UHF
RFID System

BLUEBOX CX Industrial UHF 5346-T

Preface

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Safety Instructions / Warning - Read before start-up!

- The device may only be used for the intended purpose designed by the manufacturer. The operation manual should be conveniently kept available at all times for each user.
- Unauthorized changes and the use of spare parts and additional devices that have not been sold or recommended by the manufacturer may cause fire, electric shocks or injuries. Such unauthorized measures shall exclude any liability by the manufacturer.
- The liability-prescriptions of the manufacturer in the issue valid at the time of purchase are valid for the device. The manufacturer shall not be held legally responsible for inaccuracies, errors, or omissions in the manual or automatically set parameters for a device or for an incorrect application of a device.
- Repairs may be executed by the manufacturer only.
- Only qualified personnel should carry out installation, operation, and maintenance procedures.
- Use of the device and its installation must be in accordance with national legal requirements and local electrical codes.
- When working on devices the valid safety regulations must be observed.

CE IP67 

This manual applies to the following devices:

Description:	Order Number:	
Long Range read / write UHF RFID device with up to 2 external antennas. Serial RS232/RS485 and Ethernet 10-100M communication interface on M12 4 poles D-coded female connector. EU (865 MHz … 868MHz) version.	5346U-T	

The devices object of this manual differ from standard parts for:

- Operating features (described in detail in next sections).
- Protocol specifications (described in detail in next sections).

See the user and protocol manuals of the standard parts as user and protocol manuals of these devices, as described in the following cross reference table, except of the differences listed above.

Order Number	Standard Part
5346U-T	5346U

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1 Differences from Standard Parts

This section provides details on the differences from the standard parts.

1.1 Operating Features

In 'continuous' mode the **BLUEBOX** is characterized by the coexistence of 2 'parallel' and asynchronous activities: the tag identification (inventory) and the communication with the 'host' system. The 'continuous' identification activity interacts with the communication activity through a buffer that contains the code of the last identified tags or that is empty indicating the absence of tags. Due to synchronization and filtering reasons, the buffer is handled for each identified tag by a parameter defined as 'hold time' (same as 'filter time' defined below, to be set in the range of 0 … 99 seconds or 0 ... 99 minutes, default value 1 second) and allows to extend 'artificially' the presence of the tag after it leaves the antenna's influence area; this behavior is observable looking at the yellow led status that is 'on' indicating the presence of tags and also through the activation of the relay nr 1 (if its 'automatic' management is enabled by the flag defined in the general parameters). Through the command 'data request' it is possible to get the data contained in the buffer.

The **BLUEBOX** handles also a 100 elements FIFO queue which is combined with the 'filter time' general parameter (to be set in a range of 0 … 99 seconds or 0 ... 99 minutes, default value 1 second) that prevents the queue saturation in case of a tag 'continuous' presence. When a tag is identified, the **BLUEBOX** verifies if it belongs to the list of read tags. If the tag do not belong to the list (it is defined as 'new'), its code will be inserted in the queue, a filter time assigned to the tag will be started and the buzzer will be activated for 0.5 seconds (if its 'automatic' management is enabled by the flag defined in the general parameters). Otherwise (the tag belong to the list of read tags), the **BLUEBOX** verifies if the relative filter time is expired. In this case (the filter time is expired), the tag is defined as 'new' and will be processed as described above, otherwise only the relative filter time will be rearmed. Through the command 'queue data request' and the relative 'ack', it is possible to get the data contained in the queue and unload it.

Buffer and FIFO queue will hold onto a maximum of 82 bytes of tag data. Once the 82 bytes of tag data limit is reached, the exceeded bytes will be discarded!

In 'continuous' mode the **BLUEBOX** can be configured to obtain the behavior of a 'spontaneous' reader that will send a message on the serial line (if available) and/or on the Ethernet 10-100M connection (if available), as a TCP Server or

TCP Client. This feature is enabled (on) / disabled (off) by the switch 2 of the dip switch SW1 or via communication software.

- If configured and available an host can receive the 'spontaneous' message through the serial port. The 'spontaneous' message is sent only once and no ACK/NAK reply message is implemented, see the protocol manual for details. Do not use the 'spontaneous' message feature in a RS485 'multipoint' network to avoid communication errors due to unmanaged collisions on RS485 bus!

- If configured and available an host can connect the reader on the configured TCP server socket and wait for 'spontaneous' messages. The 'spontaneous' message is sent only once and no ACK/NAK reply message is implemented except of the normal TCP handshake mechanism, see the protocol manual for details.

- If configured and available an host can wait for an incoming TCP connection to receive the 'spontaneous' messages. The 'spontaneous' message is sent only once and no ACK/NAK reply message is implemented except of the normal TCP handshake mechanism, see the protocol manual for details. On a succesful connection there is a fixed inactivity timeout of 120 seconds.

In case of a 'spontaneous' message send error, due to a connection or communication error, no further attempts will be made and the tag will be discarded!

BLUEBOX will hold onto a maximum of 10 tags when configured to use the 'spontaneous' message. Once the 10 tag limit is reached, the new tags will be discarded!

A subset of the 'continuous' mode is also defined:

- 'Trigger' mode: the activation and deactivation of the 'continuous' mode is triggered with inputs. The trigger could be level sensitive or edge sensitive depending on the 'extension time' setting (to be set in a range of 0 … 99 seconds or 0 ... 99 minutes, default value 0 seconds).

The **BLUEBOX** allows the execution of 'on request' functions. During the execution of these functions, the 'continuous' identification activity will be suspended temporarily; the involved commands are relative to device configuration and tag read/write specific activities.

If not required, the 'continuous' identification activity can be disabled through flags defined in the general parameters. In this case, the **BLUEBOX** will only execute the 'on request' commands already defined above.

'Test' modes are also defined:

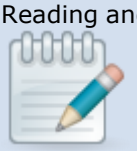
- 'RF Reading' test: in 'continuous' mode allows the user to easily and quickly test the read range of the reader with fast beeping (100ms) the buzzer for every identified tag. This 'test' mode is stored in non volatile memory and its status is kept at every reader restart and until it is disabled.
- 'RF Power' test: allows the user to easily and quickly test the minimum RF output power needed to read a tag in a fixed position. The reader sweeps from the minimum RF output power to maximum RF output power or until it finds a tag, increasing the RF power of 1 dB every 500ms with fixed Q selection algorithm and Q=0. It is an 'on request' function which temporarily suspends the 'continuous' mode.
- 'RF Sensitivity' test: allows the user to easily and quickly test the minimum RF input sensitivity needed to read a tag in a fixed position. The reader sweeps from the minimum RF input sensitivity to maximum RF input sensitivity or until it finds a tag, increasing the RF sensitivity of 1 dB every 500ms with fixed Q selection algorithm and Q=0. It is an 'on request' function which temporarily suspends the 'continuous' mode.
- Read Reflected Power: allows the user to read the reflected power of the antenna at a given frequency to check the antenna connection.
- Read RSSI: allows the user to read the signal strengh received by the antenna at a given frequency to check the presence of external RF sources.

The **BLUEBOX** integrates an RF antenna tuning feature which allows the usage of the reader in many different environments and configurations. The auto antenna tuning is done at every power on and during normal operations of the reader based on RF tuning configuration parameters described in next sections.

1.1.1 General Parameters

This section provides details on the configurable general parameters of the **BLUEBOX**.

