gas flow technology by **vögtlin**

analog signals · Modbus · EtherCAT · PROFINET · Bluetooth · VADy®

Instruction manual PROFINET interface

vögtlin instruments

Table of contents

Intro

This manual describes how to use the Vögtlin PROFINET interface with your PROFINET system.

PROFINET is an open Industrial Ethernet standard developed by the PROFIBUS Organization (PI). Based on Ethernet versatility, PROFINET make vertical integration of field level with Enterprise level easily. PROFINET is automation in real time, so it can cover all requirements of the Automation Industry. PROFINET is fit for factory automation, process automation, safety applications and motion control applications, etc.

Detailed information on PROFINET can be found on the PROFIBUS website user organization, which also develops the PROFINET communication technology: www.profibus.com

Overview

- PROFINET IO specification v2.33
- PROFINET IO devices conformance class B (RT)
- Security level 1 – Netload class 2
- Endianness type at Voegtlin Instruments Device is **Big Endian**
- Power supply: 15 – 36 VDC / Meter 275mA@24Vdc, Controller 2000mA@24Vdc

About this documentation

Content

This documentation contains only descriptions of the communication protocol (PROFINET).

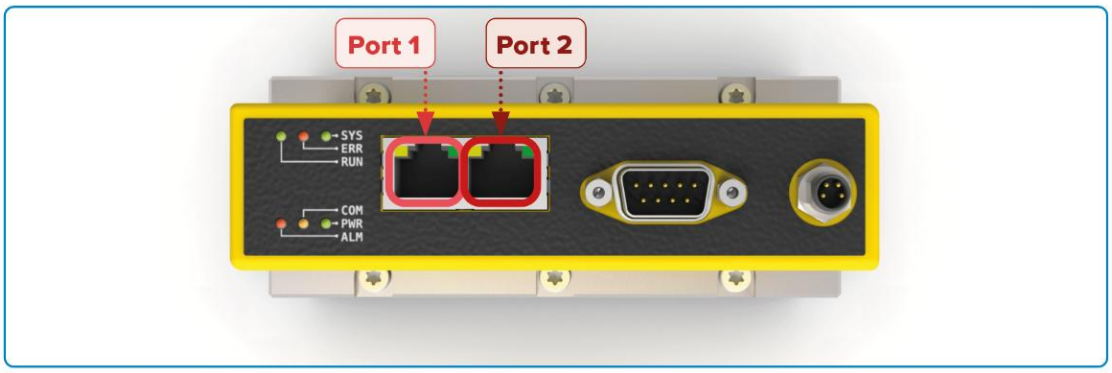
NOTICE!

This documentation is a supplement of D·flux multi series Operating Instructions. *Please visit the Vögtlin website, www.voegtlin.com, and look under the download section to find the manuals.*

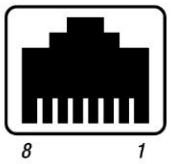
The information in this documentation is valid for the following device: D-Flux

Connection

The ProfiNet device is equipped with two RJ45 connectors which both can be used to connect the device to an ProfiNet master or switch.



8-pin RJ45 connector female



Pin	Assignment	Wire color
1	Data (TX+)	Yellow
2	Data (TX-)	Orange
3	Data (RX+)	Withe
4	not used	
5	not used	
6	Data (RX-)	Blue
7	not used	
8	not used	

Note: For reliable communication, it is advised to use Cat5E or higher graded cables.

The devices can be daisy-chained to optimize the cabling:

Note: *It is important that each device has a unique name assigned in order to hook-up the devices with each other.*

More about daisy chain

This configuration requires less cabling than alternative star topologies and thus is simpler and more cost-effective to implement. A daisy chain topology can be arranged in two ways:

A linear topology:

Message must go from one device to another in one direction.

Line

Inconvenient:
Communication failures in the case of a break in the chain

Ring topology:

It is formed by all the devices connected by each other through their ends.

