FSoE communication

Reference guide

v5 - EN

Original instructions

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Document updates

Publication date	Code	Updates
DEC 2025	Inxpect 100S_200S FSoE RG_7_00237_en_v5	Added note for control unit 0x03 error code Added bits description for sensor 0x8A error code
SEP 2025	Inxpect 100S_200S FSoE RG_7_00237_en_v5	Updated xml file name Updated Notice for Inxpect SRE 100 Series firmware versions. Added Mute group 1 and Mute group 2 bits Added "5. Control unit and sensor error status" on page 18.
FEB 2025	Inxpect 100S_200S FSoE RG_7_00237_en_v4	Fixed Restart feedback signal description

Contents

1. Purpose and Scope 4

2. Applicability 4
   2.1 NOTICE 4

3. System Overview 5

4. Exchanged data 5
   4.1 Addressing 6
   4.2 Watchdog 6
   4.3 Available cyclic data 6
   4.4 Process data object (PDO) 10
   4.5 Service data object (SDO) 13

5. Control unit and sensor error status 18
   5.1 Control unit error codes 18
   5.2 S101A sensor error codes 20
   5.3 SRE 200 Series sensor error codes 21

1. Purpose and Scope

This document is an addendum of the safety manual of Inxpect SRE 100 Series and Inxpect SRE 200 Series and it defines the data exchanged through EtherCAT® and Safety over EtherCAT® fieldbus interface. In particular, this document describes and specifies the fieldbus interface provided by C201A-F and C201B-F control units as part of both Inxpect SRE 100 Series and Inxpect SRE 200 Series.

The following topics will be covered:

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

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2. Applicability

This release of this document is applicable to the Inxpect SRE 100 Series and Inxpect SRE 200 Series in accordance with:

Core Line:

- INXPECT_C200_Series_20230227.xml and control unit firmware version 2.0.0.
- INXPECT_C200_Series_20250601.xml and control unit firmware version 2.0.1.

eXtended Line:

- INXPECT_C200_Series_20240529.xml and control unit firmware version 2.1.0
- INXPECT_C200_Series_20250604.xml and control unit firmware version 2.1.1

2.1 NOTICE

The following considerations shall be taken into account:

- Inxpect SRE 200 Series supports four detection fields and it is a multi-target system, able to detect up to four targets for each sensor.
- Inxpect SRE 100 Series supports two detection fields and it is a mono-target system, able to detect only the nearest target to each sensor.

For this reason, some data are available only in Inxpect SRE 200 Series. In the document, a note is present where a difference between Inxpect SRE 200 Series and Inxpect SRE 100 Series is present.

Inxpect SRE 100 Series is supported up to control unit firmware version 2.0.0 (for Core Line) and 2.1.0 (for eXtended Line).

3. System Overview

Either C201A-F or C201B-F control units (Refer to Figure 1 and 2), part of both Inxpect SRE 100 Series and Inxpect SRE 200 Series, communicate with the machine control unit via FSoE/EtherCAT by means of one of the two RJ45 connectors [**X1**] and [**X2**] at the bottom (Refer to Figure 3).

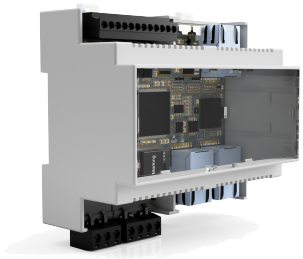


Figure 1 *C201A-F device*

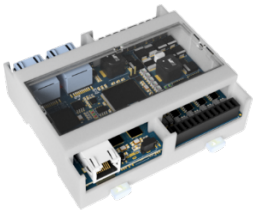
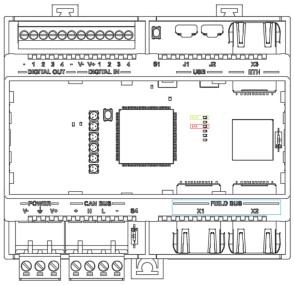


Figure 2 *C201B-F device*

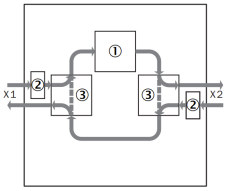
The processing direction is from the [**X1**] connection to the [**X2**] connection. That is, in normal operation the device receives the data from the controller on [**X1**] and sends the outgoing data on [**X2**] (Refer to Figure 3 and Figure 4).



X1 = ETHERCAT IN

X2 = ETHERCAT OUT

Figure 3 *C201A-F and C201B-F layout*



1 = EtherCAT processing unit

2 = Auto forwarder

3 = Loopback function

Figure 4 *Internal topology of the Ethercat connections*

4. Exchanged data

The cyclical data transmission between the Fieldbus master and the control unit, acting as a slave, occurs via process data objects (PDOs). The control unit provides one slot where various PDOs can be exclusively plugged in for transmitting the safety-related process data.