Parameter	Description	Range	Default
Device Address	Device address of the reader on serial interface.	0 … 254	1

Parameter	Description	Range	Default
Baud Rate	Communication baud rate on serial interface.	1200 2400 4800 9600 19200 38400	9600
Data Bits	Data bits on serial interface.	7 8	8
Stop Bits	Stop bits on serial interface.	1 2	1
Parity	Parity on serial interface.	None Even Odd	None
Filter Time	Reading and tag queue management filter time.  Note that 0 setting is internally overwritten with 1 second.	0 … 99 sec 0 … 99 min	2 seconds
Buzzer Management	Buzzer management on 'new tag' event.	Disabled Enabled	Enabled
Output 1 Management	Output 1 activation on tag presence / new tag event.	Disabled Enabled	Disabled
Reading Antenna Information	To add the reading antenna information to the tag's code.	Disabled Enabled	Disabled
Transponder Type Information	To add the transponder type information in the tag's code.	Disabled Enabled	Disabled
'Spontaneous' Mode	Spontaneous mode activation. It is OR'ed with the dip switch SW1-2 setting.	Disabled Enabled	Disabled
Trigger 'Continuous' Mode with Inputs	'Continuous' mode activation management with inputs.	Disabled Enabled	Disabled
'Continuous' Mode	'Continuous' mode. If activated overrides the trigger 'continuous' mode with inputs setting.	Disabled Enabled	Disabled

The general parameters are managed through the 'Read RAM General Parameters' and 'Write ROM General Parameters' commands as described in protocol technical manuals where the parameters 1…7 fields with default values are:

1	2	3	4	5	6	7
Device Address	Serial1	Serial2	0x00	0x00	Filter Time	Functional Flags
0x00	**0x38**	**0x10**	**0x00**	**0x00**	**0x01**	**0x01**

Where:

Parameter	Description
Device Address	Device address of the reader on serial interface in the range 0 … 254.

Serial1	Serial interface communication settings.
	• High nibble: baud rate:
	  ○ 0x0: 1200 bps;
	  ○ 0x1: 2400 bps;
	  ○ 0x2: 4800 bps;
	  ○ 0x3: 9600 bps;
	  ○ 0x4: 19200 bps;
	  ○ 0x5: 38400 bps;
	• Low nibble: data bits:
	  ○ 0x7: 7 bits;
	  ○ 0x8: 8 bits.

Serial2	Serial interface communication settings.
	• High nibble: stop bits:
	  ○ 0x1: 1 bits;
	  ○ 0x2: 2 bits.
	• Low nibble: parity:
	  ○ 0x0: None;
	  ○ 0x1: Even;
	  ○ 0x2: Odd.

Filter Time	Reading management filter time (0 setting is internally overwritten with 1 second): • Decimal 0 … 99 for time in seconds (0 … 99 seconds); • Decimal 100 … 199 for time in minutes (0 … 99 minutes).
Functional Flags	Functional flags. Single bits are dedicated to disable (0 value) or enable (1 value) functions:

Bit	Description
Bit 7	Automatic buzzer management
Bit 6	Automatic output 1 management
Bit 5	Reading antenna information
Bit 4	Transponder type information
Bit 3	‘Spontaneous’ mode
Bit 2	Not used

Parameter	Description	
	Bit 1	'Continuous' mode with inputs
	Bit 0	'Continuous' mode (0=enabled, 1=disabled).

1.1.2 Configuration Parameters

This section provides details on the configurable operational parameters of the **BLUEBOX**.

1.1.2.1 Ethernet Interface

This section provides details on the configurable Ethernet interface parameters of the **BLUEBOX**

Parameter	Description	Range	Default
IP Address	IP address.  Note that this parameter become effective only after a reboot of the reader.	IPv4	192.168.4.200
Port	Communication port.  Note that this parameter become effective only after a reboot of the reader.	0 … 65535	3000
Subnet	Subnet mask.  Note that this parameter become effective only after a reboot of the reader.	IPv4	255.255.255.0
Gateway	Gateway address.  Note that this parameter become effective only after a reboot of the reader.	IPv4	0.0.0.0

The Ethernet interface parameters are stored in configuration page nr. 0x80 and are managed through the 'Read RAM/ROM Configuration Parameters' and 'Write RAM/ROM Configuration Parameters' commands as described in protocol technical manuals where the parameters 1…14 fields with default values are:

1	2	3	4	5	6	7
PortH	PortL	IP0	IP1	IP2	IP3	Subnet0
0x0B	0xB8	0xC0	0xA8	0x04	0xC8	0xFF

8	9	10	11	12	13	14
Subnet1	Subnet2	Subnet3	Gateway0	Gateway1	Gateway2	Gateway3
0xFF	0xFF	0x00	0x00	0x00	0x00	0x00

Where:

Parameter	Description
IP0 … IP3	IP address.
PortH	TCP communication port. MSB.
PortL	TCP communication port. LSB.
Subnet0 … Subnet3	Subnet mask.
Gateway0 … Gateway3	Gateway address.

1.1.2.2 Remote Server

This section provides details on the configurable remote server parameters of the **BLUEBOX**

Parameter	Description	Range	Default
IP Address	'Spontaneous' message remote server IP address. 0.0.0.0 to disable the 'spontaneous' message as TCP client.  Note that this parameter become effective only after a reboot of the reader.	IPv4	0.0.0.0
Port	'Spontaneous' message remote server TCP communication port. 0 to disable the	0 … 65535	0

Parameter	Description	Range	Default
	'spontaneous' message as TCP client, 80 or 8080 to enable the 'spontaneous' message with HTTP POST messages.  Note that this parameter become effective only after a reboot of the reader.		
Connection Time	'Spontaneous' message remote server maximum connection time.  Note that this parameter become effective only after a reboot of the reader.	1 … 99 seconds 1 … 99 minutes	1 sec

The remote server parameters are stored in configuration page nr. 0x81 and are managed through the 'Read RAM/ROM Configuration Parameters' and 'Write RAM/ROM Configuration Parameters' commands as described in protocol technical manuals.

The parameters 1…14 fields with default values of page 0x81 are:

1	2	3	4	5	6	7
PortH	PortL	IP0	IP1	IP2	IP3	Connection Time
0x00	**0x00**	**0x00**	**0x00**	**0x00**	**0x00**	**0x01**

8	9	10	11	12	13	14
0x00	0x00	0x00	0x00	0x00	0x00	0x01
0x00	**0x00**	**0x00**	**0x00**	**0x00**	**0x00**	**0x01**

Where:

Parameter	Description
PortH	'Spontaneous' message remote server TCP communication port. MSB.
PortL	'Spontaneous' message remote server TCP communication port. LSB.
IP0	'Spontaneous' message remote server IP address.

Parameter	Description
… IP3	
Connection Time	'Spontaneous' message remote server maximum connection time: • Decimal 0 … 99 for time in seconds (0 … 99 seconds); • Decimal 100 … 199 for time in minutes (0 … 99 minutes).

1.1.2.3 Input / Output

This section provides details on the configurable input / output parameters of the **BLUEBOX**

Parameter	Description	Range	Default
Input 1 Mode	Input 1 activation / deactivation mode of the 'continuous' mode in 'trigger' mode.  Note that this parameter become effective only after a reboot of the reader.	0, 1, 2, 3, 4, 5, 6	1
Input 2 Mode	Input 2 activation / deactivation mode of the 'continuous' mode in 'trigger' mode.  Note that this parameter become effective only after a reboot of the reader.	0, 1, 2, 3, 4, 5, 6	0
Extension Time	'Continuous' mode activation / deactivation management with inputs extension time. • In 'trigger' mode, if =0 the trigger is level sensitive, otherwise it is edge sensitive and defines the 'continuous' mode activation time extension after the input deactivation. • In 'gate' mode this time defines the 'continuous' mode activation time extension after the crossing of the gate. It filters any input change until the end of this time.  Note that this parameter become effective only after a reboot of the reader.	0 … 99 seconds 0 … 99 minutes	0
Debounce Time	The inputs debounce time.	0.00 … 0.99 seconds	0

Parameter	Description	Range	Default
	 Note that 0 setting is internally overwritten with 50ms.  Note that this parameter become effective only after a reboot of the reader.	0.0 … 9.9 seconds	
Output 1 Time	The output 1 activation time with output 1 activation on tag presence / new tag event enabled. If =0 the output 1 is continuously activated with the tag presence, otherwise is activated with a new tag event for a time defined by this parameter.  Note that this parameter become effective only after a reboot of the reader.	0 … 99 seconds 0 … 99 minutes	0

Where the input mode range means

- 0: Disabled;
- 1: ON -> Activate antenna 1 & 2; OFF -> Deactivate antenna 1 & 2;
- 2: OFF -> Activate antenna 1 & 2; ON -> Deactivate antenna 1 & 2;
- 3: ON -> Activate antenna 1; OFF -> Deactivate antenna 1;
- 4: OFF -> Activate antenna 1; ON -> Deactivate antenna 1;
- 5: ON -> Activate antenna 2; OFF -> Deactivate antenna 2;
- 6: OFF -> Activate antenna 2; ON -> Deactivate antenna 2.

