

BLUEBOX RFID System

COMMUNICATION PROTOCOL



CANOpen

Preface

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Issue 1.08
– 10. March 2021 –

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Printed in Germany

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.

This manual applies to the following devices:

Description:

Read / write RFID UHF device with integrated antenna.
CAN bus communication interface with CANopen protocol. EU (865 MHz ... 868MHz) version.

Order Number:

5227U



This manual is valid as of firmware version:

Order Number	Hardware Version	Firmware Version
5227U	1	1.62C
5227U	2	2.62C

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1 Introduction

This document describes the message format of the CANopen communication protocol used by the host and the **BLUEBOX** in order to issuing commands and reply with responses.

CANopen is a communication protocol and device profile specification for embedded systems. The CANopen standard consists of an addressing scheme, several small communication protocols and an application layer defined by a device profile. The communication protocols have support for network management, device monitoring and communication between nodes, including a simple transport layer for message segmentation/desegmentation.

The basic CANopen device and communication profiles are given in the CiA 301 specification released by CAN in Automation.

2 Communication Features

BLUEBOX has a standardised CANopen interface according to CiA DS-301. All measured values and parameters can be accessed via the object directory (OD). The individual configuration can be saved in the internal permanent memory.

2.1 CANopen Functions

The following CANopen functions are available:

- 4 transmit and 4 receive process data objects (TPDO, RPDO) in two possible operating modes:
 - individual check via a remote transmit-request telegram (RTR);
 - event-controlled transmission.
- Error messages per emergency object (EMCY) with support of the:
 - general error register;
 - manufacturer-specific register;
 - error list (pre-defined error field).
- Monitoring mechanism heartbeat;
- In addition to the CiA DS-301 functionality there are more manufacturer and profile-specific characteristics:
 - setting of the node ID and the bit rate via object directory entry (SDO);
 - configuration and reading/writing of operational data via service data objects (SDO).

2.2 Operating States

The CANopen standard CiA301 defines three possible operating states.

2.2.1 Pre-Operational

In the pre-operational state no PDO messages (process data) can be transmitted. The pre-operational state is used to set the **BLUEBOX** parameters or as standby mode.

During booting in the pre-operational mode on the CAN bus the **BLUEBOX** reports with the boot up message "Node-ID+700h".

2.2.2 Operational

In the operational state all communication services are carried out. The operational state is used to exchange the process data while in operation.

2.2.3 Stopped

In the stopped state only NMT messages (network management) are possible. This allows almost complete separation of redundant or faulty **BLUEBOXes** from the bus.

The master or network manager can request the **BLUEBOX** via NMT messages to change the state accordingly.

2.3 Communication Types of the PDO (Process Data Object)

The TPDO can be checked at any time by transmitting a remote transmit-request telegram (RTR). Otherwise the TPDOs are sent automatically as soon as their value changes (event-driven). A total of 4 TPDOs and 4 RPDOs is available; on delivery only the first TPDO is active. If the configuration of the CANopen network allows it, the remaining process data objects can also be activated.



Data transfer per process data object is only possible in the 'Operational' operating mode.

2.4 Object Dictionary (OD)

Standard Objects as Defined in CiA DS-301:

Index	Object	Name	Data Type	Access ¹
1000h	VAR	Device Type	UNSIGNED32	ro
1001h	VAR	Error Register	UNSIGNED8	ro
1003h	ARRAY	Pre-Defined Error Field	UNSIGNED32	ro
1008h	VAR	Manufacturer Device Name	VISIBLE_STRING	const

¹ Access type listed here may vary for certain sub-indices. See detailed object specification.

Index	Object	Name	Data Type	Access ¹
100Ah	VAR	Manufacturer Software Version	VISIBLE_STRING	const
1010h	ARRAY	Store Parameters	UNSIGNED32	rw
1011h	ARRAY	Restore Default Parameters	UNSIGNED32	rw
1014h	VAR	COB-ID EMCY	UNSIGNED32	rw
1015h	VAR	Inhibit Time EMCY	UNSIGNED16	rw
1017h	VAR	Producer Heartbeat Time	UNSIGNED16	rw
1018h	RECORD	Identity Object	IDENTITY (23h)	ro
1200h	RECORD	1 st SDO Server Parameter	SDO PARAM (22h)	rw
1400h	RECORD	1 st RPDO Communication Parameter	PDO COMMPAR (20h)	rw
...
1404h	RECORD	4 th RPDO Communication Parameter	PDO COMMPAR (20h)	rw
1600h	RECORD	1 st RPDO Mapping Parameter	PDO MAPPING (21h)	rw
...
1604h	RECORD	4 th RPDO Mapping Parameter	PDO MAPPING (21h)	rw
1800h	RECORD	1 st TPDO Communication Parameter	PDO COMMPAR (20h)	rw
...
1804h	RECORD	4 th TPDO Communication Parameter	PDO COMMPAR (20h)	rw
1A00h	RECORD	1 st TPDO Mapping Parameter	PDO MAPPING (21h)	rw
...
1A04h	RECORD	4 th TPDO Mapping Parameter	PDO MAPPING (21h)	rw

Manufacturer Defined Objects:

Index	Object	Name	Data Type	Access ²
20F0h	VAR	Node ID	UNSIGNED8	rw
20F2h	VAR	Bit Rate	UNSIGNED8	rw
2100h	VAR	Device Status	UNSIGNED32	ro
2101h	VAR	Error Status Bits	OCTET STRING	ro
2102h	VAR	Temperature	UNSIGNED8	ro
2111h	RECORD	RF Power Test	-	rw
2112h	RECORD	RF Sensitivity Test	-	rw
2113h	RECORD	Read Reflected Power	-	rw
2114h	RECORD	Read RSSI Power	-	rw
2151h	VAR	RF On Off	UNSIGNED8	wo
2180h	RECORD	Current Tag in Field	-	ro
2181h	VAR	Oldest Tag in Queue	DOMAIN	ro
2182h	VAR	Dequeue Oldest Tag in Queue	UNSIGNED32	wo
2183h	RECORD	Current Tags in Buffer Data	-	ro
2200h	RECORD	General Configuration	-	rw
2201h	RECORD	RF Configuration	-	rw
2202h	RECORD	EPC C1G2 Configuration	-	rw
2203h	RECORD	Dynamic Power Configuration	-	rw
2204h	RECORD	RF Tuning Configuration	-	rw
2500h	VAR	ISO 18000-63 Transponder Inventory Trigger	UNSIGNED32	wo

² Access type listed here may vary for certain sub-indices. See detailed object specification.

Index	Object	Name	Data Type	Access ²
2501h	VAR	ISO 18000-63 Transponder Inventory Flag	UNSIGNED8	rw
2502h	RECORD	ISO 18000-63 Transponder Inventory Data	-	rw
2510h	VAR	ISO 18000-63 Transponder ID	DOMAIN	rw
2511h	VAR	ISO 18000-63 Transponder Password	UNSIGNED32	rw
2520h	RECORD	ISO 18000-63 Transponder Read Data	-	rw
2521h	RECORD	ISO 18000-63 Transponder Write Data	-	rw
2522h	RECORD	ISO 18000-63 Transponder Program EPC	-	rw
2523h	RECORD	ISO 18000-63 Transponder Lock	-	rw
2524h	RECORD	ISO 18000-63 Transponder Kill	-	rw
2530h	RECORD	Impinj Monza 4QT Transponder QT Read	-	rw
2531h	RECORD	Impinj Monza 4QT Transponder QT Write	-	rw
2540h	RECORD	RFMicron Magnus Sx Transponder Read Sensor Code	-	rw
2541h	RECORD	RFMicron Magnus Sx Transponder Read On-Chip RSSI	-	rw
2542h	RECORD	RFMicron Magnus Sx Transponder Read Temperature Code	-	rw
2F50h	VAR	Download Firmware File	DOMAIN	wo

Index	Object	Name	Data Type	Access ²
2F51h	VAR	Download Firmware File Control	UNSIGNED32	wo

2.4.1 Object 1000h: Device Type

This object shall provide information about the device type as defined in CiA DS-301.

Value Definition:

See the CiA DS-301 for value definition details.

Object Description:

Index	1000h
Name	Device type
Object Code	VAR
Data Type	UNSIGNED32

Entry Description:

Sub-Index	00h
Access	RO
PDO Mapping	No
Value Range	See value definition
Default Value	00000000h
Save Object	No

2.4.2 Object 1001h: Error Register

This object shall provide error information as defined in CiA DS-301. The CANopen device maps internal errors into this object. It is a part of an emergency object.

Value Definition:

Bit	Meaning
0	Generic error
1	Current (not supported, always 0b)
2	Voltage (not supported, always 0b)
3	Temperature (not supported, always 0b)
4	Communication error (overflow, error state)
5	Device profile specific (not supported, always 0b)
6	Reserved (always 0b)
7	Manufacturer specific

If a specific error occurs the corresponding bit shall be set to 1b. The generic error shall be signaled at any error situation.

Object Description:

Index	1001h
Name	Error register
Object Code	VAR
Data Type	UNSIGNED8

Entry Description:

Sub-Index	00h
Access	RO
PDO Mapping	No
Value Range	See value definition
Default Value	00h
Save Object	No

2.4.3 Object 1003h: Pre-Defined Error Field

This object shall provide the errors that occurred in the CANopen device and were signaled via the emergency object as defined in CiA DS-301.

Value Definition:

See the CiA DS-301 for value definition details.

Object Description:

Index	1003h
Name	Pre-defined error field
Object Code	ARRAY
Data Type	UNSIGNED32

Entry Description:

Sub-Index	00h
Description	Number of errors
Data Type	UNSIGNED8
Access	RW
PDO Mapping	No
Value Range	00h ... 08h
Default Value	00h
Save Object	No

Sub-Index	01h ... 08h
Description	n-th standard error field (with n = sub-index)
Data Type	UNSIGNED32
Access	RO
PDO Mapping	No
Value range	UNSIGNED32
Default Value	00000000h
Save Object	No

2.4.4 Object 1008h: Manufacturer Device Name

This object shall provide the name of the device as defined in CiA DS-301.

Object Description:

Index	1008h
Name	Manufacturer device name
Object Code	VAR
Data Type	VISIBLE_STRING

Entry Description:

Sub-Index	00h
Access	RO
PDO Mapping	No
Value Range	VISIBLE_STRING
Default Value	See device user manual
Save Object	No

2.4.5 Object 1009h: Manufacturer Hardware Version

This object shall provide the manufacturer hardware version as defined in CiA DS-301.

