

R2100 - CANopen Protocol

Manual



With regard to the supply of products, the current issue of the following document is applicable: The General Terms of Delivery for Products and Services of the Electrical Industry, published by the Central Association of the Electrical Industry (Zentralverband Elektrotechnik und Elektroindustrie (ZVEI) e.V.) in its most recent version as well as the supplementary clause: "Expanded reservation of proprietorship"

Worldwide

Pepperl+Fuchs Group
Lilienthalstr. 200
68307 Mannheim
Germany
Phone: +49 621 776 - 0
E-mail: info@de.pepperl-fuchs.com

North American Headquarters

Pepperl+Fuchs Inc.
1600 Enterprise Parkway
Twinsburg, Ohio 44087
USA
Phone: +1 330 425-3555
E-mail: sales@us.pepperl-fuchs.com

Asia Headquarters

Pepperl+Fuchs Pte. Ltd.
P+F Building
18 Ayer Rajah Crescent
Singapore 139942
Phone: +65 6779-9091
E-mail: sales@sg.pepperl-fuchs.com
<https://www.pepperl-fuchs.com>

1	Commissioning	4
1.1	Supported Features and Standards	4
1.2	Network Management (NMT).....	4
1.3	Setting the Baud Rate and Node ID	5
1.4	Heartbeat Function	5
2	Operation and Communication	6
2.1	Process Data Object (PDO)	6
2.2	Service Data Object (SDO)	6
3	Object Directory	7
3.1	Communication Segment	7
3.2	Manufacturer Segment.....	13

1 Commissioning

1.1 Supported Features and Standards

The CANopen interface on the Pepperl+Fuchs R2100 supports the following CANopen features:

- Network management (NMT)
- Heartbeat
- Acyclic parameter access via service data objects (SDO)
- 6 transmit process data object (TPDOs)
- Layer setting services (LSS) for configuring the node ID and baud rate
- Store/restore configuration

The CANopen interface for the R2100 works with the following standard configuration:

- Node ID: 16
- Baud rate: 250 kBit/s (CiA)

Note

Before connecting the device to a network, make sure to configure the node ID according to the IDs present in the network.

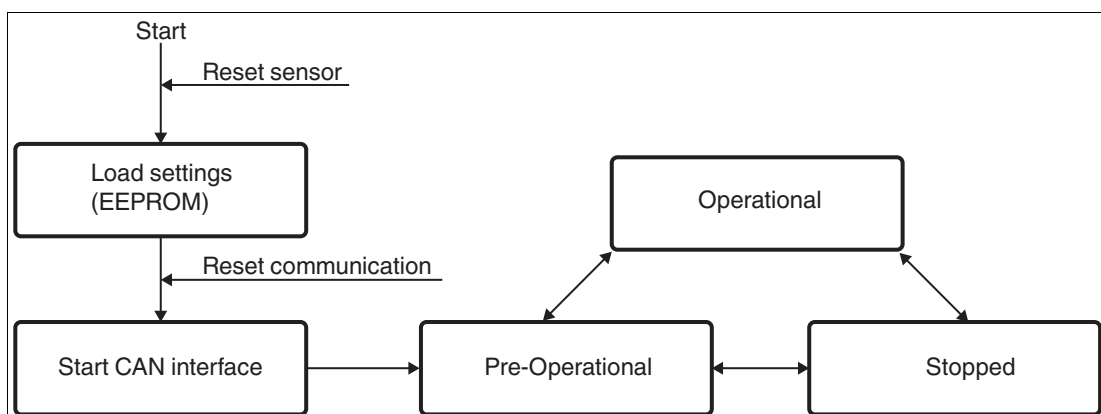
A node ID must be unambiguous, otherwise message collisions and errors can occur.

1.2 Network Management (NMT)

The CANopen standard CiA301 specifies 3 possible states for the sensor node.

- Preoperational
- Operational
- Stopped

The node can be set to any of these states as required. When activated, a sensor always starts in preoperational state and issues a boot up message.



Preoperational

PDO (process data) messages cannot be sent in the "preoperational" state; as such, this state is used to parameterize the sensor or indicate a standby state.

Operational

In the "operational" state, all communication services are performed and process data is exchanged.

Stopped

In the "stopped" state, only NMT (network management) messages can be sent; redundant or defective sensors can be isolated from the bus almost completely in this state.