The following modules are available:

- 2-byte Safe Data PDOs (module ID: 0x50008101)
  - RxPDO 2-byte Data Process - index 0x1600
  - TxPDO 2-byte Data Process - index 0x1A00
- 4-byte Safe Data PDOs (module ID: 0x50008102)
  - RxPDO 4-byte Data Process - index 0x1601
  - TxPDO 4-byte Data Process - index 0x1A01
- 16-byte Safe Data PDOs * (module ID: 0x50008103)
  - RxPDO 4-byte Data Process - index 0x1601
  - TxPDO 16-byte Data Process - index 0x1A02

Note *: *TwinCAT 2 is not supported by the device when using the configuration "16-byte Safe Data PDOs".*

Also non-safety-related process data is available (just if activated)

- 16-byte Non-Safe Data PDOs
  - TxPDO Non-Safe Data Process - index 0x1A03

In addition, the control unit provides acyclical data via service data objects (SDOs) implemented using CoE (CAN Application Protocol over EtherCAT), e.g., for diagnostic purposes or configuration information. The CoE data must not be used for safety-related tasks.

4.1 Addressing

In order to identify an FSoE device in the network, a unique FSoE address in the 1 to 65,534 range is required. You can assign an FSoE address to the device by means of the system application.

4.2 Watchdog

The protocol includes watchdog timers that work with the master frame and checksums to ensure an optimal safety connection and error-proof monitoring across each FSoE frame transmissions.

The watchdog time is parametrized individually for each slave using the FSoE master in the 100 to 1000 ms range.

4.3 Available cyclic data

4.3.1 Safe input data of the control unit (safe output data of the master)

Depending on the selected module the following data are available as input of the device (output of the master; RxPDO):

- Selection of the dynamic configuration to be used
- Restart signal
- System recondition signal
- Sensor muting signal
- OSSD settings

The following table reports in detail the exchanged RxPDO data.

Name	Data type	Values	Definition
ID of configuration to be set bit0	BOOL	0 - 31	Set dynamically the dynamic configuration to be used. ***Note**: this value has effect only if digital inputs are not set as "Dynamic configuration switch".*
ID of configuration to be set bit1	BOOL		
ID of configuration to be set bit2	BOOL		
ID of configuration to be set bit3	BOOL		
ID of configuration to be set bit4	BOOL		
Restart signal Field 1	BOOL	TRUE FALSE	To perform a restart of the specific detection field, the control has to do a transition of this signal from FALSE to TRUE followed by another transition from TRUE to FALSE with a minimum duration of 2 seconds and within 5 seconds.
Restart signal Field 2	BOOL	TRUE FALSE	
Restart signal Field 3 (available only in Inxpect SRE 200 Series)	BOOL	TRUE FALSE	
Restart signal Field 4 (available only in Inxpect SRE 200 Series)	BOOL	TRUE FALSE	
System recondition signal	BOOL	TRUE FALSE	To perform a recondition of the system, the control has to set value TRUE.

Name	Data type	Values	Definition
Muting command of S1	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".*
Muting command of S2	BOOL	TRUE FALSE	
Muting command of S3	BOOL	TRUE FALSE	
Muting command of S4	BOOL	TRUE FALSE	
Muting command of S5	BOOL	TRUE FALSE	
Muting command of S6	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 the digital inputs are not set as "Muting group 1 and/or "Muting group 2".*
Mute group 2*	BOOL	TRUE FALSE	

Note: available only for eXtended Line.*

4.3.2 Safe output data of the control unit (safe input data of the master)

Depending on the selected module, the following data are available as output of the device (input of the master; TxPDO):

- Detection field status
- Muting feedback
- Stop signal feedback
- Diagnostic signal feedback
- Configuration signal feedback
- Restart signal feedback
- Static object detection field status (available only in Inxpect SRE 200 Series)
- Configuration ID currently in use
- OSSD values
- Double channel digital input values
- Single channel digital input values
- Sensor presence for each detection field
- Safety working mode for each detection field

NOTICE: to interpret the safety stop signal message sent by the control unit to the host, take into account the values of detection field status, stop signal feedback, diagnostic signal feedback, configuration signal feedback and restart signal feedback bits.

The following table reports in detail the exchanged TxPDO data at the system level.

