

PROFIBUS DP Register Documentation

PROFIBUS DP Register Map – Process Data Entries

PROFIBUS DP Input and Output Registers

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PROFIBUS DP Register Documentation

This document describes the process data mapping for PROFIBUS DP communication with the N₂O Wastewater System. It provides details for N₂O measurement, temperature measurement, emission data, and status, together with instructions on how to configure the slave and how to add it to a PROFIBUS DP master.

The N₂O Wastewater Operator Console connects to the PROFIBUS network directly, acting as a PROFIBUS DP slave through the PFXZCDEUPF1 interface unit. Eight N₂O Wastewater Sensors are supported.

1. Changing the PROFIBUS Configuration on the N₂O Wastewater Operator Console

To modify the PROFIBUS settings of the N₂O Wastewater Operator Console, follow these steps carefully. Connect the PROFIBUS cable to the DP connector of the interface unit.

Important: Do not change any settings outside this section, as it may have critical effects on other system connections.

1. Login as **ADVANCED** user.
2. Open the **Console configuration** menu.
3. Navigate to the PROFIBUS DP interface settings.
4. Set the slave station address. It must match the station address configured for this slave in the master project. If the two do not match, the master will not find the slave on the bus.
5. Under **I/O Configuration**, set the following values:
 - Input Size (words): 104
 - Output Size (words): 16
 - Use Packet Transfer: cleared
6. After making the changes, press **Save and Reboot**.
7. Once the system restarts, it will be ready to communicate using the new configuration.

Important: The input and output sizes must be set exactly as above. If they do not match the sizes configured on the master, the panel reports RHxx147 Wrong configuration received from PROFIBUS master and no data is exchanged.

2. Installing the GSD File and Configuring the Slave

1. Install the supplied GSD file **PFE_08DF.gsd** in the master engineering tool.
2. Add the slave to the PROFIBUS network from the hardware catalogue, under PROFIBUS DP, Additional Field Devices, MMI, Proface-PROFIBUS DP Slave.
3. Set the slave station address to the address configured on the console.
4. Place the process data modules into the slot list in the order given below.
5. Address the data using the register tables in this document.

Property	Value
GSD file	PFE_08DF.gsd
Vendor / model	Pro-face / Proface-PROFIBUS DP Slave
Ident number	0x08DF
Input size	104 words / 208 bytes (console to master)
Output size	16 words / 32 bytes (master to console)
Supported baud rates	9.6 kbit/s to 12 Mbit/s

Important: The input and output sizes configured on the master must equal the sizes above. A mismatch produces the message RHxx147 Wrong configuration received from PROFIBUS master on the panel, and the slave never exchanges data.

3. Modules to Place in the Slot List

Important: Byte offsets follow the order in which the modules are placed into slots, and the GSD file cannot enforce that order. Placing the modules out of order silently shifts every value while the bus still appears healthy.

Slot	Module name in the catalogue	Direction	Words
1	UE Sensor 1 IN (13W) b0-25	Input	13
2	UE Sensor 2 IN (13W) b26-51	Input	13
3	UE Sensor 3 IN (13W) b52-77	Input	13
4	UE Sensor 4 IN (13W) b78-103	Input	13
5	UE Sensor 5 IN (13W) b104-129	Input	13
6	UE Sensor 6 IN (13W) b130-155	Input	13
7	UE Sensor 7 IN (13W) b156-181	Input	13
8	UE Sensor 8 IN (13W) b182-207	Input	13
9	UE Sensor 1 OUT (2W) b0-3	Output	2
10	UE Sensor 2 OUT (2W) b4-7	Output	2
11	UE Sensor 3 OUT (2W) b8-11	Output	2
12	UE Sensor 4 OUT (2W) b12-15	Output	2
13	UE Sensor 5 OUT (2W) b16-19	Output	2
14	UE Sensor 6 OUT (2W) b20-23	Output	2
15	UE Sensor 7 OUT (2W) b24-27	Output	2
16	UE Sensor 8 OUT (2W) b28-31	Output	2

4. Data Encoding and Byte Order

Measured values are transmitted as 32-bit IEEE-754 floating-point numbers (REAL), each occupying four consecutive bytes. Status values are transmitted as 16-bit unsigned integers (WORD) occupying two bytes. All transmitted values are numeric; no string data is exchanged.

Multi-byte values are transmitted high byte first. Writing the four bytes of a REAL as A B C D, where A is the most significant byte and D the least significant, they appear on the bus in the order ABCD. A WORD is transmitted as the high byte followed by the low byte. This is the convention also written as H/L, or big-endian.

