands to discover the transponder UIDs.

Trucks shall be discovered while driving by:

- ⇒ Automatic operation and automatic telegram transmission (Continuous Mode + Spontaneous Mode). Transponder-IDs are automatically sent to your software. If this is not wanted:
- ⇒ Automatic operation with several seconds of filter time (Continuous Mode + 3-10 seconds filter time) while regularly requesting the filtered list with "Data Request".

Please pay attention that your request cycle must be shorter than the filter time. Otherwise, you will lose transponder-IDs. If you request every 4 seconds, the filter time should be at least 5 seconds.

### 3 The Commands in Detail

#### 3.1 Data Request

##### Telegram from PC/SPS to BLUEBOX

Byte #	Number of Bytes	Data	Value	Description
0	1	0x01	SOH	Start of Header, Start of Telegram
1..2	2	0x46 0x46	0xFF (255)	Device address
3	1	0x05	ENQ	Command code, enquiry
4	1	0x05	05	BCC
5	1	0x0D	0D (CR)	Carriage Return, End of Telegram

6 Bytes in total.

##### Reply from Bluebox to PC/SPS in case of error

Byte #	Number of Bytes	Data	Value	Description
0	1	0x01	SOH	Start of Header, Start of telegram
1..2	2	0x46 0x46	0xFF (255)	Device address
3	1	0x16	NAK	No Acknowledge – Command error
4	1	0x05	05	BCC
5	1	0x0D	0D (CR)	Carriage Return, End of telegram

6 Bytes in total.

##### Reply from Bluebox to PC/SPS in case of an empty list

Byte #	Number of Bytes	Data	Value	Description
0	1	0x01	SOH	Start of Header, Start of telegram
1..2	2	0x46 0x46	0xFF (255)	Device address
3	1	0x02	STX	Start of Text
4..13	10	0x30303030 0x30303030 0x3030	0000 0000 00	10 ASCII-Characters „0“
14	1	0x03	03 (ETX)	End of Text
15	1	0x05	05	BCC
16	1	0x0D	0D (CR)	Carriage Return, End of telegram

17 Bytes in total.

##### Reply from Bluebox to PC/SPS with one Transponder-ID

Byte #	Number of Bytes	Data	Value	Description
0	1	0x01	SOH	Start of Header, Start of telegram
1..2	2	0x46 0x46	0xFF (255)	Device address
3	1	0x02	STX	Start of Text
4..27	24	0x37463334 0x41303531 0x31443743 0x42383039 0x31374338	7F 34 A0 51 1D 7C B8 09 17 C8	Transponder-ID (here with a 12-byte EPC)



		0x30343934	04 94	
30	1	0x03	03 (ETX)	End of Text
31	1	0x05	05	BCC
32	1	0x0D	0D (CR)	Carriage Return, End of telegram

33 Bytes in total.

The section marked in blue (bytes 4 to 27) is repeated for every transponder-ID. Each instance of this section is then separated with an “-” (ASCII character 0x2D) from the following section carrying a transponder UID.

#### Reply from Bluebox to PC/SPS with two Transponder-IDs

Byte #	Number of Bytes	Data	Value	Description
0	1	0x01	SOH	Start of Header, Start of telegram
1..2	2	0x46 0x46	0xFF (255)	Device address
3	1	0x02	STX	Start of Text
4..7	4	0x33303030	3000	PC (Protocol Control, from the EPC memory bank)
8..31	24	0x37463334 0x41303531 0x31443743 0x42383039 0x31374338 0x30343934	7F 34 A0 51 1D 7C B8 09 17 C8 04 94	Transponder-ID (here with a 12-byte EPC)
32..35	4	0x43423939	CB99	EPC CRC (from the EPC memory bank)
36	1	0x2D	“-“	Separator
37..40	4	0x33303030	3000	PC (Protocol Control, from the EPC memory bank)
41..64	24	0x37463334 0x31443743 0x42383039 0x31374338 0x30343934 0x41303531	7F 34 1D 7C B8 09 17 C8 04 94 A0 51	Transponder-ID (here with a 12-byte EPC)
65..68	4	0x43423939	CB99	EPC CRC (from the EPC memory bank)
69	1	0x03	03 (ETX)	End of Text
70	1	0x05	05	BCC
71	1	0x0D	0D (CR)	Carriage Return, End of telegram