Name	Data type	Values	Definition
Detection Field 1	BOOL	TRUE FALSE	Value is FALSE if the specific detection field of, at least, a sensor is detecting a movement or if 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. Value is TRUE otherwise.
Detection Field 2	BOOL	TRUE FALSE	
Detection Field 3 (available only in Inxpect SRE 200 Series)	BOOL	TRUE FALSE	
Detection Field 4 (available only in Inxpect SRE 200 Series)	BOOL	TRUE FALSE	
Muting feedback	BOOL	TRUE FALSE	Value is FALSE if at least one detection field of one sensor is muted. Value is TRUE otherwise.
Stop Signal feedback	BOOL	TRUE FALSE	Value is FALSE if a stop signal is present on the digital input set as “Stop signal”. TRUE otherwise.
Diagnostic Signal feedback	BOOL	TRUE FALSE	Value is FALSE if a diagnostic condition is present. TRUE otherwise.
Configuration Signal feedback	BOOL	TRUE FALSE	Value is FALSE if the system is in “Configuration” state. TRUE otherwise.
Restart Signal feedback	BOOL	TRUE FALSE	Value is FALSE if at least one detection field of one sensor is ready to be restarted by a “Restart signal”. TRUE otherwise.
Configuration ID bit0	BOOL	0 - 31	Value indicates the ID of the configuration currently in use.
Configuration ID bit1	BOOL		
Configuration ID bit2	BOOL		
Configuration ID bit3	BOOL		
Configuration ID bit4	BOOL		
Restart Signal feedback Field 1	BOOL	TRUE FALSE	Value is FALSE if the specific detection field of at least a sensor is ready to be restarted by a “Restart signal”. TRUE otherwise.
Restart Signal feedback Field 2	BOOL	TRUE FALSE	
Restart Signal feedback Field 3 (available only in Inxpect SRE 200 Series)	BOOL	TRUE FALSE	
Restart Signal feedback Field 4 (available only in Inxpect SRE 200 Series)	BOOL	TRUE FALSE	
Static Object Detection Field 1 (available only in Inxpect SRE 200 Series)	BOOL	TRUE FALSE	Value is TRUE if in the specific field of at least a sensor is performed a static detection. FALSE otherwise.
Static Object Detection Field 2 (available only in Inxpect SRE 200 Series)	BOOL	TRUE FALSE	
Static Object Detection Field 3 (available only in Inxpect SRE 200 Series)	BOOL	TRUE FALSE	
Static Object Detection Field 4 (available only in Inxpect SRE 200 Series)	BOOL	TRUE FALSE	

Name	Data type	Values	Definition
OSSD 1	BOOL	TRUE FALSE	Value is TRUE if the specific OSSD is set as ON-state. FALSE otherwise.
OSSD 2	BOOL	TRUE FALSE	
OSSD 3	BOOL	TRUE FALSE	
OSSD 4	BOOL	TRUE FALSE	
Double channel Digital Input 1	BOOL	TRUE FALSE	Value is TRUE if the specific double channel input is set as ON-state. FALSE otherwise.
Double channel Digital Input 2	BOOL	TRUE FALSE	
Channel 1 Digital Input 1	BOOL	TRUE FALSE	Value is TRUE if the specific single channel input is set as ON-state. FALSE otherwise.
Channel 2 Digital Input 1	BOOL	TRUE FALSE	
Channel 1 Digital Input 2	BOOL	TRUE FALSE	
Channel 2 Digital Input 2	BOOL	TRUE FALSE	

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

Name	Data type	Values	Definition
S*n* Detection Field 1	BOOL	TRUE FALSE	Value is FALSE if the specific detection field of sensor n is detecting a movement or if 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.
S*n* Detection Field 2	BOOL	TRUE FALSE	
S*n* Detection Field 3 (available only in Inxpect SRE 200 Series)	BOOL	TRUE FALSE	
S*n* Detection Field 4 (available only in Inxpect SRE 200 Series)	BOOL	TRUE FALSE	
S*n* Diagnostic feedback	BOOL	TRUE FALSE	Value is FALSE if a diagnostic condition is present. TRUE otherwise.
S*n* Muting feedback	BOOL	TRUE FALSE	Value is FALSE if the sensor is muted TRUE otherwise
S*n* Reserved	BOOL	TRUE FALSE	
S*n* Installation status	BOOL	TRUE FALSE	Value is TRUE if the sensor is installed and used. FALSE otherwise.
S*n* Presence Field 1	BOOL	TRUE FALSE	Value is FALSE if a target is present in the specific field. TRUE otherwise.
S*n* Presence Field 2	BOOL	TRUE FALSE	
S*n* Presence Field 3 (available only in Inxpect SRE 200 Series)	BOOL	TRUE FALSE	
S*n* Presence Field 4 (available only in Inxpect SRE 200 Series)	BOOL	TRUE FALSE	

Name	Data type	Values	Definition
S*n* Working Mode Field 1	BOOL	TRUE FALSE	It represents the current safety working mode of the sensor, for each detection field: • FALSE, it is working in “Restart prevention”. • TRUE, it is working in “Access detection”.
S*n* Working Mode Field 2	BOOL	TRUE FALSE	
S*n* Working Mode Field 3 (available only in Inxpect SRE 200 Series)	BOOL	TRUE FALSE	
S*n* Working Mode Field 4 (available only in Inxpect SRE 200 Series)	BOOL	TRUE FALSE	

4.3.3 Non-safe output data of the control unit (input data of the master)

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.

