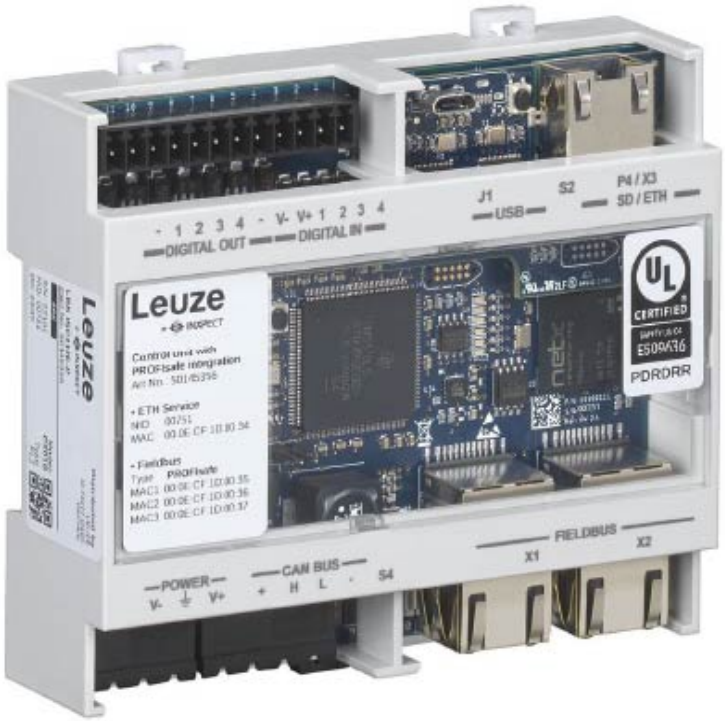
Leuze

Original Operating Instructions

Controller LBK ISC

CIP Safety Specification



The Sensor People

We reserve the right to make technical changes

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1 Purpose and Scope

This document is an addendum of the safety manual of LBK SBV System and it defines the data exchanged through CIP™ (Common Industrial Interface) based on Ethernet/IP™ and CIP Safety™ fieldbus interface.

In particular, this document describes and specifies the Fieldbus interface provided by LBK ISC110E-C controller as part of LBK SBV System.

The following topics will be covered:

- Overview of the Fieldbus interface;
- Definition of the exchanged data;
- Fieldbus parameters settings.

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2 Applicability

This release of this document is applicable to LBK SBV System, controller LBK ISC110E-C in accordance with the following .eds files:

LEUZE_LBK_ISC110E_20250627.eds	Standard ODVA configuration file

- Vendor ID: 524 (0x020C)
- Device type: 150 (0x0096)
- Product code: 5301
- Major revision: 1
- Minor revision: 1

3 System Overview

LBK ISC110E-C controller (Refer to Figure 1), part of LBK SBV System, communicates with the machine controller via CIP Safety and Ethernet/IP by means of one of the two RJ45 connectors [**X1**] and [**X2**] at the bottom (Refer to Figure 3).

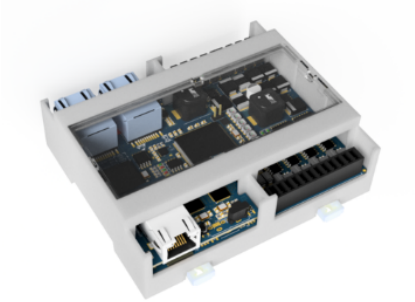

Figure 1 *LBK ISC110E-C device*

The controller is suitable for the following network topologies:

1. Linear;
2. Star;
3. Ring (DLR).

So in case 1 and 2 the two RJ45 connectors are interchangeable with the same scope while in the third case the two ports are used to create the ring topology.

The two ports are identified by the Ethernet Link CIP object in the following way:

- [X1] as “port1”
- [X2] as “port2”

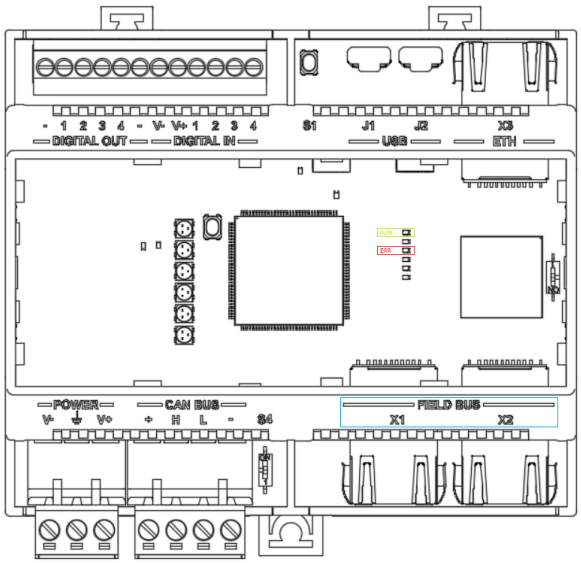

Figure 2 *LBK ISC110E-C layout*

In case of Ring network topology the controller supports the Device Level Ring (DLR) networking technology but just as a beacon-based ring node.

4 Integration into the network

To integrate the controller into the Fieldbus network the following steps shall be taken:

- Danger due to unintended use of SIL 2 data of the controllers in SIL 3 applications. Ensure that the safety-related data of the controller is only used in applications which do not exceed safety integrity level SIL 2 (IEC 61508);
- Before integrating an already-configured device into a safety-related network, reset the Fieldbus parameters (Refer to Factory reset of the fieldbus parameters on page 30);
- The controller needs a unique IP address, the sub-network mask and, possibly, the IP address of the gateway to be able to exchange data with other devices in the network.

  Options for assigning the data to the controller:

  - Using the LBK Designer application in the **Admin**/ **Fieldbus Parameters** page;
  - With a BOOTP- or DHCP server (if BOOTP or DHCP are enabled)

- Via CIP with the TCP/IP object (0xF5)

Note: Upon delivery, the controller requests an IP address via BOOTP and DHCP. Once the controller has received a valid IP address, the BOOTP and DHCP are disabled and the IP address is set as a static. Therefore, it can only be changed via LBK Designer application or via CIP with the TCP/IP object (0xF5).

The factory reset of the Fieldbus parameter described in Factory reset of the fieldbus parameters on page 30 restores the DHCP.

- The controller requires a safety network number (SSN) in a safety-relevant EtherNet/IP network. The safety network number should be identical for all devices in a safety-related EtherNet/IP network. The safety network is identified using the safety network number. The safety network number is a 48-bit identifier.

  You can assign the safety network number to the controller using the LBK Designer application in the **Admin**/ **Fieldbus Parameters** page.

Note: A function of automatic setting of the safety network number is not supported.

- If the controller has already been connected to a control and should be connected to another control, the link to the old control must be explicitly removed.

  You can remove the link to a control using the Reset ownership command of the LBK Designer application in the **Admin**/ **Fieldbus Parameters** page.

