

**plasma**brush<sup>®</sup>

# Operating instructions

## Communication package

### ProfiNet



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Thank you for buying a high-quality **relyon plasma** GmbH product.  
To get the best from your product, please read these instructions carefully.



### **Important!**

**Read these instructions carefully before assembling, installing and starting up the machine!**

**Always follow the safety instructions!** Failure to follow the safety instructions may result in accidents, serious injury and serious damage to the machine.

**The product may only be started up and operated by trained and qualified persons!**

**Train your staff!** The operator / user is responsible for ensuring that personnel have fully understood the operation of the machine and the safety requirements.

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Original Operating  
Instructions

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# 1 Safety

The system was designed in accordance with the relevant international standards. However, as with any technical product, hazards may arise if the system is not used properly or is used for purposes other than its intended use.

Working with the system can be dangerous and may result in serious or fatal injury. It is therefore essential to protect yourself and others.

In addition to the safety instructions in this document, you must also comply with general safety standards.



## **Caution - Danger!**

When working with the system, please note and observe the safety instructions and requirements in these operating instructions because non-compliance may result in serious or fatal injury.

## 1.1 Residual risks

This system has been manufactured in accordance with the current state of the art. However, it is impossible to eliminate residual risks.

Always adhere to the following safety instructions:



## **Caution – Electrical voltage!**

- Danger: 230 V. If damage is visible on the electrical connection, mains cable or system:
  - Do not start up the system.
  - Have the damaged parts repaired by a qualified person or replace them.



## **Trip hazard!**

Lay the connection cables in suitable cable trays. Lay cables such that they do not present a trip hazard.

## 1.2 Information and obligations for the operator

- The system may emit interference.
  - The system has been tested in accordance with EMC legislation.
  - The operator must verify and assure electromagnetic compatibility with other electrical and electronic equipment in the immediate vicinity of the system.
- Ensure that
  - operating personnel have read and understood these operating instructions.
  - anyone working near the machine is made aware of the dangers and is provided with the necessary protective equipment.
  - Repairs are only carried out by qualified persons.
- In particular, make operating personnel aware of the safety instructions in this document.
- Always keep the system in fully functional condition.
- Any modifications made to the machine will invalidate the operating licence and the warranty unless such modifications are expressly authorised by the manufacturer.

### 1.3 Intended use

The system is intended solely for operation with the PS2000 high-voltage source and a plasma generator from **relyon plasma** GmbH.

Coupled with a suitable plasma generator, the machine is intended solely for the plasma treatment of surfaces (metals, textiles, glass, plastics) to activate, clean, coat or remove residue at atmospheric pressure.

Under no circumstances may the system be used by non-trained persons.

### 1.4 Impermissible operating conditions

The system must not be operated under the following conditions:

- In explosive (ex) zones
- In areas with severe build-up of dust
- Where there is excessive air humidity (see Technical data, chapter 3)
- Installation heights above 2,000m above Sea Level
- Where there are strong vibrations



#### **Note!**

Please also observe the information in the operating instructions of all additional components connected to the system.

## 2 System description

### 2.1 Function

The components of this system are the basic elements for communicating with a PS2000 current source via Profinet.