4.4 Process data object (PDO)

4.4.1 RxPDO 2-byte Data Process (index: 0x1600)

Byte 0							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Restart signal Field 3 *	Restart signal Field 2	Restart signal 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 of S6	Muting command of S5	Muting command of S4	Muting command of S3	Muting command of S2	Muting command of S1	System recondition signal	Restart signal Field 4 *

Note*: available only for Inxpect SRE 200 Series.*

4.4.2 RxPDO 4-byte Data Process (index: 0x1601)

Byte 0							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Restart signal Field 3*	Restart signal Field 2	Restart signal 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 of S6	Muting command of S5	Muting command of S4	Muting command of S3	Muting command of S2	Muting command of S1	System recondition signal	Restart signal Field 4*
Byte 2							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Reserved	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	Reserved

Note*: available only for Inxpect SRE 200 Series.*

Note***: available only for eXtended Line.*

4.4.3 TxPDO 2-byte Data Process (index: 0x1A00)

Byte 0							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Configuration Signal feedback	Diagnostic Signal feedback	Stop Signal feedback	Muting feedback	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 bit4	Configuration ID bit3	Configuration ID bit2	Configuration ID bit1	Configuration ID bit0	Restart Signal feedback

Note*: available only for Inxpect SRE 200 Series.*

4.4.4 TxPDO 4-byte Data Process (index: 0x1A01)

Byte 0							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Configuration Signal feedback	Diagnostic Signal feedback	Stop Signal feedback	Muting feedback	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 Signal feedback Field 4*	Restart Signal feedback Field 3*	Restart Signal feedback Field 2	Restart Signal feedback 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 bit4	Configuration ID bit3	Configuration ID bit2	Configuration ID bit1	Configuration ID bit0
Byte 3							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Reserved	Channel 2 Digital Input 2	Channel 1 Digital Input 2	Channel 2 Digital Input 1	Channel 1 Digital Input 1	Double channel Digital Input 2	Double channel Digital Input 1	OSSD 4

Note*: available only for Inxpect SRE 200 Series.*

4.4.5 TxPDO 16-byte Data Process (index: 0x1A02 and 0x1A03)

Byte 0							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Configuration Signal feedback	Diagnostic Signal feedback	Stop Signal feedback	Muting feedback	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 Signal feedback Field 4*	Restart Signal feedback Field 3*	Restart Signal feedback Field 2	Restart Signal feedback 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	ConfigurationID bit4	ConfigurationID bit3	ConfigurationID bit2	ConfigurationID bit1	ConfigurationID bit0

Byte 3							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Reserved	Channel 2 Digital Input 2	Channel 1 Digital Input 2	Channel 2 Digital Input 1	Channel 1 Digital Input 1	Double channel Digital Input 2	Double channel Digital Input 1	OSSD 4
Byte 4							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
S1 Installed	S1 Reserved	S1 Muting feedback	S1 Diagnostic feedback	S1 Detection Field 4*	S1 Detection Field 3*	S1 Detection Field 2	S1 Detection Field 1
Byte 5							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
S1 Working Mode Field 4*	S1 Working Mode Field 3*	S1 Working Mode Field 2	S1 Working Mode Field 1	S1 Presence Field 4*	S1 Presence Field 3*	S1 Presence Field 2	S1 Presence Field 1
Byte 6							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
S2 Installed	S2 Reserved	S2 Muting feedback	S2 Diagnostic feedback	S2 Detection Field 4*	S2 Detection Field 3*	S2 Detection Field 2	S2 Detection Field 1
Byte 7							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
S2 Working Mode Field 4*	S2 Working Mode Field 3*	S2 Working Mode Field 2	S2 Working Mode Field 1	S2 Presence Detection Field 4*	S2 Presence Detection Field 3*	S2 Presence Detection Field 2	S2 Presence Detection Field 1
Byte 8							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
S3 Installed	S3 Reserved	S3 Muting feedback	S3 Diagnostic feedback	S3 Detection Field 4*	S3 Detection Field 3*	S3 Detection Field 2	S3 Detection Field 1
Byte 9							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
S3 Working Mode Field 4*	S3 Working Mode Field 3*	S3 Working Mode Field 2	S3 Working Mode Field 1	S3 Presence Detection Field 4*	S3 Presence Detection Field 3*	S3 Presence Detection Field 2	S3 Presence Detection Field 1
Byte 10							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
S4 Installed	S4 Reserved	S4 Muting feedback	S4 Diagnostic feedback	S4 Detection Field 4*	S4 Detection Field 3*	S4Detection Field 2	S4 Detection Field 1
Byte 11							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
S4 Working Mode Field 4*	S4 Working Mode Field 3*	S4 Working Mode Field 2	S4 Working Mode Field 1	S4 Presence Detection Field 4*	S4 Presence Detection Field 3*	S4 Presence Detection Field 2	S4 Presence Detection Field 1
Byte 12							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
S5 Installed	S5 Reserved	S5 Muting feedback	S5 Diagnostic feedback	S5 Detection Field 4*	S5 Detection Field 3*	S5 Detection Field 2	S5 Detection Field 1