5 Exchanged data

The following data are available:

- Explicit messages, refer to Exchanged data - CIP standard objects below.
- Implicit messages used for the cyclical data transmission, refer to Exchanged data - Assembly objects on page 17.

6 Exchanged data - CIP standard objects

In addition to the cyclical data, the controller provides acyclical data via explicit messaging, e.g., for diagnostic purposes or configuration information. The data are organized in CIP objects. The CIP standard objects provided by the controllers are the following:

- Identity object (0x01);
- Message Router object (0x02);
- Assembly objects (0x04);
- Connection Manager object (0x06);
- Safety Supervisor object (0x39);
- Safety Validator objects (0x3a);
- Device Level Ring (DLR) object (0x47);
- Quality of Service (QoS) object (0x48);
- TCP/IP Interface object (0xf5);
- Ethernet Link objects (0xf6);
- LLDP Management object (0x109);
- LLDP Data Table (0x10a)

6.1 Identity object (0x01)

Class attributes

Attribute ID		Access rules	Name	Data type
Decimal	Hex			
1	0x01	get	Revision	UINT
2	0x02	get	Max. instance	UINT
3	0x03	get	Number of instances	UINT
6	0x06	get	Max. ID number class attributes	UINT
7	0x07	get	Max. ID number instance attributes	UINT

Class services

Service ID		Name	Description
Decimal	Hex		
1	0x01	Get attribute all	Retrieve all attribute values
14	0x0e	Get attribute single	Retrieve attribute value

Available instances

Instance ID	
Decimal	Hex
1	0x01

Instance attributes

Attribute ID		Access rules	Name	Data type
Decimal	Hex			
1	0x01	get	Vendor ID	UINT
2	0x02	get	Device type	UINT
3	0x03	get	Product code	UINT
4	0x04	get	Revision	STRUCT
5	0x05	get	Status	WORD
6	0x06	get	Serial number	UDINT
7	0x07	get	Product name	SHORT STRING
8	0x08	get	State	USINT

Instance services

Service ID		Name	Description
Decimal	Hex		
1	0x01	Get attribute all	Retrieve all attribute values
14	0x0e	Get attribute single	Retrieve attribute value

6.2 Message Router object (0x02)

Class attributes

Attribute ID		Access rules	Name	Data type
Decimal	Hex			
1	0x01	get	Revision	UINT
2	0x02	get	Max. instance	UINT

Attribute ID		Access rules	Name	Data type
Decimal	Hex			
3	0x03	get	Number of instances	UINT
6	0x06	get	Max. ID number class attributes	UINT
7	0x07	get	Max. ID number instance attributes	UINT

Class services

Service ID		Name	Description
Decimal	Hex		
14	0x0e	Get attribute single	Retrieve attribute value

Available instances

The controller implements the Message Router object exclusively at class level. It does not provide any instances.

6.3 Assembly object (0x04)

Class attributes

Attribute ID		Access rules	Name	Data type
Decimal	Hex			
1	0x01	get	Revision	UINT
2	0x02	get	Max. instance	UINT
3	0x03	get	Number of instances	UINT
6	0x06	get	Max. ID number class attributes	UINT
7	0x07	get	Max. ID number instance attributes	UINT

Class services

Service ID		Name	Description
Decimal	Hex		
14	0x0e	Get attribute single	Retrieve attribute value

Available instances

Instance ID		Notes
Decimal	Hex	
200	0xc8	4 bytes safe input data of the target (safe output data of the originator)
101	0x65	2 bytes safe output data of the target (safe input data of the originator)
103	0x67	4 bytes safe output data of the target (safe input data of the originator)
105	0x69	16 bytes safe output data of the target (safe input data of the originator)
107	0x6b	120 bytes non-safe output data of the target (non-safe input data of the originator)

Instance attributes

Attribute ID		Access rules	Name	Data type
Decimal	Hex			
1	0x01	get	Number of members in list	UINT
2	0x02	get	Member list	STRUCT
3	0x03	get / set *	Data	ARRAY of BYTE
4	0x04	get	Size	UINT

Note *: just for safe input data of the target (safe output data of the originator).

Instance services

Service ID		Name	Description
Decimal	Hex		
14	0x0e	Get attribute single	Retrieve attribute value
16	0x10	Set attribute single	Modify attribute value
24	0x18	Get member	Get a member of instance attribute 2

6.4 Connection Manager object (0x06)

Class attributes

Attribute ID		Access rules	Name	Data type
Decimal	Hex			
1	0x01	get	Revision	UINT
2	0x02	get	Max. instance	UINT
3	0x03	get	Number of instances	UINT
6	0x06	get	Max. ID number class attributes	UINT
7	0x07	get	Max. ID number instance attributes	UINT

Class services

Service ID		Name	Description
Decimal	Hex		
14	0x0e	Get attribute single	Retrieve attribute value

Available instances

The controller does not provide any instance attributes for the Connection Manager object.

Instance ID	
Decimal	Hex
1	0x01

Instance services

Service ID		Name	Description
Decimal	Hex		
14	0x0e	Get attribute single	Retrieve attribute value
78	0x4e	Forward Close	Close connection
84	0x54	Forward Open	Open new connection
91	0x5b	Large Forward Open	Open new connection using Large I/O data

6.5 Safety Supervisor object (0x39)

Class attributes

Attribute ID		Access rules	Name	Data type
Decimal	Hex			
1	0x01	get	Revision	UINT

Class services

Service ID		Name	Description
Decimal	Hex		
14	0x0e	Get attribute single	Retrieve attribute value

Available instances

Instance ID	
Decimal	Hex
1	0x01

Instance attributes

Attribute ID		Access rules	Name	Data type
Decimal	Hex			
11	0x0B	get	Device Status	USINT
12	0x0C	get	Exception Status	BYTE
15	0x0F	get / set	Alarm Enable	BOOL
16	0x10	get / set	Warning Enable	BOOL
25	0x19	get	Configuration UNID	10 octets
26	0x1A	get	Safety Configuration Identifier	10 octets
27	0x1B	get	Target UNID	10 octets
28	0x1C	get	OCPOUNID	STRUCT

Instance services

Service ID		Name	Description
Decimal	Hex		
14	0x0e	Get attribute single	Retrieve attribute value
16	0x10	Set attribute single	Modify attribute value
84	0x54	Safety Reset	Type 0: completely restart device

6.6 Safety Validator object (0x3a)

Class attributes

Attribute ID		Access rules	Name	Data type
Decimal	Hex			
1	0x01	get	Revision	UINT
8	0x08	get	Safety connection fault count	UINT

Class services

Service ID		Name	Description
Decimal	Hex		
14	0x0e	Get attribute single	Retrieve attribute value
75	0x4b	Reset all error counters	Reset all error counters

