

PROFINET Register Documentation

PROFINET Register Map – Process Data Entries

PROFINET Input and Output Registers

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PROFINET Register Documentation

This document describes the process data mapping for PROFINET communication with the N₂O Wastewater System. It provides details for N₂O measurement, temperature measurement, emission data, status and TagName, together with instructions on how to configure the network settings and how to add the device to a PROFINET controller.

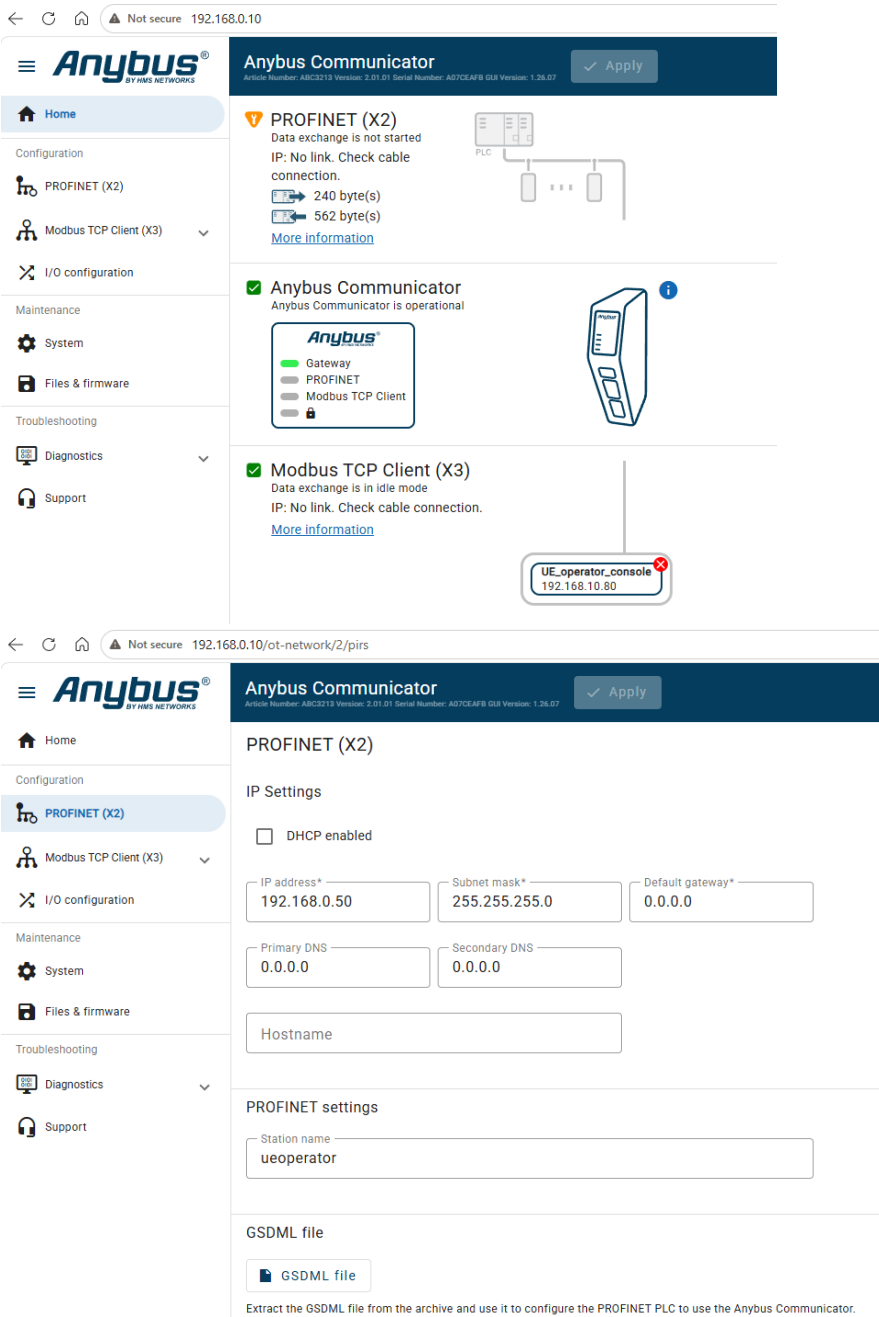
The system connects to the PROFINET network through an Anybus Communicator ABC3213-A gateway, which appears on the network as a standard PROFINET IO device. Eight sensors are supported.

1. Changing the PROFINET Configuration on the Anybus Communicator

To modify the PROFINET settings of the gateway, follow these steps carefully. Connect the PROFINET network cable to port X2.