Byte 13							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
S5 Working Mode Field 4*	S5 Working Mode Field 3*	S5 Working Mode Field 2	S5 Working Mode Field 1	S5 Presence Detection Field 4*	S5 Presence Detection Field 3*	S5 Presence Detection Field 2	S5 Presence Detection Field 1
Byte 14							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
S6 Installed	S6 Reserved	S6 Muting feedback	S6 Diagnostic feedback	S6 Detection Field 4*	S6 Detection Field 3*	S6 Detection Field 2	S6 Detection Field 1
Byte 15							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
S6 Working Mode Field 4*	S6 Working Mode Field 3*	S6 Working Mode Field 2	S6 Working Mode Field 1	S6 Presence Detection Field 4*	S6 Presence Detection Field 3*	S6 Presence Detection Field 2	S6 Presence Detection Field 1

Note*: available only for Inxpect SRE 200 Series.*

4.5 Service data object (SDO)

Index	Name	Data type	Value
Communication parameters (Communication Area)			
0x1000	Device Type	UDINT	5001
0x1008	Device Name	STRING (10)	C20xy-F
0x1009	Hardware Version	STRING(6)	HW revision (E.g. 2)
0x100A	Software Version	STRING(9)	FW revision (E.g. 2.0.0)
0x1018	Identity Object	RECORD	See Identity Object (0x1018)
0x1600	RxPDO 2-byte Data Process	PDO MAPPING	Complete FSoE master frame (safety-related FSoE process data object, input of the device, output of the controller) with command, 2 byte data, CRCs and connection ID
0x1601	RxPDO 4-byte Data Process	PDO MAPPING	Complete FSoE master frame (safety-related FSoE process data object, input of the device, output of the con- troller) with command, 4 byte data, CRCs and connection ID
0x1A00	TxPDO 2-byte Data Process	PDO MAPPING	Complete FSoE slave frame (safety-related FSoE process data object, output of the device, input of the controller) with command, 2 byte data, CRCs and connection ID
0x1A01	TxPDO 4-byte Data Process	PDO MAPPING	Complete FSoE slave frame (safety-related FSoE process data object, output of the device, input of the controller) with command, 4 byte data, CRCs and connection ID
0x1A02	TxPDO 16-byte Data Process	PDO MAPPING	Complete FSoE slave frame (safety-related FSoE process data object, output of the device, input of the controller) with command, 16 byte data, CRCs and connection ID
0x1A03	TxPDO Non-Safe Data Process	PDO MAPPING	Complete EtherCAT slave frame (non-safety-related EtherCAT process data object, output of the device, input of the master), 16 byte data
0x1C00	Sync Manager Communication Type	ARRAY	See "4.5.2 Sync Manager Communication Type (0x1C00)" on the next page
0x1C12	Sync Manager 2 PDO Assignment	ARRAY	See "4.5.3 Sync Manager 2 PDO Assignment (process data output, 0x1C12)" on page 15
0x1C13	Sync Manager 3 PDO Assignment	ARRAY	See "4.5.4 Sync Manager 3 PDO Assignment (process data input, 0x1C13)" on page 15
0x1E00	Safety Parameter Set	PDO MAPPING	See "4.5.5 Safety Parameter Set (0x1E00)" on page 15 (Available only off-line)

Index	Name	Data type	Value
Manufacturer-specific parameters (Manufacturer Specific Area)			
0x2000	Diagnostics	RECORD	See "4.5.6 Diagnostics (0x2000)" on page 16
0x2100	FSoE Address Settings	RECORD	See "4.5.7 FSoE Address Settings (0x2100)" on page 16
0x2200	Configuration Info	RECORD	See "4.5.8 Configuration info (0x2200)" on page 16
0x2210	System Info	RECORD	See "4.5.9 System info (0x2210)" on page 17
Input Area			
0x6000	FSOE TxPDO Header	FSOE FRAME	Frame metadata of all TxPDO Data Process (Without safety-related data)
0x6001	System Status	RECORD	Safety-related data of TxPDO 2-byte and 4-byte Data Process (Without frame metadata)
0x6002	Sensors Status	RECORD	Safety-related data of TxPDO 16-byte Data Process (Without frame metadata)
Output Area			
0x7000	FSOE RxPDO Header	FSOE FRAME	Frame metadata of all RxPDO Data Process (Without safety-related data)
0x7001	Commands	RECORD	Safety-related data of all RxPDO Process (Without frame metadata)
Information Area			
0x9001	FSoE Communication Parameter	RECORD	See "4.5.10 FSoE Connection Communication Parameter (0x9001)" on page 17
Device Area			
0xF000	Modular Device Profile	RECORD	See "4.5.11 Modular Device Profile (0xF000)" on page 17
0xF050	Detected Module List	ARRAY	See "4.5.12 Detected Module List (0xF050)" on page 18
0xF980	Device Safety Address	RECORD	See "4.5.13 Device Safety Address (0xF980)" on page 18

