

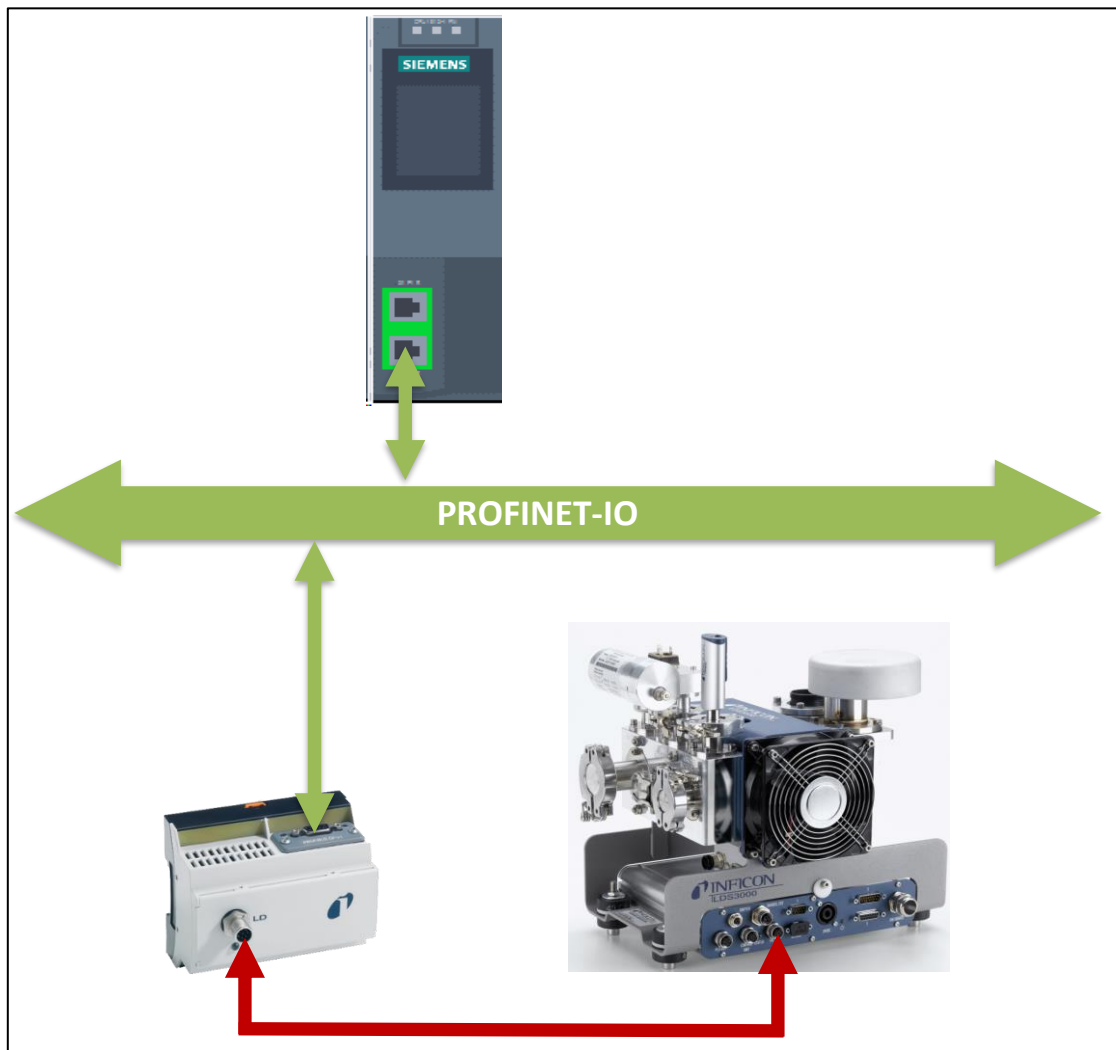
Marc Blaufuß, INFICON Cologne

iaa54en1-01 (2101)

Application Leak Detection  
+49-221-56788-619  
E-mail: [Marc.Blaufuss@inficon.com](mailto:Marc.Blaufuss@inficon.com)