72 Bytes in total.

#### Reply from Bluebox to PC/SPS with one Transponder-ID and configured transmission of transponder type and antenna number

Byte #	Number of Bytes	Data	Value	Description
0	1	0x01	SOH	Start of Header, Start of telegram
1..2	2	0x46 0x46	0xFF (255)	Device address
3	1	0x02	STX	Start of Text
4..5	2	0x3032	02	Transponder type, ASCII-coded hex number: <ul style="list-style-type: none"> <li>0x01: ISO18000-6B</li> <li>0x02: ISO18000-6C (EPC Class-1 Gen2)</li> </ul>
6..9	4	0x33303030	3000	PC (Protocol Control, from the EPC memory bank)
10..33	24	0x37463334	7F 34	Transponder-ID (here with a 12-byte EPC)

		0x41303531 0x31443743 0x42383039 0x31374338 0x30343934	A0 51 1D 7C B8 09 17 C8 04 94	
34..37	4	0x43423939	CB99	EPC CRC (from the EPC memory bank)
38	1	0x30	0	Padding
39	1	0x31	1	Antenna number; ASCII-character: <ul style="list-style-type: none"> <li>• „1“: Antenna 1</li> <li>• „2“: Antenna 2</li> <li>• „3“: Antenna 3</li> <li>• „4“: Antenna 4</li> </ul>
40	1	0x03	03 (ETX)	End of Text
41	1	0x05	05	BCC
42	1	0x0D	0D (CR)	Carriage Return, End of telegram

43 Bytes in total.

The section marked in blue (bytes 4 to 39) is repeated for every transponder-ID. Each instance of this section is then separated with an “-” (ASCII character 0x2D) from the following section carrying a transponder UID.

### 3.2 Queue Data Request

This command returns a single transponder-ID per request. To get the complete list, repeat this command followed by a delete command (ACK) until the reply indicates an empty list.

#### Telegram from PC/SPS to BLUEBOX

Byte #	Number of Bytes	Data	Value	Description
0	1	0x01	SOH	Start of Header, Start of telegram
1..2	2	0x46 0x46	0xFF (255)	Device address
3	1	0x16	SYN	Command code
4	1	0x05	05	BCC
5	1	0x0D	0D (CR)	Carriage Return, End of telegram

6 Bytes in total.

#### Reply from Bluebox to PC/SPS in case of error

Byte #	Number of Bytes	Data	Value	Description
0	1	0x01	SOH	Start of Header, Start of telegram
1..2	2	0x46 0x46	0xFF (255)	Device address
3	1	0x16	NAK	No Acknowledge – Command error
4	1	0x05	05	BCC
5	1	0x0D	0D (CR)	Carriage Return, End of telegram

6 Bytes in total.

#### Reply from Bluebox to PC/SPS in case of an empty list

Byte #	Number of Bytes	Data	Value	Description
0	1	0x01	SOH	Start of Header, Start of telegram
1..2	2	0x46 0x46	0xFF (255)	Device address

3	1	0x02	STX	Start of Text
4..13	10	0x30303030 0x30303030 0x3030	0000 0000 00	10 ASCII-Characters „0“
14	1	0x03	03 (ETX)	End of Text
15	1	0x05	05	BCC
16	1	0x0D	0D (CR)	Carriage Return, End of telegram

17 Bytes in total.

#### Reply from Bluebox to PC/SPS with one transponder-ID

Byte #	Number of Bytes	Data	Value	Description
0	1	0x01	SOH	Start of Header, Start of telegram
1..2	2	0x46 0x46	0xFF (255)	Device address
3	1	0x02	STX	Start of Text
4..7	4	0x33303030	3000	PC (Protocol Control, from the EPC memory bank)
8..31	24	0x37463334 0x41303531 0x31443743 0x42383039 0x31374338 0x30343934	7F 34 A0 51 1D 7C B8 09 17 C8 04 94	Transponder-ID (here with a 12-byte EPC)
32..35	4	0x43423939	CB99	EPC CRC (from the EPC memory bank)
36	1	0x03	03 (ETX)	End of Text
37	1	0x05	05	BCC
38	1	0x0D	0D (CR)	Carriage Return, End of telegram