Available instances

Instance ID	
Decimal	Hex
1	0x01
2	0x02
3	0x03
4	0x04

Instance attributes

Attribute ID		Access rules	Name	Data type
Decimal	Hex			
1	0x01	get	Safety Validator state	USINT
2	0x02	get	Safety Validator type	USINT
3	0x03	get	Ping interval EPI multiplier	UINT
4	0x04	get	Time coord msg min multiplier	STRUCT
5	0x05	get	Network time expectation multiplier	STRUCT
6	0x06	get	Timeout multiplier	STRUCT
7	0x07	get	Max consumer number	USINT
12	0x0c	get	Max data age	UINT
13	0x0d	get	Application data path	EPATH
14	0x0e	get	Error code	UINT
15	0x0f	get	Producer / consumer fault counters	STRUCT

Instance services

Service ID		Name	Description
Decimal	Hex		
14	0x0e	Get attribute single	Retrieve attribute value
16	0x10	Set attribute single	Modify attribute value

6.7 Device Level Ring object (0x47)

Class attributes

Attribute ID		Access rules	Name	Data type
Decimal	Hex			
1	0x01	get	Revision	UINT
2	0x02	get	Max. instance	UINT
3	0x03	get	Number of instances	UINT
6	0x06	get	Max. ID number class attributes	UINT
7	0x07	get	Max. ID number instance attributes	UINT

Class services

Service ID		Name	Description
Decimal	Hex		
14	0x0e	Get attribute single	Retrieve attribute value

Available instances

Instance ID	
Decimal	Hex
1	0x01

Instance attributes

Attribute ID		Access rules	Name	Data type
Decimal	Hex			
1	0x01	get	Network topology	USINT
2	0x02	get	Network status	USINT
10	0x0a	get	Active supervisor address	STRUCT
12	0x0c	get	Capability flags	DWORD

Instance services

Service ID		Name	Description
Decimal	Hex		
1	0x01	Get attribute all	Retrieve all attribute values
14	0x0e	Get attribute single	Retrieve attribute value

6.8 Quality of Service object (0x48)

Class attributes

Attribute ID		Access rules	Name	Data type
Decimal	Hex			
1	0x01	get	Revision	UINT
2	0x02	get	Max. instance	UINT
3	0x03	get	Number of instances	UINT
6	0x06	get	Max. ID number class attributes	UINT
7	0x07	get	Max. ID number instance attributes	UINT

Class services

Service ID		Name	Description
Decimal	Hex		
14	0x0e	Get attribute single	Retrieve attribute value

Available instances

Instance ID	
Decimal	Hex
1	0x01

Instance attributes

Attribute ID		Access rules	Name	Data type
Decimal	Hex			
4	0x04	get / set	DSCP Urgent	USINT
5	0x05	get / set	DSCP Scheduled	USINT
6	0x06	get / set	DSCP High	USINT

Attribute ID		Access rules	Name	Data type
Decimal	Hex			
7	0x07	get / set	DSCP Low	USINT
8	0x08	get / set	DSCP Explicit	USINT

Instance services

Service ID		Name	Description
Decimal	Hex		
14	0x0e	Get attribute single	Retrieve attribute value
16	0x10	Set attribute single	Modify attribute value

6.9 TCP/IP Interface object (0xf5)

Class attributes

Attribute ID		Access rules	Name	Data type
Decimal	Hex			
1	0x01	get	Revision	UINT
2	0x02	get	Max. instance	UINT
3	0x03	get	Number of instances	UINT
6	0x06	get	Max. ID number class attributes	UINT
7	0x07	get	Max. ID number instance attributes	UINT

Class services

Service ID		Name	Description
Decimal	Hex		
14	0x0e	Get attribute single	Retrieve attribute value

Available instances

Instance ID	
Decimal	Hex
1	0x01

Instance attributes

Attribute ID		Access rules	Name	Data type
Decimal	Hex			
1	0x01	get	Status	DWORD
2	0x02	get	Configuration capability	DWORD
3	0x03	get / set	Configuration control	DWORD
4	0x04	get	Physical link object	STRUCT
5	0x05	get / set	Interface configuration	STRUCT
6	0x06	get / set	Host name	STRING
7	0x07	get	Safety Network Number	6 octets
10	0x0a	get / set	Select ACD	BOOL
11	0x0b	get / set	Last Conflict Detected	STRUCT
13	0x0d	get / set	Encapsulation inactivity timeout	UINT

Instance services

Service ID		Name	Description
Decimal	Hex		
1	0x01	Get attribute all	Retrieve all attribute values
14	0x0e	Get attribute single	Retrieve attribute value
16	0x10	Set attribute single	Modify attribute value

6.10 Ethernet Link object (0xf6)

Class attributes

Attribute ID		Access rules	Name	Data type
Decimal	Hex			
1	0x01	get	Revision	UINT
2	0x02	get	Max. instance	UINT
3	0x03	get	Number of instances	UINT
6	0x06	get	Max. ID number class attributes	UINT
7	0x07	get	Max. ID number instance attributes	UINT

Class services

Service ID		Name	Description
Decimal	Hex		
14	0x0e	Get attribute single	Retrieve attribute value

Available instances

Instance ID	
Decimal	Hex
1	0x01
2	0x02

Instance attributes

Attribute ID		Access rules	Name	Data type
Decimal	Hex			
1	0x01	get	Interface speed	UDINT
2	0x02	get	Interface flags	DWORD
3	0x03	get	Physical address	ARRAY
4	0x04	get	Interface counters	STRUCT
5	0x05	get	Media counters	STRUCT
6	0x06	get / set	Interface control	STRUCT
7	0x07	get	Interface type	USINT
8	0x08	get	Interface state	USINT
10	0x0a	get	Interface label	SHORT STRING
11	0x0b	get	Interface capability	STRUCT

Instance services

Service ID		Name	Description
Decimal	Hex		
1	0x01	Get attribute all	Retrieve all attribute values
14	0x0e	Get attribute single	Retrieve attribute value
16	0x10	Set attribute single	Modify attribute value
76	0x4c	Get and clear	Retrieve attribute value and clear it

6.11 LLDP Management object (0x109)

Class attributes

Attribute ID		Access rules	Name	Data type
Decimal	Hex			
1	0x01	get	Revision	UINT
2	0x02	get	Max. instance	UINT
3	0x03	get	Number of instances	UINT
6	0x06	get	Max. ID number class attributes	UINT
7	0x07	get	Max. ID number instance attributes	UINT

Class services

Service ID		Name	Description
Decimal	Hex		
14	0x0e	Get attribute single	Retrieve attribute value

Available instances

Instance ID	
Decimal	Hex
1	0x01

Instance attributes

Attribute ID		Access rules	Name	Data type
Decimal	Hex			
1	0x01	get / set	LLDP enable	STRUCT
2	0x02	get / set	Message tx interval	UINT
3	0x03	get / set	Message tx hold	USINT
4	0x04	get	LLDP datastore	WORD
5	0x05	get	Last Change	UDINT

Instance services

Service ID		Name	Description
Decimal	Hex		
1	0x01	Get attribute all	Retrieve all attribute values
14	0x0e	Get attribute single	Retrieve attribute value
16	0x10	Set attribute single	Modify attribute value