Object Description:

Index	1009h
Name	Manufacturer software version
Object Code	VAR
Data Type	VISIBLE_STRING

Entry Description:

Sub-Index	00h
-----------	-----

Access	RO
PDO Mapping	No
Value Range	VISIBLE_STRING
Default Value	See device user manual
Save Object	No

2.4.6 Object 100Ah: Manufacturer Software Version

This object shall provide the manufacturer software version as defined in CiA DS-301.

Object Description:

Index	100Ah
Name	Manufacturer software version
Object Code	VAR
Data Type	VISIBLE_STRING

Entry Description:

Sub-Index	00h
Access	RO
PDO Mapping	No
Value Range	VISIBLE_STRING
Default Value	See device user manual
Save Object	No

2.4.7 Object 1010h: Store Parameters

This object shall control the saving of parameters in non-volatile memory as defined in CiA DS-301.

Value Definition:

See the CiA DS-301 for value definition details.

Object Description:

Index	1010h
Name	Store parameters
Object Code	ARRAY
Data Type	UNSIGNED32

Entry Description:

Sub-Index	00h
Description	Highest sub-index supported
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	01h
Default Value	01h
Save Object	No

Sub-Index	01h
Description	Save all parameters
Data Type	UNSIGNED32
Access	RW
PDO Mapping	No
Value Range	See value definition
Default Value	00000000h
Save Object	No

2.4.8 Object 1011h: Restore Default Parameters

With this object the default values of parameters according to the communication profile, device profile, and application profile are restored as defined in CiA DS-301.

Value Definition:

See the CiA DS-301 for value definition details.

Object Description:

Index	1011h
Name	Restore default parameters
Object Code	ARRAY
Data Type	UNSIGNED32

Entry Description:

Sub-Index	00h
Description	Highest sub-index supported
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	01h
Default Value	01h
Save Object	No

Sub-Index	01h
Description	Restore all default parameters
Data Type	UNSIGNED32
Access	RW
PDO Mapping	No
Value Range	See value definition
Default Value	00000000h
Save Object	No

2.4.9 Object 1014h: COB-ID EMCY

This object shall indicate the configured COB-ID for the EMCY write service as defined in CiA DS-301.

Value Definition:

See the CiA DS-301 for value definition details.

Object Description:

Index	1014h
Name	COB-ID EMCY
Object Code	VAR
Data Type	UNSIGNED32

Entry Description:

Sub-Index	00h
Access	RW
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	NodeID + 80h
Save Object	No

2.4.10 Object 1015h: Inhibit Time EMCY

This object shall indicate the configured inhibit time for the EMCY message as defined in CiA DS-301.

Value Definition:

See the CiA DS-301 for value definition details.

Object Description:

Index	1015h
Name	Inhibit time EMCY

Object Code	VAR
Data Type	UNSIGNED16

Entry Description:

Sub-Index	00h
Access	RW
PDO Mapping	No
Value Range	UNSIGNED16
Default Value	0000h
Save Object	Yes

2.4.11 Object 1017h: Producer Heartbeat Time

This object shall indicate the configured cycle time of the heartbeat as defined in CiA DS-301.

Value Definition:

See the CiA DS-301 for value definition details.

Object Description:

Index	1017h
Name	Producer heartbeat time
Object Code	VAR
Data Type	UNSIGNED16

Entry Description:

Sub-Index	00h
Access	RW
PDO Mapping	No
Value Range	UNSIGNED16
Default Value	0000h

Save Object

Yes

2.4.12 Object 1018h: Identity Object

This object shall provide general identification information of the **BLUEBOX** as defined in CiA DS-301.

Value Definition:

See the CiA DS-301 for value definition details.

Object Description:

Index	1018h
Name	Identity object
Object Code	RECORD
Data Type	Identity

Entry Description:

Sub-Index	00h
Description	Highest sub-index supported
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	04h
Default Value	04h
Save Object	No

Sub-Index	01h
Description	Vendor ID
Data Type	UNSIGNED32
Access	RO
PDO Mapping	No

Value Range	UNSIGNED32
Default Value	00000482h
Save Object	No

Sub-Index	02h
Description	Product code
Data Type	UNSIGNED32
Access	RO
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	No
Save Object	No

Sub-Index	03h
Description	Revision number
Data Type	UNSIGNED32
Access	RO
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	No
Save Object	No

Sub-Index	04h
Description	Serial number
Data Type	UNSIGNED32
Access	RO
PDO Mapping	No
Value Range	UNSIGNED32

Default Value	No
Save Object	No

2.4.13 Object 1200h: SDO Server Parameter

This object shall provide information about the SDOs used on the **BLUEBOX** as defined in CiA DS-301.

Value Definition:

See the CiA DS-301 for value definition details.

Object Description:

Index	1200h
Name	SDO server parameter
Object Code	RECORD
Data Type	SDO parameter record

Entry Description:

Sub-Index	00h
Description	Highest sub-index supported
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	02h
Default Value	02h
Save Object	No

Sub-Index	01h
Description	COB-ID client to server
Data Type	UNSIGNED32
Access	RO

PDO Mapping	No
Value Range	See value definition
Default Value	NodeID + 600h
Save Object	No

Sub-Index	02h
Description	COB-ID server to client
Data Type	UNSIGNED32
Access	RO
PDO Mapping	No
Value Range	See value definition
Default Value	NodeID + 580h
Save Object	No

2.4.14 Object 1400h to 1403h: RPDO Communication Parameter

This object contains the communication parameters for the PDOs the **BLUEBOX** is able to receive as defined in CiA DS-301.

Value Definition:

See the CiA DS-301 for value definition details.

Object Description:

Index	1400h to 1403h
Name	RPDO communication parameter
Object Code	RECORD
Data Type	PDO communication parameter record

Entry Description:

Sub-Index	00h
Description	Highest sub-index supported

Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	02h
Default Value	02h
Save Object	No

Sub-Index	01h
Description	COB-ID used by RPDO
Data Type	UNSIGNED32
Access	RW
PDO Mapping	No
Value Range	See value definition
Default Value	See value definition
Save Object	No

Sub-Index	02h
Description	Transmission type
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	FFh
Default Value	FFh
Save Object	No

2.4.15 Object 1600h to 1603h: RPDO Mapping Parameter

This object contains the mapping parameters for the PDOs the **BLUEBOX** is able to receive as defined in CiA DS-301.

Value Definition:

See the CiA DS-301 for value definition details.

Object Description:

Index	1600h to 1603h
Name	RPDO mapping parameter
Object Code	RECORD
Data Type	PDO mapping parameter record

Entry Description:

Sub-Index	00h
Description	Number of mapped application objects in PDO
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	00h ... 08h
Default Value	00h
Save Object	No

Sub-Index	01h ... 08h
Description	n-th application object (with n = sub-index)
Data Type	UNSIGNED32
Access	RW
PDO Mapping	No
Value Range	See value definition
Default Value	00000000h
Save Object	No

2.4.16 Object 1800h to 1803h: TPDO Communication Parameter

This object contains the communication parameters for the PDOs the **BLUEBOX** is able to transmit as defined in CiA DS-301.

Value Definition:

See the CiA DS-301 for value definition details.

Object Description:

Index	1800h to 1803h
Name	TPDO communication parameter
Object Code	RECORD
Data Type	PDO communication parameter record

Entry Description:

Sub-Index	00h
Description	Highest sub-index supported
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	03h
Default Value	03h
Save Object	No

Sub-Index	01h
Description	COB-ID used by RPDO
Data Type	UNSIGNED32
Access	RW
PDO Mapping	No
Value Range	See value definition

Default Value	See value definition
Save Object	No

Sub-Index	02h
Description	Transmission type
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	FFh
Default Value	FFh
Save Object	No

Sub-Index	03h
Description	Inhibit time
Data Type	UNSIGNED16
Access	RW
PDO Mapping	No
Value Range	See value definition
Default Value	0000h
Save Object	No

2.4.17 Object 1A00h to 1A03h: TPDO Mapping Parameter

This object contains the mapping parameters for the PDOs the **BLUEBOX** is able to transmit as defined in CiA DS-301.

Value Definition:

See the CiA DS-301 for value definition details.

Object Description:

Index	1A00h to 1A03h
Name	TPDO mapping parameter
Object Code	RECORD
Data Type	PDO mapping parameter record

Entry Description:

Sub-Index	00h
Description	Number of mapped application objects in PDO
Data Type	UNSIGNED8
Access	RW
PDO Mapping	No
Value Range	00h ... 08h
Default Value	01h
Save Object	No

Sub-Index	01h ... 08h
Description	n-th application object (with n = sub-index)
Data Type	UNSIGNED32
Access	RW
PDO Mapping	No
Value Range	See value definition
Default Value	See value definition
Save Object	No

2.4.18 Object 20F0h: Node ID

This object shall indicate the node ID of the **BLUEBOX**.

Object Description:

Index	20F0h
-------	-------

Name	Node ID
Object Code	VAR
Data Type	UNSIGNED8

Entry Description:

Sub-Index	00h
Access	RW
PDO Mapping	No
Value Range	01h ... 7Fh
Default Value	7Eh
Save Object	Yes



Each node ID must only be assigned once in the CANopen network. If a node ID is assigned several times it results in a CANopen network malfunction.

2.4.19 Object 20F2h: Bit Rate

This object shall indicate the bit rate of the **BLUEBOX**.

Value Definition:

Value	Bit Rate
0	10 kbit/s
1	20 kbit/s
2	50 kbit/s
3	100 kbit/s
4	125 kbit/s
5	250 kbit/s
6	500 kbit/s

Value	Bit Rate
8	1000 kbit/s

Object Description:

Index	20F2h
Name	Bit rate
Object Code	VAR
Data Type	UNSIGNED8

Entry Description:

Sub-Index	00h
Access	RW
PDO Mapping	No
Value Range	See value definition
Default Value	05h
Save Object	Yes

2.4.20 Object 2100h: Device Status

This object shall provide information about the status of the **BLUEBOX**.