39 Bytes in total.

#### Reply from Bluebox to PC/SPS with one Transponder-ID and configured transmission of transponder type and antenna number

Byte #	Number of Bytes	Data	Value	Description
0	1	0x01	SOH	Start of Header, Start of telegram
1..2	2	0x46 0x46	0xFF (255)	Device address
3	1	0x02	STX	Start of Text
4..5	2	0x3032	02	Transponder type, ASCII-coded hex number: <ul style="list-style-type: none"> <li>0x01: ISO18000-6B</li> <li>0x02: ISO18000-6C (EPC Class-1 Gen2)</li> </ul>
6..9	4	0x33303030	3000	PC (Protocol Control, from the EPC memory bank)
10..33	24	0x37463334 0x41303531 0x31443743 0x42383039 0x31374338 0x30343934	7F 34 A0 51 1D 7C B8 09 17 C8 04 94	Transponder-ID (here with a 12-byte EPC)
34..37	4	0x43423939	CB99	EPC CRC (from the EPC memory bank)
38	1	0x30	0	Padding
39	1	0x31	1	Antenna number, ASCII-Character: <ul style="list-style-type: none"> <li>„1“: Antenna 1</li> </ul>

				<ul style="list-style-type: none"> <li>• „2“: Antenna 2</li> <li>• „3“: Antenna 3</li> <li>• „4“: Antenna 4</li> </ul>
40	1	0x03	03 (ETX)	End of Text
41	1	0x05	05	BCC
42	1	0x0D	0D (CR)	Carriage Return, End of telegram

43 Bytes in total.

### 3.2.1 Delete unfiltered List

After having received the transponder-IDs you should delete the entry from the unfiltered list, otherwise the same entry will be sent at the next Queue Data Request.

#### Telegram from PC/SPS to BLUEBOX

Byte #	Number of Bytes	Data	Value	Description
0	1	0x01	SOH	Start of Header, Start of telegram
1..2	2	0x46 0x46	0xFF (255)	Device address
3	1	0x06	ACK	Acknowledgement
4	1	0x05	05	BCC
5	1	0x0D	0D (CR)	Carriage Return, End of telegram

6 Bytes in total.

## 3.3 Inventory

Following is the special command for detection of ISO18000-6C compatible transponders.

#### Telegram from PC/SPS to BLUEBOX

Byte #	Number of Bytes	Data	Value	Description
0	1	0x01	SOH	Start of Header, Start of telegram
1..2	2	0x46 0x46	0xFF (255)	Device address
3	1	0x02	STX	Start of Text
4..5	2	0x3138	18	Command code
6	1	0x03	03 (ETX)	End of Text
7	1	0x05	05	BCC
8	1	0x0D	0D (CR)	Carriage Return, End of telegram

9 Bytes in total.

#### Reply from Bluebox to PC/SPS in case of an error

Byte #	Number of Bytes	Data	Value	Description
0	1	0x01	SOH	Start of Header, Start of telegram
1..2	2	0x46 0x46	0xFF (255)	Device address
3	1	0x16	NAK	No acknowledge – Command error
4	1	0x05	05	BCC
5	1	0x0D	0D (CR)	Carriage Return, End of telegram

6 Bytes in total.

**Reply from Bluebox to PC/SPS in case no transponder was found**

Byte #	Number of Bytes	Data	Value	Description
0	1	0x01	SOH	Start of Header, Start of telegram
1..2	2	0x46 0x46	0xFF (255)	Device address
3	1	0x02	STX	Start of Text
4..5	2	0x3138	18	Command code
6..7	2	0x3031	01	Error code: No tag
8	1	0x03	03 (ETX)	End of Text
9	1	0x05	05	BCC
10	1	0x0D	0D (CR)	Carriage Return, End of telegram