6.12 LLDP Data Table object (0x10a)

Class attributes

Attribute ID		Access rules	Name	Data type
Decimal	Hex			
1	0x01	get	Revision	UINT
2	0x02	get	Max. instance	UINT
3	0x03	get	Number of instances	UINT
6	0x06	get	Max. ID number class attributes	UINT
7	0x07	get	Max. ID number instance attributes	UINT

Class services

Service ID		Name	Description
Decimal	Hex		
14	0x0e	Get attribute single	Retrieve attribute value
17	0x11	Find next object instance	Retrieve all existing instance IDs of the LLDP Data Table Object. The syntax and semantics of this service are defined in the CIP Specification (Vol1_3.36 A-4.14)

Available instances

Instance ID	
Decimal	Hex
1	0x01
2	0x02
3	0x03
4	0x04
5	0x05
6	0x06
7	0x07
8	0x08

Instance attributes

Attribute ID		Access rules	Name	Data type
Decimal	Hex			
1	0x01	get	Ethernet Link Instance Number	UINT
2	0x02	get	MAC address	ETH_MAC_ADDR_
3	0x03	get	Interface Label	SHORT_STRING
4	0x04	get	Time To Live	UINT
5	0x05	get	System Capabilities TLV	STRUCT
6	0x06	get	IPv4 Management Addresses	STRUCT
7	0x07	get	CIP Identification	STRUCT
8	0x08	get	Additional Ethernet Capabilities	UDINT
9	0x09	get	Last Change	UINT

Instance services

Service ID		Name	Description
Decimal	Hex		
14	0x0e	Get attribute single	Retrieve attribute value

7 Exchanged data - Assembly objects

The cyclical data transmission between the CIP Safety Originator (e.g. the Safety PLC) and the controller, acting as a CIP Safety target, occurs via Assembly Objects with Safety characteristics. The controller provides one slot where various Assembly Objects can be exclusively (or all together) plugged in for transmitting the safety-related process data. The following Assembly Objects are available:

- O2T Safety 4 bytes (Assembly object 200) - 4 bytes safe input data of the target (safe output data of the originator);
- T2O Safety 2 bytes (Assembly object 101) - 2 bytes safe output data of the target (safe input data of the originator);
- T2O Safety 4 bytes (Assembly object 103) - 4 bytes safe output data of the target (safe input data of the originator);
- T2O Safety 16 bytes (Assembly object 105) - 16 bytes safe output data of the target (safe input data of the originator);

Also non-safety-related process data is available by another Assembly Object without Safety characteristics.

- T2O Non-Safe 120 bytes (Assembly object 107) - 120 bytes output non-safe data of the target (non-safe input data of the originator).

The Null instance for the Connection Application Paths is (hex): 0x8f.

7.1 Safe input data of the target (safe output data of the originator)

The following data are available as input of the controller (output of the originator):

- Selection of the dynamic configuration to be used
- Restart signal
- System recondition signal
- Sensor muting signal
- OSSD values setting
- Anti-masking reference saving
- Anti-rotation reference saving

The following table reports in detail the exchanged input data of the controller.

Name	Data type	Values	Definition
Set configuration ID (bit 0 - 4)	BOOL	0 - 31	Set dynamically the configuration to be used. **Note**: this value has effect only if digital inputs are not set as “Dynamic configuration switch”.
Restart signal Detection Field 1	BOOL	TRUE FALSE	To activate the action, the control has to perform a transition of this signal from FALSE to TRUE and from TRUE to FALSE with a minimum duration of 50 ms.
Restart signal Detection Field 2	BOOL	TRUE FALSE	
Restart signal Detection Field 3	BOOL	TRUE FALSE	
Restart signal Detection Field 4	BOOL	TRUE FALSE	
System recondition signal	BOOL	TRUE FALSE	To activate the action, the control has to perform a transition of this signal from FALSE to TRUE and from TRUE to FALSE with a minimum duration of 50 ms.
Mute Sensor 1	BOOL	TRUE FALSE	To mute a specific sensor, the control has to set the value to TRUE. To unmute a specific sensor, the control has to set the value to FALSE. **Note**: this value has effect only if digital inputs are not set as “Muting group 1” and/or “Muting group 2”.
Mute Sensor 2	BOOL	TRUE FALSE	
Mute Sensor 3	BOOL	TRUE FALSE	
Mute Sensor 4	BOOL	TRUE FALSE	
Mute Sensor 5	BOOL	TRUE FALSE	
Mute Sensor 6	BOOL	TRUE FALSE	
Set OSSD 1	BOOL	TRUE FALSE	To set as ON-state a specific OSSD, the control has to set the value to TRUE. To set as OFF-state a specific OSSD, the control has to set the value to FALSE. **Note**: this value has effect only if digital outputs are set as “Fieldbus controlled”.
Set OSSD 2	BOOL	TRUE FALSE	
Set OSSD 3	BOOL	TRUE FALSE	
Set OSSD 4	BOOL	TRUE FALSE	
Mute Group 1	BOOL	TRUE FALSE	To mute a specific sensor, the control has to set the value to TRUE. To unmute a specific sensor, the control has to set the value to FALSE. **Note**: this value has effect only if digital inputs are not set as “Muting group 1” and/or “Muting group 2”.
Mute Group 2	BOOL	TRUE FALSE	

Name	Data type	Values	Definition
Anti-masking reference saving	BOOL	TRUE FALSE	To activate the action, the control has to perform a transition of this signal from FALSE to TRUE and from TRUE to FALSE with a minimum duration of 50 ms.
Anti-rotation reference saving	BOOL	TRUE FALSE	To activate the action, the control has to perform a transition of this signal from FALSE to TRUE and from TRUE to FALSE with a minimum duration of 50 ms.

7.2 Safe output data of the target (safe input data of the originator)

Depending on the selected module, the following data are available as output of the controller (input of the originator):

- Detection field status
- Muting status
- Stop signal feedback
- Diagnostic signal feedback
- Configuration signal feedback
- Restart signal feedback
- Static object detection field status
- Current configuration ID
- OSSD values
- Input values
- Single channel input values
- Sensor presence field
- Sensor working mode

The following table reports in detail the exchanged output data of the controller at the system level.

Name	Data type	Values	Definition
Detection Field 1	BOOL	TRUE FALSE	Value is FALSE if the specific detection field is in detection or the restart timeout is not expired. In addition, any fault condition results in reaching the safe state of the system, forcing the value to FALSE. TRUE otherwise.
Detection Field 2	BOOL	TRUE FALSE	
Detection Field 3	BOOL	TRUE FALSE	
Detection Field 4	BOOL	TRUE FALSE	
Muting status	BOOL	TRUE FALSE	Value is FALSE if at least a field of a sensor is muted. TRUE otherwise.
Stop feedback signal	BOOL	TRUE FALSE	Value is FALSE if a stop signal is present on the digital input set as “Stop signal”. TRUE otherwise.