January 2021

## **LDS3000 platform – BM1000 PROFINET-IO configuration with SIMATIC TIA Portal V15.1**



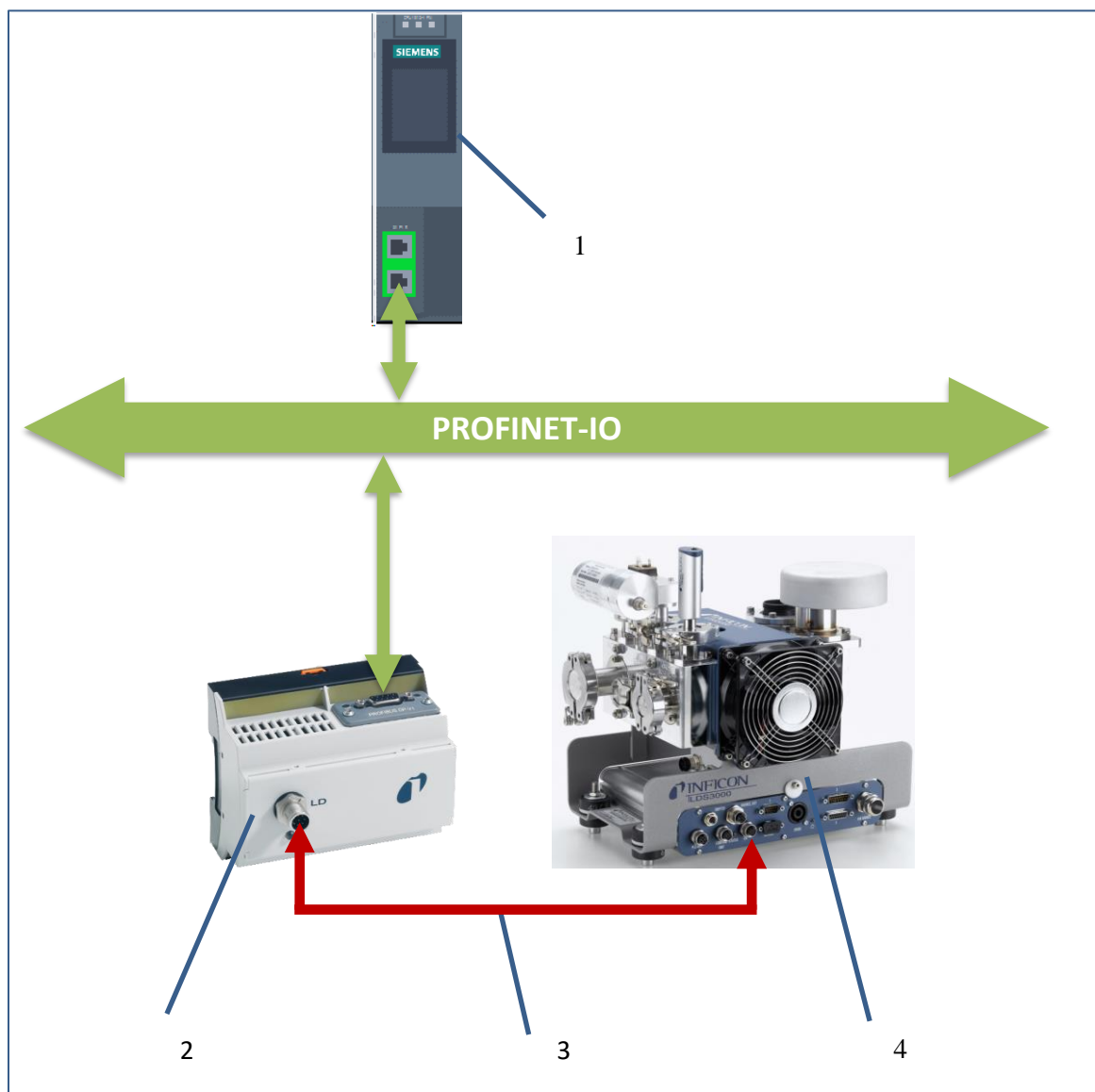
## Table of contents

1	Preface.....	1
2	Set up BM1000 PROFINET-IO configuration of the LDS3000 platform .....	3
2.1	Set up BM1000 Bus interface .....	3
2.2	Set up BM1000 PROFINET-IO address.....	4
2.3	Set up the BM1000 field bus profile.....	4
2.4	Activate BM1000 PROFINET-IO set up .....	5
2.5	Check PROFINET-IO communication between PROFINET-IO Master and INFICON BM1000 PROFINET-IO slave .....	5
3	TIA Portal .....	8
3.1	Installation GSDML-File BM1000 PROFINET-IO module .....	8
3.2	Add BM1000 PROFINET-IO module to PROFINET-IO network .....	10
3.3	Change I/O addresses of BM1000 PROFINET-IO module.....	13
3.4	Set IP address of BM1000 PROFINET-IO module .....	14
3.5	Change device name of BM1000 Bus module.....	16
3.6	Cyclic data exchange – PROFINET-IO Master and INFICON BM1000 PROFINET-IO slave .....	21
3.6.1	Control word – Write Process Data (PLC → Leak Detector) .....	22
3.6.2	Status word – Read Process Data (Leak Detector → PLC) .....	24
3.7	Acyclic data exchange – PROFINET-IO Master and INFICON BM1000 PROFINET-IO slave ...	30
3.7.1	Acyclic data exchange addressing rules .....	31
3.7.2	Reading data from leak detector acyclically.....	31
3.7.2.1	Using Siemens standard function block “RDREC” .....	32
3.7.2.1.1	Parameter ID .....	34
3.7.2.1.2	Parameter INDEX.....	35
3.7.2.1.3	Parameter MLEN .....	35
3.7.2.1.4	Parameter RECORD .....	37
3.7.2.2	Example 1: read Mass using LD command 506 .....	38
3.7.2.3	Example 2: read Calibration factors vacuum using LD command 520 .....	39
3.7.2.4	Example 3: read Trigger using LD command 385 .....	40
3.7.2.5	Example 4: read Flow control using LD command 229 .....	42
3.7.2.6	Example 5: read Unfiltered ion current [A] using LD command 1568 .....	43
3.7.3	Writing data to leak detector acyclically .....	44