### 2.2 System overview

#### 2.2.1 Description of the components

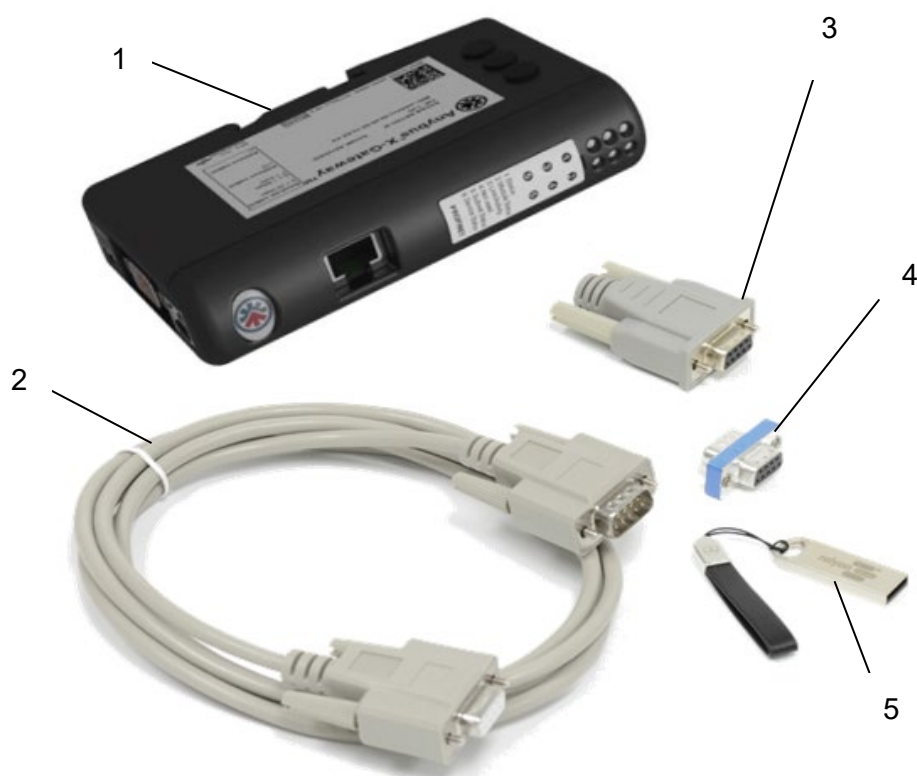


Figure 1: Scope of delivery

No.	Component
1	Anybus X-gateway (CANopen Master – PROFINET-IO AB7307-B)
2	CAN cable (length 2m)
3	CAN terminal resistor (sub-D)
4	CAN terminal resistor (RJ45)
5	USB stick with software and documentation

### 2.2.2 Scope of delivery

The scope of delivery includes the following components:

- Anybus X-gateway with specific Software by relyon plasma
- CAN cable (length 2m)
- CAN terminal resistor (sub-D)
- CAN terminal resistor (RJ45)
- Manual
- USB stick with software

### 2.2.3 Other hardware components needed

Depending on the stage of expansion, several additional hardware components are needed for a functioning overall system. Either recommendations for these or the characteristics needed are listed below.

Component	Description
Voltage supply	U = 24 V DC; I ≥ 1 A; to supply the Anybus X-gateway
Wiring material	Various cables, top hat rail terminals and bridges depending on stage of expansion

## 2.3 Connection assignments

### 2.3.1 Anybus X-gateway control connection assignments

The following figures show the connection assignment of the converter. On the front of the Anybus X-gateway (Figure 2) is the network connector for the Profinet. On the lower side (Figure 4) there are the connections for the supply voltage (+24V DC), the CANopen bus and a USB interface for programming. On the side of the module (Figure 5) are various parameters for setting the CANopen network. The allowed node address range is 1 - 127, the baud rate is pre-set to 500kbit/s and the address (Node-ID) of the module is 1.