Name	Data type	Values	Definition
Diagnostic feedback signal	BOOL	TRUE FALSE	Value is FALSE if a diagnostic condition is present. TRUE otherwise.
Configuration feedback	BOOL	TRUE FALSE	Value is FALSE if the system is in “Configuration” state. TRUE otherwise.
Restart feedback signal	BOOL	TRUE FALSE	Value is FALSE if at least a field of a sensor is ready to restart by a “Restart signal”. TRUE otherwise.
Configuration ID bit 0	BOOL	0 - 31	Value indicates the dynamic configuration ID currently in use.
Configuration ID bit 1	BOOL		
Configuration ID bit 2	BOOL		
Configuration ID bit 3	BOOL		
Configuration ID bit 4	BOOL		
Restart Signal feedback Detection Field 1	BOOL	TRUE FALSE	Value is FALSE if the specific field of at least a sensor is ready to restart by a “Restart signal”. TRUE otherwise.
Restart Signal feedback Detection Field 2	BOOL	TRUE FALSE	
Restart Signal feedback Detection Field 3	BOOL	TRUE FALSE	
Restart Signal feedback Detection Field 4	BOOL	TRUE FALSE	
Static Object Detection status Detection Field 1	BOOL	TRUE FALSE	Value is TRUE if in the specific detection field of at least a sensor is performed a static detection. FALSE otherwise.
Static Object Detection status Detection Field 2	BOOL	TRUE FALSE	
Static Object Detection status Detection Field 3	BOOL	TRUE FALSE	
Static Object Detection status Detection Field 4	BOOL	TRUE FALSE	
OSSD 1	BOOL	TRUE FALSE	Value is TRUE if the specific OSSD is set ON. FALSE otherwise.
OSSD 2	BOOL	TRUE FALSE	
OSSD 3	BOOL	TRUE FALSE	
OSSD 4	BOOL	TRUE FALSE	
Input 1	BOOL	TRUE FALSE	Value is TRUE if the specific double channel input is set ON. FALSE otherwise.
Input 2	BOOL	TRUE FALSE	

Name	Data type	Values	Definition
Channel 1 Input 1	BOOL	TRUE FALSE	Value is TRUE if the specific single channel input is set ON. FALSE otherwise.
Channel 2 Input 1	BOOL	TRUE FALSE	
Channel 1 Input 2	BOOL	TRUE FALSE	
Channel 2 Input 2	BOOL	TRUE FALSE	

The following table reports in detail the exchanged output data of the controller for each connected sensor (where n is the sensor number and the range is from 1 to 6).

Name	Data type	Values	Definition
Sensor n Detection Field 1	BOOL	TRUE FALSE	Value is FALSE if the specific detection field of the sensor is in detection or the restart timeout is not expired. In addition, any fault condition results in reaching the safe state of the system, forcing the value to FALSE. TRUE otherwise.
Sensor n Detection Field 2	BOOL	TRUE FALSE	
Sensor n Detection Field 3	BOOL	TRUE FALSE	
Sensor n Detection Field 4	BOOL	TRUE FALSE	
Sensor n Diagnostic feedback	BOOL	TRUE FALSE	Value is FALSE if a diagnostic condition is present. TRUE otherwise.
Sensor n Muting feedback	BOOL	TRUE FALSE	Value is FALSE if at least a field is muted. TRUE otherwise.
Sensor n Reserved	BOOL	TRUE FALSE	
Sensor n Installation status	BOOL	TRUE FALSE	Value is TRUE if the sensor is used. FALSE otherwise.
Sensor n Presence Detection Field 1	BOOL	TRUE FALSE	Value is FALSE if a target is present in the specific field. TRUE otherwise.
Sensor n Presence Detection Field 2	BOOL	TRUE FALSE	
Sensor n Presence Detection Field 3	BOOL	TRUE FALSE	
Sensor n Presence Detection Field 4	BOOL	TRUE FALSE	

Name	Data type	Values	Definition
Sensor n Working Mode 1	BOOL	TRUE FALSE	It represents the current working mode of the sensor: FALSE, it is working in “Restart prevention”. TRUE, it is working in “Access mode”.
Sensor n Working Mode 2	BOOL	TRUE FALSE	
Sensor n Working Mode 3	BOOL	TRUE FALSE	
Sensor n Working Mode 4	BOOL	TRUE FALSE	

7.3 Non-safe output data of the target (non-safe input data of the originator)

The same information of safe output is also available as non-safe output data for monitoring purposes. They must not be used for safety-related tasks.

Detection field distance

Detection field x distance represents the minimum distance of the target detected in the field x. The distance is reported in mm. Value 0 is used in case of no detection.
By default, the value is given in big endian format. It is possible during the configuration of the system to select a little endian format.

Detection field azimuth angle

Detection field x azimuth angle represents the azimuth angle of the minimum distance of the target detected in the field x. The angle is reported in degrees(°) in the range (0°, +180°) and centered in 90°.

Note: this section is not available for LBK S-01 System.

Note: in order to obtain an angle in the range [-90°, +90°] centered in 0°, just subtract 90 to the read value.

7.4 O2T Safety 4 bytes (Assembly object 200)

Connection Application Paths (hex): 20 04 24 8F 2C C8 2C 8F

Byte 0							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Restart signal Detection Field 3	Restart signal Detection Field 2	Restart signal Detection Field 1	ID of configuration to be set bit4	ID of configuration to be set bit3	ID of configuration to be set bit2	ID of configuration to be set bit1	ID of configuration to be set bit0
Byte 1							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Muting command Sensor 6	Muting command Sensor 5	Muting command Sensor 4	Muting command Sensor 3	Muting command Sensor 2	Muting command Sensor 1	System recondition signal	Restart signal Detection Field 4
Byte 2							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Anti-masking reference saving	Reserved	Muting command Group 2	Muting command Group 1	Set OSSD 4	Set OSSD 3	Set OSSD 2	Set OSSD 1

Byte 3							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Anti-rotation reference saving

7.5 T2O Safety 2 bytes (Assembly object 101)

Connection Application Paths (hex): 20 04 24 8F 2C 8F 2C

Byte 0							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Configuration feedback	System diagnostic signal	Stop feedback signal	Muting status	Detection Field 4	Detection Field 3	Detection Field 2	Detection Field 1
Byte 1							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Reserved	Reserved	Configuration ID bit 4	Configuration ID bit 3	Configuration ID bit 2	Configuration ID bit 1	Configuration ID bit 0	Restart feedback signal