11 Bytes in total.

**Reply from Bluebox to PC/SPS in case of transmit error**

Byte #	Number of Bytes	Data	Value	Description
0	1	0x01	SOH	Start of Header, Start of telegram
1..2	2	0x46 0x46	0xFF (255)	Device address
3	1	0x02	STX	Start of Text
4..5	2	0x3138	18	Command code
6..7	2	0x3032	02	Error code: Transmit error
8	1	0x03	03 (ETX)	End of Text
9	1	0x05	05	BCC
10	1	0x0D	0D (CR)	Carriage Return, End of telegram

11 Bytes in total.

**Reply from Bluebox to PC/SPS with one transponder-ID found on antenna 1 with transmission error**

Byte #	Number of Bytes	Data	Value	Description
0	1	0x01	SOH	Start of Header, Start of telegram
1..2	2	0x46 0x46	0xFF (255)	Device address
3	1	0x02	STX	Start of Text
4..5	2	0x3138	18	Command code
6..7	2	0x3030	0	Status 0 = OK
8..11	4	0x33303030	3000	PC (Protocol Control, from the EPC memory bank)
12..35	24	0x37463334 0x41303531 0x31443743 0x42383039 0x31374338 0x30343934	7F 34 A0 51 1D 7C B8 09 17 C8 04 94	Transponder-ID (here with a 12-byte EPC)
36..39	4	0x43423939	CB99	EPC CRC (from the EPC memory bank)
40	1	0x30	0	Padding
41	1	0x31	1	Antenna number, ASCII-Characters: <ul style="list-style-type: none"> <li>• „1“: Antenna 1</li> <li>• „2“: Antenna 2</li> <li>• „3“: Antenna 3</li> <li>• „4“: Antenna 4</li> </ul>
42	1	0x03	03 (ETX)	End of Text

43	1	0x05	05	BCC
44	1	0x0D	0D (CR)	Carriage Return, End of telegram

45 Bytes in total.

### 3.4 Telegrams in Spontaneous Mode

#### 3.4.1 RS232 or Ethernet

If “Continuous Mode” and “Spontaneous Mode” are active, the Bluebox automatically sends following telegrams as soon as a new transponder-ID is discovered:

##### Telegram from Bluebox to PC/SPS

Byte #	Number of Bytes	Data	Value	Description
0	1	0x02	STX	Start of Text
1..4	4	0x33303030	3000	PC (Protocol Control, from the EPC memory bank)
5..28	24	0x37463334 0x41303531 0x31443743 0x42383039 0x31374338 0x30343934	7F 34 A0 51 1D 7C B8 09 17 C8 04 94	Transponder-ID (here with a 12-byte EPC)
29..32	4	0x43423939	CB99	EPC CRC (from the EPC memory bank)
33	1	0x03	03 (ETX)	End of Text
34	1	0x05	05	BCC
35	1	0x0D	0D (CR)	Carriage Return, End of telegram

36 Bytes in total.

##### Telegram from Bluebox to PC/SPS with one transponder-ID and the antenna number

Byte #	Number of Bytes	Data	Value	Description
0	1	0x02	STX	Start of Text
1..4	4	0x33303030	3000	PC (Protocol Control, from the EPC memory bank)
5..28	24	0x37463334 0x41303531 0x31443743 0x42383039 0x31374338 0x30343934	7F 34 A0 51 1D 7C B8 09 17 C8 04 94	Transponder-ID (here with a 12-byte EPC)
29..32	4	0x43423939	CB99	EPC CRC (from the EPC memory bank)
33	1	0x30	0	Padding
34	1	0x31	1	Antenna number, ASCII-Character: <ul style="list-style-type: none"> <li>• „1“: Antenna 1</li> <li>• „2“: Antenna 2</li> <li>• „3“: Antenna 3</li> <li>• „4“: Antenna 4</li> </ul>
35	1	0x03	03 (ETX)	End of Text
36	1	0x05	05	BCC
37	1	0x0D	0D (CR)	Carriage Return, End of telegram