Important: Change only the settings described in this section. Altering other settings may disrupt other system connections.

1. Connect a PC to the configuration port of the **Anybus Communicator**.
2. Set the PC to a free address in the same subnet, for example 192.168.0.20 with subnet mask 255.255.255.0.
3. Open a web browser and go to **http://192.168.0.10**.
4. In the left menu, select **Configuration**, then **PROFINET (X2)**.
5. Under **IP Settings**, clear the DHCP enabled checkbox to enter a **fixed address**, then adjust the desired parameters:
 - IP address
 - Subnet mask
 - Default gateway
 - DNS settings and DNS server IP address
6. Under **PROFINET settings**, enter the **Station name**. This is the name the controller uses to identify the device, and it must match the name configured in the controller project.
7. Press **Apply** in the top bar. Changes are staged and do not take effect until **Apply** is pressed.



Station names must use lowercase letters, digits, hyphens, and period only. Uppercase letters, spaces and underscores are not permitted.

2. Current Network Settings

Interface	Function	Default setting
Configuration port	Web interface only	192.168.0.10 / 255.255.255.0
X2	PROFINET, to the controller	192.168.0.50 / 255.255.255.0
	PROFINET station name	ueoperator
X3*	Modbus TCP, to the operator console	192.168.10.1 / 255.255.255.0

*Don't attempt to change the default settings between Anybus and N₂O Wastewater Operator Sonsole. Changes in this section may result in failed connections.

3. Changing the Connection to the N₂O Wastewater Operator Console (skip if using default values)

The gateway reads all measured values from the N₂O Wastewater Operator Console over Modbus TCP on port X3. If the console is moved to a different address, the new address must be entered here.

Important: This address must be changed in two places. It must be changed both on this page and on the N₂O Wastewater Operator Console itself. If the two do not match, the gateway cannot reach the console and all PROFINET values read as zero.

1. In the left menu, select Configuration, then Modbus TCP Client (X3), then Servers.
2. Select the server in the left panel to open its properties.
3. Enter the address of the operator console in the IP address field. The target port number is 502.
4. Press Apply in the top bar.
5. Change the address on the N₂O Wastewater Operator Console to match.

The Communication page under Modbus TCP Client (X3) holds the gateway's own address on the Modbus network. The Servers page holds the address of the console it connects to. These are two different addresses in the same subnet.

4. Changing TCP/IP Configuration on the N₂O Wastewater Operator Console (skip if using default values)

To modify the TCP/IP settings of the N₂O Wastewater Operator Console, follow these steps carefully. Connect the TCP/IP network cable to the Ethernet1 port.

Important: Change only the settings described in this section. Altering other settings may disrupt other system connections.

1. Login as ADVANCED user.
2. Open the Console configuration menu.
3. Use the down button to navigate to Ethernet1, then press the button with the three dots to open the network settings.
4. In this section, you can adjust the desired parameters:
 - IP address
 - Subnet mask
 - Default gateway
5. After making the changes, press Save and Reboot.
6. Once the system restarts, it will be ready to communicate using the new network configuration.

The address set here must match the IP address entered on the Servers page of the Anybus Communicator, as described in the previous section.

5. Installing the GSDML File and Adding the Device

1. Extract the supplied GSDML archive and import the XML file into the engineering tool. In TIA Portal: Options, then Manage general station description files (GSD).
2. Add the device to the PROFINET network from the hardware catalogue, under Other field devices, PROFINET IO, Gateway, HMS Industrial Networks, Anybus Communicator.
3. Assign the device name and the IP address to the device. In TIA Portal: right-click the device, then Assign device name, followed by Assign IP address. The controller must use the same name it wrote, or it will not find the device on start-up.
4. Insert the process data modules into slot 1 and slot 2 as listed below.
5. Address the data using the register tables in this document.

Every value is declared in the GSDML as a named, typed data item, so it appears in the engineering tool as S3_Temperature rather than as raw bytes. Items shown as Reserved carry no data and can be ignored.

6. Process Data Modules

Slot	Module	Size
1	N ₂ O Sensor Data S1-S8	562 bytes input
2	Sensor Tag / Airflow S1-S8	240 bytes output

Direction is given from the controller's point of view. Input is read by the controller from the device; output is written by the controller to the device.

7. Data Encoding and Byte Order

Measured values are transmitted as 32-bit IEEE-754 floating-point numbers, each occupying four consecutive bytes. Status values are transmitted as 16-bit unsigned integers occupying two bytes. TagName is transmitted as a character string of 24 characters followed by a null terminator, occupying 26 bytes.