The network manager can issue NMT messages to prompt the sensor to change from one state to another. Other NMT functions include 2 reset commands for resetting either the entire sensor or bus communication only.

Example of an NMT message sent by the network manager

0x000	0x80	0x10	0	0	0	0	0	0
CAN-ID	Command	Node	not used					
	Data byte 1	Data byte 2	Data byte 3	Data byte 4	Data byte 5	Data byte 6	Data byte 7	Data byte 8

Table 1.1

CAN-ID: 000h, NMT message from the network manager

Command: 80h, switch to preoperational state

Command: 02h, switch to stopped state

Command: 01h, switch to operational state

Command: 82h, reset communication

Command: 81h, reset sensor

Node: 01h ... 7Fh, to address nodes 1 ... 127 individually

Node: 00h, to address all nodes in the network simultaneously

1.3 Setting the Baud Rate and Node ID

CANopen specifies the layer setting service (CiA 305) for this purpose.

The baud rate and node ID can be configured via the LSS.

1.4 Heartbeat Function

The interval after which status messages are sent can be set via the object 1017h "Producer heartbeat time".

Entering the value 0 will deactivate the function. Every other 16-bit value determines the heartbeat interval in milliseconds. Default value is 500 ms.

Example of writing an object with max. 4 bytes of data

0x710	0x04	0	0	0	0	0	0	0
CAN-ID	Status	not used						
	Data byte 1	Data byte 2	Data byte 3	Data byte 4	Data byte 5	Data byte 6	Data byte 7	Data byte 8

Table 1.2

CAN-ID: 710h, heartbeat message from the node with node number 16

Status: 7Fh, sensor in "preoperational" state

Status: 04h, sensor in "stopped" state

Status: 05h, sensor in "operational" state

2 Operation and Communication

2.1 Process Data Object (PDO)

A maximum of 8 bytes of useable data can be sent in each message using the process data object (PDO). This feature is only available in the operational state and can be activated in different modes set using the objects 0x1800 ... 0x1805 "TPDO communication parameter" and 0x1A00 ... 0x1A05 "TPDO mapping parameter."

A total of 6 transmit PDOs are supported; no receive PDOs are supported. The protocol supports dynamic PDO mapping.

Example of the PDO1 message for the first 4 segments of the device: This PDO message contains some of the distance measuring readings of the sensor that are sent periodically and automatically once new values are available. The measuring rate of the device is 12 ms. The transfer rate of the PDO can be slowed with the "inhibit time" (subindex 3).

0x190	0x4D3	0x4D4	0x4D3	0x4D5
CAN-ID	Distance segment 1	Distance segment 2	Distance segment 3	Distance segment 4
	Data word 1	Data word 2	Data word 3	Data word 4

Table 2.1

CAN-ID: 190h, PDO1 channel of node 16

Distance of beam segment 1: 0x4D3, corresponds to 1235 mm

Distance of beam segment 2: 0x4D4, corresponds to 1236 mm

Distance of beam segment 3: 0x4D3, corresponds to 1235 mm

Distance of beam segment 4: 0x4D5, corresponds to 1237 mm

Individual PDOs can be disabled via communication object identifier (COB-ID; e.g. 1800sub1). To do this, the highest bit must be set to "1." For example, for 1800sub1, the following would need to be set: \$NODEID+0x80000180. The distances are active and the echoes are disabled by default.

TPDO1 ... TPDO4 COB-IDs are always set to their default value on power up. However, the valid bit is stored on request (object 0x1010). For customer-specific COB-IDs the value must be overwritten after booting up.

2.2 Service Data Object (SDO)

The device from Pepperl+Fuchs is equipped with service data channel 1 as required by CiA301.

The channel is permanently set to CAN-IDs 580h + node ID for transmission and 600h + node ID for reception. A maximum of 4 bytes of usable data can be transmitted in a single message. Larger quantities of data are divided among several messages.

Example of reading an object with max. 4 bytes of data

0x610	0x40	0x00	0x20	0x01	0x4D3	-	-	-
CAN-ID	Com- mand	Object index			Subin- dex	Data		
	Databyte 1	Databyte 2	Databyte 3	Databyte 4	Databyte 5	Databyte 6	Databyte 7	Databyte 8

CAN-ID: 610h, SDO1 channel of node 16

Command: 40h, read object, 1 bytes ... 4 bytes of usable data

3 Object Directory



Note

Data Types correspond to Data Types defined by CANopen standard.