3.7.3.1	Limited write operations to leak detectors .....	45
3.7.3.2	Using Siemens standard function block “WRREC” .....	46
3.7.3.2.1	Parameter ID .....	48
3.7.3.2.2	Parameter INDEX.....	49
3.7.3.2.3	Parameter LEN.....	49
3.7.3.2.4	Parameter RECORD .....	51
3.7.3.3	Example 1: write Trigger by using LD command 385 .....	52
3.7.3.4	Example 2: write Test leak extern vacuum by using LD command 390 .....	53
3.7.3.5	Example 3: write Flow control by using LD command 229 .....	55

## 1 Preface

In order to use PROFINET-IO fieldbus communication, an INFICON Bus-Module BM1000 PROFINET-IO needs to be connected to the I/O port of the leak detector by using a data cable.



POS	Catalog number	
1	PROFINET-IO Master (e.g. S7-1500)	---
2	BM1000 PROFINET-IO module	560-316 BM1000 PROFINET-IO module
3	Data Cable	560-332 Data cable 2 m 560-335 Data cable 5 m 560-340 Data cable 10 m
4	Leak Detector (e.g. LDS3000)	560-300

Fieldbus systems normally support device-specific configuration files e.g. GSDML files for the PROFINET-IO field bus system.

The appropriate configuration files (GSDML) is on the USB memory stick which is supplied with the BM1000 bus module.

**\\LDS3000(AQ)-Documentation-V~~xx~~\Manuals\LDS3000 Interface Description\Profinet\GSD INFICON Profile**

**xx = version number**

The LDS3000 platform contains the following devices:

POS		Catalog number
<b>1</b>	LDS3000	560-300
<b>2</b>	LDS3000 XL	560-300 560-319
<b>3</b>	LDS3000 AQ	560-600
<b>4</b>	XL3000flex	520-200

This manual is valid for all the devices listed above.

This manual is based on the following version numbers:

POS		Version
<b>1</b>	LDS3000	MSB v2.72 or higher
<b>2</b>	CU1000	v2.72 or higher
<b>3</b>	BM1000 PROFINET-IO	
<b>4</b>	LDS3000 Protocol Description	jira54en1-07 (1803) or higher
<b>5</b>	SIMATIC TIA Portal V15.1	V15.1 Update 5 or higher

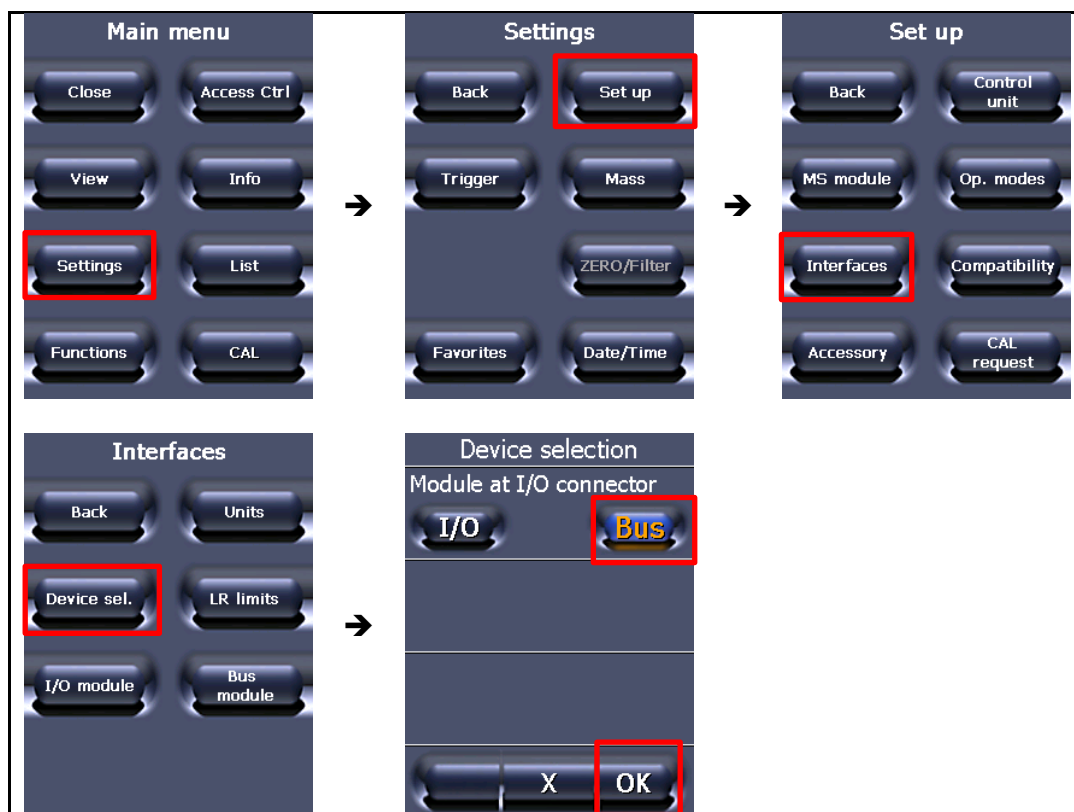
If using the devices listed above with the installed software versions or higher all explained functions in this document should be possible.