The input 1 and 2 modes combination allowed are

Input 1 Mode	Input 2 Mode
ON -> Activate antenna 1 & 2; OFF -> Deactivate antenna 1 & 2	Disabled
OFF -> Activate antenna 1 & 2; ON -> Deactivate antenna 1 & 2	Disabled
Disabled	ON -> Activate antenna 1 & 2; OFF -> Deactivate antenna 1 & 2
Disabled	OFF -> Activate antenna 1 & 2; ON -> Deactivate antenna 1 & 2

Input 1 Mode	Input 2 Mode
Disabled	ON -> Activate antenna 1; OFF -> Deactivate antenna 1
Disabled	OFF -> Activate antenna 1; ON -> Deactivate antenna 1
Disabled	ON -> Activate antenna 2; OFF -> Deactivate antenna 2
Disabled	OFF -> Activate antenna 2; ON -> Deactivate antenna 2
ON -> Activate antenna 1; OFF -> Deactivate antenna 1	Disabled
ON -> Activate antenna 1; OFF -> Deactivate antenna 1	ON -> Activate antenna 2; OFF -> Deactivate antenna 2
ON -> Activate antenna 1; OFF -> Deactivate antenna 1	OFF -> Activate antenna 2; ON -> Deactivate antenna 2
OFF -> Activate antenna 1; ON -> Deactivate antenna 1	Disabled
OFF -> Activate antenna 1; ON -> Deactivate antenna 1	ON -> Activate antenna 2; OFF -> Deactivate antenna 2
OFF -> Activate antenna 1; ON -> Deactivate antenna 1	OFF -> Activate antenna 2; ON -> Deactivate antenna 2
ON -> Activate antenna 2; OFF -> Deactivate antenna 2	Disabled
ON -> Activate antenna 2; OFF -> Deactivate antenna 2	ON -> Activate antenna 1; OFF -> Deactivate antenna 1
ON -> Activate antenna 2; OFF -> Deactivate antenna 2	OFF -> Activate antenna 1; ON -> Deactivate antenna 1
OFF -> Activate antenna 2; ON -> Deactivate antenna 2	Disabled
OFF -> Activate antenna 2; ON -> Deactivate antenna 2	ON -> Activate antenna 1; OFF -> Deactivate antenna 1
OFF -> Activate antenna 2; ON -> Deactivate antenna 2	OFF -> Activate antenna 1; ON -> Deactivate antenna 1

The input / output parameters are stored in configuration page nr. 0x05 and are managed through the 'Read RAM/ROM Configuration Parameters' and 'Write RAM/ROM Configuration Parameters' commands as described in protocol technical manuals where the parameters 1…7 fields with default values are:

1	2	3	4	5	6	7

Input1 Mode	Input2 Mode	Extension Time	0x00	Debounce Time	Output 1 Time	0x00
0x01	**0x00**	**0x00**	**0x00**	**0x00**	**0x00**	**0x00**

Where:

Parameter	Description
Input1 Mode	Input 1 activation / deactivation mode of the 'continuous' mode in 'trigger' mode: • 0x00: Disabled; • 0x01: ON -> Activate antennas; OFF -> Deactivate antennas; • 0x02: OFF -> Activate antennas; ON -> Deactivate antennas; • 0x03: ON -> Activate antenna 1; OFF -> Deactivate antenna 1; • 0x04: OFF -> Activate antenna 1; ON -> Deactivate antenna 1; • 0x05: ON -> Activate antenna 2; OFF -> Deactivate antenna 2; • 0x06: OFF -> Activate antenna 2; ON -> Deactivate antenna 2.
Input2 Mode	Input 2 activation / deactivation mode of the 'continuous' mode in 'trigger' mode: • 0x00: Disabled; • 0x01: ON -> Activate antennas; OFF -> Deactivate antennas; • 0x02: OFF -> Activate antennas; ON -> Deactivate antennas; • 0x03: ON -> Activate antenna 1; OFF -> Deactivate antenna 1; • 0x04: OFF -> Activate antenna 1; ON -> Deactivate antenna 1; • 0x05: ON -> Activate antenna 2; OFF -> Deactivate antenna 2; • 0x06: OFF -> Activate antenna 2; ON -> Deactivate antenna 2.
Extension Time	'Continuous' mode activation/deactivation management with inputs extension time. • In 'trigger' mode, if =0 the trigger is level sensitive, otherwise it is edge sensitive and this time defines the 'continuous' mode activation time extension. • In 'gate' mode it defines the 'continuous' mode activation time extension after the crossing of the gate. And the values allowed are: • Decimal 0 … 99 for time in seconds (0 … 99 seconds); • Decimal 100 … 199 for time in minutes (0 … 99 minutes).
Debounce Time	The inputs anti-bounce time. 0 setting is internally overwritten with 50ms. • Decimal 0 … 99 for time in mseconds (0 … 990 mseconds) • Decimal 100 … 199 for time in seconds (0.0 … 9.9 seconds)
Output 1 Time	Output 1 activation time with output 1 activation on tag presence / new tag event enabled. If =0 the output 1 is continuously activated with the tag presence, otherwise is activated with a new tag event for a time defined by this parameter. • Decimal 0 … 99 for time in seconds (0 … 99 seconds); • Decimal 100 … 199 for time in minutes (0 … 99 minutes).

1.1.2.4 'Spontaneous' Message

This section provides details on the configurable 'spontaneous' message parameters of the **BLUEBOX**

Parameter	Description	Range	Default
Message on Serial Interface	'Spontaneous' message on serial interface activation/deactivation. Note that this parameter become effective only after a reboot of the reader.	Disabled Enabled	Enabled
Message on Ethernet (TCP Server, TCP Client)	'Spontaneous' message on Ethernet (TCP server or TCP client, see the remote server parameters) interface activation/deactivation. Note that this parameter become effective only after a reboot of the reader.	Disabled Enabled	Enabled

The 'spontaneous' message parameters are stored in configuration page nr. 0x09 and are managed through the 'Read RAM/ROM Configuration Parameters' and 'Write RAM/ROM Configuration Parameters' commands as described in protocol technical manuals where the parameters 1…7 fields with default values are:

1	2	3	4	5	6	7
0x00	Interface	0x00	0x00	0x00	0x00	0x00
0x00	**0x00**	**0x00**	**0x00**	**0x00**	**0x00**	**0x00**

Where:

Parameter	Description
Interface	The interface where to send the 'spontaneous' message activation/deactivation. Single bits are dedicated to enable (0 value) or disable (1 value) an interface:

Bit	Description
Bit 7	Not used
Bit 6	Not used
Bit 5	Not used
Bit 4	Not used
Bit 3	Not used
Bit 2	Not used
Bit 1	Ethernet (TCP server, TCP client)
Bit 0	Serial interface

1.1.2.5 RF and EPC C1G2 (Class-1 Gen-2)

This section provides details on the configurable RF and EPC C1G2 (Class-1 Gen-2) parameters of the **BLUEBOX**

Parameter	Description	Range	Default
RF Geographical Region	RF geographical region.  Note that ETSI, FCC and Brazil readers cannot be altered and only operate per the regulatory laws in USA/Canada, the European Union and Brazil.	EU1: ETSI FCC: FCC BRA: Brazil	EU1: ETSI FCC: FCC BRA: Brazil
RF Trasmit Power	RF conducted transmit power in dBm.  Refer to country specific regulations for limitations. You, the user, are responsible to ensure operation with the correct RF settings and are solely responsible for any fines and other damages due to incorrect or non-compliant country/region settings.	(See the technical specifications section)	20 dBm
RF Receive Sensitivity	RF receive sensitivity in dBm.	-49 … -85 dBm	-76 dBm
RF Channel	RF channel.  Note that 0 value stands for default settings of the selected region.  Refer to country specific regulations for channel allocation within the band. You, the user, are responsible to ensure operation with the correct RF settings and are solely responsible for any fines and other damages due to incorrect or non-compliant country/region settings.	EU1: 0 … 10 FCC: 0 … 50 BRA: 0 … 50	0
Antenna 1 Activation	Activation of antenna 1.	Disabled Enabled	Enabled
Antenna 2 Activation	Activation of antenna 2 (for devices with up to 2 antennas).	Disabled Enabled	Disabled
RF Channel Allocation Time	The maximum period of consecutive transmission on the same RF channel.  Note that 0 value stands for default settings of the selected region.	0.00 … 0.99 seconds 0 … 99 seconds	0