Multi-byte values are transmitted high byte first. Writing the four bytes of a 32-bit floating-point value as A B C D, where A is the most significant byte and D the least significant, they appear on the wire in the order ABCD. A 16-bit value is transmitted as the high byte followed by the low byte. This is the convention also known as big-endian.

The byte order is fixed by the PROFINET standard and cannot be configured. All byte offsets in this document are counted from the start of the module in the respective slot. Bytes that are not listed are reserved and carry no data.

8. N₂O Measurement

The N₂O measurement values are transmitted as 32-bit floating-point numbers. Each sensor reports its current nitrous oxide concentration.

N₂O Measurement:

Sensor	Byte offset (slot 1)	Data type
N ₂ O Sensor 1	4 – 7	Float32
N ₂ O Sensor 2	76 – 79	Float32
N ₂ O Sensor 3	148 – 151	Float32
N ₂ O Sensor 4	220 – 223	Float32
N ₂ O Sensor 5	292 – 295	Float32
N ₂ O Sensor 6	364 – 367	Float32
N ₂ O Sensor 7	436 – 439	Float32
N ₂ O Sensor 8	508 – 511	Float32

9. Temperature Measurement

The temperature measurement values are also encoded as 32-bit floating-point numbers. Each sensor provides its current temperature reading in this format, allowing for precise monitoring and trending.

Temperature Measurement:

Sensor	Byte offset (slot 1)	Data type
N ₂ O Sensor 1	14 – 17	Float32
N ₂ O Sensor 2	86 – 89	Float32
N ₂ O Sensor 3	158 – 161	Float32
N ₂ O Sensor 4	230 – 233	Float32
N ₂ O Sensor 5	302 – 305	Float32
N ₂ O Sensor 6	374 – 377	Float32
N ₂ O Sensor 7	446 – 449	Float32
N ₂ O Sensor 8	518 – 521	Float32

10. N₂O Emission Data

The emission data is derived from the measured concentration and the airflow. Rates are given per aerated area volume; emissions are given as a mass flow. All values are 32-bit floating-point numbers.

N₂O Emission Rate (gN/m³/d):

Sensor	Byte offset (slot 1)	Data type
N ₂ O Sensor 1	20 – 23	Float32
N ₂ O Sensor 2	92 – 95	Float32
N ₂ O Sensor 3	164 – 167	Float32
N ₂ O Sensor 4	236 – 239	Float32
N ₂ O Sensor 5	308 – 311	Float32
N ₂ O Sensor 6	380 – 383	Float32
N ₂ O Sensor 7	452 – 455	Float32
N ₂ O Sensor 8	524 – 527	Float32

Non-N₂O Emission Rate (gN/m³/d):

Sensor	Byte offset (slot 1)	Data type
N ₂ O Sensor 1	24 – 27	Float32
N ₂ O Sensor 2	96 – 99	Float32
N ₂ O Sensor 3	168 – 171	Float32
N ₂ O Sensor 4	240 – 243	Float32
N ₂ O Sensor 5	312 – 315	Float32
N ₂ O Sensor 6	384 – 387	Float32
N ₂ O Sensor 7	456 – 459	Float32
N ₂ O Sensor 8	528 – 531	Float32

N₂O Emission (kgN/d):

Sensor	Byte offset (slot 1)	Data type
N ₂ O Sensor 1	28 – 31	Float32
N ₂ O Sensor 2	100 – 103	Float32
N ₂ O Sensor 3	172 – 175	Float32
N ₂ O Sensor 4	244 – 247	Float32
N ₂ O Sensor 5	316 – 319	Float32
N ₂ O Sensor 6	388 – 391	Float32
N ₂ O Sensor 7	460 – 463	Float32
N ₂ O Sensor 8	532 – 535	Float32

Non-N₂O Emission (kgN/d):

Sensor	Byte offset (slot 1)	Data type
N ₂ O Sensor 1	32 – 35	Float32
N ₂ O Sensor 2	104 – 107	Float32
N ₂ O Sensor 3	176 – 179	Float32
N ₂ O Sensor 4	248 – 251	Float32
N ₂ O Sensor 5	320 – 323	Float32
N ₂ O Sensor 6	392 – 395	Float32
N ₂ O Sensor 7	464 – 467	Float32
N ₂ O Sensor 8	536 – 539	Float32

Total N₂O Emission (kgN/d):

Sensor	Byte offset (slot 1)	Data type
N ₂ O Sensor 1	36 – 39	Float32
N ₂ O Sensor 2	108 – 111	Float32
N ₂ O Sensor 3	180 – 183	Float32
N ₂ O Sensor 4	252 – 255	Float32
N ₂ O Sensor 5	324 – 327	Float32
N ₂ O Sensor 6	396 – 399	Float32
N ₂ O Sensor 7	468 – 471	Float32
N ₂ O Sensor 8	540 – 543	Float32

11. Sensor Status

The status value is a 16-bit unsigned integer in which each bit reports one condition of the sensor.