4.5.1 Identity Object (0x1018)

Index	Subindex	Name	Data type	Value
0x1018	0	Number of entries	UINT8	4
	1	Vendor ID	UINT32	0x00000E12
	2	Product Code	UINT32	0x00000002
	3	Revision Number	UINT32	0x000B0001
	4	Serial Number	UINT32	NID of the Device

4.5.2 Sync Manager Communication Type (0x1C00)

Index	Subindex	Name	Data type	Value
0x1C00	0	Number Of Elements	UINT8	4
	1	SubIndex 001	UINT8	1: receiver mailbox (master to slave)
	2	SubIndex 002	UINT8	2: sender mailbox (slave to master)
	3	SubIndex 003	UINT8	3: process data output (master to slave)
	4	SubIndex 004	UINT8	4: process data input (slave to master)

4.5.3 Sync Manager 2 PDO Assignment (process data output, 0x1C12)

Index	Subindex	Name	Data type	Value
0x1C12	0	Number Of Elements	UINT8	Depending on the Module configuration: 0 - no PDO is used as input of the Device 1 - one PDO is used as input of the Device
	1	SubIndex 001	UINT16	Depending on the Module configuration: 0x1600 - RxPDO 2-byte Data Process 0x1601 - RxPDO 4-byte Data Process

4.5.4 Sync Manager 3 PDO Assignment (process data input, 0x1C13)

Index	Subindex	Name	Data type	Value
0x1C13	0	Number Of Elements	UINT8	Depending on the Module configuration: 0 - no PDO is used as output of the Device 1 - one PDO is used as output of the Device 2 - two PDO is used as output of the Device
	1	SubIndex 001	UINT16	Depending on the Module configuration: 0x1A00 - TxPDO 2-byte Data Process 0x1A01 - TxPDO 4-byte Data Process 0x1A02 - TxPDO 16-byte Data Process 0x1A03 - TxPDO Non-Safe Data Process
	2	SubIndex 002	UINT16	Depending on the Module configuration: 0x1A00 - TxPDO 2-byte Data Process 0x1A01 - TxPDO 4-byte Data Process 0x1A02 - TxPDO 16-byte Data Process 0x1A03 - TxPDO Non-Safe Data Process

4.5.5 Safety Parameter Set (0x1E00)

***Note**: available only off-line.*

Index	Subindex	Name	Data type	Value
0x1E00	0	Number Of Elements	UINT8	3
	1	Communication Parameter Length	UINT8	Such as 0x9001:07
	2	Watchdog Time	UINT8	Such as 0x9001:04
	3	Application Parameter Length	UINT8	Such as 0x9001:08

4.5.6 Diagnostics (0x2000)

Index	Subindex	Name	Data type	Value
0x2000	0	Number Of Elements	UINT8	14
	1	Control unit Error Code	UINT16	Error code of control unit
	2	Control unit Error Details	UINT16	Detailed error of control unit
	3	S1 Error Code	UINT16	Error code of sensor 1
	4	S1 Unit Error Details	UINT16	Detailed error of sensor 1
	5	S2 Error Code	UINT16	Error code of sensor 2
	6	S2 Unit Error Details	UINT16	Detailed error of sensor 2
	7	S3 Error Code	UINT16	Error code of sensor 3
	8	S3 Unit Error Details	UINT16	Detailed error of sensor 3
	9	S4 Error Code	UINT16	Error code of sensor 4
	10	S4 Unit Error Details	UINT16	Detailed error of sensor 4
	11	S5 Error Code	UINT16	Error code of sensor 5
	12	S5 Unit Error Details	UINT16	Detailed error of sensor 5
	13	S6 Error Code	UINT16	Error code of sensor 6
	14	S6 Unit Error Details	UINT16	Detailed error of sensor 6

4.5.7 FSoE Address Settings (0x2100)

Index	Subindex	Name	Data type	S
0x2100	0	Number Of Elements	UINT8	2
	1	Set FSoE Address	UINT16	Configurable range from 0x0001 to 0xFFFE
	2	Check NID	STRING (32)	Only writable NID of the Device necessary to set the FSoE address by 0x2100 subindex 1