Ring

Advantage:
This ensures that all the data is transmitted by the devices one after the other and if there is a broken link, then the data is transmitted in the reverse fashion ensuring that the signals are received.

Profinet Topology

Profinet is very flexible when it comes to laying out the network.

However, Ring, line, or Tree and Star topologies comes with advantages and disadvantages that need to be considered at the design phase.

Device network setup

The device comes with the following network settings:

Name : “D-Flux”
IP address : 0.0.0.0

The name and IP address can be changed using tools like **Proneta** (which can be downloaded from the Siemens website www.siemens.com).

Tips: Voegtlin uses following USB- to Ethernet Adapter: **D-Link DUB-E100**

Status LED’s

The status LED’s are located on top of the device.

SYS – System status

Colour State		Description
	On (green)	PROFINET Operating system running
	Blinking (red/green)	PROFINET OS waiting for firmware
	On (red)	PROFINET bootloader waiting for second stage loader
	Off	Power supply missing or hardware failure

ERR – Bus status

Colour State		Description
	Blinking (red)	No data exchange
	On (red)	No configuration; or low speed physical link; or no physical link
	Off	No error

RUN – Run status

Colour State		Description
	Blinking (red)	DCP signal service is initiated via the bus
	On (red)	Watchdog timeout; channel, generic or extended diagnosis present; system error
	Off	No error

COM – Modbus communication status

Colour State		Description
	Flashing (yellow)	Modbus messages are being exchanged
	Off	No communication

PWR – Power

Colour State		Description
	On	Device is powered and operational
	Off	Device is powered off

ALM – Alarm

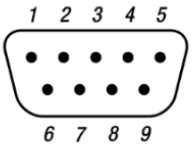
Colour State		Description
	Blinking (red)	Alarm condition occurred. Check alarm status register for more info
	On (red)	Hardware failure. Disconnect the device from the power supply and connect it again. If the fault is still present, please send it to the responsible service centre.
	Off	No alarm

Electrical power supply

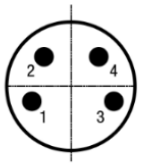
The device can be powered through the Sub-D9 connector which is located on the side of the device.

- Power supply: 15 – 36 VDC
- Power consumption: Meter 275mA@24Vdc, Controller 2000mA@24Vdc

Sub–D9 and M8 Pin assignment for Modbus RTU, power supply, analog signals

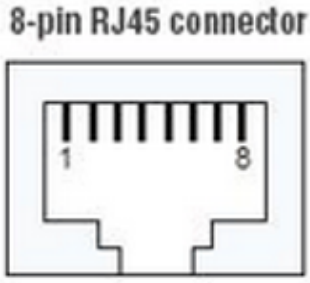


Pin	Assignment	
1	Analog Ground	
2	Supply Ground	
3	Supply Power	
4	Analog Out Voltage	
5	Setpoint (MFC only)	
6	Valve Mode (MFC only)	
7	Analog Out Current	
8	RS485-A	Modbus
9	RS485-B	Modbus



Pin	Assignment
1	Supply Power
2	Not Connected
3	Supply Ground
4	Output
enclosure	Protective Earth

Pin assignment Ethernet RJ45 (Profinet/EtherCAT)

RJ45 Connector	Socket version RJ45, female connector	Pin	Assignment	Wire Color
		1	Data (TX+)	Yellow
		2	Data (TX-)	Orange
		3	Data (RX+)	White
		4	Not used	
		5	Not used	
		6	Data (RX-)	Blue
		7	Not used	
		8	Not used	

NOTICE!

More information can be found on ***D-Flux Operation Instructions***

Please visit the Vögtlin website, www.voegtlin.com, and look under the download section to find the manuals.

Serial Interface

In addition to the PROFINET interface, the device has, as standard, a digital interface with the Modbus RTU protocol. This interface enables access to numerous parameters.