## 2 Set up BM1000 PROFINET-IO configuration of the LDS3000 platform

In order to set up the PROFINET-IO configuration a CU1000 control unit is required.

### 2.1 Set up BM1000 Bus interface

In order to activate the BM1000 Bus communication, the module at the I/O connector needs to be set to “**Bus**”



## 2.2 Set up BM1000 PROFINET-IO address

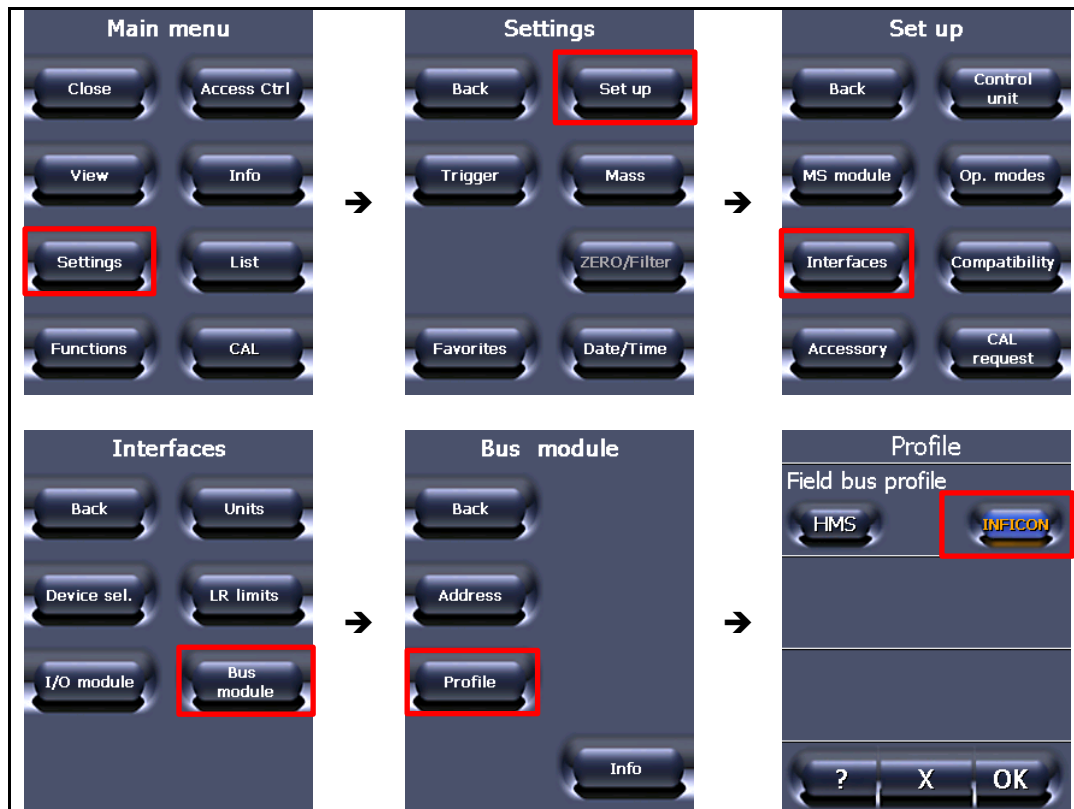
### Attention!

The BM1000 PROFINET-IO IP address can only be set with the SIMATIC TIA Portal device configuration tool. It is not possible to set or change the IP address via the CU1000 manually!

Please look at chapter 3.4

## 2.3 Set up the BM1000 field bus profile

The leak detector offers two different bus telegram, “HMS” and “INFICON”. Please use the INFICON profile only.



### Attention!

Use “INFICON” profile only.

## 2.4 Activate BM1000 PROFINET-IO set up

### **Attention!**

**Address and profile do not come into effect until a restart of the leak detector (power off/power on)!**

To make the changes effective, the BM1000 Bus module needs to be restarted. Therefore, do the following steps:

1. Disconnect the data connection cable between the leak detector and the BM1000 Bus module
2. Wait 10 seconds
3. Connect the data connection cable between the leak detector and the BM1000 Bus module again

Alternatively, the leak detector can also be switched off and on again. The leak detector needs to be switched off for minimum at least 10 seconds.