4.5.8 Configuration info (0x2200)

Index	Subindex	Name	Data type	Value
0x2210	0	Number Of Elements	UINT8	10
	1	Control unit Label	STRING(32)	A customizable label to identify the control unit
	2	S1 Label	STRING(32)	A customizable label to identify the sensor 1
	3	S2 Label	STRING(32)	A customizable label to identify the sensor 2
	4	S3 Label	STRING(32)	A customizable label to identify the sensor 3
	5	S4 Label	STRING(32)	A customizable label to identify the sensor 4
	6	S5 Label	STRING(32)	A customizable label to identify the sensor 5
	7	S6 Label	STRING(32)	A customizable label to identify the sensor 6
	8	Fieldset CRC	UINT32	CRC32 of the current fieldset (dynamic configuration)
	9	Integrity Hash	ARRAY [0..15] OF BYTE	Hash the current system configuration
	10	Modification Time	UINT32	Time of the last system configuration in seconds elapsed from 01st January 2000

4.5.9 System info (0x2210)

Index	Subindex	Name	Data type	Value
0x2210	0	Number Of Elements	UINT8	5
	1	Reserved2	UINT16	Reserved
	2	Reserved2	UINT16	Reserved
	3	Operation Hours	UINT16	Operating hours of the device
	4	Current time	UINT32	Note: no RTC is present on the control unit. After system configuration the current time contains the number of the seconds elapsed from 01 January 2000. Otherwise, it is just the number of the seconds elapsed from the boot.
	5	Power-on count	UINT16	Number of power-up processes

4.5.10 FSoE Connection Communication Parameter (0x9001)

Index	Subindex	Name	Data type	Value
0x9001	0	Number Of Elements	UINT8	8
	1	Version	STRING	Supported FSoE version of the FSoE connection
	2	Safety Address	UINT16	FSoE slave address of the FSoE connection
	3	FSoE Connection ID	UINT16	Connection ID of the FSoE connection
	4	Watchdog Time	UINT16	Watchdog time of the FSoE connection (assigned by the FSoE master)
	5	Unique Device ID	OCTET STRING	0 (not used)
	6	Connection Type	UINT16	Connection type of the FSoE connection: • 0: master connection • 1: slave connection
	7	Communication Parameter Length	UINT16	Byte number of the communication parameter in the FSoE connection parameter set (Size is 2)
	8	Application Parameter Length	UINT16	Byte number of the application parameter in the FSoE connection parameter set (Size is 0)

4.5.11 Modular Device Profile (0xF000)

Index	Subindex	Name	Data type	Value
0xF000	0	Number Of Elements	UINT8	2
	1	Index distance	UINT16	Index distance between 2 modules (maximum object number per module and area). Default: 16
	2	Maximum number of modules	UINT16	Maximum number of modules

4.5.12 Detected Module List (0xF050)

Index	Subindex	Name	Data type	Value
0xF050	0	Number Of Elements	UINT8	1
	1	SubIndex 001		Module ID of the active module: 0x50008101 0x50008102 0x50008103 0x50008104

4.5.13 Device Safety Address (0xF980)

Index	Subindex	Name	Data type	Value
0xF980	0	Number Of Elements	UINT8	1
	1	FSoE Address	UINT16	FSoE address of the device such as 0x9001:02

5. Control unit and sensor error status

Erroneous conditions related to the control unit 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 control unit and sensor error codes are listed and described.

5.1 Control unit error codes

The error codes of the control unit are reported in the table below.

Error Code	Error	Description
0x01	Power supply error	At least one voltage value on the control unit 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	Control unit temperature value is wrong. Detailed error is a bit mask composed of the following faults: • 0x0001 Low Temperature • 0x0002 High Temperature

Error Code	Error	Description
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) ***Note**: the errors are reported only if the error occur and the Short-circuit/Open circuit diagnostics option has been enabled in the system application and the outputs are safety-related.*
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
0x05	Internal peripheral error	There is an error with at least one of the control unit 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.

Error Code	Error	Description
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

5.2 S101A sensor error codes

The error codes of the S101A sensor are reported in the table below.

Error Code	Error	Description
0x06	Control unit communication error	Communication error with the control unit. Detailed error is a bit mask composed of the following faults: • 0x0010 Communication lost
0x81	Power supply 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 1.2V Undervoltage • 0x0020 1.2V Overvoltage • 0x0040 V+ Undervoltage • 0x0080 V+ Overvoltage • 0x0100 V DC/DC Undervoltage • 0x0200 V DC/DC Overvoltage • 0x0400 VOp.Amp. Undervoltage • 0x0800 VOp.Amp. Overvoltage • 0x1000 VADC Ref. Undervoltage • 0x2000 VADC Ref. Overvoltage • 0x4000 ADC conversion error
0x82	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 Generic Temperature Error
0x84	Internal peripheral error	At least one of the sensor peripherals is in error. Detailed error not relevant.
0x85	Control unit communication error	Communication error with the control unit. 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
0x8F	Signal error	Signal errors of the sensor. Detailed error is a bit mask composed of the following faults: • 0x0001 Not used • 0x0002 Head fault • 0x0004 Head power off • 0x0008 Signal dynamic • 0x0010 Signal Min • 0x0020 Signal Min Max • 0x0040 Signal Max • 0x0080 Signal Avg • 0x0100 Dynamic Low • 0x0200 Min Dynamic High • 0x0400 Min Dynamic Low • 0x0800 Max Dynamic Low • 0x1000 Avg Dynamic Low • 0x2000 Generic Signal Error
0x90	Accelerometer error	Placement error of the sensor. Detailed error is a bit mask composed of the following faults: • 0x0001 Tilt angle error • 0x0002 Roll angle error • 0x0004 Reading error
0xFD	Masking error	Masking/Occlusion error