NOTICE!
Any changes to the settings through the standard interface Modbus RTU, are not reflected in the Profinet PDO's. Please apply a **power reset** after changing the settings through the standard interface.

GSDML File

The GSDML file contains the facilities/features which the device offers to the PROFINET master. The file is called: *GSDML-V2.33-Voegtlin Instruments-04AD-D-Flux-yymmdd.xml*

The GSDML file is an xml file containing:

- Device identification info. This contains general information like:
  - Vendor (Vögtlin Instruments)
  - Vendor ID (0x04AD)
  - Product family (D-Flux)
- Device Access Point (DAP) contains information about:
  - Used hardware
  - Ethernet related settings
  - Supported features

Note: The PROFINET interface only supports cyclic data exchange

Alarms

To handle alarms it is necessary to actively poll the available alarm PDO`s "**Warnings Status**" & "**Error Status**" in the PLC Program.

Process Data Objects (PDO's)

PDO's are variables continuously transferred between the Device (slave) and the PLC (master)
The PROFINET interface supports only one slot for input and one slot for output.
Each sub-slot can have one register (from the list below) assigned to it. The input slot supports a maximum of 20 sub-slots. The output slot supports 12 sub-slots. When adding a sub-slot, a list is available (through the GSDML) with all the available registers. The order in which the registers can be added is not fixed.

This document describes how the data is encoded in the PDO's. The name of the register corresponds to the name used in the GSDML. The tables also show the Modbus registers which are linked to the PDO data. More information about the registers can be found on the Vögtlin website under the download section, look for digital communication.

Read with **Input PDO's** (slave to master)

Register	Modbus Addr. (zero base)	Data Type	Description
Flow	0x0000	F32	Actual flow
Temperature	0x0002	F32	Actual temperature
Totalizer	0x0004	F32	Total amount of gas used
Set point Flow	0x0112	F32	Set point flow (controller)
Valve power	0x0162	F32	Actual valve power
Warnings status	0x0301	UINT	Warning status
Error status	0x0321	UINT	Error status
Valve mode	0x0160	UINT	Operating mode of the valve
Ramp time	0x0104	UINT	Time of the ramp
Ramp mode	0x0106	UINT	Ramp mode
Flow unit name	0x0054	String (16 Bytes)	Flow unit
Gas name	0x0044	String (16 Bytes)	Gas name
Serial Number	0x0402	UDW	Serial number of the device
Device Type 1	0x0404	String (12 Bytes)	Device description
Select Parameter set	0x0131	UINT	Currently selected parameter set
Flow limit	0x00B4	F32	Maximum allowed flow
Device type 2	0x040A	String (12 Bytes)	Device description
Totalizer unit	0x0084	String (16 Bytes)	Totalizer unit
Profile select	0x0032	SINT	Currently selected profile
Pressure (ABS)	0x0006	F32	Actual pressure
I/O on/off	0x0343	UINT	Open collector switch state
Pressure unit	0x0074	String (16 Bytes)	Pressure unit
Temp unit	0x0064	String (16 Bytes)	Temperature unit

Write with **Output PDO's** (master to slave)

Register	Modbus Addr. (zero base)	Data Type	Description
Set point Flow	0x0100	F32	Set preferred flow
Valve mode	0x0160	UINT	Set valve mode
Ramp time	0x0104	UINT	Set ramp time
Ramp mode	0x0106	UINT	Set ramp mode
Select Parameter set	0x0131	UINT	Select parameter set
Flow limit	0x00B4	F32	Change current flow limit
Profile select	0x0032	SINT	Select profile
I/O on/off	0x0343	UINT	Set open collector switch state
Reset Device	0x0600	UINT	Soft reset the device
Write Protect	Special	UINT	Set the access level of the output PDO's