3.1 Communication Segment

Index	Sub-index	Parameters	Data Type	Access	Default	Description
0x1000	0	Device type	u32	Read-only	0	No device profile available
0x1001	0	Error register	u8	Read-only		
0x1005	0	COB-ID SYNC message	u32	Read/write	0x80	
0x1008	0	Manufacturer device name	String	Const	R2100	
0x1009	0	Manufacturer hardware version	String	Const		Current hardware version
0x100A	0	Manufacturer software version	String	Const		Current hardware version
0x1010	1	Save all parameters	u32	Read/write	1	Device saves parameters on command. <ul style="list-style-type: none"> To save, write "0x65766173." Reading always returns default value.
0x1011	1	Restore all default parameters	u32	Read/write	1	Device restores parameters on command. <ul style="list-style-type: none"> To restore default configuration, write "0x64616663." Reading always returns default value.
0x1017	0	Producer heartbeat time	u16	Read/write	500	Multiple of 1 ms
0x1018	Identity object					
	0	Number of entries	u8	Read-only	4	
	1	Vendor ID	u32	Read-only	0xAD	Pepperl+Fuchs, listed with the CiA
	2	Product code	u32	Read-only	0x01000001	
	3	Revision number	u32	Read-only		Current revision number
	4	Serial number	u32	Read-only		Last 8 digits of product serial number

Index	Sub-index	Parameters	Data Type	Access	Default	Description
0x1200	Server SDO parameter					
	0	Number of entries	u8	Read-only	2	
	1	COB-ID client to server	u32	Read-only	\$NODEID+0x600	
	2	COB-ID server to client	u32	Read-only	\$NODEID+0x580	
0x1800	Transmit PDO communication parameter					
	0	Highest sub-index supported	u8	Const	3	
	1	COB-ID	u32	Read/write	\$NODEID+0x180	TPDO COB-ID is set to default value on power up. The valid bit is stored on command (0x1010). For a customer-specific COB-ID overwrite after booting up.
	2	Transmission type	u8	Read/write	0xFE	0x0: every SYNC if changed 0x1 ... 0xF0: every nth SYNC message 0xFE: event-driven (manufacturer-specific)
	3	Inhibit time	u16	Read/write	0x0000	Minimum interval for PDO transmission (transmission type 0xFE). Multiple of 100 µs.
0x1801	Transmit PDO communication parameter					
	0	Highest sub-index supported	u8	Const	3	
	1	COB-ID	u32	Read/write	\$NODEID+0x280	TPDO COB-ID is set to default value on power up. The valid bit is stored on command (0x1010). For a customer-specific COB-ID overwrite after booting up.
	2	Transmission type	u8	Read/write	0xFE	
	3	Inhibit time	u16	Read/write	0x0000	

Index	Sub-index	Parameters	Data Type	Access	Default	Description
0x1802	Transmit PDO communication parameter					
	0	Highest sub-index supported	u8	Const	3	
	1	COB-ID	u32	Read/write	\$NODEID+0x380	TPDO COB-ID is set to default value on power up. The valid bit is stored on command (0x1010). For a customer-specific COB-ID overwrite after booting up.
	2	Transmission type	u8	Read/write	0xFE	
	3	Inhibit time	u16	Read/write	0x0000	
0x1803	Transmit PDO communication parameter					
	0	Highest sub-index supported	u8	Const	3	
	1	COB-ID	u32	Read/write	\$NODEID+0x80000480	TPDO COB-ID is set to default value on power up. The valid bit is stored on command (0x1010). For a customer-specific COB-ID overwrite after booting up.
	2	Transmission type	u8	Read/write	0xFE	
	3	Inhibit time	u16	Read/write	0x0000	
0x1804	Transmit PDO communication parameter					
	0	Highest sub-index supported	u8	Const	3	
	1	COB-ID	u32	Read/write	\$NODEID+0x80000000	
	2	Transmission type	u8	Read/write	0xFE	
	3	Inhibit time	u16	Read/write	0x0000	
0x1805	Transmit PDO communication parameter					
	0	Highest sub-index supported	u8	Const	3	
	1	COB-ID	u32	Read/write	\$NODEID+0x80000000	
	2	Transmission type	u8	Read/write	0xFE	
	3	Inhibit time	u16	Read/write	0x0000	