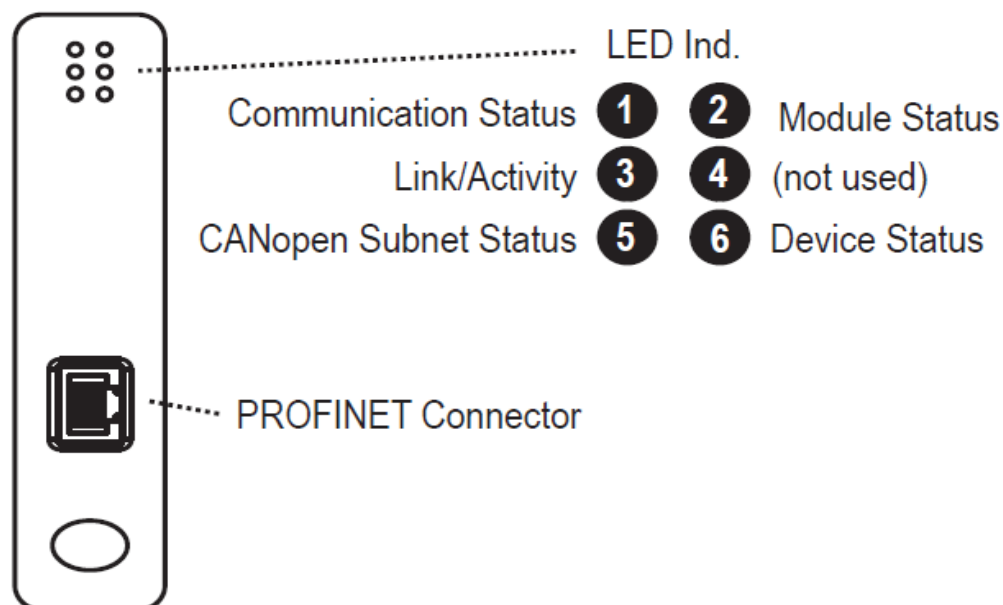


Figure 2: Front of the Anybus X-gateway

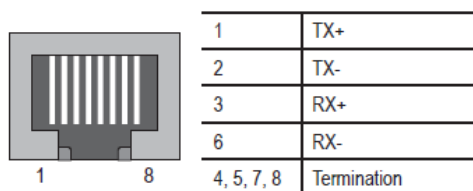


Figure 3: Profinet port

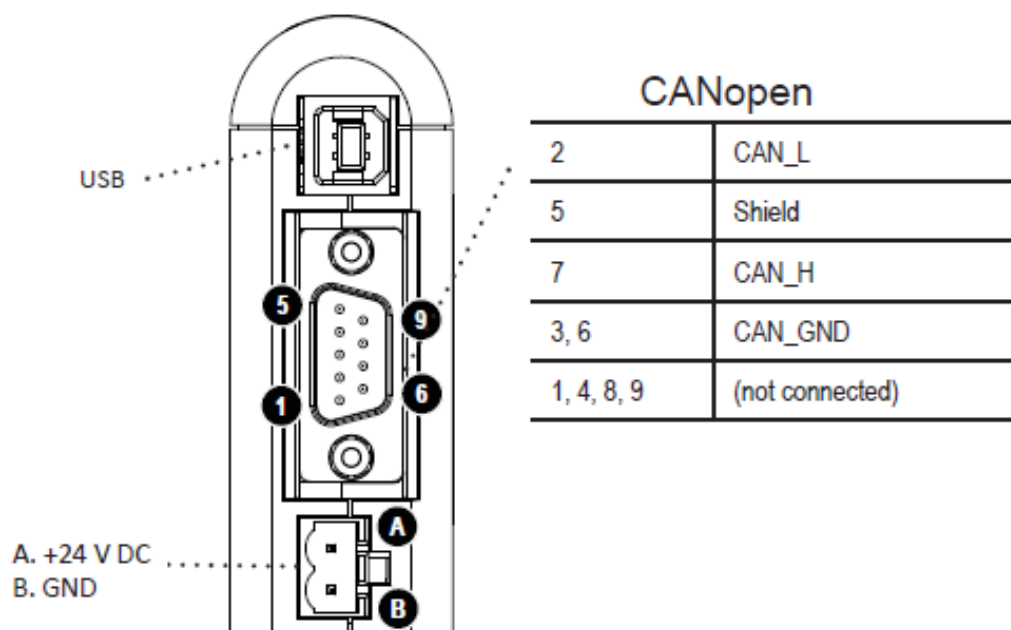


Figure 4: Lower side of the Anybus X-gateway

Setting	Baud Rate (kbit/s)
0	20
1	50
2	125
3	250
4	500
5	800
6	1000
7	Auto
8, 9	Not available