Write Protect/Output Enable

At power-up the output PDO's are disabled. This means that any changes to the output PDO will not be executed by the Device. In order to enable writing to the Device, it is necessary to write "Bit weight or the sum of the Bit weight value into Write Protect / Output Enable register. Each bit in this register corresponds to a "Selected output PDO register". The table below gives an overview:

Bit	Selected output PDO register	Bit weight
0	Set point Flow	1
1	Valve mode	2
2	Ramp time	4
3	Ramp mode	8
4	Select Parameter set	16
5	Flow limit	32
6	Profile select	64
7	I/O on/off	128
8	Reset Device	256

Divers examples

Enable writing:

Input PDO's = Read= Rd and *Output's PDO's =Write = Wr*

- - To **enable writing a value to the set point (flow)**, set bit 0 with "Bit weight = 1", in writing "Output enable /Write protect" with value = 1

- To **enable writing the Ramp time & set point (flow)**, add both Bit weight, and write "Output enable/Write Protect" with value = 5

NOTICE!

Why the register does not react of values modification?
Nothing will happen, if the register been modified already has the same value.
To write the same value a different value needs to be written first followed by the same value which was previously in the register.

Example:
To clear the totalizer the value zero is written to it. Clearing it again would require to write the value zero again. Since the current value is already zero nothing will happen. Setting the totalizer to zero requires the following sequence:

1. Write a non-zero value to the register
2. Write the value zero to the register

Register Description Input PDO's

FLOW: Current gas flow in the selected engineering unit

Address hex	Name	Access	Type	Count	default
0x0000	FLOW_VALUE	R	F32	2	-

Current flow of gas in the engineering unit selected

TEMPERATURE: Current gas temperature in the selected temperature unit

Address hex	Name	Access	Type	Count	default
0x0002	TEMP_VALUE	R	F32	2	-

Current Temperature of gas in the engineering unit selected

TOTALIZER: Current totalizer value in the selected totalizer unit

Address hex	Name	Access	Type	Count	default
0x0004	TOTALIZER_VALUE	R	F32	2	-

Current totalizer value of gas in the engineering unit selected

SETPOINT FLOW: Current set point

Address hex	Name	Access	Type	Count	default
0x0100	SETPOINT	R	F32	2	-

Reading this register returns the user set point in current selected flow unit.

VALVE POWER: Current valve power

Address hex	Name	Access	Type	Count	default
0x0162	VALVE POWER	R	F32	2	-

Reading this register returns the power applied to the valve in %.

WARNING_GLOBAL_STATUS: Available warnings

Address hex	Name	Access	Type	Count	default
0x0301	WARNING_GLOBAL_STATUS	R	U16	1	0

Temporary operation state that emerges from an unexpected device behaviour in the process (e.g. measured zero flow, although the valve is fully opened). These types of warnings require user interaction.

Bit	Warning
0	No flow although valve is open.
1	Negative flow
2	Set point is not reached.
3	Pressure out of range
4	Temperature out of range
5	Flow measured although valve is closed.
6	Watchdog
7	Underflow
8	Overflow
9	Analog input above range.
10	Device not operating in measurement state.

Note: See manual for additional information

ERROR_GLOBAL_STATUS: Which global errors are active/inactive

Address hex	Name	Access	Type	Count	default
0x0321	ERROR_GLOBAL_STATUS	R	U16	1	-

This register shows which errors are currently active.

Active errors are associated with a 1 bit. Only available errors are considered.