### **Attention!**

**After each change of the fieldbus profile or the configuration of the BM1000 in the device configuration of the TIA Portal, the device must be restarted!**

## 2.5 Check PROFINET-IO communication between PROFINET-IO Master and INFICON BM1000 PROFINET-IO slave

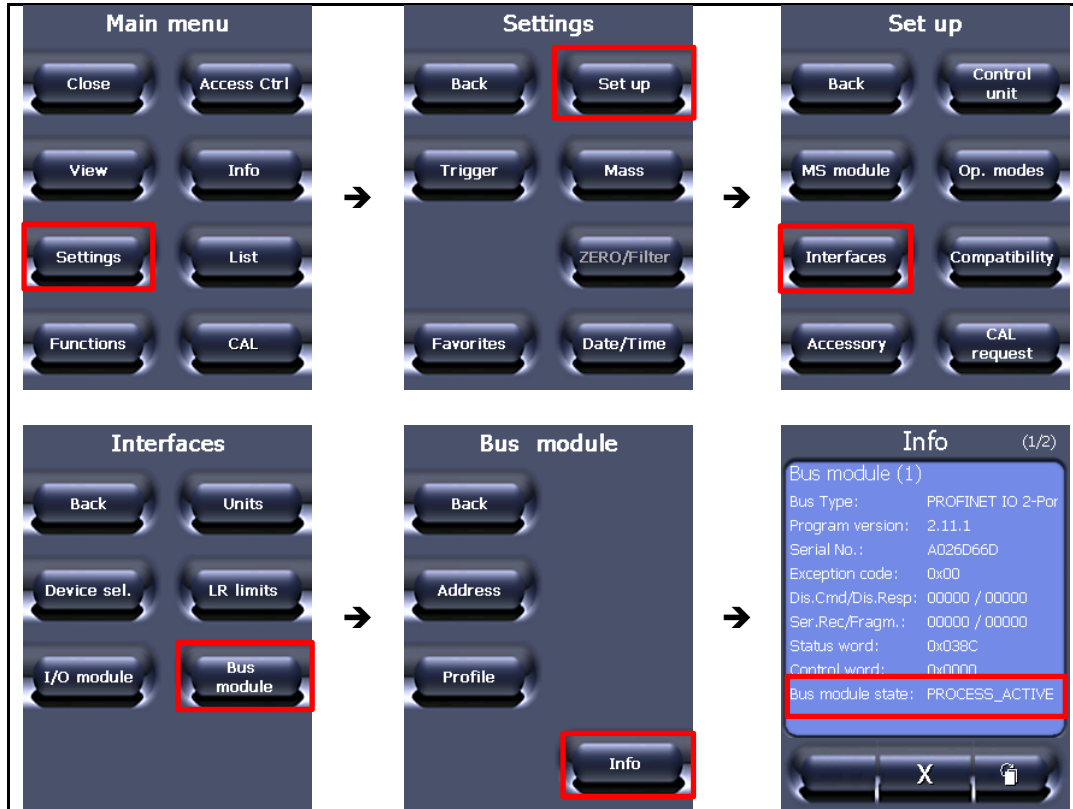
After finishing the PROFINET-IO configuration of the PROFINET-IO System and the PROFINET-IO adjustments of the leak detector, the PROFINET-IO communication between the PROFINET-IO master (e.g. PLC controller) and the PROFINET-IO slave (BM1000 PROFINET-IO bus module) can be checked.

Therefore, the following steps needs to be done:

1. Connect the leak detector with the BM1000 PROFINET-IO Module by using the Data cable
2. Connect the BM1000 PROFINET-IO Module with the PROFINET-IO Master (e.g. PLC controller)
3. Connect the CU1000 to the leak detector by using the Data cable
4. Switch on the leak detector and wait till the leak detector is ready to operate
5. Switch on the PLC controller and set the PLC controller to "RUN"



To check the status of the PROFINET-IO communication between the PROFINET-IO master (e.g. PLC controller) and the BM1000 PROFINET-IO bus module the info section of the CU1000 can be used. Therefore, the following menu needs to be opened:



As soon as a PROFINET-IO connection has been established between the PROFINET-IO master (PLC control) and the PROFINET-IO slave (BM1000 PROFIBUS-IO bus module), the status of the "Bus module state" changes to "**PROCESS\_ACTIVE**".