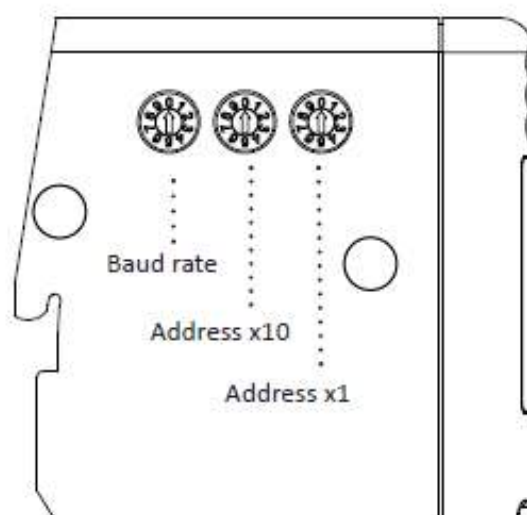


Figure 5: Side of the Anybus X-gateway



### 3

## Technical data

X-gateway CANopen		
Maximum number of Slaves	126	
CANopen Connector	DSUB9M	
Baud rate	Up to 1 Mbit/s	
I/O data	128 PDOs received/128 PDOs transmitted, 510 bytes IN/OUT	
Extras	CANopen specifications DS301 v4.0.2	
Technical details		Standard
Weight	150 g, 0,33 lb	
Dimensions (L•W•H)	120 x 75 x 27 mm, 4,72" x 2,95" x 1,06"	
Protection class	IP20, NEMA 1	
Housing material	PC-ABS, UL 94	
Position for installation	any	
Mounting	DIN rail (35 x 7, 5/15)	EN 50022
Electrical properties		
Electrical connection	24 VDC +/- 10 %	
Electrical consumption	250 mA	
Hardware properties		
Voltage protection	Yes	
Short-circuit protection	Yes	
Galvanic isolation in the subnet	Yes	
Operating conditions		
Temperature	-25 - 55 °C, -13 - 131 °F	IEC 60068-2-1 IEC 60068-2-2
Humidity	< 90 % rel. (non-condensing)	IEC 60068-2-30
Installation height	< 2000 m	
Storage conditions		
Temperature	-40 - 85 °C, -40 - 185 °F	IEC 60068-2-1 IEC 60068-2-2
Humidity	< 80 % rel. (non-condensing)	IEC 60068-2-30
Electromagnetic emissions		
Elektrostatic discharge	+/- 4 kV	EN 61000-4-2
Electromagnetic HF-fields	10 V/m 80 MHz - 1 GHz 3 V/m 1,4 GHz - 2,0 GHz 1 V/m 2,0 GHz - 2,7 GHz	EN 61000-4-3
Fast transients	+/- 1 kV	EN 61000-4-4
Overvoltage protection	+/- 1 kV	EN 61000-4-5
HF-guided interference	10 V/rms	EN 61000-4-6
Emissions (at 10 m)	40 dB 30 MHz - 230 MHz 47 dB 30 MHz - 1 GHz	EN 55016-2-3

### 4

## Transport/Storage

- Store the device in a dry place. This protects the device from corrosion of the electrical contacts.
- Protect the device from dirt and foreign bodies.

## 5 Unpacking and Installation

### 5.1 Unpacking

- Open the packaging carefully. Observe the directional instructions on the packaging.
- Take the components out of the packaging.

### 5.2 Installation requirements

Before installing the machine, the following must be true:

- The components must be undamaged.
- If installing as a permanent installation or in a building, a suitable switch or circuit breaker that satisfies national safety requirements (in Germany: VDE 0100) must be fitted as an upstream all-pole cut-off device that will disconnect the system from the power supply. This cut-off device should be fitted near the machine and must be easily accessible to the user. The switch must also be labelled as the cut-off device for the machine.
- Only a trained electrician may wire the system.
- Observe all installation requirements and safety notices of the additional machines connected.

### 5.3 Installation

To install the system, perform the following steps in the order given:

1. Mount the components provided for this purpose on a DIN rail (35 x 7, 5/15) to ensure stable mounting.
2. Ensure that the Anybus X-gateway and the power source P2000 are without power.
3. Connect the CAN terminating resistor bushing (Sub-D) (#4) to the CAN cable (length 2m) (#2) and all this to the Anybus X-gateway

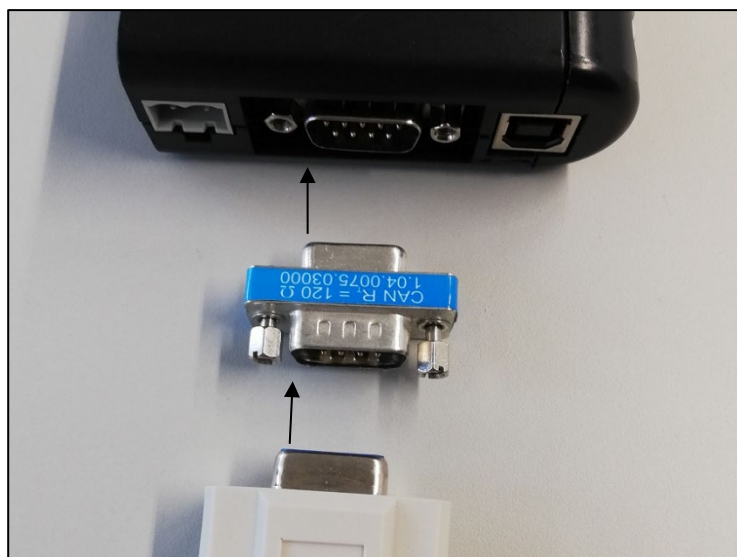
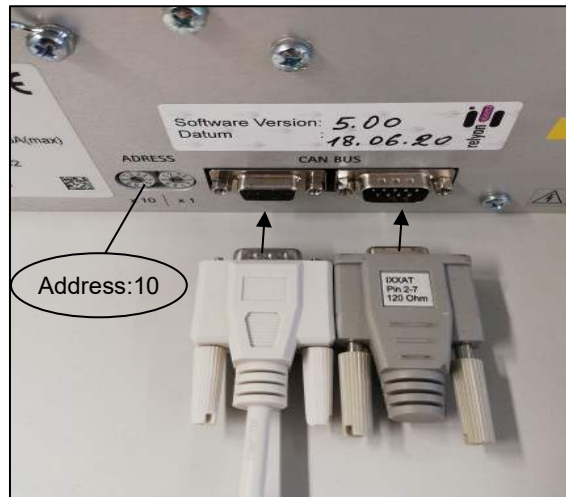