Index	Error
0	EEPROM error
1	NA
2	Sensor incompatible
3	Sensor damaged
4	Sensor not responding
5	Temperature sensor damaged
6	NA
7	Analog Input damaged
8	Analog Output damaged
9	Bluetooth® module not responding

Note: See manual for additional information

VALVE MODE: Current valve mode

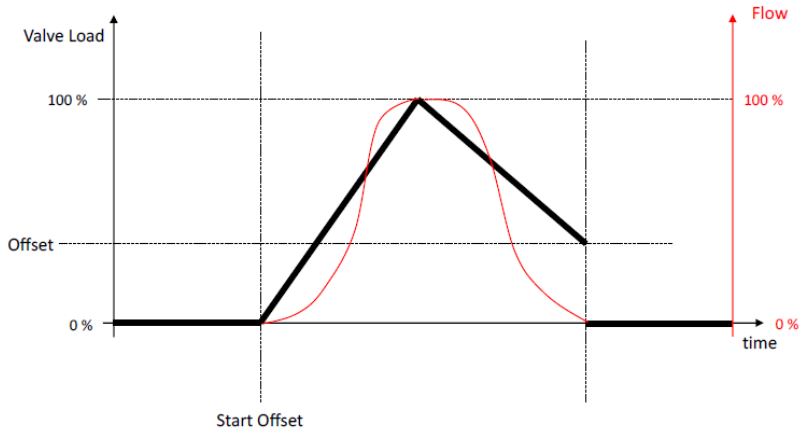
Address hex	Name	Access	Type	Count	default
0x0160	VALVE MODE	R	F32	2	-

Reading this register returns the current mode of the valve.

Index	Mode	Description
0	Idle	Valve closed.
1	Control (default)	Valve controlled automatically by PID Controller.
2	Manual	Valve can be controlled manually by user.
3	Min Detect	Valve minimum detection is applied.
4	Purge	Valve purge is applied.

Note:
If the valve mode is “Idle” or “Manual” the green LED on the device flashes with 1 Hz (500 ms on, 500 ms off). Otherwise, the LED is constantly on.

Min Detect:
The device is capable of detecting the valve minimum automatically.
The following figure depicts the functionality of the minimum detection.



Selecting “Min Detect” in this register will start the detection. Selecting any other mode in this register while the detection is running stops it immediately.

RAMPING TIME

Address hex	Name	Access	Type	Count	default
0x0104	SETPOINT_RAMPING_TIME_MS	R	U16	1	-

Set point ramping can be used to protect the process from rapid changes in the set point.

Reading this register returns the ramping time in milliseconds.

Note:

- Ramping is not applied when user set point is set to zero.
- If constant slope is selected as mode the given ramping time is applied to the maximum range value to determine the slope. In other words, the ramping time determines how long it would take the ramp if the set point was the maximum range starting from zero.

RAMPING MODE

Address hex	Name	Access	Type	Count	default
0x0106	SETPOINT_RAMPING_MODE	R	U16	1	-

The ramping mode determines how the ramp is executed.

Reading this register returns the ramping mode:

Index	Description
0	Off
1	Constant time
2	Constant slope

FLOW UNIT NAME: Name of currently selected flow unit

Address hex	Name	Access	Type	Count	default
0x0054	FLOW_UNIT_NAME	R	STR <16>	8	-

Reading this register returns the name of the current selected unit. Any read request must target the base address of this register and is rejected otherwise.

GAS NAME: Name of selected gas

Address hex	Name	Access	Type	Count	default
0x0044	GAS_NAME	R	STR <16>	8	-

Reading this register returns the current active gas name in ASCII code

SERIAL NUMBER: Serial number of device

Address hex	Name	Access	Type	Count	default
0x0402	INFO_SERIAL	R	U32	2	-

Reading this register returns the serial number of the device.

DEVICE TYPE 1: Type code of device part 1

Address hex	Name	Access	Type	Count	default
0x0404	INFO_TYPECODE_1	R	STR <12>	6	-

Type code (part 1) as a string.

SELECT PARAMETER SET: Current parameter set

Address hex	Name	Access	Type	Count	default
0x0131	PARAMETER_SELECT	R	U16	1	-

Reading this register returns the index of the current selected parameter set.

FLOW LIMIT: Range max of range which is selected and in use for editing

Address hex	Name	Access	Type	Count	default
0x00B4	FLOW LIMIT	R	F32	2	-

Reading this register returns the effective maximum value excluding the overflow area. This value is in current selected flow unit.