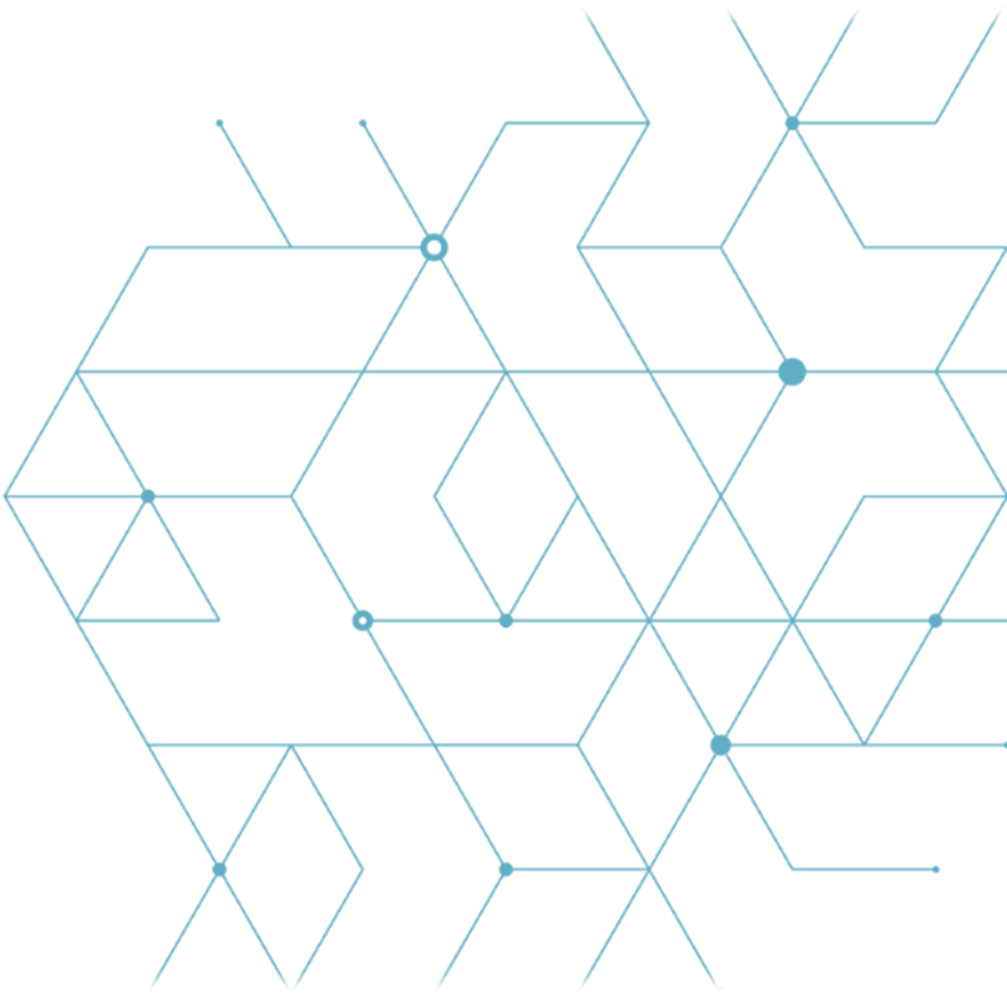
5.3 SRE 200 Series sensor error codes

The error codes of the SRE 200 Series sensor are reported in the table below.

Error Code	Error	Description
0x06	Control unit communication error	Communication error with the control unit. 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 control unit. 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.

Error Code	Error	Description
0x85	Control unit communication error	Communication error with the control unit. 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
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 1.8V 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 • 0x0003 Pan+roll angle error • 0x0004 Tilt angle error • 0x0005 Pan+tilt angle error • 0x0006 Roll+titl angle error • 0x0007 Pan+roll+tilt angle 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.

Error Code	Error	Description
0x8B	DSS error	Error detected by diagnostics relative to the internal micro-controller (DSS), its internal peripherals or memories. Detailed error not relevant.
0xFD	Masking error	Masking/Occlusion error
0xFE	Masking reference error	The sensor is not able to acquire the reference for masking functionality.



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