Parameter	Description	Range	Default
	 Refer to country specific regulations for limitations. You, the user, are responsible to ensure operation with the correct RF settings and are solely responsible for any fines and other damages due to incorrect or non-compliant country/region settings.		
RF Channel Pause Time	The minimum time between two consecutive transmissions in the same RF channel.  Note that 0 value stands for default settings of the selected region.  Refer to country specific regulations for limitations. You, the user, are responsible to ensure operation with the correct RF settings and are solely responsible for any fines and other damages due to incorrect or non-compliant country/region settings.	0.00 … 0.99 seconds 0 … 99 seconds	0
RF Chip Standby Mode	Activation / deactivation of the standby mode of the RF chip during RF off conditions to reduce power consumption and temperature increase.	Disabled Enabled	Enabled
RSSI Information	The detection tag's signal RSSI I and Q measured values information.  Note that this parameter become effective only after a reboot of the reader.	Disabled Enabled	Disabled
Max RSSI Information	The detected tag's signal max RSSI I and Q measured values information.  Note that this parameter become effective only after a reboot of the reader.	Disabled Enabled	Disabled
Tag Read Count Information	The tag read count information.  Note that this parameter become effective only after a reboot of the reader.	Disabled Enabled	Enabled

Hereinafter the configurable EPC C1G2 (Class-1 Generation-2) parameters of the **BLUEBOX**.

Parameter	Description	Range	Default
Inventory Mode	How the reader does an inventory in 'continuous' mode.	Fast Multi Tag Fast Single Tag Standard Multi Tag Standard Single Tag	Standard Multi Tag
R->T Link Frequency	R->T Link Frequency as defined in EPC Class 1 Generation 2 protocol.	40 kHz 160 kHz 256 kHz 320 kHz 640 kHz	160 kHz
R->T Bit Coding	R->T Bit coding as defined in EPC Class 1 Geneneration 2 protocol.	FM0 Miller 2 Miller 4 Miller 8	Miller 2
Q Selection Algorithm	The Q selection algorithm used for setting the slot-counter parameter as defined in EPC Class 1 Generation 2 protocol.	Dynamic Fixed	Dynamic
Q Value	The Q value used in fixed Q selection algorithm or the starting Q value used in dynamic Q selection algorithm as defined in EPC Class 1 Generation 2 protocol.	0 … 15	3
Q Initial	The minimum allowed Q value in dynamic Q algorithm mode.	0 … 15	0
Q Final	The maximum allowed Q value in dynamic Q algorithm mode.	0 … 15	4
Q Adjust Rounds	The maximum Q adjust rounds in dynamic Q algorithm mode.	0 … 5	3
Inventory Cycles	The inventory cycles in inventory command.	0 … 5	3
Search Mode	How the reader singulates (select) tags in 'continuous' mode.	Dual Target Single Target	Dual Target
Session	The session used as defined in EPC Class 1 Generation 2 protocol.	S0 S1 S2 S3	S0
Target	The target used as defined in EPC Class 1 Generation 2 protocol.	A B	A
EPC size	The size of the recognized EPC in bytes. 0 means all EPC sizes,	0 … 62	0

The RF and EPC C1G2 (Class-1 Generation-2) parameters are stored in configuration pages nr. 0x01, 0x02, 0x04 and 0x82 and are managed through the 'Read RAM/ROM Configuration Parameters' and 'Write RAM/ROM Configuration Parameters' commands as described in protocol technical manuals.

The parameters 1…7 fields with default values of page 0x01 are:

1	2	3	4	5	6	7
RF Receive Sensitivity	Functional Flags	0x00	0x00	0x00	0x00	0x00
0x4C	**0x00**	**0x00**	**0x00**	**0x00**	**0x00**	**0x00**

Where:

Parameter	Description
RF Receive Sensitivity	Absolute value of the RF input sensitivity.
Functional Flags	Functional flags. Single bits are dedicated to disable (0 value) or enable (1 value) functions:

Bit	Description
Bit 7	Not used
Bit 6	Not used
Bit 5	Not used
Bit 4	Not used
Bit 3	Max RSSI information
Bit 2	Tag read count information
Bit 1	RSSI information
Bit 0	To disable the RF chip standby mode (0=enabled, 1=disabled).

The parameters 1…7 fields with default values of page 0x02 are:

1	2	3	4	5	6	7
RF Geograph. Region	RF Transmit Power	RF Channel	Antennas Activation	EPC C1G2	RF Maximum Allocation Time	RF Minimum Pause Time
0x02	**0x14**	**0x00**	**0x01**	**0x30**	**0x00**	**0x00**

Where:

<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>RF Geographical Region</td><td>RF geographical region:
0x01: North America (FCC compliant);
0x02: Europe (ETSI compliant);
0x03: Brazil (FCC subset compliant).</td></tr>
<tr><td>RF Transmit Power</td><td>RF conducted transmit power.</td></tr>
<tr><td>RF Channel</td><td>RF channel. Channel 0 stands for default settings of the selected region.</td></tr>
<tr><td>Antennas Activation</td><td>A byte whose bits are dedicated to disable (0 value) or enable (1 value) the antennas to use:
<table>
<tr><th>Bit</th><th>Description</th></tr>
<tr><td>Bit 7</td><td>Not used</td></tr>
<tr><td>Bit 6</td><td>Not used</td></tr>
<tr><td>Bit 5</td><td>Not used</td></tr>
<tr><td>Bit 4</td><td>Not used</td></tr>
<tr><td>Bit 3</td><td>Not used</td></tr>
<tr><td>Bit 2</td><td>Not used</td></tr>
<tr><td>Bit 1</td><td>Antenna 2(for devices with up to 2 antennas).</td></tr>
<tr><td>Bit 0</td><td>Antenna 1</td></tr>
</table></td></tr>
<tr><td>EPC C1G2</td><td>A byte whose bits are dedicated to manage Q value and session/target parameters:
<table>
<tr><th>Bit</th><th>Description</th></tr>
<tr><td>Bit 7 ... 4</td><td>Q value in fixed Q selection algorithm or starting Q value in dynamic Q selection algorithm, as defined EPC Class 1 Generation 2 protocol (0x0=0 … 0xF=15)</td></tr>
<tr><td>Bit 3 … 2</td><td>Session as defined in EPC Class 1 Generation 2 protocol (00b=S0, 01b=S1, 10b=S2, 11b=S3)</td></tr>
<tr><td>Bit 1</td><td>Q selection algorithm (0=dynamic, 1=fixed);</td></tr>
<tr><td>Bit 0</td><td>Target as defined in EPC Class 1 Generation 2 protocol (0=A, 1=B)</td></tr>
</table></td></tr>
<tr><td>RF Maximum Allocation Time</td><td>The maximum period of consecutive transmission on the same RF channel. 0 stands for default settings of the selected region. The allowed values are:
Decimal 0 … 99 for time in mseconds (0 … 990 mseconds);
Decimal 100 … 199 for time in seconds (0 … 99 seconds).</td></tr>
<tr><td>RF Minimum Pause Time</td><td>The minimum time between two consecutive transmission in the same RF channel. 0 stands for default settings of the selected region. The allowed values are:
Decimal 0 … 99 for time in mseconds (0 … 990 mseconds);
Decimal 100 … 199 for time in seconds (0 … 99 seconds).</td></tr>
</table>

The parameters 1…7 fields with default values of page 0x04 are:

1	2	3	4	5	6	7

Inventory Mode	R->T Link Frequency	R->T Bit Coding	0x00	EPC Size	0x00	0x00
0x02	**0x02**	**0x01**	**0x00**	**0x00**	**0x00**	**0x00**

Where:

Parameter	Description
Inventory Mode	A byte whose bits are dedicated to manage the inventory mode, the search mode and the ReadAfterDetect info activation parameters:

Bit	Description
Bit 7	Not used
Bit 6	Search mode (how the reader singulates tags in 'continuous' mode): • 0b: Dual Target (the reader singulates tags in both A and B states) • 1b: Single Target (the reader singulates only tags that are in A state)
Bit 5	Activation of the ReadAfterDetect with custom info as defined in ReadAfterDetect Password, Bank, Address, Length and EPC Info parameters (0b=OFF, 1b=ON)
Bit 4	Activation of the ReadAfterDetect with auto TID info (0b=OFF, 1b=ON)
Bit 3 … 0	Inventory mode (how the reader does an inventory in 'continuous' mode): • 0x0: Fast Multi Tag: Inventory mode that does not take the tag to the Opened but to the Acknowledged state. This inventory mode is not as secure as the standard mode, but it is faster • 0x1: Fast Single Tag: The same inventory mode like the Fast Multi Tag, but with the slot count of 1. This has the effect that no anticollision procedure is performed • 0x2: Standard Multi Tag: Inventory mode like defined in the EPC C1G2 standard • 0x4: Standard Single Tag: The same inventory mode like the Standard Multi Tag, but with the slot count of 1. This has the effect that no anticollision procedure is performed

Note that allowed values are:

Inventory Mode	ReadAfterDetect with Custom Info	ReadAfterDetect with Auto TID	Search Mode
Fast Multi Tag, Fast Single Tag	Disabled	Disabled	Dual Target, Single Target
Standard Multi Tag, Standard Single Tag	Disabled	Disabled	Dual Target, Single Target
Standard Multi Tag, Standard Single Tag	Disabled	Enabled	Dual Target, Single Target
Standard Multi Tag, Standard Single Tag	Enabled	Disabled	Dual Target, Single Target

<table>
<tr><th>Parameter</th><th>Description</th></tr>
<tr><td>R->T Link Frequency</td><td>R->T link frequency:
0x00: 40 kHz;
0x02: 160 kHz;
0x04: 256 kHz;
0x05: 320 kHz;
0x06: 640 kHz.</td></tr>
<tr><td>R->T Bit Coding</td><td>R->T bit coding:
0x00: FM0;
0x01: Miller 2;
0x02: Millller 4;
0x03: Miller 8.
Note that allowed values are:
<table>
<tr><th>R->T Link Frequency</th><th>R->T Bit Coding</th></tr>
<tr><td>40 kHz</td><td>FM0, Miller 2, Miller 4, Miller 8</td></tr>
<tr><td>160 kHz</td><td>FM0, Miller 2, Miller 4, Miller 8</td></tr>
<tr><td>256 kHz</td><td>Miller 4, Miller 8</td></tr>
<tr><td>320 kHz</td><td>Miller 4, Miller 8</td></tr>
<tr><td>640 kHz</td><td>Miller 4, Miller 8</td></tr>
</table>
DRM (Dense Reader Mode):
<table>
<tr><th>R->T Link Frequency</th><th>R->T Bit Coding</th></tr>
<tr><td>256 kHz</td><td>Miller 4, Miller 8</td></tr>
<tr><td>320 kHz</td><td>Miller 4, Miller 8</td></tr>
</table></td></tr>
<tr><td>EPC Size</td><td>The size of the recognized EPC in bytes. 0 means all EPC sizes.</td></tr>
</table>

The parameters 1…14 fields with default values of page 0x82 are:

1	2	3	4	5	6	7
0x00	0x00	0x00	0x00	0x00	0x00	0x00
0x00	**0x00**	**0x00**	**0x00**	**0x00**	**0x00**	**0x00**

8	9	10	11	12	13	14
0x00	0x00	0x00	0x03	Q	Q Adjust Rounds	Inventory Cycles
0x00	**0x00**	**0x00**	**0x03**	**0x05**	**0x03**	**0x03**

Where:

Parameter	Description
Q	Minimum and maximum Q value to be used in dynamic Q selection algorithm: • High nibble: minimum Q value (0x0 … 0xF); • Low nibble: maximum Q value (0x0 … 0xF).
Q Adjust Rounds	Maximum Q adjust rounds in dynamic Q selection algorithm.
Inventory Cycles	The inventory cycles in inventory command.

1.1.2.6 RF Antenna Tuning

This section provides details on the configurable RF antenna tuning management parameters of the **BLUEBOX**

Parameter	Description	Range	Default
Max Tune Steps	The maximum runtime RF antenna tune steps. 0 to disable the runtime RF antenna tuning.	0 … 250	15
Max Tune Frequency Hops	The maximum RF frequency hops on the same RF frequency before RF antenna tuning.	0 … 250	15
Min Tune Frequency Hops	The minimum RF frequency hops on different RF frequency after RF antenna tuning.	0 … 250	15
Tune Hysteresis Index	The runtime RF antenna tune hysteresis index of measured reflected power.	10% … 50%	30%

The Tuning parameters are stored in configuration page nr. 0x0D and are managed through the 'Read RAM/ROM Configuration Parameters' and 'Write RAM/ROM Configuration Parameters' commands as described in protocol technical manuals where the parameters 1…7 fields with default values are:

1	2	3	4	5	6	7
Max Tune Steps	Max Tune Frequency Hops	Min Tune Frequency Hops	Tune Hysteresis Index	0x00	0x00	0x00
0x64	**0x0F**	**0x0F**	**0x1E**	**0x00**	**0x00**	**0x00**

Where:

Parameter	Description
Max Tune Steps	The maximum runtime RF antenna tune steps. 0 to disable the runtime RF antenna tuning.
Max Tune Frequency Hops	The maximum RF frequency hops on the same RF frequency before RF antenna tuning.
Min Tune Frequency Hops	The minimum RF frequency hops on different RF frequency after RF antenna tuning.
Tune Hysteresis Index	The runtime RF antenna tune hysteresis index of measured reflected power.

1.2 Protocol Specifications

The **BLUEBOX**'s firmware supports two different protocols on serial interface: **BLUEBOX** protocol and Tiris protocol. The Tiris protocol is the original protocol provided and all the **BLUEBOX** are delivered with this protocol as default. Users are advised to choose only one protocol that suits their needs, a software utility is provided to switch the protocol during the device startup as described in the sections below.

1.2.1 Device Startup

During the startup phase, it is possible to configure through the serial line the communication parameters of the **BLUEBOX** sending the following message (with the default communication settings 19200, n, 8, 1):

STX '2' 'F' <addn h> <addn l> <bdr> <bit> <stop> <par> ETX <bcc> CR

Where:

<add h> <add l>	New address to be set. ASCII encoded byte.
<bdr>	Serial interface baud rate. ASCII character: • '0' -> 1200 bps; • '1' -> 2400 bps; • '2' -> 4800 bps; • '3' -> 9600 bps; • '4' -> 19200 bps; • '5' -> 38400 bps.
<bit>	Serial interface data bits. ASCII character:

	• '7' -> 7 bits; • '8' -> 8 bits.
<stop>	Serial interface stop bits. ASCII character: • '1' -> 1 bit; • '2' -> 2 bits.
<par>	Serial interface parity. ASCII character: • '0' -> None; • '1' -> Even; • '2' -> Odd.
<bcc>	Block check character or checksum calculated as 'xor' of the previous characters starting from STX applying the following rule: if <bcc> = STX or <bcc> = CR, then <bcc> := <bcc>+1 (increment of 1).

If the **BLUEBOX** is able to execute the command, it answers with:

STX '2' 'F' '0' '0' <bcc> CR

The 'BLUEBOX Serial Config' program is provided to explicate these operations.

During the startup phase, it is also possible to configure through the serial line the serial interface communication protocol of the **BLUEBOX** sending the following message (with the default communication settings 19200, n, 8, 1):

STX '3' 'E' <prot h> <prot l> ETX <bcc> CR

Where:

<prot h> <prot l>	New protocol to be set on serial interface. ASCII encoded byte: • 0x00: BLUEBOX protocol; • 0x02: Tiris protocol.
<bcc>	Block check character or checksum calculated as 'xor' of the previous characters starting from STX applying the following rule: if <bcc> = STX or <bcc> = CR, then <bcc> := <bcc>+1 (increment of 1).

If the **BLUEBOX** is able to execute the command, it answers with:

STX '3' 'E' '0' '0' <bcc> CR

The 'BLUEBOX Protocol Switch' program is provided to explicate these operations.

1.2.2 Tiris Protocol Specifications

The 'master/slave' Tiris serial protocol expects that the **BLUEBOX** (as 'slave') after the reception of a message sent to it by the 'host' (as 'master'), sends back an answer message after a minimum time of about 10 ms. For the communication through the serial line interface, by default, the **BLUEBOX** will apply the following parameters: 'master/slave' protocol address 0, baud rate 9600 bps, 8 data bits, parity none and 1 stop bit. These parameters can be modified as specified in the 'Write ROM General Parameters' protocol command.