DEVICE TYP 2: Type code of device part 2

Address hex	Name	Access	Type	Count	default
0x040A	INFO_TYPECODE_2	R	STR <12>	6	-

Type code (part 2) as a string.

TOTALIZER UNIT: Name of currently selected totalizer unit

Address hex	Name	Access	Type	Count	default
0x0084	TOTALIZER_UNIT_NAME	R	STR <16>	8	-

Reading this register returns the name of the current selected totalizer unit. Any read request must target the base address of this register and is rejected otherwise.

PROFILE SELECT:

Address hex	Name	Access	Type	Count	default
0x0032	PROFILE_SELECT	R	SINT	1	-

Reading this register returns the current active profile index (zero based).

PRESSURE (ABS): Current pressure in the device

Address hex	Name	Access	Type	Count	default
0x0006	PRESSURE	R	F32	2	-

Reading this register returns the actual pressure in the device.

I/O ON/OFF: OC switch value in manual mode

Address hex	Name	Access	Type	Count	default
0x0343	SWITCH_VALUE	RW	U16	1	-

Reading this register returns the value of the open collector switch for “manual” mode.

PRESSURE UNIT: Name of currently selected pressure unit

Address hex	Name	Access	Type	Count	default
0x0074	PRESSURE_UNIT_NAME	R	STR <16>	8	-

Reading this register returns the name of the current selected pressure unit. Any read request must target the base address of this register and is rejected otherwise.

TEMP UNIT: Name of currently selected temperature unit

Address hex	Name	Access	Type	Count	default
0x0064	TEMP_UNIT_NAME	R	STR <16>	8	-

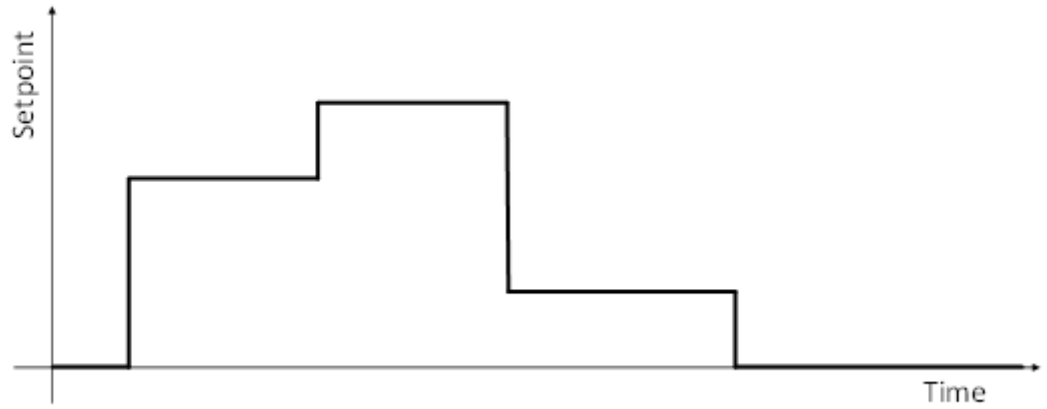
Reading this register returns the name of the current selected temperature unit. Any read request must target the base address of this register and is rejected otherwise.

Register Description Output PDO's

SETPOINT FLOW:

Address hex	Name	Access	Type	Count	default
0x0100	SETPOINT	W	F32	2	-

As can be seen in the figure the set point it applied to the controller input.



Writing this register updates the user set point in current selected flow unit. This register is volatile only and any value written is not stored in persistent memory.

VALVE MODE: Current valve mode

Address hex	Name	Access	Type	Count	default
0x0160	VALVE MODE	W	U16	1	-

Writing this register sets the current mode of the valve.

Index	Mode	Description
0	Idle	Valve closed.
1	Control (default)	Valve controlled automatically by PID Controller.
2	Manual	Valve can be controlled manually by user.
3	Min Detect	Valve minimum detection is applied.
4	Purge	Valve purge is applied.