Value Definition:

Bit	31	30	29	28	27	26	25	24
Status	Tag Error							
Default Value	0	0	0	0	0	0	0	0

Bit	23	22	21	20	19	18	17	16
Status	Cmd Error							
Default Value	0	0	0	0	0	0	0	0

Bit	15	14	13	12	11	10	9	8
Status	r	r	r	r	r	r	r	r
Default Value	0	0	0	0	0	0	0	0

Bit	7	6	5	4	3	2	1	0
Status	r	r	r	r	r	r	Present	Busy
Default Value	0	0	0	0	0	0	0	0

Status	Value	Description	EMCY Msg.
Busy	0b	Idle	No
	1b	Busy	No
Present	0b	No tag present	No
	1b	Tag present	No
Tag Error	..h	Error message for last operation (updated after each triggered access of the tag)	No
Cmd Error	..h	Error message for last operation (updated after each triggered command execution)	No

Tag Error	Description
0x00	Status success
0x01	Tag not found
0x02	Error from tag
0x15	Invalid parameters

Cmd Error	Description
0x00	Status success
0x01	Execution error
0x15	Invalid parameters

Object Description:

Index	2100h
Name	Device status
Object Code	VAR
Data Type	UNSIGNED32

Entry Description:

Sub-Index	00h
Access	RO
PDO Mapping	Yes
Value Range	See value definition
Default Value	00000000h
Save Object	No

2.4.21 Object 2101h: Error Status Bits

This object shall provide information about the error conditions inside the stack or application of the **BLUEBOX**. Emergency message is sent on each change of

any error status bit. If critical bits are set, node will not be able to stay in operational state.

Value Definition:

Default error status bits are:

Communication or protocol errors from driver (informative)

Value	Error
00h	Error reset or no error
01h	CAN bus warning
02h	Wrong data length of received CAN message
03h	Previous received CAN message wasn't processed yet
04h	Wrong data length of received PDO
05h	Previous received PDO wasn't processed yet
06h	CAN receive bus is passive
07h	CAN transmit bus is passive

Communication or protocol errors from driver (critical)

Value	Error
08h	Reserved
09h	Reserved
0Ah	CAN transmit bus is off
0Bh	CAN module receive buffer has overflowed
0Ch	CAN transmit buffer has overflowed
0Dh	TPDO is outside SYNC window
0Eh	Configuration of CAN module CAN failed (Rx or Tx)
0Fh	Reserved

Communication or protocol errors (informative)

Value	Error
10h	Wrong NMT command received
11h	SYNC message was too early
12h	Reserved
13h	Reserved
14h	Reserved
15h	Reserved
16h	Reserved
17h	Reserved

Communication or protocol errors (critical)

Value	Error
18h	SYNC message timeout
19h	Unexpected SYNC data length
1Ah	Error with PDO mapping
1Bh	Heartbeat consumer timeout
1Ch	Heartbeat consumer detected remote node reset
1Dh	Reserved
1Eh	Reserved
1Fh	Reserved

Generic errors (informative)

Value	Error
20h	Reserved
21h	Reserved
22h	Reserved

Generic errors (informative)

Value	Error
23h	Generic hardware error
24h	Reserved
25h	Reserved
26h	Reserved
27h	Reserved

Generic errors (critical)

Value	Error
28h	Reserved
29h	Reserved
2Ah	Reserved
2Bh	Reserved
2Ch	Reserved
2Dh	Reserved
2Eh	Reserved
2Fh	Reserved

Object Description:

Index	2101h
Name	Error status bits
Object Code	VAR
Data Type	OCTECT_STRING

Entry Description:

Sub-Index	00h
Access	RO

PDO Mapping	No
Value Range	See value definition
Default Value	00h 00h 00h 00h 00h 00h 00h 00h 00h 00h
Save Object	No

2.4.22 Object 2102h: Temperature

This object shall provide information about the internal temperature of the **BLUEBOX**.

Value Definition:

The value shall be given in Celsius degrees.

Object Description:

Index	2102h
Name	Temperature
Object Code	VAR
Data Type	UNSIGNED8

Entry Description:

Sub-Index	00h
Access	RO
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	No
Save Object	No

2.4.23 Object 2111h: RF Power Test

This object shall be used 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.

Value Definition:

Sub-index 00h contains the number of valid object entries within the record. Its value is 04h.

Sub-index 01h shall be used to start the RF power test. In order to avoid the RF power test start by mistake, it shall be only executed when a specific signature is written to the appropriate sub-index. The signature that shall be written is 'trig':

	32			0
ASCII	g	i	r	t
HEX	67h	69h	72h	74h
	MSB		LSB	

On reception of the correct signature in the appropriate sub-index the **BLUEBOX** shall start the RF power test and then it shall confirm the SDO transmission (SDO download initiate response). The status of the operation execution shall be checked through the device status object (object 2100h).

If a wrong signature is written or the **BLUEBOX** is already executing a triggered operation, the **BLUEBOX** shall refuse to start the operation execution and it shall respond with the SDO abort transfer service (abort code: 0800002xh).

Sub-index 02h contains the RF antenna to test. An attempt to change the value of the RF antenna to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h).

Sub-index 03h contains the RF channel to test. An attempt to change the value of the RF antenna to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h).

Sub-index 04h shall provide the RF output power in dBm.

Object Description:

Index	2111h
Name	RF power test
Object Code	RECORD
Data Type	RF power test record

Entry Description:

Sub-Index	00h
Description	Highest sub-index supported
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	04h
Default Value	04h
Save Object	No

Sub-Index	01h
Description	Command trigger
Data Type	UNSIGNED32
Access	WO
PDO Mapping	No
Value Range	See value definition
Default Value	No
Save Object	No

Sub-Index	02h
Description	RF antenna
Data Type	UNSIGNED8
Access	RW
PDO Mapping	No
Value Range	1 to max number of antennas supported
Default Value	1
Save Object	No

Sub-Index	03h
-----------	-----

Description	RF channel
Data Type	UNSIGNED8
Access	RW
PDO Mapping	No
Value Range	EU1 region: 1 to 10 FCC region: 1 to 50
Default Value	1
Save Object	No

Sub-Index	04h
Description	RF output power
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	No
Save Object	No

2.4.24 Object 2112h: RF Sensitivity Test

This object shall be used 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.

Value Definition:

Sub-index 00h contains the number of valid object entries within the record. Its value is 04h.

Sub-index 01h shall be used to start the RF sensitivity test. In order to avoid the RF sensitivity test start by mistake, it shall be only executed when a specific signature is written to the appropriate sub-index. The signature that shall be written is 'trig':

	32				0
ASCII	g	i	r	t	
HEX	67h	69h	72h	74h	
	MSB				LSB

On reception of the correct signature in the appropriate sub-index the **BLUEBOX** shall start the RF sensitivity test and then it shall confirm the SDO transmission (SDO download initiate response). The status of the operation execution shall be checked through the device status object (object 2100h).

If a wrong signature is written or the **BLUEBOX** is already executing a triggered operation, the **BLUEBOX** shall refuse to start the operation execution and it shall respond with the SDO abort transfer service (abort code: 0800002xh).

Sub-index 02h contains the RF antenna to test. An attempt to change the value of the RF antenna to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h).

Sub-index 03h contains the RF channel to test. An attempt to change the value of the RF antenna to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h).

Sub-index 04h shall provide the absolute value of the RF input sensitivity in dBm.

Object Description:

Index	2112h
Name	RF sensitivity test
Object Code	RECORD
Data Type	RF power sensitivity record

Entry Description:

Sub-Index	00h
Description	Highest sub-index supported
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No

Value Range	04h
Default Value	04h
Save Object	No

Sub-Index	01h
Description	Command trigger
Data Type	UNSIGNED32
Access	WO
PDO Mapping	No
Value Range	See value definition
Default Value	No
Save Object	No

Sub-Index	02h
Description	RF antenna
Data Type	UNSIGNED8
Access	RW
PDO Mapping	No
Value Range	1 to max number of antennas supported
Default Value	1
Save Object	No

Sub-Index	03h
Description	RF channel
Data Type	UNSIGNED8
Access	RW
PDO Mapping	No
Value Range	EU1 region: 1 to 10

	FCC region: 1 to 50
Default Value	1
Save Object	No

Sub-Index	04h
Description	RF input sensitivity
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	No
Save Object	No

2.4.25 Object 2113h: Read Reflected Power

This object shall be used to read the approximation of the antenna reflected power to easily check the antenna connection.

Value Definition:

Sub-index 00h contains the number of valid object entries within the record. Its value is 06h.

Sub-index 01h shall be used to start the reflected power read. In order to avoid the reflected power read start by mistake, it shall be only executed when a specific signature is written to the appropriate sub-index. The signature that shall be written is 'trig':

	32			0
ASCII	g	i	r	t
HEX	67h	69h	72h	74h
	MSB		LSB	

On reception of the correct signature in the appropriate sub-index the **BLUEBOX** shall start the reflected power read and then it shall confirm the SDO transmission (SDO download initiate response). The status of the operation execution shall be checked through the device status object (object 2100h).

If a wrong signature is written or the **BLUEBOX** is already executing a triggered operation, the **BLUEBOX** shall refuse to start the operation execution and it shall respond with the SDO abort transfer service (abort code: 0800002xh).

Sub-index 02h contains the RF antenna to test. An attempt to change the value of the RF antenna to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h).

Sub-index 03h contains the RF frequency to test. An attempt to change the value of the RF antenna to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h).

Sub-index 04h shall provide the I-channel value in dBm.

Sub-index 05h shall provide the Q-channel value in dBm.

Sub-index 06h shall provide the G value to be used to calculate the reflected power as defined below.

$$mixDC = \sqrt{Ich^2 + Qch^2}$$

$$Pin(dBm) = 20 \log \left(\frac{mixDC}{G} \right)$$

Object Description:

Index	2113h
Name	Read reflected power
Object Code	RECORD
Data Type	Read reflected power record

Entry Description:

Sub-Index	00h
Description	Highest sub-index supported
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	06h
Default Value	06h

Save Object	No
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Sub-Index	01h
Description	Command trigger
Data Type	UNSIGNED32
Access	WO
PDO Mapping	No
Value Range	See value definition
Default Value	No
Save Object	No

Sub-Index	02h
Description	RF antenna
Data Type	UNSIGNED8
Access	RW
PDO Mapping	No
Value Range	1 to max number of antennas supported
Default Value	1
Save Object	No

Sub-Index	03h
Description	RF frequency
Data Type	UNSIGNED32
Access	RW
PDO Mapping	No
Value Range	840000 ... 960000
Default Value	900000
Save Object	No

Sub-Index	04h
Description	I-channel
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	No
Save Object	No

Sub-Index	05h
Description	Q-channel
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	No
Save Object	No

Sub-Index	06h
Description	G value
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	No
Save Object	No

2.4.26 Object 2114h: Read RSSI Power

This object shall be used to read the approximation of the RF signal strength received by the antenna to easily check the presence or not of external RF sources.

Value Definition:

Sub-index 00h contains the number of valid object entries within the record. Its value is 06h.