7.6 T2O Safety 4 bytes (Assembly object 103)

Connection Application Paths (hex): 20 04 24 8F 2C 8F 2C 67

Byte 0							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Configuration feedback	System diagnostic signal	Stop feedback signal	Muting status	Detection Field 4	Detection Field 3	Detection Field 2	Detection Field 1
Byte 1							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Static Object Detection Field 4	Static Object Detection Field 3	Static Object Detection Field 2	Static Object Detection Field 1	Restart feedback signal Detection Field 4	Restart feedback signal Detection Field 3	Restart feedback signal Detection Field 2	Restart feedback signal Detection Field 1
Byte 2							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
OSSD 3	OSSD 2	OSSD 1	Configuration ID bit 4	Configuration ID bit 3	Configuration ID bit 2	Configuration ID bit 1	Configuration ID bit 0
Byte 3							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Reserved	Channel 2 Input 2	Channel 1 Input 2	Channel 2 Input 1	Channel 1 Input 1	Input 2	Input 1	OSSD 4

7.7 T2O Safety 16 bytes (Assembly object 105)

Connection Application Paths (hex): 20 04 24 8F 2C 8F 2C 69

Byte 0							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Configuration feedback	System diagnostic signal	Stop feedback signal	Muting status	Detection Field 4	Detection Field 3	Detection Field 2	Detection Field 1
Byte 1							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Static Object Detection Field 4	Static Object Detection Field 3	Static Object Detection Field 2	Static Object Detection Field 1	Restart feedback signal Detection Field 4	Restart feedback signal Detection Field 3	Restart feedback signal Detection Field 2	Restart feedback signal Detection Field 1
Byte 2							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
OSSD 3	OSSD 2	OSSD 1	Configuration ID bit 4	Configuration ID bit 3	Configuration ID bit 2	Configuration ID bit 1	Configuration ID bit 0
Byte 3							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Reserved	Channel 2 Input 2	Channel 1 Input 2	Channel 2 Input 1	Channel 1 Input 1	Input 2	Input 1	OSSD 4
Byte 4							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Sensor 1 Installation status	Sensor 1 Reserved	Sensor 1 Muting feedback	Sensor 1 Diagnostic feedback	Sensor 1 Detection Field 4	Sensor 1 Detection Field 3	Sensor 1 Detection Field 2	Sensor 1 Detection Field 1
Byte 5							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Sensor 1 Working Mode 4	Sensor 1 Working Mode 3	Sensor 1 Working Mode 2	Sensor 1 Working Mode 1	Sensor 1 Presence Field 4	Sensor 1 Presence Field 3	Sensor 1 Presence Field 2	Sensor 1 Presence Field 1
Byte 6							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Sensor 2 Installation status	Sensor 2 Reserved	Sensor 2 Muting feedback	Sensor 2 Diagnostic feedback	Sensor 2 Detection Field 4	Sensor 2 Detection Field 3	Sensor 2 Detection Field 2	Sensor 2 Detection Field 1
Byte 7							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Sensor 2 Working Mode 4	Sensor 2 Working Mode 3	Sensor 2 Working Mode 2	Sensor 2 Working Mode 1	Sensor 2 Presence Field 4	Sensor 2 Presence Field 3	Sensor 2 Presence Field 2	Sensor 2 Presence Field 1
Byte 8							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Sensor 3 Installation status	Sensor 3 Reserved	Sensor 3 Muting feedback	Sensor 3 Diagnostic feedback	Sensor 3 Detection Field 4	Sensor 3 Detection Field 3	Sensor 3 Detection Field 2	Sensor 3 Detection Field 1

Byte 9							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Sensor 3 Working Mode 4	Sensor 3 Working Mode 3	Sensor 3 Working Mode 2	Sensor 3 Working Mode 1	Sensor 3 Presence Field 4	Sensor 3 Presence Field 3	Sensor 3 Presence Field 2	Sensor 3 Presence Field 1
Byte 10							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Sensor 4 Installation status	Sensor 4 Reserved	Sensor 4 Muting feedback	Sensor 4 Diagnostic feedback	Sensor 4 Detection Field 4	Sensor 4 Detection Field 3	Sensor 4 Detection Field 2	Sensor 4 Detection Field 1
Byte 11							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Sensor 4 Working Mode 4	Sensor 4 Working Mode 3	Sensor 4 Working Mode 2	Sensor 4 Working Mode 1	Sensor 4 Presence Field 4	Sensor 4 Presence Field 3	Sensor 4 Presence Field 2	Sensor 4 Presence Field 1
Byte 12							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Sensor 5 Installation status	Sensor 5 Reserved	Sensor 5 Muting feedback	Sensor 5 Diagnostic feedback	Sensor 5 Detection Field 4	Sensor 5 Detection Field 3	Sensor 5 Detection Field 2	Sensor 5 Detection Field 1
Byte 13							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Sensor 5 Working Mode 4	Sensor 5 Working Mode 3	Sensor 5 Working Mode 2	Sensor 5 Working Mode 1	Sensor 5 Presence Field 4	Sensor 5 Presence Field 3	Sensor 5 Presence Field 2	Sensor 5 Presence Field 1
Byte 14							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Sensor 6 Installation status	Sensor 6 Reserved	Sensor 6 Muting feedback	Sensor 6 Diagnostic feedback	Sensor 6 Detection Field 4	Sensor 6 Detection Field 3	Sensor 6 Detection Field 2	Sensor 6 Detection Field 1
Byte 15							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Sensor 6 Working Mode 4	Sensor 6 Working Mode 3	Sensor 6 Working Mode 2	Sensor 6 Working Mode 1	Sensor 6 Presence Field 4	Sensor 6 Presence Field 3	Sensor 6 Presence Field 2	Sensor 6 Presence Field 1

7.8 T2O Non-Safe 120 bytes (Assembly object 107)

Note: the sequence of the bytes is compliant with Rockwell EDS-AOP feature.

Connection Application Paths (hex): 20 04 2C C1 2C 6B

It provides 120-byte output data (inputs of the control host) divided in:

- **Controller and sensor diagnostics** as reported in Table 1 .

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Controller status							
1	Controller - Error status							
2 - 3	Controller - Detailed error status (16 bit)							
4	Sensor 1 - Error status							

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
5	Sensor 2 - Error status							
6	Sensor 3 - Error status							
7	Sensor 4 - Error status							
8	Sensor 5 - Error status							
9	Sensor 6 - Error status							
10 - 11	Sensor 1- Detailed error status (16 bit)							
12 - 13	Sensor 2 - Detailed error status (16 bit)							
14 -15	Sensor 3 - Detailed error status (16 bit)							
16 - 17	Sensor 4 - Detailed error status (16 bit)							
18 - 19	Sensor 5 - Detailed error status (16 bit)							
20 - 21	Sensor 6 - Detailed error status (16 bit)							

Table 1 *Extended Info module - Error status*

- **Target distance and azimuth angle** of each sensor (as reported in Table 2 , Table 3 , Table 4 , Table 5 , Table 6 and Table 7). It is the current distance and azimuth angle of a target detected by each sensor. For details refer to par. Detection field distance on page 22 and par. Detection field azimuth angle on page 22.