Index	Sub-index	Parameters	Data Type	Access	Default	Description
0x1A00	Transmit PDO mapping parameter					
	0	Highest sub-index supported	u8	Read/write	4	
	1	Mapping entry 1	u32	Read/write	0x20000110	Distance segment 1
	2	Mapping entry 2	u32	Read/write	0x20000210	Distance segment 2
	3	Mapping entry 3	u32	Read/write	0x20000310	Distance segment 3
	4	Mapping entry 4	u32	Read/write	0x20000410	Distance segment 4
	5	Mapping entry 5	u32	Read/write		
	6	Mapping entry 6	u32	Read/write		
	7	Mapping entry 7	u32	Read/write		
0x1A01	Transmit PDO mapping parameter					
	0	Highest sub-index supported	u8	Read/write	4	
	1	Mapping entry 1	u32	Read/write	0x20000510	Distance segment 5
	2	Mapping entry 2	u32	Read/write	0x20000610	Distance segment 6
	3	Mapping entry 3	u32	Read/write	0x20000710	Distance segment 7
	4	Mapping entry 4	u32	Read/write	0x20000810	Distance segment 8
	5	Mapping entry 5	u32	Read/write	0x00000000	
	6	Mapping entry 6	u32	Read/write	0x00000000	
	7	Mapping entry 7	u32	Read/write	0x00000000	
8	Mapping entry 8	u32	Read/write	0x00000000		

Index	Sub-index	Parameters	Data Type	Access	Default	Description
0x1A02	Transmit PDO mapping parameter					
	0	Highest sub-index supported	u8	Read/write	3	
	1	Mapping entry 1	u32	Read/write	0x20000910	Distance segment 9
	2	Mapping entry 2	u32	Read/write	0x20000A10	Distance segment 10
	3	Mapping entry 3	u32	Read/write	0x20000B10	Distance segment 11
	4	Mapping entry 4	u32	Read/write	0x00000000	
	5	Mapping entry 5	u32	Read/write	0x00000000	
	6	Mapping entry 6	u32	Read/write	0x00000000	
	7	Mapping entry 7	u32	Read/write	0x00000000	
8	Mapping entry 8	u32	Read/write	0x00000000		
0x1A03	Transmit PDO mapping parameter					
	0	Highest sub-index supported	u8	Read/write	4	
	1	Mapping entry 1	u32	Read/write	0x20010110	Echo segment 1
	2	Mapping entry 2	u32	Read/write	0x20010210	Echo segment 2
	3	Mapping entry 3	u32	Read/write	0x20010310	Echo segment 3
	4	Mapping entry 4	u32	Read/write	0x20010410	Echo segment 4
	5	Mapping entry 5	u32	Read/write	0x00000000	
	6	Mapping entry 6	u32	Read/write	0x00000000	
	7	Mapping entry 7	u32	Read/write	0x00000000	
8	Mapping entry 8	u32	Read/write	0x00000000		

Index	Sub-index	Parameters	Data Type	Access	Default	Description
0x1A04	Transmit PDO mapping parameter					
	0	Highest sub-index supported	u8	Read/write	4	
	1	Mapping entry 1	u32	Read/write	0x20010510	Echo segment 5
	2	Mapping entry 2	u32	Read/write	0x20010610	Echo segment 6
	3	Mapping entry 3	u32	Read/write	0x20010710	Echo segment 7
	4	Mapping entry 4	u32	Read/write	0x20010810	Echo segment 8
	5	Mapping entry 5	u32	Read/write	0x00000000	
	6	Mapping entry 6	u32	Read/write	0x00000000	
	7	Mapping entry 7	u32	Read/write	0x00000000	
0x1A05	Transmit PDO mapping parameter					
	0	Highest sub-index supported	u8	Read/write	3	
	1	Mapping entry 1	u32	Read/write	0x20010910	Echo segment 9
	2	Mapping entry 2	u32	Read/write	0x20010A10	Echo segment 10
	3	Mapping entry 3	u32	Read/write	0x20010B10	Echo segment 11
	4	Mapping entry 4	u32	Read/write	0x00000000	
	5	Mapping entry 5	u32	Read/write	0x00000000	
	6	Mapping entry 6	u32	Read/write	0x00000000	
	7	Mapping entry 7	u32	Read/write	0x00000000	
8	Mapping entry 8	u32	Read/write	0x00000000		