This is the general structure of a message from master to slave:

Byte	Contents
0	Start-Mark (SOH, 01h)
1	Dest-Address
2	Source-Address
3	Message-Code
4	Data-Length
5	Data-Field(1)
…	…
N+4	Data-Field(N)
N+5	CRC-Field(1)
N+6	CRC-Field(2)
N+7	End-Mark (EOT, 04h)

The **Start-Mark** signifies the beginning of a message. It is represented by the ASCII character SOH ('Start Of Header', 01h).

The **Dest-Address** indicates the destination of the message. The binary value corresponds to the unit ID of the destination or a special code for broadcast messages. Unit IDs range from 0x00 to 0xFE (254 decimal). The maximum number of units possible in a specific application will be determined by physical limitations like, for example: 31 readers on a RS485 bus. A destination address of 0xFF indicates a broadcast message.

The **Source-Address** indicates the source of the message. The binary value corresponds to the unit ID of the sending.

The **Message-Code** byte defines the meaning of the message. Depending on the direction of transfer, the code contained in this byte will be a **Command-Message-Code** (master-to-slave) or a **Response-Message-Code** (slave-to-master) unit.

The **Command-Message-Code** indicates to the slave the action requested by the master. It has the following structure:

Bit	Contents
7	Queued-Response Flag: • 0 = no queued response • 1 = queued response (not supported)
6	Command-Code (0 … 127)
5	
4	
3	
2	
1	
0	

The **Queued-Response-Flag** indicates that the destination unit should acknowledge and execute the command but that its response should be queued until requested by the master. This mechanism is utilized for certain commands which have a delayed response to avoid suspension of other line activity. The **Command-Code** indicates the operation requested by the master.

The **Response-Message-Code** indicates the slave's acknowledgment of the command. It has the following structure:

Bit	Contents
7	Error-Flag
6	Busy-Flag
5	Data-Available-Flag
4	Broadcast-Received-Flag
3	Response-Code (0 … 15)
2	

Bit	Contents
1	
0	

ll flags are set with '1' and reset with '0'.

The **Error-Flag** indicates that the slave detected an error in the transmission or contents of the command. The error encountered is described by the **Response-Code**.

The **Busy-Flag** indicates that the slave is temporarily unable to accept commands. The master can retry the command at a later time.

The **Data-Available-Flag** informs the master that there is at least one message in the slave's output queue. The master can access the queue by issuing the appropriate command.

The **Broadcast-Received-Flag** signifies that a previously broadcast message has been received correctly. The flag is set only if a broadcast message contained no errors and could be actioned. The response to the broadcast command will be queued and can be accessed by the master using a 'Send-Next' command. The flag is reset once it has been transmitted in a response message.

The **Response-Code** describes the error encountered in more details. Depending on the **Error-Flag** the **Response-Code** has different meanings:

- **Process-Response (Error-Flag = 0)**
    - 0 = Command-Completed: Indicates that a non-queued-response command has been received and executed correctly. Any relevant data will be contained in the data field.
    - 1 = Accepted (Queued): Indicates that a queued-response command has been correctly received and is being executed. The response will not be transmitted directly, however, but will be placed on the queue until requested by the master issuing a 'Send-Next' command.
    - 2 = Queue Empty: Indicates that there is no message in the queue.
    - 3 = Nothing to resend: Indicates that there is no information for resending available.
- **Error-Response (Error-Flag = 1)**

- 0 = Transmission-Error: Indicates that the slave received a message containing its own destination ID but found an error in the data. The slave uses this code to signify that either the message failed the CRC check or the complete frame was not received within the expected time.
- 1 = Command-Invalid: Indicates that although the complete message frame was received and the CRC check was correct, the command code is not valid for this slave. This could e.g. result from the use of a wrong slave destination ID.
- 2 = Task-Error: Indicates that, while the transmission was successful, the command was rejected by the processing task.
- 3 = Data field length-Error: Indicates that the command was not executed because the data field length was wrong.
- 4 = Parameter-Error: Indicates that the command was not executed due to an invalid parameter

The **Data-Length** byte indicates the length, in bytes, of the following data field. If no data field is required by the command or response, **Data-Length** will be zero. Otherwise, the binary value (1 to 255 decimal) defines the number of data bytes which will follow.

The **Data-Field** exists only if **Data-Length** is non-zero. It consists of the number of bytes specified in **Data-Length**. The content of the field depends on the message code and may include any byte value. There is no special end code for the data section.

The **CRC** field is a two-byte value containing the Longitudinal Redundancy Check (LRC) values for the preceding message. The LRC calculation is performed on the whole message excluding the 'SOH' character, the CRC field and the 'EOT' character. Each character is XORed with the previous value and the result is stored in the LSByte, the 1's Complement of the result is stored in the MSByte. If the MSB and the LSB are ANDed together the result is zero.

The **End-Mark** signifies the end of a message. It is represented by the ASCII character EOT ('End Of Transmission', 04h).

1.2.2.1 Device Reset

This command is used to restart the **BLUEBOX** (the device has the same behavior like when it is powered up).

Command-Code	0x5F

Description	Reset the device unit
Response Type	Immediate
Command Data	None
Returned Data	None

1.2.2.2 Get Version

This command is used to get the firmware version of the **BLUEBOX**.

Command-Code	0x40
Description	Returns a string of characters which contain the device firmware version. The length of the string is returned in the Data-Field-Length byte of the response.
Response Type	Immediate
Command Data	None
Returned Data	Version string

Where

Data Field Index	Content	Description
0 … strlen - 1	Version string	

1.2.2.3 Read Page N

This command is used to read a specified MPT (Multi Protocol Transponder) page.

Command-Code	0x21
Description	Single read of specified MPT page.
Response Type	Immediate
Command Data	Page No, range: 0x01 … 0x3F
Returned Data	Status, {ID, {Page No}}

Where, in command data:

Data Field Index	Content	Description
0	Page No	MPT page number to be read

and in returned data:

Data Field Index	Content	Description
0	Status	Read status
1 … 8	ID	MPT ID. LSB at Data-Field(1)
9	Page No	Read MPT page number

Depending on the returned status code, the data field length of this command varies. Possible status codes with the corresponding data field length are

Data Field Length	Status Code	Note
1	NO_READ INCOMPLETE MPTRERR_SPC_DATA MPTERERR_STATUS	
9	RO_TRP RW_TRP	Data fields 1 to 8 contain the read Transponder ID
10	MPTRP_U MPTRP_L MPTRERR_PAGE_U MPTRERR_PAGE_L	Data fields 1 to 8 contain the read Transponder ID. Data field element 9 contains the read page number

Where the status codes are

Status Code	Status Value	Description
RO_TRP	0x00	Successful read of RO transponder
RW_TRP	0x01	Successful read of R/W transponder
MPTCOTRP_U	0x02	Successful read of page 1 (unlocked) of an MPT as a result of a charge-only read
MPTCOTRP_L	0x03	Successful read of page 1 (locked) of an MPT as a result of a charge-only read
MPTRP_U	0x04	Successful read of an unlocked page of an MPT as a result of a read command
MPTRP_L	0x05	Successful read of a locked page of an MPT as a result of a read command
MPTRP_80_U	0x06	Successful read of an unlocked page of an MPT as a result of a read command in 80 bit mode