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
22 - 23	Sensor 1 - Detection field 1 distance (16 bit)							
24 - 25	Sensor 1 - Detection field 2 distance (16 bit)							
26 - 27	Sensor 1 - Detection field 3 distance (16 bit)							
28 - 29	Sensor 1 - Detection field 4 distance (16 bit)							
30	Sensor 1 - Detection field 1 azimuth angle (8 bit)							
31	Sensor 1 - Detection field 2 azimuth angle (8 bit)							
32	Sensor 1 - Detection field 3 azimuth angle (8 bit)							
33	Sensor 1 - Detection field 4 azimuth angle (8 bit)							

Table 2 *Extended Info module - Target distances and azimuth angles for Sensor 1*

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
34 - 35	Sensor 2 - Detection field 1 distance (16 bit)							
36 - 37	Sensor 2 - Detection field 2 distance (16 bit)							
38 - 39	Sensor 2 - Detection field 3 distance (16 bit)							
40 - 41	Sensor 2 - Detection field 4 distance (16 bit)							
42	Sensor 2 - Detection field 1 azimuth angle (8 bit)							
43	Sensor 2 - Detection field 2 azimuth angle (8 bit)							
44	Sensor 2 - Detection field 3 azimuth angle (8 bit)							
44	Sensor 2 - Detection field 4 azimuth angle (8 bit)							

Table 3 *Extended Info module - Target distances and azimuth angles for Sensor 2*

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
46 - 47	Sensor 3 - Detection field 1 distance (16 bit)							
48 - 49	Sensor 3 - Detection field 2 distance (16 bit)							
50 - 51	Sensor 3 - Detection field 3 distance (16 bit)							
52 - 53	Sensor 3 - Detection field 4 distance (16 bit)							
54	Sensor 3 - Detection field 1 azimuth angle (8 bit)							
55	Sensor 3 - Detection field 2 azimuth angle (8 bit)							
56	Sensor 3 - Detection field 3 azimuth angle (8 bit)							
57	Sensor 3 - Detection field 4 azimuth angle (8 bit)							

Table 4 *Extended Info module - Target distances and azimuth angles for Sensor 3*

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
58 - 59	Sensor 4 - Detection field 1 distance (16 bit)							
60 -61	Sensor 4 - Detection field 2 distance (16 bit)							
62 - 63	Sensor 4 - Detection field 3 distance (16 bit)							
64 - 65	Sensor 4 - Detection field 4 distance (16 bit)							
66	Sensor 4 - Detection field 1 azimuth angle (8 bit)							
67	Sensor 4 - Detection field 2 azimuth angle (8 bit)							
68	Sensor 4 - Detection field 3 azimuth angle (8 bit)							
69	Sensor 4 - Detection field 4 azimuth angle (8 bit)							

Table 5 *Extended Info module - Target distances and azimuth angles for Sensor 4*

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
70 - 71	Sensor 5 - Detection field 1 distance (16 bit)							
72 -73	Sensor 5 - Detection field 2 distance (16 bit)							
74 - 75	Sensor 5 - Detection field 3 distance (16 bit)							
76 - 77	Sensor 5 - Detection field 4 distance (16 bit)							
78	Sensor 5 - Detection field 1 azimuth angle (8 bit)							
79	Sensor 5 - Detection field 2 azimuth angle (8 bit)							
80	Sensor 5 - Detection field 3 azimuth angle (8 bit)							
81	Sensor 5 - Detection field 4 azimuth angle (8 bit)							

Table 6 *Extended Info module - Target distances and azimuth angles for Sensor 5*

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
82 - 83	Sensor 6 - Detection field 1 distance (16 bit)							
84 -85	Sensor 6 - Detection field 2 distance (16 bit)							
86 - 87	Sensor 6 - Detection field 3 distance (16 bit)							
88 - 89	Sensor 6 - Detection field 4 distance (16 bit)							
90	Sensor 6 - Detection field 1 azimuth angle (8 bit)							
91	Sensor 6 - Detection field 2 azimuth angle (8 bit)							
92	Sensor 6 Detection field 3 azimuth angle (8 bit)							
93	Sensor 6 - Detection field 4 azimuth angle (8 bit)							

Table 7 *Extended Info module - Target distances and azimuth angles for Sensor 6*

- **Controller and sensors status** as reported in Table 8 .

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
94	Sensor 1 status (1/2)							
95	Sensor 1 status (2/2)							
96	Sensor 2 status (1/2)							
97	Sensor 2 status (2/2)							
98	Sensor 3 status (1/2)							
99	Sensor 3 status (2/2)							
100	Sensor 4 status (1/2)							
101	Sensor 4 status (2/2)							
102	Sensor 5 status (1/2)							
103	Sensor 5 status (2/2)							
104	Sensor 6 status (1/2)							
105	Sensor 6 status (2/2)							

Table 8 *Extended Info module - Status*

- Static object detection option information (as reported in Table 9).

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
106	Sensor 1 static object detection field 1 to 4 (+4 reserved bits)							
107	Sensor 2 static object detection field 1 to 4 (+4 reserved bits)							
108	Sensor 3 static object detection field 1 to 4 (+4 reserved bits)							
109	Sensor 4 static object detection field 1 to 4 (+4 reserved bits)							
110	Sensor 5 static object detection field 1 to 4 (+4 reserved bits)							
111	Sensor 6 static object detection field 1 to 4 (+4 reserved bits)							

Table 9 *Extended Info module - Static object detection option information*

- Reserved extra info for future implementation (as reported in Table 10).

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
112 - 119	Reserved							

Table 10 *Extended Info module - Extra info*

8 Fieldbus settings

By the LBK Designer application the user can manage the following fieldbus parameters (relative to the CIP and CIP Safety based on the Ethernet/IP):

- Network parameters;
- Safety Network Number (SNN);
- Safety Configuration Signature (SCID);
- Endianness of the exchanged data;
- Reset ownership command;
- Factory reset of the fieldbus parameters.

8.1 Network parameters

This section contains the following parameters to set:

- DHCP
- Unique IP address (used also as Node ID of the CIP Safety Unique ID);
- Netmask;
- Gateway;
- Host name.

8.2 Safety Network Number (SNN)

This section allows to set the SNN in the following ways:

- Manual;
- Time-based (date and time in CIP format).

The configuration with a safety network configuration tool (SNCT) is not possible and the SNN is settable only by the LBK Designer application.

8.3 Safety Configuration Signature (SCID)

This section allows to copy and get the Safety Configuration Identifier composed by:

- Safety Configuration CRC32 calculated as the CRC32 of all System configurations;
- date and time (in CIP format) relative when a new System configuration is performed.

8.4 Endianness of the exchanged data

The controller manages the data in Big endian format but the user can choose to exchange data in Little endian format.
The parameter affects only on the uint16 data of not-safe Assembly object 107.

8.5 Reset ownership command

The LBK Designer application allows resetting the controller association with a CIP Safety PLC if the user wants to connect it to another one.

8.6 Factory reset of the fieldbus parameters

The LBK Designer application allows setting the factory values to the fieldbus parameters.