Figure 6: Wiring to X-gateway

4. Connect the CAN cable (length 2m) (#2) to the rear connector of the power source PS2000 and terminate the CAN bus with the terminating resistor provided for this purpose, see also the operating manual of the power source PS2000 if applicable. If two power sources are used, they are connected to each other with another CAN cable. (Figure 7)
5. Set the node number of the PS2000 to "10" (or "11" for a possible second power source) (#7).



*Figure 7: Wiring to PS2000*

6. Establish the emergency stop circuit of the PS2000 as well as all other connections of the additional devices as described in the corresponding operating manuals.
- ✓ The system is installed.

## 6 Operation and configurations

### 6.1 Taking into operation

To operate the system the following requirements must be met:

- The main switches of the connected power sources PS2000 must be switched on.
- The emergency stop circuit must be connected correctly.
- There must be no error on the PS2000.
- The CAN bus line must be connected, both ends terminated with terminating resistors and the correct CAN bus address must be set on the power sources.
- The Profinet cable must be connected.
- The power supply of the Anybus X-gateway must be provided.
- The status LEDs of the Anybus X-gateway must be green.
- The gas supply of the plasma generator must be given.
- All additionally connected devices/components must be connected correctly.

### 6.2 Anybus X-gateway CANopen Master Configuration

Anybus X-gateway is set as manager in the CANopen network with the following parameters:

▼ Manager Settings	
Download NMT Startup Config	<input checked="" type="checkbox"/>
Device is NMT master	<input checked="" type="checkbox"/>
Start all remote nodes	<input checked="" type="checkbox"/>
Application will decide when to switch to op	<input type="checkbox"/>
Master shall not start the slaves	<input type="checkbox"/>
Reset all remote nodes	<input type="checkbox"/>
Node is flying master	<input type="checkbox"/>
Stop all remote nodes	<input type="checkbox"/>
Download Concise DCF to the manager	<input checked="" type="checkbox"/>

Figure 8: CANopen master configuration

The control of the manager and all nodes is monitored with a heartbeat of:

- Producer Interval (ms): 1000ms
- Consuming Node ID/Time Out (ms): 1500ms

## 6.3 PS2000 CANopen Slave Konfiguration

PS2000 is set as slave in the CANopen network with the following parameters:

Slave Settings in Manager 1 - Anybus X-gateway CANopen master		
Download Slave Assignment	<input checked="" type="checkbox"/>	
Node is NMT slave and available	<input checked="" type="checkbox"/>	
Slave shall be booted by the NMT master	<input checked="" type="checkbox"/>	
Slave is mandatory on the network	<input type="checkbox"/>	
Slave shall not be reset in operational	<input type="checkbox"/>	
Check software version of slave	<input type="checkbox"/>	
Restore slave to factory default	<input type="checkbox"/>	
Download Concise DCF to the manager	<input checked="" type="checkbox"/>	
Check device type identification	<input type="checkbox"/>	0x0
Check vendor identification	<input type="checkbox"/>	0x0
Check product code	<input type="checkbox"/>	0x0
Check revision number	<input type="checkbox"/>	0.00
Check serial number	<input type="checkbox"/>	0x0

Figure 9: CANopen slave configuration

## 6.4 PDO mapping

Translation of the signals from CANopen to PROFINET is realized with the following PDO mappings:

Node	Transmit Object	Node	Receive Object
1 - Anybus X-gateway CANopen master	Parameter Byte 1 [2000,00]	10 - PS2000CEM	Reset PS2000 [2000,00]
Anybus X-gateway CANopen master	Parameter Byte 2 [2000,00]	10 - PS2000CEM	High Voltage [2030,00]
1 - Anybus X-gateway CANopen master	Parameter Byte 3 [2040,00]	10 - PS2000CEM	Power Set [2040,00]
Anybus X-gateway CANopen master	Parameter Word 2 [2041,00]	10 - PS2000CEM	Frequency Set [2041,00]
1 - Anybus X-gateway CANopen master	Parameter Word 4 [2042,00]	10 - PS2000CEM	Voltage Threshold [2042,00]
Anybus X-gateway CANopen master	Parameter Word 5 [2043,00]	10 - PS2000CEM	Current Threshold [2043,00]
10 - PS2000CEM	Parameter Word 1 [2000,00]	1 - Anybus X-gateway CANopen master	Reset PS2000 [2000,00]
10 - PS2000CEM	Parameter Word 2 [2030,00]	1 - Anybus X-gateway CANopen master	High Voltage [2030,00]
10 - PS2000CEM	Parameter Word 3 [2040,00]	1 - Anybus X-gateway CANopen master	Power Set [2040,00]
10 - PS2000CEM	Parameter Word 4 [2041,00]	1 - Anybus X-gateway CANopen master	Frequency Set [2041,00]
10 - PS2000CEM	Parameter Word 5 [2042,00]	1 - Anybus X-gateway CANopen master	Voltage Threshold [2042,00]
10 - PS2000CEM	Parameter Word 6 [2043,00]	1 - Anybus X-gateway CANopen master	Current Threshold [2043,00]
10 - PS2000CEM	Parameter Word 7 [2000,00]	1 - Anybus X-gateway CANopen master	Reset PS2000 [2000,00]
10 - PS2000CEM	Parameter Word 8 [2030,00]	1 - Anybus X-gateway CANopen master	High Voltage [2030,00]
10 - PS2000CEM	Parameter Word 9 [2040,00]	1 - Anybus X-gateway CANopen master	Power Set [2040,00]
10 - PS2000CEM	Parameter Word 10 [2041,00]	1 - Anybus X-gateway CANopen master	Frequency Set [2041,00]
10 - PS2000CEM	Parameter Word 11 [2042,00]	1 - Anybus X-gateway CANopen master	Voltage Threshold [2042,00]
10 - PS2000CEM	Parameter Word 12 [2043,00]	1 - Anybus X-gateway CANopen master	Current Threshold [2043,00]
10 - PS2000CEM	Parameter Word 13 [2000,00]	1 - Anybus X-gateway CANopen master	Reset PS2000 [2000,00]
10 - PS2000CEM	Parameter Word 14 [2030,00]	1 - Anybus X-gateway CANopen master	High Voltage [2030,00]
10 - PS2000CEM	Parameter Word 15 [2040,00]	1 - Anybus X-gateway CANopen master	Power Set [2040,00]
10 - PS2000CEM	Parameter Word 16 [2041,00]	1 - Anybus X-gateway CANopen master	Frequency Set [2041,00]
10 - PS2000CEM	Parameter Word 17 [2042,00]	1 - Anybus X-gateway CANopen master	Voltage Threshold [2042,00]
10 - PS2000CEM	Parameter Word 18 [2043,00]	1 - Anybus X-gateway CANopen master	Current Threshold [2043,00]

Figure 10: PDO mapping

In the Master/Slave configuration the first 6 objects of the PDO mapping are to be considered as outputs and the remaining 10 objects as inputs. These are the data sets:

Output Data	Output Data Size	Details
Error Status [2000,00]	1 Byte	Reset PS2000 [0 / 1]
High Voltage [2030,00]	1 Byte	Switch on plasma [0 / 1]
Power Set [2040,00]	1 Byte	Setting power level [70 - 100%] (Default: 100 %)
Frequency Set [2041,00]	1 Word = 2 Byte	Setting frequency [40000Hz - 65000Hz] (Default: 54000Hz)
Voltage Threshold [2042,00]	1 Word = 2 Byte	Internal error threshold -Do not change! (Default: 500 V)
Current Threshold [2043,00]	1 Word = 2 Byte	Internal error threshold -Do not change! (Default: 100 mA)
<b>Total Output Data Size:</b>	<b>9 Byte</b>	