Status Code	Status Value	Description
MPTRP_80_L	0x07	Successful read of a locked page of an MPT as a result of a read command in 80 bit mode
RO_TRP_80	0x08	Successful read of a RO transponder in 80 bit mode
RW_TRP_80	0x09	Successful read of a R/W transponder in 80 bit mode
PROG_OK	0x30	Successful writing to a R/W transponder or MPT
LOCK_OK	0x31	Successful locking of an MPT
NO_READ	0x40	No transponder data received
INCOMPLETE	0x41	Transponder startbyte detected, but CRC check failed
MPTERR_CRC	0x42	MPT Frame CRC is O.K, but Data CRC check failed
MPTRERR_STATUS	0x43	Invalid status returned reading an MPT
MPTRERR_PAGE_U	0x44	Read unlocked page of an MPT, but it is different to the requested page
MPTRERR_PAGE_L	0x45	Read locked page of an MPT, but it is different to the requested page
MPTRERR_SPC_DATA	0x46	Special Data status returned reading an MPT
MPTPERR_STATUS	0x47	Invalid status returned writing an MPT
PERR_FALSE_ID	0x48	Different ID returned from writing a R/W transponder or MPT
MPTPERR_LOW_VOLT	0x49	Programming voltage is too low to write an MPT
MPTPERR_UNREL	0x4A	Writing to an MPT is not reliable
MPTPERR_LOCK	0x4B	Attempt to write a locked page of an MPT
MPTPERR_SPC_DATA	0x4C	Received Special Data status on writing an MPT
MPTPERR_PAGE_U	0x4D	Read unlocked page of an MPT as a result of writing an MPT, but it is different to the requested page
MPTPERR_PAGE_L	0x4E	Read locked page of an MPT as a result of writing an MPT, but it is different to the requested page
MPTLERR_STATUS	0x4F	Invalid status returned on locking an MPT page
MPTLERR_FS_DROP	0x50	Field strength dropped while locking an MPT page
MPTLERR_UNREL	0x51	Locking of an MPT page is not reliable

Status Code	Status Value	Description
MPTLERR_PAGE_U	0x52	Read unlocked page of an MPT as a result of locking an MPT, but it is different to the requested page
MPTLERR_PAGE_L	0x53	Read locked page of an MPT as a result of locking an MPT, but it is different to the requested page

1.2.2.4 Exchange BlueBox Command

This command is used to exchange a BlueBox command based on BlueBox protocol.

Command-Code	0x21
Description	Exchange a BlueBox command based on BlueBox protocol
Response Type	Immediate
Command Data	BlueBox command data
Returned Data	BlueBox returned data

Where, in command data:

Data Field Index	Content	Description
0 … N	BlueBox command data	BlueBox command data as defined in BlueBox protocol

and in returned data:

Data Field Index	Content	Description
0 … N	BlueBox returned data	BlueBox returned data as defined in BlueBox protocol

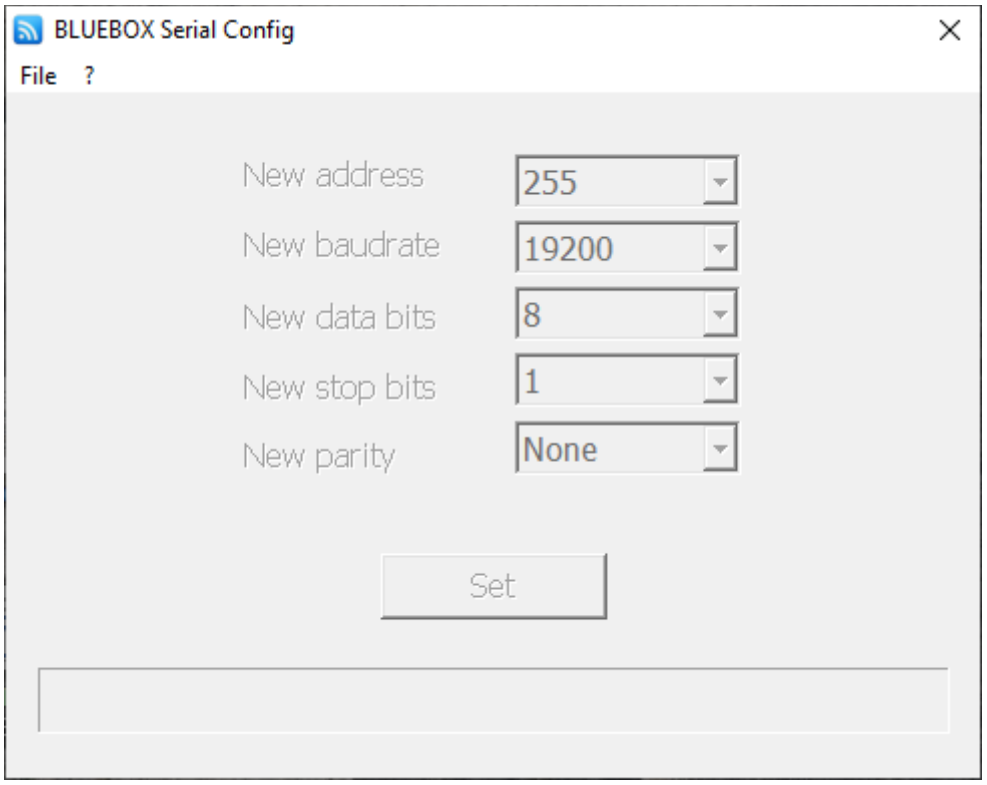
2 'BLUEBOX Serial Config' Software

This section provides details on the 'BLUEBOX Serial Config' software.

2.1 Software Startup

Double click on the 'BLUEBOX Serial Config' icon to start the software.

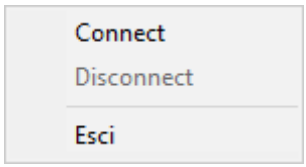
At software startup the following screenshot is shown



2.2 Menu

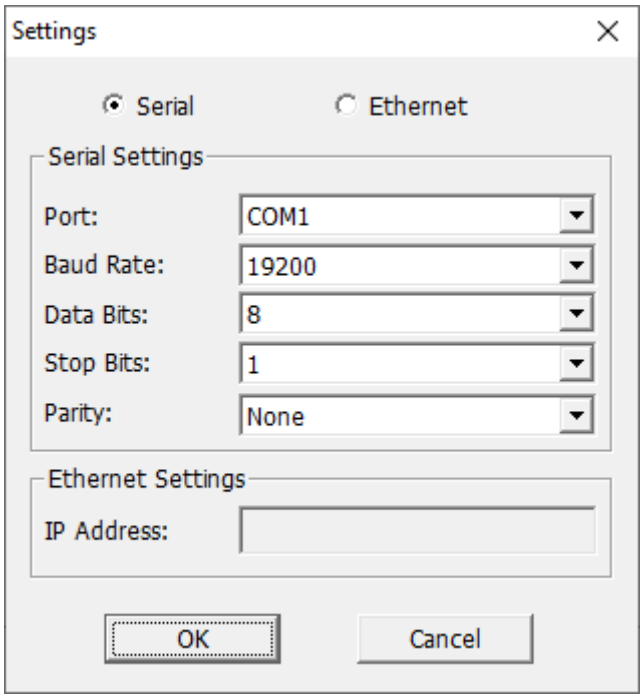
At the top of the software there is the menu bar.

2.2.1 File Menu



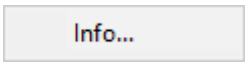
The File menu allows to select one of the following operations:

- Connect: to open the connection with the reader.



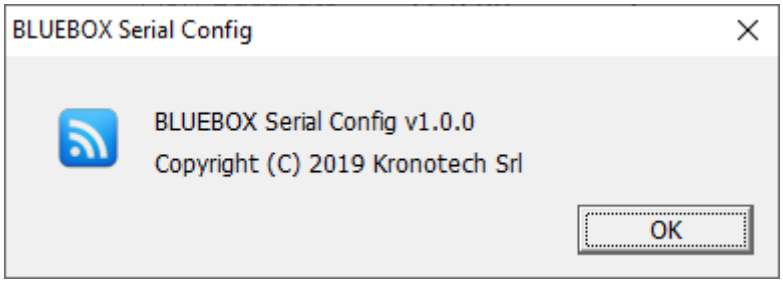
- Disconnect: to close the connection with the reader.
- Exit: to close the software.

2.2.2 Info Menu



The Info menu allows to select one of the following operations:

- About: to show the software info.



2.3 Software Usage

To set the communication parameters of the reader, first open the connection with the reader, then select the address to set from 0 to 255 and the serial settings and then click the Set button and power on the reader. A progress bar shows the communication progress. At the end a message box shows the status of the operation.