RAMP TIME:

Address hex	Name	Access	Type	Count	default
0x0104	SETPOINT_RAMPING_TIME_MS	W	U16	1	-

Set point ramping can be used to protect the process from rapid changes in the set point.

Writing any non-zero value in this register updates the ramping. Writing zero disables the ramping. The written value is interpreted as time in milliseconds. Writing this register has volatile effect and the written value is additionally stored in persistent memory.

Note:

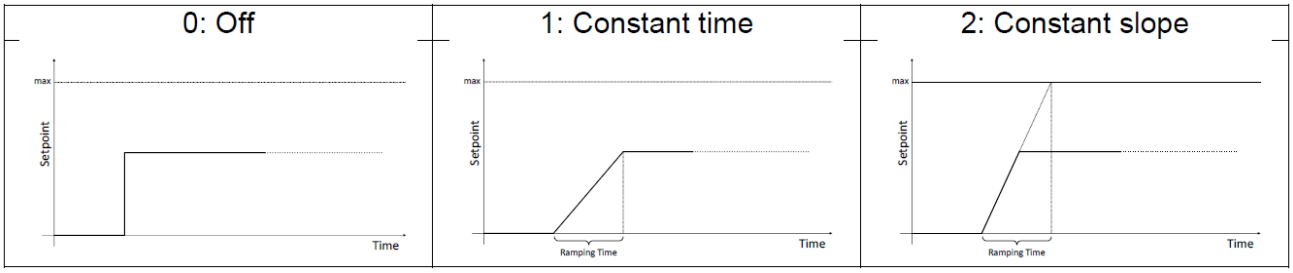
- *Ramping is not applied when user set point is set to zero.*
- *If constant slope is selected as mode the given ramping time is applied to the maximum range value to determine the slope. In other words, the ramping time determines how long it would take the ramp if the set point was the maximum range starting from zero.*

RAMP MODE: Current ramp mode

Address hex	Name	Access	Type	Count	default
0x0106	RAMP MODE	W	U16	1	-

Writing this register sets the current mode of the ramp.

Index	Mode	Description
0	Idle	Ramp function disabled
1	Constant time	Ramp determined by time
2	Constant slope	Ramp slope constant until reaching the set point



SELECT PARAMETER SELECT:

Address hex	Name	Access	Type	Count	default
0x0131	PARAMETER_SELECT	W	U16	1	-

Writing a zero based index to this register selects the corresponding parameter set. Writing 0 selects the first parameter set, writing a 1 selects the second and so on. Writing an invalid index has no effect. Writing to this register has immediate effect and updates persistent memory.

FLOW LIMIT: Range max of range which is selected and in use for editing

Address hex	Name	Access	Type	Count	default
0x00B4	FLOW LIMIT	W	F32	2	-

Writing this register sets the maximum value of the current range type in use. This value is in current selected flow unit.

PROFILE SELECT: Active Profile you want to use

Address hex	Name	Access	Type	Count	default
0x0032	PROFILE_SELECT	W	S16	1	-

Writing the register changes the current active profile. Writing 0 selects the first profile, writing 1 selects the second profile and so on. Writing an invalid index has no effect. Writing the register changes current selected profile and changes are written into persistent memory. Changes are active immediately

I/O ON/OFF: OC switch value in manual mode

Address hex	Name	Access	Type	Count	default
0x0343	SWITCH_VALUE	W	U16	1	-

Writing this register:

- Sets the value of the open collector switch for “manual” mode.
- A non-zero value to this register sets the value to 1 (activating the switch).
- Zero to this register sets the value to zero (deactivating the switch).
- Volatile effect only.

RESET DEVICE: Reset device

Address hex	Name	Access	Type	Count	default
0x0600	RESET	W	U16	1	-

Writing 0xDEAD to this register resets the device.