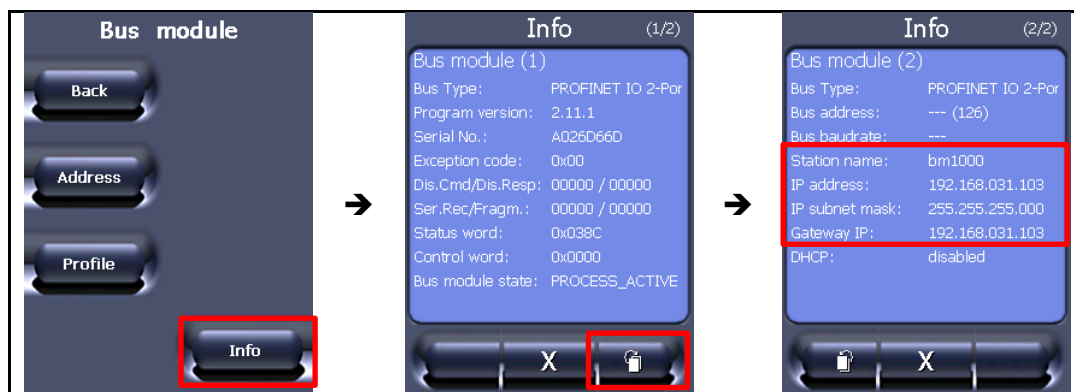
If the status of the "Bus module status" differs from "**PROCESS\_ACTIVE**", there is an error in the PROFINET-IO communication with the PROFINET-IO master (e.g. PLC controller).

The status of the "Bus module status" can assume the following states:

Bus module state	Status
<b>NW_INIT</b>	Initialization of the bus module
<b>WAIT_PROCESS</b>	Waiting for PROFINET-IO master (e.g. (PLC controller) until a PROFINET-IO connection is established.
<b>ERROR</b>	Configuration error
<b>PROCESS_ACTIVE</b>	PROFINET-IO connection with PROFINET-IO master (e.g. PLC controller) is established
<b>IDLE</b>	PROFINET-IO master (e.g. PLC controller) is in STOP mode or has not delivered a valid output at least.
<b>EXECPTION</b>	Error

The second info menu displays

- Station name
- IP address
- IP subnet mask
- Gateway IP



The station name must be equal to the PROFINET device name set up in the TIA Portal device configuration of the BM1000 bus module.

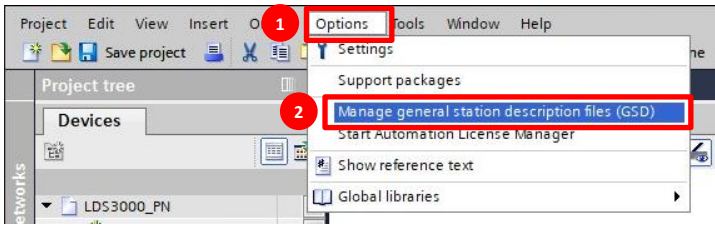
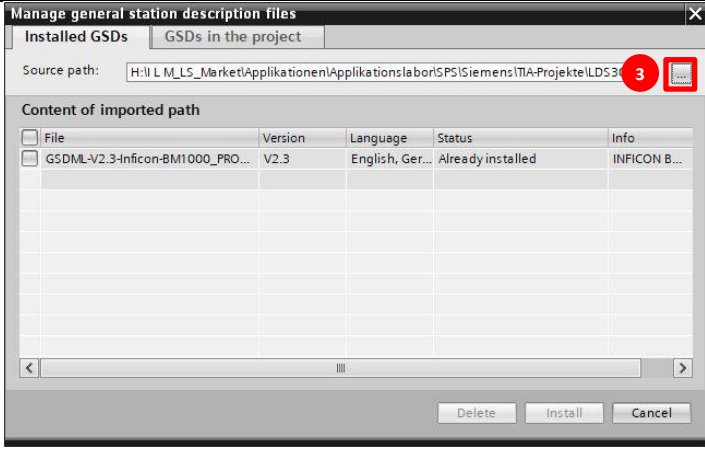
#### Attention!

If the displayed station name differs to the PROFINET device name set up in the device configuration of the TIA portal no PROFINET-IO communication can be established.