Status:

Sensor	Byte offset (slot 1)	Data type
N ₂ O Sensor 1	56 – 57	Unsigned16
N ₂ O Sensor 2	128 – 129	Unsigned16
N ₂ O Sensor 3	200 – 201	Unsigned16
N ₂ O Sensor 4	272 – 273	Unsigned16
N ₂ O Sensor 5	344 – 345	Unsigned16
N ₂ O Sensor 6	416 – 417	Unsigned16
N ₂ O Sensor 7	488 – 489	Unsigned16
N ₂ O Sensor 8	560 – 561	Unsigned16

The Status value is a bit field. Each bit reports one condition and is independent of the others, so several conditions can be reported at the same time. A bit is active when it is 1.

Bit 0 and bit 1 summarise the state: bit 0 is set whenever any warning is active, and bit 1 whenever any error is active. The individual conditions occupy the upper bits, from bit 15 downwards. Bits 2 to 7 are reserved.

Bit	Mask	Condition	Type	Description	Recommended action
15	0x8000	Sensor damaged	Error	The sensor is damaged, for example broken.	Replace the sensor head
14	0x4000	Negative signal	Error	The signal is largely negative over time.	Replace the sensor head
13	0x2000	Sensor delta-T out of range	Warning	Sensor head process temperature has changed more than ± 3 °C from the calibrated temperature. Recalibrate at process temperature.	Recalibrate the sensor head at process temperature
12	0x1000	Sensor time in use exceeded	Warning	Sensor lifetime exceeded.	Install a new sensor head
11	0x0800	Sensor autozero needs zero calibration	Warning	Autozero threshold exceeded. Zero calibration required.	Recalibrate the sensor
10	0x0400	Calibration required	Warning	Time expired for a required calibration.	Recalibrate the sensor
9	0x0200	Staggered baseline	Warning	Sensor reading has been constant for 72 hours.	Recalibrate the sensor
8	0x0100	Faulty signal	Warning	No signal for 24 hours.	Woodchop the sensor to dislodge air bubbles, then recalibrate
1	0x0002	Error	Summary	Set when any error bit in this word is active.	See the active condition bits
0	0x0001	Warning	Summary	Set when any warning bit in this word is active.	See the active condition bits

Test each condition by masking the bit, for example Status AND 0x8000 for Sensor damaged. Do not compare the whole word against a single value: once an individual condition is set the word is no longer 0, 1, 2 or 3. A damaged sensor, for example, reads 0x8002 – bit 15 for the condition and bit 1 for the error summary.

The eight conditions above are the most common. They let typical causes be identified directly from process data without consulting another system. The sensor can report additional conditions beyond these.

If the condition is not listed here, see the N₂O Wastewater Operator Console, which always shows the complete error and warning state for each sensor along with the recommended action.

12. Airflow Input

The airflow input is written by the controller and transmitted to the sensor. It is a 32-bit floating-point number.

Airflow Input:

Sensor	Byte offset (slot 2)	Data type
N ₂ O Sensor 1	26 – 29	Float32
N ₂ O Sensor 2	56 – 59	Float32
N ₂ O Sensor 3	86 – 89	Float32
N ₂ O Sensor 4	116 – 119	Float32
N ₂ O Sensor 5	146 – 149	Float32
N ₂ O Sensor 6	176 – 179	Float32
N ₂ O Sensor 7	206 – 209	Float32
N ₂ O Sensor 8	236 – 239	Float32

13. N₂O Sensor TagName

The TagName is a user-defined sensor identifier written by the controller. It is a character string of up to 24 characters followed by a null terminator, occupying 26 bytes.

TagName:

Sensor	Byte offset (slot 2)	Data type
N ₂ O Sensor 1	0 – 25	String
N ₂ O Sensor 2	30 – 55	String
N ₂ O Sensor 3	60 – 85	String
N ₂ O Sensor 4	90 – 115	String
N ₂ O Sensor 5	120 – 145	String
N ₂ O Sensor 6	150 – 175	String
N ₂ O Sensor 7	180 – 205	String
N ₂ O Sensor 8	210 – 235	String