38 Bytes in total.

**Telegram from Bluebox to PC/SPS with transponder type and transponder-ID**

Byte #	Number of Bytes	Data	Value	Description
0	1	0x02	STX	Start of Text
1..2	2	0x3032	02	Transponder type, ASCII-coded hex number: <ul style="list-style-type: none"> <li>0x01: ISO18000-6B</li> <li>0x02: ISO18000-6C (EPC Class-1 Gen2)</li> </ul>
3..6	4	0x33303030	3000	PC (Protocol Control, from the EPC memory bank)
7..30	24	0x37463334 0x41303531 0x31443743 0x42383039 0x31374338 0x30343934	7F 34 A0 51 1D 7C B8 09 17 C8 04 94	Transponder-ID (here with a 12-byte EPC)
31..34	4	0x43423939	CB99	EPC CRC (from the EPC memory bank)
35	1	0x03	03 (ETX)	End of Text
36	1	0x05	05	BCC
37	1	0x0D	0D (CR)	Carriage Return, End of telegram

38 Bytes in total.

**Telegram from Bluebox to PC/SPS with transponder type, transponder-ID and antenna number**

Byte #	Number of Bytes	Data	Value	Description
0	1	0x02	STX	Start of Text
1..2	2	0x3032	02	Transponder type, ASCII-coded hex number: <ul style="list-style-type: none"> <li>0x01: ISO18000-6B</li> <li>0x02: ISO18000-6C (EPC Class-1 Gen2)</li> </ul>
3..6	4	0x33303030	3000	PC (Protocol Control, from the EPC memory bank)
7..30	24	0x37463334 0x41303531 0x31443743 0x42383039 0x31374338 0x30343934	7F 34 A0 51 1D 7C B8 09 17 C8 04 94	Transponder-ID (here with a 12-byte EPC)
31..34	4	0x43423939	CB99	EPC CRC (from the EPC memory bank)
35	1	0x31	1	Antenna number, ASCII-Character: <ul style="list-style-type: none"> <li>„1“: Antenna 1</li> <li>„2“: Antenna 2</li> <li>„3“: Antenna 3</li> <li>„4“: Antenna 4</li> </ul>
36	1	0x03	03 (ETX)	End of Text
37	1	0x05	05	BCC
38	1	0x0D	0D (CR)	Carriage Return, End of telegram

39 Bytes in total.

**3.4.2 RS485 Serial Line**

The communication via RS485 starts with “SOH” instead of “STX”.

Furthermore, receiving of the telegram must be acknowledged by the RS485 bus master. If it isn't acknowledged, the telegram is repeated 10 times.

**Telegram from Bluebox to PC/SPS with Transponder-ID**

Byte #	Number of Bytes	Data	Value	Description
0	1	0x01	SOH	Start of Header, Start of telegram
1..2	2	0x4646	FF (255)	Device address
3	1	0x06	ACK	Acknowledge
4	1	0x05	05	BCC
5	1	0x0D	0D (CR)	Carriage Return, End of telegram

6 Bytes in total.

This telegram from the RS485 bus master must be sent within 250 ms (timeout).

The repetitions of the telegram are sent in random time intervals from 1 to 5000 ms. This way, collisions on the RS485 bus shall be avoided.

**3.4.3 LF- and HF-Versions**

With the LF-Versions with 2 antennas you always get the antenna number after the transponder-ID. A Hitag 1 is considered UNIQUE with 5 byte, meaning you get 10 byte of a ASCII-coded hex number.

With the HF-Versions of the Bluebox you always get the transponder type before the transponder-ID.



## Appendix A – ASCII Characters used in Telegrams

SOH	01h (0x01)
STX	02h (0x02)
ETX	03h (0x03)
EOT	04h (0x04)
ENQ	05h (0x05)
ACK	06h (0x06)
NAK	15h (0x15)
SYN	16h (0x16)
CR	0Dh (0x0D)
`0`...`9`	30h..39h (0x30..0x39)
`A`...`F`	41h..46h (0x41..0x46)
< . . >	30h..39h (0x30..0x39), 41h..46h (0x41..0x46)
<bcc>	Checksum