Input Data	Input Data Size	Details
Status Code [2010,00]	1 Byte	Status code of PS2000 (4: Plasma off, 7: Plasma on, 8: Error)
Power Actual [2020,00]	1 Word = 2 Byte	Power of PS2000 [0 - 3200W]
Frequency Actual [2021,00]	1 Byte	Frequency of PS2000 [40000Hz - 65000Hz]
Voltage RMS Actual [2022,00]	1 Word = 2 Byte	Voltage RMS of PS2000 [0 - 1500V]
Current RMS Actual [2023,00]	1 Word = 2 Byte	Current RMS of PS2000 [0 - 1000mA]
Temperature 1 [2050,01]	1 Byte	Temperature#1
Temperature 2 [2050,02]	1 Byte	Temperature#2
Temperature 3 [2050,03]	1 Byte	Temperature#3
Temperature 4 [2050,04]	1 Byte	Temperature#4
Power-On time [2060,00]	1 Word = 2 Byte	Power-On time
<b>Total Input Data Size:</b>	<b>14 Byte</b>	

## i Important!

In a slave/slave configuration, the first 6 objects of the PDO mapping are to be considered as inputs and the remaining 10 as outputs.

### 6.5 Siemens configuration

The Input Data Size and Output Data Size are required in the Siemens configuration to map the data networks. A correct Siemens configuration looks like this:

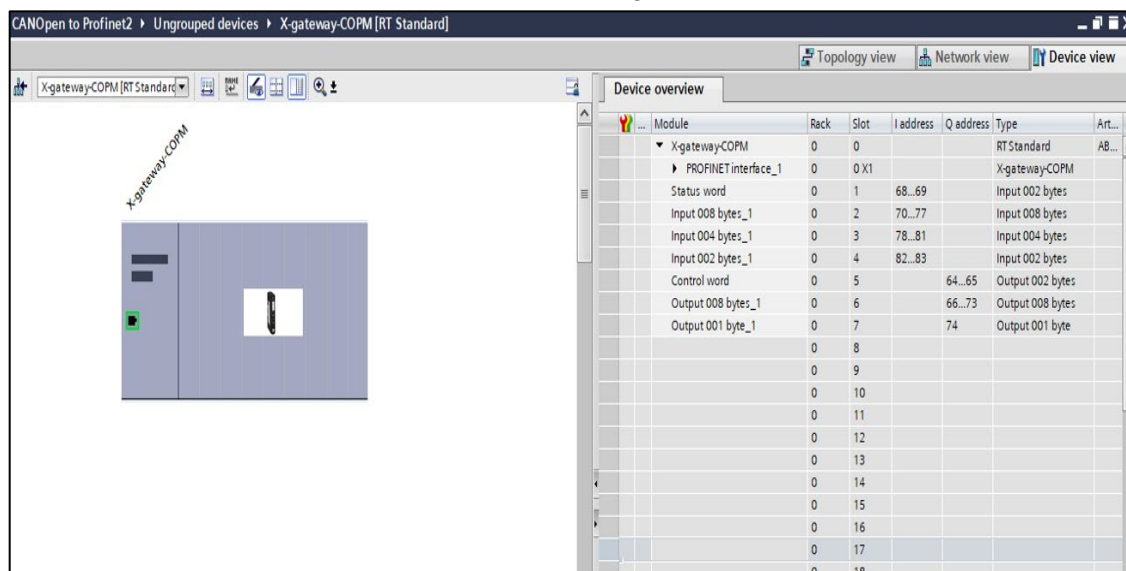


Figure 11: Siemens configuration

Name	Data type	Address	Return	Access	Visible	Comment
01 StatusInfo-Buffer	Word	%I668		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	AnybusBuffer(not used)
02 StatusCode	Byte	%I670		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	4 Plasma off, 7 Plasma on, 8 Error
03 FreqActual	Byte	%I671		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	40-65kHz, Default: 54kHz
04 PowerActual	Word	%I672		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	0..320000 (Value in Little Endian format)
05 VoltageRMSActual	Word	%I674		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	0..150000 (Value in Little Endian format)
06 CurrentRMSActual	Word	%I676		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	0..10000mA (Value in Little Endian format)
07 PowerOnTime	Word	%I678		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	0..655000 (ms machine was switched on) (Value in Little Endian format)
08 Temp1	Byte	%I680		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Temperature1
09 Temp2	Byte	%I681		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Temperature2
10 Temp3	Byte	%I682		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Temperature3
11 Temp4	Byte	%I683		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Temperature4
12 ControlStatus-Buffer	Word	%Q684		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	AnybusBuffer(not used)
13 ErrorStatus-Device	Byte	%Q686		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Reset with falling flag (1->0)
14 HighVoltage	Byte	%Q687		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Plasma on (0->1), Plasma off (1->0)
15 PowerEst	Byte	%Q688		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	70-100% (Plasma Power)
16 Bulk-Byte	Byte	%Q689		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1 Byte in Bulk-Byte
17 FreqEst	Word	%Q670		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	(Default: 54000Hz) Input Value in Little Endian format (40000-65000) (eg. 45000Hz => 0x0B0F0x) => CPU/PLC Little Endian
18 VoltageThreshold	Word	%Q672		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Do not change (Input Value in non Little Endian format if needed)
19 CurrentThreshold	Byte	%Q674		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Do not change (Input Value in non Little Endian format if needed)
add new...				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	

Figure 12: Variable configuration

More information about a Siemens integration and configuration can be found in the supplied documentation “*User Manual: Anybus X-gateway CANopen PROFINET*”.

## 6.6 Error messages on the Anybus X-gateway

The following table shows the possible status of the LEDs on the converter and serves as a possible assistance. In the figure on the right, the six LEDs are marked with a respective allocation number.

LED no	Indication	Meaning
1 (Communication Status)	Off	Not online
	Green	Online, connection with IO established, IO controller in run state
	Flashing green	Online, connection with IO established, IO controller in stop state
2 (Module status)	Off	Module initialized
	Green	Module initialized, no errors
	Single flash, green	Diagnostics available
	Double flash, green	Used by engineering tool to identify the module
	Single flash, red	Configuration error
	Triple flash, red	No station name or no IP address assigned
	Quadruple flash, red	Failed to initialize PROFINET IO object or no MAC address
3 (Link/Activity)	Off	No link
	Green	Link established
	Flashing green	Packet is recieved or transmitted
4 (not used)	-	
5 (CANopen Subnet Status) <sup>1</sup>	Off	Power off
	Flickering green/red	The LSS services are in progress
	Blinking green	Pre-operational state
	Single flash, green	Stopped state
	Green	Operational state
	Blinking red	Configuration error
	Single flash, red	Warning limit reached
	Double flash, red	Error control event
	Triple flash, red	Sync error
	Quadruple flash, red	Data communication timeout
	Red	Bus off
6 (Device Status)	Off	Power off
	Single flash, green	Bootup
	Green	Running
	Single flash, red	Initialization error
	Double flash, red	Timeout
	Triple flash, red	Hardware failure
	Quadruple flash, red	General error
	Red	Fatal error

1. This LED shows the status of the CANopen subnet that is controlled by the X-Gateway CANopen.

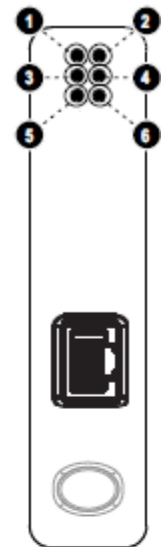


Figure 12: Error messages on the Anybus X-gateway



## 7 Environment

### 7.1 Disposal



#### **Consider the environment.**

Used electrical and electronic equipment must not be disposed of along with normal waste.

- The devices contain valuable materials that can be recycled. Take the device to a suitable collection point.

## 8 Conformity / Standards

### 8.1 CE



#### **We declare CE-conformity.**

The marking can be found on the type plate on the back of the device housing.

### 8.2 Product standards

The device complies with the following regulations and standards:

2014/30/EU EMC Directive (Electromagnetic Compatibility)
---

2011/65/EU RoHS Directive with amendment 2015/863
--

EN 61000-6-4 (2007) + AI (2011) Emission standard for industrial environment
---

EN 61000-6-2 (2005) Immunity for industrial environment
--

EN 55016-2-3, Class A (2017) EN 55032, Class A (2012)
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EN 61000-4-2 (2009) EN 61000-4-3 (2006) + AI (2008) + A2 (2010) EN 61000-4-4 (2012) EN 61000-4-5 (2014) + AI (2018) EN 61000-4-6 (2014)
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