Sub-index 01h shall be used to start the RSSI power read. In order to avoid the RSSI power read start by mistake, it shall be only executed when a specific signature is written to the appropriate sub-index. The signature that shall be written is 'trig':

	32			0
ASCII	g	i	r	t
HEX	67h	69h	72h	74h
	MSB		LSB	

On reception of the correct signature in the appropriate sub-index the **BLUEBOX** shall start the RSSI power read and then it shall confirm the SDO transmission (SDO download initiate response). The status of the operation execution shall be checked through the device status object (object 2100h).

If a wrong signature is written or the **BLUEBOX** is already executing a triggered operation, the **BLUEBOX** shall refuse to start the operation execution and it shall respond with the SDO abort transfer service (abort code: 0800002xh).

Sub-index 02h contains the RF antenna to test. An attempt to change the value of the RF antenna to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h).

Sub-index 03h contains the RF frequency to test. An attempt to change the value of the RF antenna to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h).

Sub-index 04h shall provide the I-channel value in dBm.

Sub-index 05h shall provide the Q-channel value in dBm.

Sub-index 06h shall provide the G value to be used to calculate the reflected power as defined below.

$$meanRSSI = \frac{Ich + Qch}{2}$$

$$Pin(dBm) = 2.1 * meanRSSI - G$$

Object Description:

Index	2114h
Name	Read RSSI power
Object Code	RECORD
Data Type	Read RSSI power record

Entry Description:

Sub-Index	00h
Description	Highest sub-index supported
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	06h
Default Value	06h
Save Object	No

Sub-Index	01h
Description	Command trigger
Data Type	UNSIGNED32
Access	WO
PDO Mapping	No
Value Range	See value definition
Default Value	No
Save Object	No

Sub-Index	02h
Description	RF antenna
Data Type	UNSIGNED8
Access	RW
PDO Mapping	No
Value Range	1 to max number of antennas supported
Default Value	1
Save Object	No

Sub-Index	03h
Description	RF frequency
Data Type	UNSIGNED32
Access	RW
PDO Mapping	No
Value Range	840000 ... 960000
Default Value	900000
Save Object	No

Sub-Index	04h
Description	I-channel
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	No
Save Object	No

Sub-Index	05h
-----------	-----

Description	Q-channel
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	No
Save Object	No

Sub-Index	06h
Description	G value
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	No
Save Object	No

2.4.27 Object 2151h: RF On Off

This object shall suspend/resume the activity of the RF antennas connected to the **BLUEBOX**.

Value Definition:

The value 0 shall suspend the activity of the RF antennas connected to the **BLUEBOX**. The value 1 shall resume the activity of the RF antennas connected to the **BLUEBOX**. Any other values are not allowed and shall lead to an SDO abort transfer service (error code: 06090030h).

Object Description:

Index	2151h
Name	RF On Off
Object Code	VAR

Data Type	UNSIGNED32
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Entry Description:

Sub-Index	00h
Access	WO
PDO Mapping	No
Value Range	See value definition
Default Value	0
Save Object	No

2.4.28 Object 2180h: Current Tag in Field

This object shall provide information about transponders presents in the buffer of the **BLUEBOX**.

Value Definition:

Sub-index 00h contains the number of valid object entries within the record. The number of valid objects entries shall be the number of antennas of the **BLUEBOX**. Its value is at least 01h.

Sub-index from 01h to n, with n = max number of antennas, contains the code of the last read transponder from the corresponding antenna that is present in the buffer.

a) for UHF devices

<tag> <ID 1> ... <ID i> ... <ID m> <1st RSSI Q> <1st RSSI I> <last RSSI Q> <last RSSI I> <max RSSI Q> <max RSSI I><rdcount>

Where:

Field	Description
<tag>	<p>Transponder type of the identified tag (optional parameter present only if the tag type information flag in the general parameters is active, see the reader user manual for more info):</p> <ul style="list-style-type: none"> 0x02: ISO 18000-63 (EPC Class-1 Gen-2).

Field	Description
<ID>	i-th byte of the ID of the identified tag.
<1st RSSI Q> <1st RSSI I>	The first seen RSSI Q and I channel measured values in dB of the identified tag. (optional parameter present only if the RSSI information flag in the RF configuration parameters is active, see the reader user manual for more info).
<last RSSI Q> <last RSSI I>	The last seen RSSI Q and I channel measured values in dB of the identified tag. (optional parameter present only if the RSSI information flag in the RF configuration parameters is active, see the reader user manual for more info).
<max RSSI Q> <max RSSI I>	The max seen RSSI Q and I channel measured values in dB of the identified tag. (optional parameter present only if the RSSI information flag in the RF configuration parameters is active, see the reader user manual for more info).
<rdcount>	The tag read count of the identified tag (optional parameter present only if the tag read count information flag in the RF configuration parameters is active, see the reader user manual for more info).

If the buffer is empty, it shall contain

00h 00h 00h 00h 00h

Object Description:

Index	2180h
Name	Current tag in field
Object Code	RECORD
Data Type	Current tag in field record

Entry Description:

Sub-Index	00h
Description	Number of antennas
Data Type	UNSIGNED8

Access	RO
PDO Mapping	No
Value Range	See value definition
Default Value	See value definition
Save Object	No

Sub-Index	01h ... n (with n = max number of antennas)
Description	Current tag in field
Data Type	DOMAIN
Access	RO
PDO Mapping	No
Value Range	DOMAIN
Default Value	No
Save Object	No

2.4.29 Object 2181h: Oldest Tag in Queue

This object shall provide information about the the oldest tag present in the FIFO queue of the **BLUEBOX**.

Value Definition:

Sub-index 00h contains the code of the oldest tag present in the FIFO queue of the **BLUEBOX**.

a) for UHF devices

<tag> <ID 1> ... <ID i> ... <ID m> <RSSI Q> <RSSI I> <ant>

Where:

Field	Description
<tag>	Transponder type of the identified tag (optional parameter present only if the tag type information flag in the general parameters is active, see the reader user manual for more info):

Field	Description
	<ul style="list-style-type: none"> 0x02: ISO 18000-63 (EPC Class-1 Gen-2).
<ID>	i-th byte of the ID of the identified tag.
<RSSI Q> <RSSI I>	The detected RSSI Q and I channel measured values in dB of the identified tag. (optional parameter present only if the RSSI information flag in the RF configuration parameters is active, see the reader user manual for more info).
<ant>	The reading antenna for the identified tag (optional parameter present only if the reading antenna information flag in the general parameters is active, see the reader user manual for more info). <ul style="list-style-type: none"> 0x01 -> Antenna 1. 0x02 -> Antenna 2. 0x03 -> Antenna 3. 0x04 -> Antenna 4.

If the buffer is empty, it shall contain

00h 00h 00h 00h 00h

Object Description:

Index	2181h
Name	Oldest tag in queue
Object Code	VAR
Data Type	DOMAIN

Entry Description:

Sub-Index	00h
Access	RO
PDO Mapping	No
Value Range	DOMAIN
Default Value	No
Save Object	No

2.4.30 Object 2182h: Dequeue Oldest Tag

This object shall be used to dequeue the oldest tag stored in the FIFO queue of the **BLUEBOX**.

Value Definition:

Sub-index 00h shall dequeue the oldest tag stored in the FIFO queue of the **BLUEBOX**. In order to avoid the dequeue of the oldest tag stored in the FIFO queue of the **BLUEBOX** by mistake, it shall be only executed when a specific signature is written to the appropriate sub-index. The signature that shall be written is 'ackk':

	32			0
ASCII	k	k	c	a
HEX	6Bh	6Bh	63h	61h
	MSB		LSB	

On reception of the correct signature in the appropriate sub-index the **BLUEBOX** shall start the dequeue of the oldest tag stored in the **BLUEBOX** FIFO queue and then it shall confirm the SDO transmission (SDO download initiate response).

If a wrong signature is written, the **BLUEBOX** shall refuse to start the operation execution and it shall respond with the SDO abort transfer service (abort code: 0800002xh).

Object Description:

Index	2182h
Name	Dequeue oldest tag
Object Code	VAR
Data Type	UNSIGNED32

Entry Description:

Sub-Index	00h
Data Type	UNSIGNED32
Access	WO
PDO Mapping	No

Value Range	See value definition
Default Value	No
Save Object	No

2.4.31 Object 2183h: Current Tags in Buffer

This object shall provide information about the current tags that are present in the buffer of the **BLUEBOX**.

Value Definition:

Sub-index 00h contains the number of valid object entries within the record. Its value is 21h.

Sub-index 01h shall indicate the antenna from 1 to n, with n = max number of antennas. An attempt to change its value to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h).

Sub-index 02h to n+1, with n = max number of tags in buffer, contains the code of the read transponder, from the corresponding antenna and index, that is present in the buffer.

a) for UHF devices

<tag> <ID 1> ... <ID i> ... <ID m> <1st RSSI Q> <1st RSSI I> <last RSSI Q> <last RSSI I> <max RSSI Q> <max RSSI I><rdcount>

Where:

Field	Description
<tag>	Transponder type of the identified tag (optional parameter present only if the tag type information flag in the general parameters is active, see the reader user manual for more info): <ul style="list-style-type: none"> 0x02: ISO 18000-63 (EPC Class-1 Gen-2).
<ID>	i-th byte of the ID of the identified tag.
<1st RSSI Q> <1st RSSI I>	The first seen RSSI Q and I channel measured values in dB of the identified tag. (optional parameter present only if the RSSI information flag in the RF configuration parameters is active, see the reader user manual for more info).

Field	Description
<last RSSI Q> <last RSSI I>	The last seen RSSI Q and I channel measured values in dB of the identified tag. (optional parameter present only if the RSSI information flag in the RF configuration parameters is active, see the reader user manual for more info).
<max RSSI Q> <max RSSI I>	The max seen RSSI Q and I channel measured values in dB of the identified tag. (optional parameter present only if the RSSI information flag in the RF configuration parameters is active, see the reader user manual for more info).
<rdcount>	The tag read count of the identified tag (optional parameter present only if the tag read count information flag in the RF configuration parameters is active, see the reader user manual for more info).

If the buffer from the corresponding antenna and index is empty, it shall contain

00h 00h 00h 00h 00h

Object Description:

Index	2183h
Name	Current tags in buffer
Object Code	RECORD
Data Type	Current tags in buffer record

Entry Description:

Sub-Index	00h
Description	Highest sub-index supported
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	21h
Default Value	21h

Save Object	No
-------------	----

Sub-Index	01h
Description	RF antenna
Data Type	UNSIGNED8
Access	RW
PDO Mapping	No
Value Range	See value definition
Default Value	01h
Save Object	No

Sub-Index	02h ... n+1 (with n = max number of tags in buffer)
Description	Current tags in buffer
Data Type	DOMAIN
Access	RO
PDO Mapping	No
Value Range	DOMAIN
Default Value	No
Save Object	No

2.4.32 Object 2200h: General Configuration

This object shall provide information about the general configuration of the **BLUEBOX**.