The default values are the following:

- DHCP: active;
- IP address: 0.0.0.0;
- Netmask: 0.0.0.0;
- Gateway: 0.0.0.0;
- Host name: NULL;
- SNN (hex): ffff_ffff_ffff;
- SCID:
  - CRC32: relative to the System configuration;
  - Date and time (CIP format): relative to the factory reset command;
- Endianness: Big endian.

9 Controller and sensor error status

Erroneous conditions related to the controller and/or the sensors are sent via Fieldbus filling up the relevant error code and detailed error mask fields.

The error code indicates the type of the error occurred. The detailed error mask represents the details related to the type of the error occurred and it is reported in this document where relevant and useful to understand in detail the fault.

In the following paragraphs, all the controller and sensor error codes are listed and described.

9.1 Controller error codes

The error codes of the controller are reported in the table below.

Error Code	Error	Description
0x01	Power supply error	At least one voltage value on the controller is wrong. Detailed error is a bit mask composed of the following faults: • 0x0001 Vin Undervoltage • 0x0002 Vin Overvoltage • 0x0004 1.2V Undervoltage • 0x0008 1.2V Overvoltage • 0x0010 1.2V Sensor Undervoltage • 0x0020 1.2V Sensor Overvoltage • 0x0040 VUSB Undervoltage • 0x0080 VUSB Overvoltage • 0x0100 VRef Undervoltage • 0x0200 VRef Overvoltage • 0x0400 ADC conversion error
0x02	Internal temperature error	Controller temperature value is wrong. Detailed error is a bit mask composed of the following faults: • 0x0001 Low Temperature • 0x0002 High Temperature
0x03	OSSD error	At least one digital output (OSSD) is in error. Detailed error is a bit mask composed of the following faults: • 0x0001 OSSD 1 SHORT-CIRCUIT • 0x0002 OSSD 2 SHORT-CIRCUIT • 0x0004 OSSD 3 SHORT-CIRCUIT • 0x0008 OSSD 4 SHORT-CIRCUIT • 0x0010 OSSD 1 NO LOAD • 0x0020 OSSD 2 NO LOAD • 0x0040 OSSD 3 NO LOAD • 0x0080 OSSD 4 NO LOAD • 0x0100 OSSD 1 SHORT-CIRCUIT (VDD) • 0x0200 OSSD 2 SHORT-CIRCUIT (VDD) • 0x0400 OSSD 3 SHORT-CIRCUIT (VDD) • 0x0800 OSSD 4 SHORT-CIRCUIT (VDD)
0x04	Input error	At least one digital input is in error. Detailed error is a bit mask composed of the following faults: • 0x0001 input 1 error • 0x0002 input 2 error • 0x0003 encoding error • 0x0004 0-1-0 plausibility transition error

Error Code	Error	Description
0x05	Internal peripheral error	There is an error with at least one of the controller peripherals Detailed error not relevant.
0x06	Sensor communication error	Communication error with at least one sensor. Detailed error is a bit mask composed of the following faults: • 0x0010 Communication lost • 0x0100 Polling timeout
0x07	Internal EEPROM error	Configuration saving error, configuration not performed or memory error. Detailed error not relevant.
0x08	Internal flash error	Flash memory error. Detailed error not relevant.
0x09	Internal RAM error	Invalid checksum of the internal RAM. Detailed error not relevant.
0x0A	Fieldbus error	At least one of the inputs and outputs has been configured as “Fieldbus controlled”, but the Fieldbus communication is not established, in error or passivated by the host. Detailed error not relevant.
0x0B	Dynamic configuration error	An invalid dynamic configuration has been selected. Detailed error not relevant.
0x0C	Internal communication error	An internal communication issue occurred between microprocessors. Detailed error not relevant.
0x0D	Sensor configuration error	Error occurred on the sensors during the configuration process or at system power up. At least one of the connected sensors did not get the correct configuration. The list of the not-configured sensors is reported as the detail of this error.
0x0E	Backup or Restore error	Error occurred during the backup or restore via SD card

9.2 LBK SBV sensor error codes

The error codes of the LBK SBV sensor are reported in the table below.

Error Code	Error	Description
0x06	Controller communication error	Communication error with the controller. Detailed error is a bit mask composed of the following faults: • 0x0010 Communication lost
0x81	Misconfiguration error	The misconfiguration error occurs when the sensor does not have a valid configuration or it has received an invalid configuration from the controller. Detailed error not relevant.
0x82	Status error	The status error occurs when the sensor is in an internal invalid status. Detailed error not relevant.
0x83	Protocol error	The protocol error occurs when the sensor receives commands with an unknown format. Detailed error not relevant.
0x84	Fault error	The fault error occurs when the sensor has reached an internal fault condition. Detailed error not relevant.
0x85	Controller communication error	Communication error with the controller. Detailed error is a bit mask composed of the following faults: • 0x0001 Communication timeout • 0x0002 Cross-check error • 0x0004 Sequence number error • 0x0008 Wrong CRC • 0x0020 Protocol error • 0x0040 Message ID error • 0x0080 Data format error • 0x0100 Polling timeout • 0x0200 Generic CANbus error

Error Code	Error	Description
0x86	Power error	At least one voltage value of the sensor is wrong . Detailed error is a bit mask composed of the following faults: • 0x0001 Vin Undervoltage • 0x0002 Vin Overvoltage • 0x0004 3.3V Undervoltage • 0x0008 3.3V Overvoltage • 0x0010 182V Undervoltage • 0x0020 1.8V Overvoltage • 0x0040 1.2V Undervoltage • 0x0080 1.2V Overvoltage • 0x0100 1V Undervoltage • 0x0200 1V Overvoltage
0x87	MSS error	Error detected by diagnostics relative to the internal micro-controller (MSS), its internal peripherals or memories. Detailed error not relevant.
0x88	Signal error	The signal error occurs when the sensor detects an error in the RF signal part. Detailed error not relevant.
0x89	Internal temperature error	Sensor temperature value is wrong. Detailed error is a bit mask composed of the following faults: • 0x0001 Low Temperature • 0x0002 High Temperature • 0x0004 Chip - Low Temperature • 0x0008 Chip - High Temperature • 0x0010 IMU - Low Temperature • 0x0020 IMU - High Temperature
0x8A	Tamper error	Placement error of the sensor. Detailed error is: first 4 bits, a bit mask composed of the following faults: • 0x0001 Pan angle error • 0x0002 Roll angle error • 0x0004 Tilt reading error bit 4 to bit 7: tilt angle deviation (in degrees) bit 8 to bit 11: roll angle deviation (in degrees) bit 12 to bit 15: pan angle deviation (in degrees) Max deviation in degrees: 15.
0x8B	DSS error	Error detected by diagnostics relative to the internal micro-controller (DSS), its internal peripherals or memories. Detailed error not relevant.

Error Code	Error	Description
0xFD	Masking error	Masking/Occlusion error
0xFE	Masking reference error	The sensor is not able to acquire the reference for masking functionality.