Table 3.1

3.2 Manufacturer Segment

Index	Sub-index	Name	Type	Access	Default	Description
0x2000	Distance values					
	0	Highest sub-index supported	u8	Const	11	Number of beams
	1	Distance 0	u16	Read-only		[mm]
	2	Distance 1	u16	Read-only		[mm]
	3	Distance 2	u16	Read-only		[mm]
	4	Distance 3	u16	Read-only		[mm]
	5	Distance 4	u16	Read-only		[mm]
	6	Distance 5	u16	Read-only		[mm]
	7	Distance 6	u16	Read-only		[mm]
	8	Distance 7	u16	Read-only		[mm]
	9	Distance 8	u16	Read-only		[mm]
	10	Distance 9	u16	Read-only		[mm]
11	Distance 10	u16	Read-only		[mm]	
0x2001	Echo values					
	0	Highest sub-index supported	u8	Const	11	Number of beams
	1	Echo 0	u16	Read-only		
	2	Echo 1	u16	Read-only		
	3	Echo 2	u16	Read-only		
	4	Echo 3	u16	Read-only		
	5	Echo 4	u16	Read-only		
	6	Echo 5	u16	Read-only		
	7	Echo 6	u16	Read-only		
	8	Echo 7	u16	Read-only		
	9	Echo 8	u16	Read-only		
	10	Echo 9	u16	Read-only		
11	Echo 10	u16	Read-only			

Index	Subindex	Name	Type	Access	Default	Description
0x2002	X-coordinates					
	0	Highest subindex supported	u8	Const	11	Number of beams
	1	X-coordinate 0	u16	Read-only		[mm]
	2	X-coordinate 1	u16	Read-only		[mm]
	3	X-coordinate 2	u16	Read-only		[mm]
	4	X-coordinate 3	u16	Read-only		[mm]
	5	X-coordinate 4	u16	Read-only		[mm]
	6	X-coordinate 5	u16	Read-only		[mm]
	7	X-coordinate 6	u16	Read-only		[mm]
	8	X-coordinate 7	u16	Read-only		[mm]
	9	X-coordinate 8	u16	Read-only		[mm]
	10	X-coordinate 9	u16	Read-only		[mm]
11	X-coordinate 10	u16	Read-only		[mm]	
0x2003	Y-coordinates					
	0	Highest subindex supported	u8	Const	11	Number of beams
	1	Y-coordinate 0				[mm]
	2	Y-coordinate 1				[mm]
	3	Y-coordinate 2				[mm]
	4	Y-coordinate 3				[mm]
	5	Y-coordinate 4				[mm]
	6	Y-coordinate 5				[mm]
	7	Y-coordinate 6				[mm]
	8	Y-coordinate 7				[mm]
	9	Y-coordinate 8				[mm]
	10	Y-coordinate 9				[mm]
11	Y-coordinate 10				[mm]	
0x2020		Pepperl+Fuchs serial number	String	Read-only		
0x2100	0	Locator configuration	u8	Read/write	0	To activate, set least significant byte (LSB) to 1
0x2101	0	CAN termination	u8	Read/write	0	To activate, set LSB to 1 Active after storing parameters and resetting

Table 3.2

Your automation, our passion.

Explosion Protection

- Intrinsic Safety Barriers
- Signal Conditioners
- FieldConnex® Fieldbus
- Remote I/O Systems
- Electrical Ex Equipment
- Purge and Pressurization
- Industrial HMI
- Mobile Computing and Communications
- HART Interface Solutions
- Surge Protection
- Wireless Solutions
- Level Measurement

Industrial Sensors

- Proximity Sensors
- Photoelectric Sensors
- Industrial Vision
- Ultrasonic Sensors
- Rotary Encoders
- Positioning Systems
- Inclination and Acceleration Sensors
- Fieldbus Modules
- AS-Interface
- Identification Systems
- Displays and Signal Processing
- Connectivity

Pepperl+Fuchs Quality

Download our latest policy here:

www.pepperl-fuchs.com/quality