Value Definition:

Sub-index 00h contains the number of valid object entries within the record. The number of valid objects entries shall be the number of the general configuration parameters.

Sub-index 01h to FEh contains a configuration parameter. An attempt to change the value of the configuration parameter to any not supported value shall be

responded with the SDO abort transfer service (abort code: 06090030h). See the **BLUEBOX** user manual for value definition details.

Object Description:

Index	2200h
Name	General configuration
Object Code	RECORD
Data Type	General configuration record

Entry Description:

Sub-Index	00h
Description	Number of parameters
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	See value definition
Default Value	See value definition
Save Object	Yes

Sub-Index	01h ... FEh
Description	1st parameter object to 254th parameter object
Data Type	See value definition
Access	RW
PDO Mapping	No
Value Range	See value definition
Default Value	See value definition
Save Object	Yes

2.4.33 Object 2201h: RF Configuration

This object shall provide information about RF configuration of the **BLUEBOX**.

Value Definition:

Sub-index 00h contains the number of valid object entries within the record. The number of valid objects entries shall be the number of the RF configuration parameters.

Sub-index 01h to FEh contains a configuration parameter. An attempt to change the value of the configuration parameter to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h). See the **BLUEBOX** user manual for value definition details.

Object Description:

Index	2201h
Name	RF configuration
Object Code	RECORD
Data Type	RF configuration record

Entry Description:

Sub-Index	00h
Description	Number of parameters
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	See value definition
Default Value	See value definition
Save Object	Yes

Sub-Index	01h ... FEh
Description	1st parameter object to 254th parameter object
Data Type	See value definition

Access	RW
PDO Mapping	No
Value Range	See value definition
Default Value	See value definition
Save Object	Yes

2.4.34 Object 2202h: EPC Class-1 Gen-2 Configuration

This object shall provide information about EPC Class-1 Gen-2 configuration of the **BLUEBOX**.

Value Definition:

Sub-index 00h contains the number of valid object entries within the record. The number of valid objects entries shall be the number of the EPC Class-1 Gen-2 configuration parameters.

Sub-index 01h to FEh contains a configuration parameter. An attempt to change the value of the configuration parameter to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h). See the **BLUEBOX** user manual for value definition details.

Object Description:

Index	2202h
Name	EPC Class-1 Gen-2 configuration
Object Code	RECORD
Data Type	EPC Class-1 Gen-2 configuration record

Entry Description:

Sub-Index	00h
Description	Number of parameters
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	See value definition

Default Value	See value definition
Save Object	No

Sub-Index	01h ... FEh
Description	1st parameter object to 254th parameter object
Data Type	See value definition
Access	RW
PDO Mapping	No
Value Range	See value definition
Default Value	See value definition
Save Object	No

2.4.35 Object 2203h: Dynamic Power Configuration

This object shall provide information about dynamic power configuration of the **BLUEBOX**.

Value Definition:

Sub-index 00h contains the number of valid object entries within the record. The number of valid objects entries shall be the number of the dynamic power configuration parameters.

Sub-index 01h to FEh contains a configuration parameter. An attempt to change the value of the configuration parameter to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h). See the **BLUEBOX** user manual for value definition details.

Object Description:

Index	2201h
Name	Dynamic power configuration
Object Code	RECORD
Data Type	Dynamic power configuration record

Entry Description:

Sub-Index	00h
Description	Number of parameters
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	See value definition
Default Value	See value definition
Save Object	No

Sub-Index	01h ... FEh
Description	1st parameter object to 254th parameter object
Data Type	See value definition
Access	RW
PDO Mapping	No
Value Range	See value definition
Default Value	See value definition
Save Object	No

2.4.36 Object 2204h: RF Tuning Configuration

This object shall provide information about RF tuning configuration of the **BLUEBOX**.

Value Definition:

Sub-index 00h contains the number of valid object entries within the record. The number of valid objects entries shall be the number of the RF tuning configuration parameters.

Sub-index 01h to FEh contains a configuration parameter. An attempt to change the value of the configuration parameter to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h). See the **BLUEBOX** user manual for value definition details.

Object Description:

Index	2201h
Name	RF tuning configuration
Object Code	RECORD
Data Type	RF tuning configuration record

Entry Description:

Sub-Index	00h
Description	Number of parameters
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	See value definition
Default Value	See value definition
Save Object	No

Sub-Index	01h ... FEh
Description	1st parameter object to 254th parameter object
Data Type	See value definition
Access	RW
PDO Mapping	No
Value Range	See value definition
Default Value	See value definition
Save Object	No

2.4.37 Object 2500h: ISO 18000-63 Transponder Inventory Trigger

This object shall start the ISO 18000-63 transponder inventory.

Value Definition:

Sub-index 00h shall start the ISO 18000-63 transponder inventory. In order to avoid start the ISO 18000-63 transponder inventory by mistake, it shall be only executed when a specific signature is written to the appropriate sub-index. The signature that shall be written is 'trig':

	32			0
ASCII	g	i	r	t
HEX	67h	69h	72h	74h
	MSB		LSB	

On reception of the correct signature in the appropriate sub-index the **BLUEBOX** shall start the ISO 18000-63 transponder inventory and then it shall confirm the SDO transmission (SDO download initiate response). The status of the operation execution shall be checked through the device status object (object 2100h).

If a wrong signature is written or the **BLUEBOX** is already executing a triggered operation, the **BLUEBOX** shall refuse to start the operation execution and it shall respond with the SDO abort transfer service (abort code: 0800002xh).

Object Description:

Index	2500h
Name	ISO 18000-63 Transponder Inventory Trigger
Object Code	VAR
Data Type	UNSIGNED32

Entry Description:

Sub-Index	00h
Access	WO
PDO Mapping	No
Value Range	See value definition
Default Value	No
Save Object	No

2.4.38 Object 2501h: ISO 18000-63 Transponder Inventory Flag

This object shall provide information about the ISO 18000-63 transponder inventory functionalities.

Value Definition:

Sub-index 00h shall be used to activate/deactivate functionalities for the ISO 18000-63 transponder inventory. An attempt to change its value to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h)

Value	Flag
00h	None
01h	RSSI

Object Description:

Index	2501h
Name	ISO 18000-63 Transponder Inventory Flag
Object Code	VAR
Data Type	UNSIGNED8

Entry Description:

Sub-Index	00h
Access	RW
PDO Mapping	No
Value Range	See value definition
Default Value	00h
Save Object	No

2.4.39 Object 2502h: ISO 18000-63 Transponder Inventory Data

This object shall provide information about the ISO 18000-63 transponder inventory data.

Value Definition:

Sub-index 00h contains the number of valid object entries within the record. The number of valid objects entries shall be the number of identified tags during the inventory operation.

Sub-index from 01h to 64h contains the code of the ISO 18000-63 transponder identified during the inventory operation.

<tag type> <ID 1> ... <ID i> ... <ID m> <RSSI Q> <RSSI I> <ant>

Where:

Field	Description
<tag>	Transponder type of the identified tag (optional parameter present only if the tag type information flag in the general parameters is active, see the reader user manual for more info) : <ul style="list-style-type: none"> 0x02: ISO 18000-63 (EPC Class-1 Gen-2).
<ID>	i-th byte of the ID of the identified tag.
<RSSI Q> <RSSI I>	The detected RSSI Q and I channel measured values in dB of the identified tag. (optional parameter present only if the RSSI information flag in the RF configuration parameters is active, see the reader user manual for more info) .
<ant>	Reading antenna for the identified tag (optional parameter present only if the reading antenna information flag in the general parameters is active, see the reader user manual for more info) . <ul style="list-style-type: none"> 0x01 -> Antenna 1. 0x02 -> Antenna 2. 0x03 -> Antenna 3. 0x04 -> Antenna 4.

Object Description:

Index	2502h
Name	ISO 18000-63 transponder inventory data
Object Code	RECORD
Data Type	ISO 18000-63 transponder inventory data record

Entry Description:

Sub-Index	00h
Description	Highest sub-index supported
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	See value definition
Default Value	00h
Save Object	No

Sub-Index	01h ... 64h
Description	Data
Data Type	DOMAIN
Access	RO
PDO Mapping	No
Value Range	DOMAIN
Default Value	No
Save Object	No

2.4.40 Object 2510h: ISO 18000-63 Transponder ID

This object shall provide information about the ISO 18000-63 transponder ID to use in tag's access operations.

Value Definition:

Sub-index 00h shall provide information about the ISO 18000-63 transponder ID to use in tag's access operations. An attempt to change the value of the ID to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h).

The ISO 18000-63 transponder ID is:

<PC> <EPC> <CRC>

Where:

Field	Description
<PC>	16 bits length. It is the Protocol Control field which is stored in the word nr. 1 of the EPC bank. The 5 most significant bits contain the EPC length information, for example PC = 0x0000 -> PC + EPC = 1 word (2 byte), PC = 0x0800 -> PC + EPC = 2 word (4 byte), PC = 0x1000 -> PC + EPC = 3 word (6 byte)...
<EPC>	Variable length. It is the EPC field which is stored starting from word nr. 2 of the EPC bank.
<CRC>	16 bits length. It the checksum of the PC and CRC fields and it is stored in the word nr. 0 of the EPC bank.

Object Description:

Index	2510h
Name	ISO 18000-63 Transponder ID
Object Code	VAR
Data Type	DOMAIN

Entry Description:

Sub-Index	00h
Access	WO
PDO Mapping	No
Value Range	DOMAIN
Default Value	No
Save Object	No

2.4.41 Object 2511h: ISO 18000-63 Transponder Password

This object shall provide information about the ISO 18000-63 transponder password to use in tag's access operations.

Value Definition:

Sub-index 00h shall provide information about the ISO 18000-63 transponder password to use in tag's access operations. An attempt to change the value of the password to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h)

Object Description:

Index	2511h
Name	ISO 18000-63 Transponder Password
Object Code	VAR
Data Type	UNSIGNED32

Entry Description:

Sub-Index	00h
Access	RW
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	00000000h
Save Object	No

2.4.42 Object 2520h: ISO 18000-63 Transponder Read Data

This object shall read data blocks (data block → 2 consecutive bytes) of a known (ID) ISO 18000-63 tag.

Value Definition:

Sub-index 00h contains the number of valid object entries within the record. Its value is 05h.