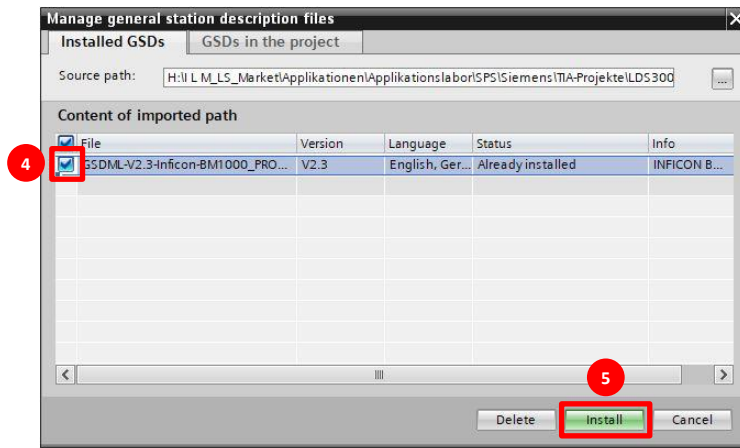
### 3 TIA Portal

#### 3.1 Installation GSDML-File BM1000 PROFINET-IO module

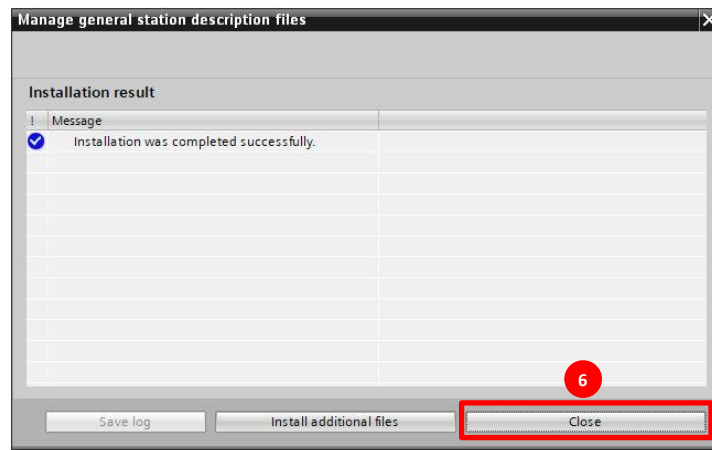
1. Open Siemens TIA Portal
2. Open or create a new TIA project the BM1000 PROFINET-IO Module should be used
3. Install GSDML File

<ol style="list-style-type: none"> <li>1. Select "<b>Options</b>"</li> <li>2. Select "<b>Manage general station description file (GSD)</b>"</li> </ol>	
<ol style="list-style-type: none"> <li>3. Select the source path of the GSD file and select the file "<b>GSDML-V2.3-Inficon-BM1000_PROFINET-20140710.xml</b>"</li> </ol>	 <div data-bbox="574 1366 1380 1668" style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>The GSD file is on the USB memory stick which is supplied with the BM1000 bus module.</p> <p>Source path:  \ LDS3000(AQ)-Documentation-Vxx\Manuals\LDS3000 Interface Description\Profinet\GSD INFICON Profile\GSDML-V2.3-Inficon-BM1000_PROFINET-20140710.xml</p> <p><b>xx = version number</b></p> </div>

4. Select the GSDML file  
“**GSDML-V2.3-  
Inficon-  
BM1000\_PROFINET-  
20140710.xml**”
5. Press the “**Install**”  
button



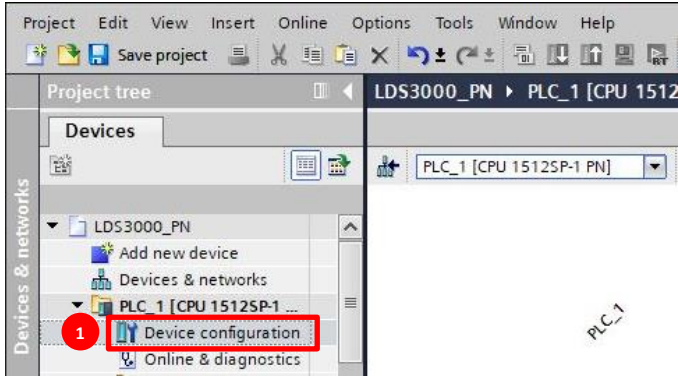
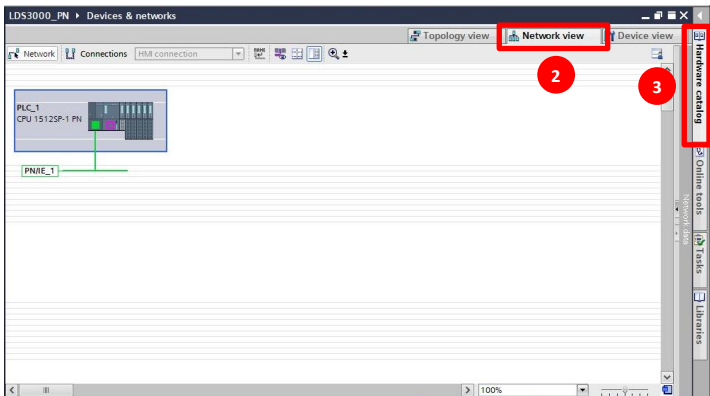
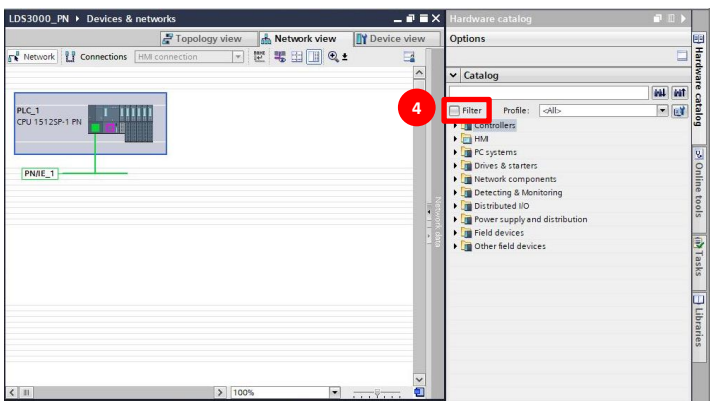
6. After installing the  
GSDML file close the  
installation manager