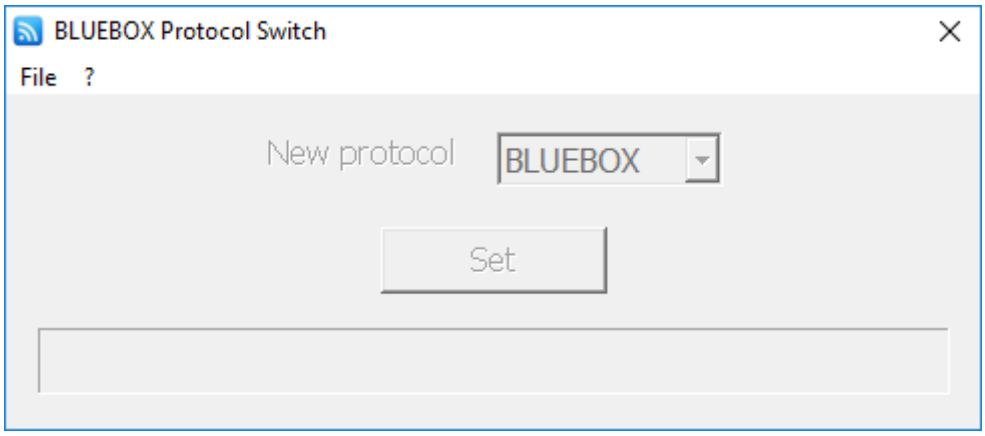
3 'BLUEBOX Protocol Switch' Software

Hereinafter the 'BLUEBOX Protocol Switch' software is shown.

3.1 Software Startup

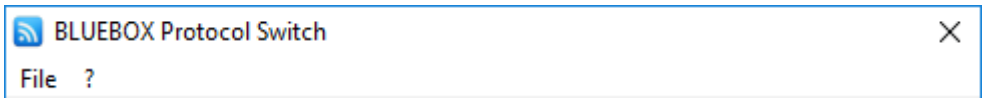
Double click on the 'BLUEBOX Protocol Switch' icon to start the software.

At software startup the following screenshot is shown

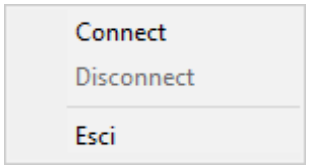


3.2 Menu

At the top of the software there is the menu bar.

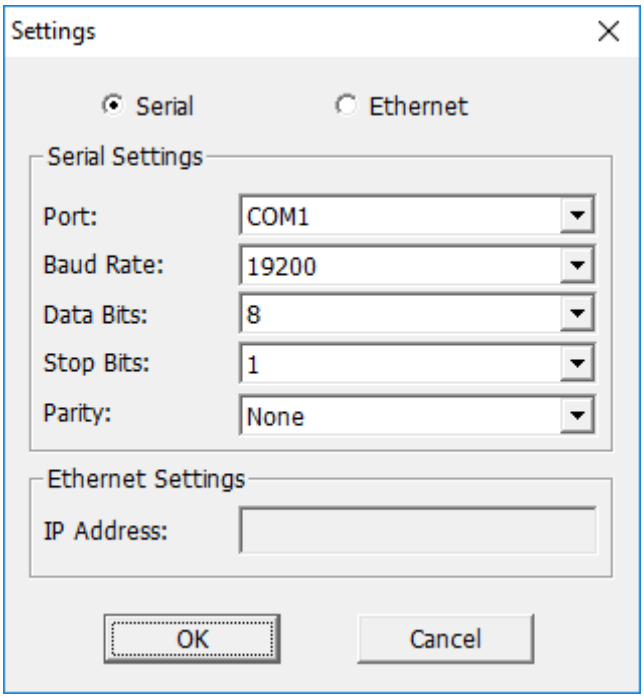


3.2.1 File Menu



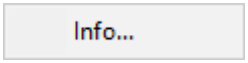
The File menu allows to select one of the following operations:

- Connect: to open the connection with the reader.



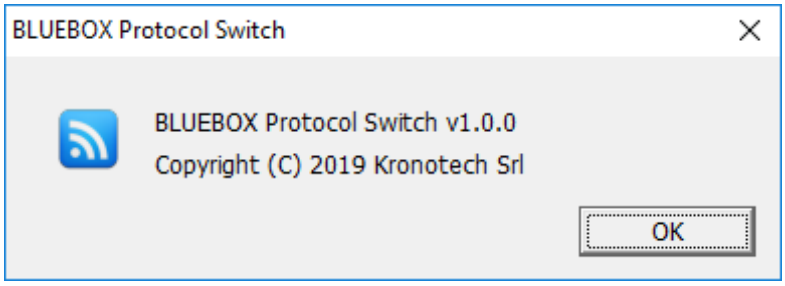
- Disconnect: to close the connection with the reader.
- Exit: to close the software.

3.2.2 Info Menu



The Info menu allows to select one of the following operations:

- Info…: to show the software info.



3.3 Software Usage

To set the protocol of the reader, first open the connection with the reader, then select the protocol to set from 0 (BLUEBOX protocol) to 2 (Tiris protocol) and then click the Set button and power on the reader. A progress bar shows the communication progress. At the end a message box shows the status of the operation.

4 Document Revision History

Date	Revision	Description
10/12/19	1.00	Preliminary release.
02/07/20	1.01	Changes in the operating features and general and configuration parameters. Added the 'BLUEBOX Serial Config' Software section. Added the tag's map description.

A. Data in UHF RFID Tag Memory

This section provides details on the data stored in the UHF RFID tag memory. GS1/EPCglobals standard defines data format, capture and query interfaces for RFID. This guideline details how to identify rail assets using GS1 Identification Keys and EPC Gen 2 UHF tags within the framework of the GS1 System. For the identification of rail assets in Europe the Global Individual Asset Identifier (GIAI) is recommended with GIAI-96 encoding.

A.1. UHF RFID Tag Memory Layout

Bank	Designation	Description
00	RESERVED	Kill and Access Passwords
01	EPC	The Global Individual Asset Identifier
10	TID	Tag Manufacturer Data
11	USER	User Memory: Asset Additional Info

A.1.1. Reserved Memory

Reserved memory contains kill and access password. The kill password is a 32-bit value stored in Reserved memory 00h to 1Fh, MSB first. The default (unprogrammed) value shall be zero. The access password is a 32-bit value stored in Reserved memory 20h to 3Fh, MSB first. It is calculated as follows:

GS1 Company Prefix => hex conversion => nibble reverse, zero pad left

A.1.2. EPC Memory

EPC memory contains a StoredCRC at addresses 00h to 0Fh, a StoredPC at 10h to 1Fh, an EPC beginning at 20h. The EPC contains the GIAI-96.

A.1.3. User Memory

User memory contains the asset additional info.

Word	Address	Content
0	00h … 0Fh	0IIN
1	10h … 1Fh	0KKK

Where:

0	Zero pad left
II	Index 01-99 (tag sequence number). This is required by the fuel terminal for the blacklist. If a transponder is stolen, the transponder is programmed again, e.g. with sequence number 02, and the transponder with sequence number 01 is transferred to the blacklist. This means that you can only refuel with the transponder where the sequence number is higher than the blacklist entry in the index.
N	User Type. The User Type controls the fuelling automat: • 0 = general transponder; • 1 = no further input from user needed; • 2 = entry of mileage/operating hours needed; • = entry of driver number needed; • 4 = entry of mileage/operating hours and driver number needed.
KKK	The Customer Number is or was important, because the vehicle number is or was not unique. (customer number: Page 3 = positions 15,14 and 13 from right) e.g. 123 or 080 or 110 etc.

A.2. UHF RFID Sample Tag Content

Bank	Word	Address	Content
RESERVED	0	00h … 0Fh	00 00
	1	10h … 1Fh	00 00
	2	20h … 2Fh	00 0B
	3	30h … 3Fh	4A 4E
EPC	0	00h … 0Fh	22 E2
	1	10h … 1Fh	34 00

Bank	Word	Address	Content
	2	20h … 2Fh	34 3B
	3	30h … 3Fh	92 92
	4	40h … 4Fh	C0 00
	5	50h … 5Fh	00 ED
	6	60h … 6Fh	8B AA
	7	70h … 7Fh	43 B7
USER	0	00h … 0Fh	00 11
	1	10h … 1Fh	01 23

Data interpretation:

- EPC Tag URI: urn:epc:tag:giai-96: 1.936523.1020250440631
  - Filter Value: 1 (rail vehicle)
  - GS1 Company Prefix: 936523
  - Individual Asset Identifier: 1020250440631, where
    - Side Indicator: 1
    - European Vehicle Number: 020250440631
- Index (II): 01
- User Type (N): 1
- Customer Number (KKK): 123