Sub-index 01h shall start the ISO 18000-63 transponder read data. In order to avoid the ISO 18000-63 transponder read data start by mistake, it shall be only executed when a specific signature is written to the appropriate sub-index. The signature that shall be written is 'trig':

	32			0
ASCII	g	i	r	t
HEX	67h	69h	72h	74h
	MSB		LSB	

On reception of the correct signature in the appropriate sub-index the **BLUEBOX** shall start the ISO 18000-63 transponder read data and then it shall confirm the SDO transmission (SDO download initiate response). The status of the operation execution shall be checked through the device status object (object 2100h).

If a wrong signature is written or the **BLUEBOX** is already executing a triggered operation, the **BLUEBOX** shall refuse to start the operation execution and it shall respond with the SDO abort transfer service (abort code: 0800002xh).

Sub-index 02h shall indicate the memory bank within the tag where the **BLUEBOX** shall read data. An attempt to change the value of the memory bank to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h).

Value	Memory Bank
00h	Reserved
01h	EPC
02h	TID
03h	User

Sub-index 03h shall indicate the starting address within the tag where the **BLUEBOX** shall start to read data. The value specifies the starting byte in the transponder memory and must be word (2 bytes) aligned. An attempt to change the value of the byte pointer to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h).

Sub-index 04h shall indicate the number of words (2 bytes) to be read at the tag starting at starting address provided by sub-index 03h. An attempt to change the value of the byte pointer to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h).

Sub-index 05h shall provide the data received from the tag.

Object Description:

Index	2520h
Name	ISO 18000-63 transponder read data
Object Code	RECORD
Data Type	ISO 18000-63 transponder read data record

Entry Description:

Sub-Index	00h
Description	Highest sub-index supported
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	05h
Default Value	05h
Save Object	No

Sub-Index	01h
Description	Command trigger
Data Type	UNSIGNED32
Access	WO
PDO Mapping	No
Value Range	See value definition
Default Value	00000000h
Save Object	No

Sub-Index	02h
Description	Memory bank
Data Type	UNSIGNED8

Access	RW
PDO Mapping	No
Value Range	See value definition
Default Value	00h
Save Object	No

Sub-Index	03h
Description	Byte pointer
Data Type	UNSIGNED32
Access	RW
PDO Mapping	No
Value Range	See value definition
Default Value	00000000h
Save Object	No

Sub-Index	04h
Description	Word count
Data Type	UNSIGNED8
Access	RW
PDO Mapping	No
Value Range	01h ... 20h
Default Value	01h
Save Object	No

Sub-Index	05h
Description	Tag data
Data Type	DOMAIN
Access	RO

PDO Mapping	No
Value Range	DOMAIN
Default Value	No
Save Object	No

2.4.43 Object 2521h: ISO 18000-63 Transponder Write Data

This object shall write data blocks (data block → 2 consecutive bytes) of a known (ID) ISO 18000-63 tag.

Value Definition:

Sub-index 00h contains the number of valid object entries within the record. Its value is 06h.

Sub-index 01h shall start the ISO 18000-63 transponder write data. In order to avoid the ISO 18000-63 transponder write data start by mistake, it shall be only executed when a specific signature is written to the appropriate sub-index. The signature that shall be written is 'trig':

	32			0
ASCII	g	i	r	t
HEX	67h	69h	72h	74h
	MSB		LSB	

On reception of the correct signature in the appropriate sub-index the **BLUEBOX** shall start the ISO 18000-63 transponder write data and then it shall confirm the SDO transmission (SDO download initiate response). The status of the operation execution shall be checked through the device status object (object 2100h).

If a wrong signature is written or the **BLUEBOX** is already executing a triggered operation, the **BLUEBOX** shall refuse to start the operation execution and it shall respond with the SDO abort transfer service (abort code: 0800002xh).

Sub-index 02h shall indicate the memory bank within the tag where the **BLUEBOX** shall write data. An attempt to change the value of the memory bank to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h).

Value	Memory Bank
00h	Reserved
01h	EPC
02h	TID
03h	User

Sub-index 03h shall indicate the starting address within the tag where the **BLUEBOX** shall start to write data. The value specifies the starting byte in the transponder memory and must be word (2 bytes) aligned. An attempt to change the value of the byte pointer to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h).

Sub-index 04h shall indicate the number of words (2 bytes) to be written to the tag starting at starting address provided by sub-index 03h. An attempt to change the value of the byte pointer to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h).

Sub-index 05h shall indicate the write mode. An attempt to change the value of the byte pointer to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h).

Value	Write Mode
00h	Write as defined in EPC Class-1 Gen-2
01h	BlockWrite as defined in EPC Class-1 Gen-2

Sub-index 06h shall indicate the data to be written to the tag.

Object Description:

Index	2521h
Name	ISO 18000-63 transponder write data
Object Code	RECORD
Data Type	ISO 18000-63 transponder write data record

Entry Description:

Sub-Index	00h
Description	Highest sub-index supported
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	06h
Default Value	06h
Save Object	No

Sub-Index	01h
Description	Command trigger
Data Type	UNSIGNED32
Access	WO
PDO Mapping	No
Value Range	See value definition
Default Value	00000000h
Save Object	No

Sub-Index	02h
Description	Memory bank
Data Type	UNSIGNED8
Access	RW
PDO Mapping	No
Value Range	See value definition
Default Value	00h
Save Object	No

Sub-Index	03h
Description	Byte pointer
Data Type	UNSIGNED32
Access	RW
PDO Mapping	No
Value Range	See value definition
Default Value	00000000h
Save Object	No

Sub-Index	04h
Description	Word count
Data Type	UNSIGNED8
Access	RW
PDO Mapping	No
Value Range	01h ... 20h
Default Value	01h
Save Object	No

Sub-Index	05h
Description	Write mode
Data Type	UNSIGNED8
Access	RW
PDO Mapping	No
Value Range	See value definition
Default Value	00h
Save Object	No

Sub-Index	06h
-----------	-----

Description	Tag data
Data Type	DOMAIN
Access	WO
PDO Mapping	No
Value Range	DOMAIN
Default Value	No
Save Object	No

2.4.44 Object 2522h: ISO 18000-63 Transponder Program EPC

This object shall program the EPC of a known (ID) ISO 18000-63 tag.

Value Definition:

Sub-index 00h contains the number of valid object entries within the record. Its value is 02h.

Sub-index 01h shall start the ISO 18000-63 transponder program EPC. In order to avoid the ISO 18000-63 transponder program EPC start by mistake, it shall be only executed when a specific signature is written to the appropriate sub-index. The signature that shall be written is 'trig':

	32			0
ASCII	g	i	r	t
HEX	67h	69h	72h	74h
	MSB		LSB	

On reception of the correct signature in the appropriate sub-index the **BLUEBOX** shall start the ISO 18000-63 transponder program EPC and then it shall confirm the SDO transmission (SDO download initiate response). The status of the operation execution shall be checked through the device status object (object 2100h).

If a wrong signature is written or the **BLUEBOX** is already executing a triggered operation, the **BLUEBOX** shall refuse to start the operation execution and it shall respond with the SDO abort transfer service (abort code: 0800002xh).

Sub-index 02h shall indicate the new EPC to be written to the tag.

Object Description:

Index	2522h
Name	ISO 18000-63 transponder program EPC
Object Code	RECORD
Data Type	ISO 18000-63 transponder program EPC record

Entry Description:

Sub-Index	00h
Description	Highest sub-index supported
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	02h
Default Value	02h
Save Object	No

Sub-Index	01h
Description	Command trigger
Data Type	UNSIGNED32
Access	WO
PDO Mapping	No
Value Range	See value definition
Default Value	00000000h
Save Object	No

Sub-Index	02h
Description	New EPC
Data Type	DOMAIN

Access	WO
PDO Mapping	No
Value Range	DOMAIN
Default Value	No
Save Object	No

2.4.45 Object 2523h: ISO 18000-63 Transponder Lock

This object shall lock individual passwords and/or individual memory banks of a known (ID) ISO 18000-63 tag.

Value Definition:

Sub-index 00h contains the number of valid object entries within the record. Its value is 06h.

Sub-index 01h shall start the ISO 18000-63 transponder lock. In order to avoid the ISO 18000-63 transponder lock start by mistake, it shall be only executed when a specific signature is written to the appropriate sub-index. The signature that shall be written is 'trig':

	32			0
ASCII	g	i	r	t
HEX	67h	69h	72h	74h
	MSB		LSB	

On reception of the correct signature in the appropriate sub-index the **BLUEBOX** shall start the ISO 18000-63 transponder lock and then it shall confirm the SDO transmission (SDO download initiate response). The status of the operation execution shall be checked through the device status object (object 2100h).

If a wrong signature is written or the **BLUEBOX** is already executing a triggered operation, the **BLUEBOX** shall refuse to start the operation execution and it shall respond with the SDO abort transfer service (abort code: 0800002xh).

Sub-index 02h shall indicate the kill password lock mode. An attempt to change the value of the kill password lock mode to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h).

Value	Memory Bank
00h	Accessible from all states
01h	Permanently accessible from all states and may never be locked
02h	Accessible only from the secured state
03h	Not accessible from any state
04h	No change

Sub-index 03h shall indicate the access password lock mode. An attempt to change the value of the access password lock mode to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h).

Value	Memory Bank
00h	Accessible from all states
01h	Permanently accessible from all states and may never be locked
02h	Accessible only from the secured state
03h	Not accessible from any state
04h	No change

Sub-index 04h shall indicate the EPC memory bank lock mode. An attempt to change the value of the EPC memory bank lock mode to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h).

Value	Memory Bank
00h	Writable from all states
01h	Permanently writable from all states and may never be locked
02h	Writable only from the secured state
03h	Not writable from any state
04h	No change

Sub-index 05h shall indicate the TID memory bank lock mode. An attempt to change the value of the TID memory bank lock mode to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h).

Value	Memory Bank
00h	Writable from all states
01h	Permanently writable from all states and may never be locked
02h	Writable only from the secured state
03h	Not writable from any state
04h	No change

Sub-index 06h shall indicate the user memory bank lock mode. An attempt to change the value of the user memory bank lock mode to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h).