The byte order is fixed by the interface and cannot be configured.

PROFIBUS DP carries anonymous bytes. The master learns only the length of each module, never that four particular bytes represent a floating-point value. The controller program must interpret the data according to the tables in this document.

5. Address Notation

The tables in this document give the byte offset from the start of this slave's data area. The absolute address in the controller is the start address that the master assigns to this slave, plus the offset given here.

Direction is given from the master's point of view. Input is read by the master from the console; output is written by the master to the console. Note that Airflow Input is supplied by the controller and therefore lives in the output area despite its name.

6. 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	Data type	Byte offset
N ₂ O Sensor 1	REAL	0
N ₂ O Sensor 2	REAL	26
N ₂ O Sensor 3	REAL	52
N ₂ O Sensor 4	REAL	78
N ₂ O Sensor 5	REAL	104
N ₂ O Sensor 6	REAL	130
N ₂ O Sensor 7	REAL	156
N ₂ O Sensor 8	REAL	182

7. 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	Data type	Byte offset
N ₂ O Sensor 1	REAL	4
N ₂ O Sensor 2	REAL	30
N ₂ O Sensor 3	REAL	56
N ₂ O Sensor 4	REAL	82
N ₂ O Sensor 5	REAL	108
N ₂ O Sensor 6	REAL	134
N ₂ O Sensor 7	REAL	160
N ₂ O Sensor 8	REAL	186

8. 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.

Emission Rate, Aerated (gN/m³/d):

Sensor	Data type	Byte offset
N ₂ O Sensor 1	REAL	8
N ₂ O Sensor 2	REAL	34
N ₂ O Sensor 3	REAL	60
N ₂ O Sensor 4	REAL	86
N ₂ O Sensor 5	REAL	112
N ₂ O Sensor 6	REAL	138
N ₂ O Sensor 7	REAL	164
N ₂ O Sensor 8	REAL	190

Emission Rate, Non-Aerated (gN/m³/d):

Sensor	Data type	Byte offset
N ₂ O Sensor 1	REAL	12
N ₂ O Sensor 2	REAL	38
N ₂ O Sensor 3	REAL	64
N ₂ O Sensor 4	REAL	90

N ₂ O Sensor 5	REAL	116
N ₂ O Sensor 6	REAL	142
N ₂ O Sensor 7	REAL	168
N ₂ O Sensor 8	REAL	194

Emission, Aerated (kgN/d):

Sensor	Data type	Byte offset
N ₂ O Sensor 1	REAL	16
N ₂ O Sensor 2	REAL	42
N ₂ O Sensor 3	REAL	68
N ₂ O Sensor 4	REAL	94
N ₂ O Sensor 5	REAL	120
N ₂ O Sensor 6	REAL	146
N ₂ O Sensor 7	REAL	172
N ₂ O Sensor 8	REAL	198

Emission, Non-Aerated (kgN/d):

Sensor	Data type	Byte offset
N ₂ O Sensor 1	REAL	20
N ₂ O Sensor 2	REAL	46
N ₂ O Sensor 3	REAL	72
N ₂ O Sensor 4	REAL	98
N ₂ O Sensor 5	REAL	124
N ₂ O Sensor 6	REAL	150
N ₂ O Sensor 7	REAL	176
N ₂ O Sensor 8	REAL	202

9. Sensor Status

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

Status:

Sensor	Data type	Byte offset
N ₂ O Sensor 1	WORD	24
N ₂ O Sensor 2	WORD	50
N ₂ O Sensor 3	WORD	76
N ₂ O Sensor 4	WORD	102
N ₂ O Sensor 5	WORD	128

N ₂ O Sensor 6	WORD	154
N ₂ O Sensor 7	WORD	180
N ₂ O Sensor 8	WORD	206

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-Temp out of range	Warning	Sensor head process temperature has changed more than ± 3 °C from the calibrated temperature. Recalibrate to current 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.

10. 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	Data type	Byte offset
N ₂ O Sensor 1	REAL	0
N ₂ O Sensor 2	REAL	4
N ₂ O Sensor 3	REAL	8
N ₂ O Sensor 4	REAL	12
N ₂ O Sensor 5	REAL	16
N ₂ O Sensor 6	REAL	20
N ₂ O Sensor 7	REAL	24
N ₂ O Sensor 8	REAL	28