Value	Memory Bank
00h	Writable from all states
01h	Permanently writable from all states and may never be locked
02h	Writable only from the secured state
03h	Not writable from any state
04h	No change

Object Description:

Index	2523h
Name	ISO 18000-63 transponder lock
Object Code	RECORD
Data Type	ISO 18000-63 transponder lock record

Entry Description:

Sub-Index	00h
Description	Highest sub-index supported
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	06h
Default Value	06h
Save Object	No

Sub-Index	01h
Description	Command trigger
Data Type	UNSIGNED32
Access	WO
PDO Mapping	No
Value Range	See value definition
Default Value	00000000h
Save Object	No

Sub-Index	02h
Description	Kill password lock mode
Data Type	UNSIGNED8
Access	RW
PDO Mapping	No
Value Range	See value definition
Default Value	04h
Save Object	No

Sub-Index	03h
Description	Access password lock mode
Data Type	UNSIGNED8
Access	RW
PDO Mapping	No
Value Range	See value definition
Default Value	04h
Save Object	No

Sub-Index	04h
Description	EPC memory bank lock mode
Data Type	UNSIGNED8
Access	RW
PDO Mapping	No
Value Range	See value definition
Default Value	04h
Save Object	No

Sub-Index	05h
Description	TID memory bank lock mode
Data Type	UNSIGNED8
Access	RW
PDO Mapping	No
Value Range	See value definition
Default Value	04h
Save Object	No

Sub-Index	06h
Description	User memory bank lock mode
Data Type	UNSIGNED8
Access	RW
PDO Mapping	No
Value Range	See value definition
Default Value	04h
Save Object	No

2.4.46 Object 2524h: ISO 18000-63 Transponder Kill

This object shall kill a known (ID) ISO 18000-63 tag.

Value Definition:

Sub-index 00h contains the number of valid object entries within the record. Its value is 02h.

Sub-index 01h shall start the ISO 18000-63 transponder kill. In order to avoid the ISO 18000-63 transponder kill start by mistake, it shall be only executed when a specific signature is written to the appropriate sub-index. The signature that shall be written is 'trig':

	32			0
ASCII	g	i	r	t
HEX	67h	69h	72h	74h
	MSB		LSB	

On reception of the correct signature in the appropriate sub-index the **BLUEBOX** shall start the ISO 18000-63 transponder kill and then it shall confirm the SDO transmission (SDO download initiate response). The status of the operation execution shall be checked through the device status object (object 2100h).

If a wrong signature is written or the **BLUEBOX** is already executing a triggered operation, the **BLUEBOX** shall refuse to start the operation execution and it shall respond with the SDO abort transfer service (abort code: 0800002xh).

Sub-index 02h shall indicate the kill password.

Object Description:

Index	2524h
Name	ISO 18000-63 transponder kill
Object Code	RECORD
Data Type	ISO 18000-63 transponder kill record

Entry Description:

Sub-Index	00h
Description	Highest sub-index supported
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	02h
Default Value	02h
Save Object	No

Sub-Index	01h
Description	Command trigger
Data Type	UNSIGNED32
Access	WO
PDO Mapping	No
Value Range	See value definition
Default Value	00000000h
Save Object	No

Sub-Index	02h
Description	Kill password
Data Type	UNSIGNED32

Access	RW
PDO Mapping	No
Value Range	UNSIGNED32
Default Value	00000000h
Save Object	No

2.4.47 Object 2530h: Monza 4QT Transponder QT Read

This object shall send a QT read command to an **Impinj Monza 4QT** transponder. For more details see the specific transponder data sheet..

Value Definition:

Sub-index 00h contains the number of valid object entries within the record. Its value is 02h.

Sub-index 01h shall start the Impinj Monza 4QT transponder QT read. In order to avoid the Impinj Monza 4QT transponder QT read start by mistake, it shall be only executed when a specific signature is written to the appropriate sub-index. The signature that shall be written is 'trig':

	32			0
ASCII	g	i	r	t
HEX	67h	69h	72h	74h
	MSB		LSB	

On reception of the correct signature in the appropriate sub-index the **BLUEBOX** shall start the Impinj Monza 4QT transponder QT read and then it shall confirm the SDO transmission (SDO download initiate response). The status of the operation execution shall be checked through the device status object (object 2100h).

If a wrong signature is written or the **BLUEBOX** is already executing a triggered operation, the **BLUEBOX** shall refuse to start the operation execution and it shall respond with the SDO abort transfer service (abort code: 0800002xh).

Sub-index 02h shall provide the QT control field read from tag.

Object Description:

Index	2530h
Name	Impinj Monza 4QT transponder QT read
Object Code	RECORD
Data Type	Impinj Monza 4QT transponder QT read record

Entry Description:

Sub-Index	00h
Description	Highest sub-index supported
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	02h
Default Value	02h
Save Object	No

Sub-Index	01h
Description	Command trigger
Data Type	UNSIGNED32
Access	WO
PDO Mapping	No
Value Range	See value definition
Default Value	00000000h
Save Object	No

Sub-Index	02h
Description	QT control
Data Type	UNSIGNED16

Access	RO
PDO Mapping	No
Value Range	UNSIGNED16
Default Value	0000h
Save Object	No

2.4.48 Object 2531h: Monza 4QT Transponder QT Write

This object shall send a QT write command to an **Impinj Monza 4QT** transponder. For more details see the specific transponder data sheet..

Value Definition:

Sub-index 00h contains the number of valid object entries within the record. Its value is 03h.

Sub-index 01h shall start the Impinj Monza 4QT transponder QT write. In order to avoid the Impinj Monza 4QT transponder QT write start by mistake, it shall be only executed when a specific signature is written to the appropriate sub-index. The signature that shall be written is 'trig':

	32			0
ASCII	g	i	r	t
HEX	67h	69h	72h	74h
	MSB		LSB	

On reception of the correct signature in the appropriate sub-index the **BLUEBOX** shall start the Impinj Monza 4QT transponder QT write and then it shall confirm the SDO transmission (SDO download initiate response). The status of the operation execution shall be checked through the device status object (object 2100h).

If a wrong signature is written or the **BLUEBOX** is already executing a triggered operation, the **BLUEBOX** shall refuse to start the operation execution and it shall respond with the SDO abort transfer service (abort code: 0800002xh).

Sub-index 02h shall indicate wheter the QT control is written to non volatile or volatile memory. An attempt to change the value of the persistence to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h).

Value	Persistence
00h	Write to volatile memory
01h	Write to non volatile memory

Sub-index 03h shall indicate the QT control field to be written to tag.

Object Description:

Index	2531h
Name	Impinj Monza 4QT transponder QT write
Object Code	RECORD
Data Type	Impinj Monza 4QT transponder QT write record

Entry Description:

Sub-Index	00h
Description	Highest sub-index supported
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	03h
Default Value	03h
Save Object	No

Sub-Index	01h
Description	Command trigger
Data Type	UNSIGNED32
Access	WO
PDO Mapping	No
Value Range	See value definition
Default Value	No

Save Object	No
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Sub-Index	02h
Description	Persistence
Data Type	UNSIGNED8
Access	RW
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	00h
Save Object	No

Sub-Index	03h
Description	QT control
Data Type	UNSIGNED16
Access	RW
PDO Mapping	No
Value Range	UNSIGNED16
Default Value	0000h
Save Object	No

2.4.49 Object 2540h: Magnus Sx Transponder Read Sensor Code

This object shall read the sensor code of an **RFMicron Magnus S2** and **S3** transponder. For more details see the specific transponder data sheet.

Value Definition:

Sub-index 00h contains the number of valid object entries within the record. Its value is 03h.

Sub-index 01h shall start the RFMicron Magnus Sx transponder read sensor code. In order to avoid the RFMicron Magnus Sx transponder read sensor code start by mistake, it shall be only executed when a specific signature is written to the appropriate sub-index. The signature that shall be written is 'trig':

	32			0
ASCII	g	i	r	t
HEX	67h	69h	72h	74h
	MSB		LSB	

On reception of the correct signature in the appropriate sub-index the **BLUEBOX** shall start the RFMicron Magnus Sx transponder read sensor code and then it shall confirm the SDO transmission (SDO download initiate response). The status of the operation execution shall be checked through the device status object (object 2100h).

If a wrong signature is written or the **BLUEBOX** is already executing a triggered operation, the **BLUEBOX** shall refuse to start the operation execution and it shall respond with the SDO abort transfer service (abort code: 0800002xh).

Sub-index 02h shall indicate the chip type. An attempt to change the value of the chip type to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h).

Value	Chip Type
02h	Magnus S2
03h	Magnus S3

Sub-index 03h shall provide the sensor code received from the tag.

Object Description:

Index	2540h
Name	RFMicron Magnus Sx transponder read sensor code
Object Code	RECORD
Data Type	RFMicron Magnus Sx transponder read sensor code record

Entry Description:

Sub-Index	00h
Description	Highest sub-index supported
Data Type	UNSIGNED8

Access	RO
PDO Mapping	No
Value Range	03h
Default Value	03h
Save Object	No

Sub-Index	01h
Description	Command trigger
Data Type	UNSIGNED32
Access	WO
PDO Mapping	No
Value Range	See value definition
Default Value	No
Save Object	No

Sub-Index	02h
Description	Chip type
Data Type	UNSIGNED8
Access	RW
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	02h
Save Object	No

Sub-Index	03h
Description	Sensor code
Data Type	UNSIGNED16
Access	RO

PDO Mapping	No
Value Range	UNSIGNED16
Default Value	0000h
Save Object	No

2.4.50 Object 2541h: Magnus Sx Transponder Read On-Chip RSSI

This object shall read the on-chip RSSI of an **RFMicron Magnus S2** and **S3** transponder. For more details see the specific transponder data sheet.

Value Definition:

Sub-index 00h contains the number of valid object entries within the record. Its value is 05h.

Sub-index 01h shall start the RFMicron Magnus Sx transponder read on-chip RSSI. In order to avoid the RFMicron Magnus Sx transponder read on-chip RSSI start by mistake, it shall be only executed when a specific signature is written to the appropriate sub-index. The signature that shall be written is 'trig':

	32			0
ASCII	g	i	r	t
HEX	67h	69h	72h	74h
	MSB		LSB	

On reception of the correct signature in the appropriate sub-index the **BLUEBOX** shall start the RFMicron Magnus Sx transponder read on-chip RSSI and then it shall confirm the SDO transmission (SDO download initiate response). The status of the operation execution shall be checked through the device status object (object 2100h).

If a wrong signature is written or the **BLUEBOX** is already executing a triggered operation, the **BLUEBOX** shall refuse to start the operation execution and it shall respond with the SDO abort transfer service (abort code: 0800002xh).

Sub-index 02h shall indicate the chip type. An attempt to change the value of the chip type to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h).

Value	Chip Type
02h	Magnus S2

Value	Chip Type
03h	Magnus S3

Sub-index 03h shall indicate the threshold match criteria. An attempt to change the value of the threshold match criteria to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h).

Value	Match Criteria
00h	Match if code is \leq threshold
01h	Match if code is $>$ threshold

Sub-index 04h shall indicate the RSSI threshold. An attempt to change the value of the RSSI threshold to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h).

Sub-index 05h shall provide the on-chip RSSI received from the tag.

Object Description:

Index	2541h
Name	RFMicron Magnus Sx transponder read on-chip RSSI
Object Code	RECORD
Data Type	RFMicron Magnus Sx transponder read on-chip RSSI record

Entry Description:

Sub-Index	00h
Description	Highest sub-index supported
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	05h
Default Value	05h
Save Object	No

Sub-Index	01h
Description	Command trigger
Data Type	UNSIGNED32
Access	WO
PDO Mapping	No
Value Range	See value definition
Default Value	No
Save Object	No

Sub-Index	02h
Description	Chip type
Data Type	UNSIGNED8
Access	RW
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	02h
Save Object	No

Sub-Index	03h
Description	Match criteria
Data Type	UNSIGNED8
Access	RW
PDO Mapping	No
Value Range	See value definition
Default Value	00h
Save Object	No

Sub-Index	04h
Description	RSSI threshold
Data Type	UNSIGNED8
Access	RW
PDO Mapping	No
Value Range	0 ... 31
Default Value	00h
Save Object	No

Sub-Index	05h
Description	On-chip RSSI
Data Type	UNSIGNED8
Access	RO
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	00h
Save Object	No

2.4.51 Object 2542h: Magnus Sx Transponder Read Temperature Code

This object shall read the temperature code of an **RFMicron Magnus S3** transponder. For more details see the specific transponder data sheet.

Value Definition:

Sub-index 00h contains the number of valid object entries within the record. Its value is 03h.

Sub-index 01h shall start the RFMicron Magnus Sx transponder read temperature code. In order to avoid the RFMicron Magnus Sx transponder read temperature code start by mistake, it shall be only executed when a specific signature is written to the appropriate sub-index. The signature that shall be written is 'trig':

	32			0
ASCII	g	i	r	t
HEX	67h	69h	72h	74h
	MSB		LSB	

On reception of the correct signature in the appropriate sub-index the **BLUEBOX** shall start the RFMicron Magnus Sx transponder read temperature code and then it shall confirm the SDO transmission (SDO download initiate response). The status of the operation execution shall be checked through the device status object (object 2100h).

If a wrong signature is written or the **BLUEBOX** is already executing a triggered operation, the **BLUEBOX** shall refuse to start the operation execution and it shall respond with the SDO abort transfer service (abort code: 0800002xh).

Sub-index 02h shall indicate the chip type. An attempt to change the value of the chip type to any not supported value shall be responded with the SDO abort transfer service (abort code: 06090030h).

Value	Chip Type
03h	Magnus S3

Sub-index 03h shall provide the temperature code received from the tag.

Object Description:

Index	2542h
Name	RFMicron Magnus Sx transponder read temperature code
Object Code	RECORD
Data Type	RFMicron Magnus Sx transponder read temperature code record

Entry Description:

Sub-Index	00h
Description	Highest sub-index supported
Data Type	UNSIGNED8
Access	RO

PDO Mapping	No
Value Range	03h
Default Value	03h
Save Object	No

Sub-Index	01h
Description	Command trigger
Data Type	UNSIGNED32
Access	WO
PDO Mapping	No
Value Range	See value definition
Default Value	No
Save Object	No

Sub-Index	02h
Description	Chip type
Data Type	UNSIGNED8
Access	RW
PDO Mapping	No
Value Range	UNSIGNED8
Default Value	03h
Save Object	No

Sub-Index	03h
Description	Temperature code
Data Type	UNSIGNED16
Access	RO
PDO Mapping	No

Value Range	UNSIGNED16
Default Value	0000h
Save Object	No

2.4.52 Object 2F50h: Download Firmware File

This object shall download the firmware file to the **BLUEBOX**.

Object Description:

Index	2F50h
Name	Download firmware file
Object Code	VAR
Data Type	DOMAIN

Entry Description:

Sub-Index	00h
Access	WO
PDO Mapping	No
Value Range	DOMAIN
Default Value	No
Save Object	No

2.4.53 Object 2F51h: Download Firmware File Control

This object shall control the firmware upgrade of the **BLUEBOX**.

Value Definition:

Sub-index 00h shall control the firmware upgrade of the **BLUEBOX**. In order to avoid to start the firmware upgrade by mistake, it shall be only executed when a specific signature is written to the appropriate sub-index. The signature that shall be written is 'upgr':

	32			0
ASCII	r	g	p	u
HEX	72h	67h	70h	76h
	MSB		LSB	

On reception of the correct signature in the appropriate sub-index the **BLUEBOX** shall start the firmware upgrade and then it shall confirm the SDO transmission (SDO download initiate response). At the end of the firmware upgrade the **BLUEBOX** shall reset itself.

If a wrong signature is written or the **BLUEBOX** is already executing a triggered operation, the **BLUEBOX** shall refuse to start the operation execution and it shall respond with the SDO abort transfer service (abort code: 0800002xh).

Object Description:

Index	2F51h
Name	Download firmware file control
Object Code	VAR
Data Type	UNSIGNED32

Entry Description:

Sub-Index	00h
Access	WO
PDO Mapping	No
Value Range	See value definition
Default Value	No
Save Object	No

2.5 Error Messages

The **BLUEBOX** supports a number of emergency messages that are sent in the event of a communication, hardware or RFID error. If one of these errors occurs, the error register (OV index 1001h), the pre-defined error field (OV index 1003h) and the error status bits (OV index 2101h) are updated.

The COB ID of the emergency message can be changed in the object "COB ID EMCY" (OV index 1014h). By setting bit 31 in this object the emergency messages are deactivated.

The disable time between two emergency messages can be defined via the object 1015h. The indication is made in steps of 100 µs



The COB ID of emergency messages is preset to NodeID+80h.

2.6 Heartbeat Monitoring

By means of the heartbeat function the activity of a device in the CANopen network can be monitored by the master. The device regularly sends a heartbeat message containing the device status.

The heartbeat function is activated by entering a value greater than '0' into the heartbeat interval time object (OV index 1017h). The value indicates the time between two heartbeat signals in milliseconds. The heartbeat function is deactivated with the value '0'.

2.7 Change Objects

Changes of the objects in the object directory are applied at once. The changes will get lost by a reset. To prevent this the objects have to be saved in the internal permanent memory. All objects marked in the object directory as 'Save object value: yes' are permanently stored in the internal permanent memory. By writing the command 'save' (65766173h) to save the objects (OV index 1010h/01h) all current objects of the object directory are transferred to the flash memory. The objects can be reset to factory setting by writing the signature 'load' (64616F63h) to the OV index 1011h/01h. After a reset the changes are applied.

2.8 Process Data Objects (PDO)

Transmit and receive process data object each are available. On delivery 1 transmit process data object is active.

2.8.1 Transmit Process Data Objects (TPDO)

The table below contains the transmit process data objects (TPDO) on delivery.

TPDO	COB ID	Mapped Object Index	Mapped Object Sub-Index	Mapped Object Length
1	NodeID + 180h	2100h	00h	20h
2	0 (deactivated)	0000h	00h	00h
3	0 (deactivated)	0000h	00h	00h
4	0 (deactivated)	0000h	00h	00h

2.8.2 Receive Process Data Objects (RPDO)

The table below contains the receive process data objects (RPDO) on delivery.

TPDO	COB ID	Mapped Object Index	Mapped Object Sub-Index	Mapped Object Length
1	0 (deactivated)	0000h	00h	00h
2	0 (deactivated)	0000h	00h	00h
3	0 (deactivated)	0000h	00h	00h
4	0 (deactivated)	0000h	00h	00h

3 Document Revision History

Date	Revision	Description
12/09/18	1.00	Initial release.
22/10/18	1.01	Updated reader's firmware versions object of this manual. Added the tag read count info in 'Current Tag' object. Minor corrections.
11/01/19	1.02	Updated the company name/logo and BLUEBOX logo. Updated reader's firmware versions object of this manual. Added the max RSSI info in 'Current Tag' object. Corrected the RSSI info in 'Current Tag' object.
05/02/19	1.03	Updated reader's firmware versions object of this manual. Added the 'Current Tags in Buffer' object.
02/09/19	1.04	Updated reader's firmware versions object of this manual. Added the 'RF Tuning Configuration' object.
06/09/19	1.05	Document format corrections.
10/12/19	1.06	Replaced ISO 18000-6C with ISO 18000-63. They are the same standard, 18000-6C became 18000-63 in 2012 due to ISO naming rules that do not allow letters in standards names.
04/05/20	1.07	Updated the reader's description object of this manual. Format changes and document fixes to all sections.
20/11/20	1.08	Updated reader's firmware versions object of this manual. Added the 'Manufacturer Hardware Version' object.

A. Supported Object Dictionary (OD) Table

	5227U HW: v1	5227U HW: v2
1000h	✓	✓
1001h	✓	✓
1003h	✓	✓
1008h	✓	✓
100Ah	✓	✓
1010h	✓	✓
1011h	✓	✓
1014h	✓	✓
1015h	✓	✓
1017h	✓	✓
1018h	✓	✓
1200h	✓	✓
1400h	✓	✓
1401h	✓	✓
1402h	✓	✓
1403h	✓	✓
1600h	✓	✓
1601h	✓	✓
1602h	✓	✓
1603h	✓	✓
1800h	✓	✓
1801h	✓	✓
1802h	✓	✓
1803h	✓	✓
1A00h	✓	✓
1A01h	✓	✓
1A02h	✓	✓
1A03h	✓	✓
20F0h	✓	✓
20F2h	✓	✓
2100h	✓	✓
2101h	✓	✓

	5227U HW: v1	5227U HW: v2
2102h	✓	✓
2111h	✓	✓
2112h	✓	✓
2113h	✓	✓
2114h	✓	✓
2151h	✓	✓
2180h	✓	✓
2181h	✓	✓
2182h	✓	✓
2183h	✓	✓
2200h	✓	✓
2201h	✓	✓
2202h	✓	✓
2203h	✓	✓
2204h		✓
2500h	✓	✓
2501h	✓	✓
2502h	✓	✓
2510h	✓	✓
2511h	✓	✓
2520h	✓	✓
2521h	✓	✓
2522h	✓	✓
2523h	✓	✓
2524h	✓	✓
2530h	✓	✓
2531h	✓	✓
2540h	✓	✓
2541h	✓	✓
2542h	✓	✓
2F50h	✓	✓
2F51h	✓	✓