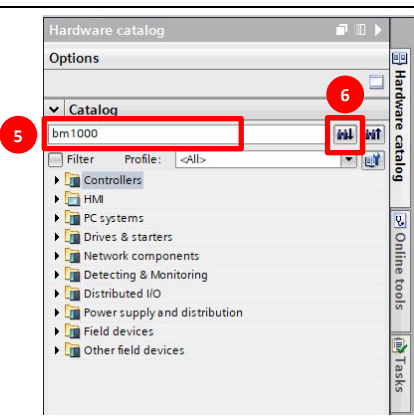
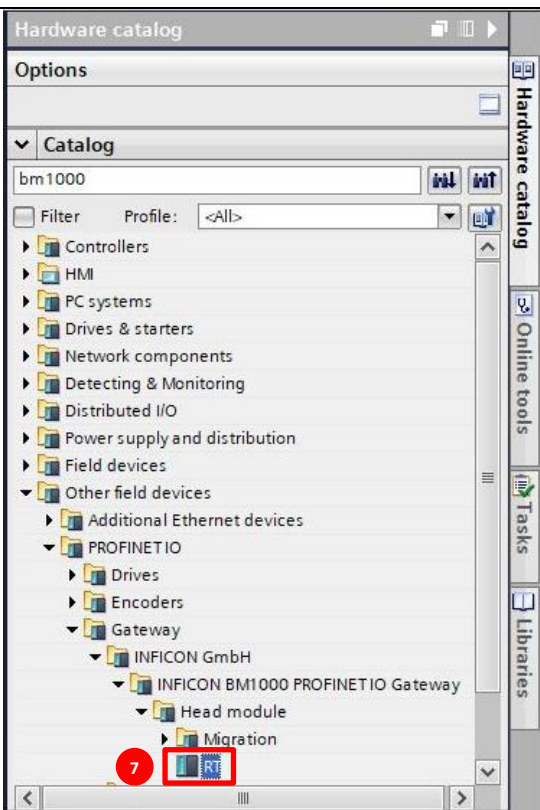


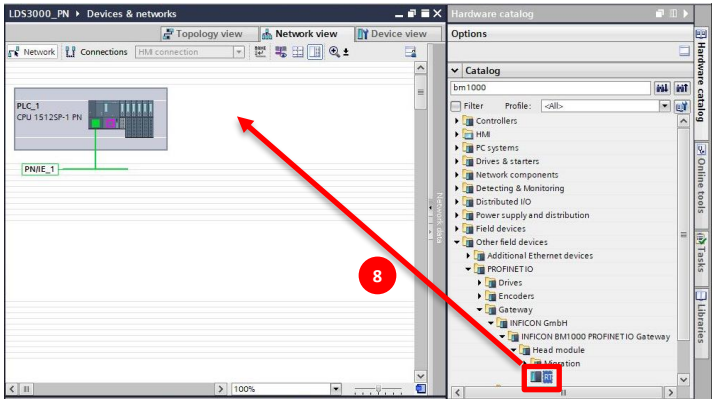
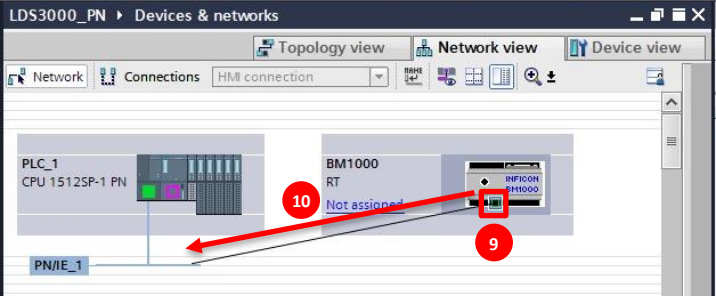
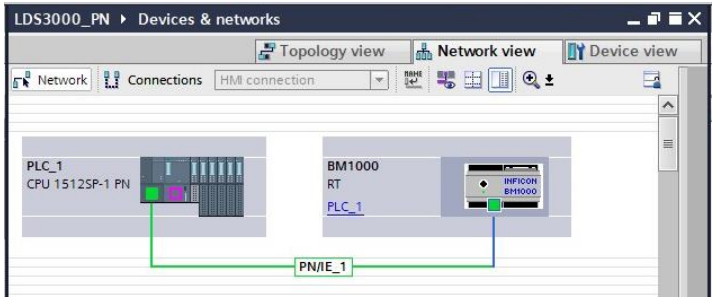
4. The INFICON BM1000 PROFINET-IO module is now installed and can be used

### 3.2 Add BM1000 PROFINET-IO module to PROFINET-IO network

1. Open Siemens TIA Portal
2. Open or create a new TIA project the BM1000 PROFINET-IO Module should be used
3. Insert the INFICON BM1000 PROFINET-IO module

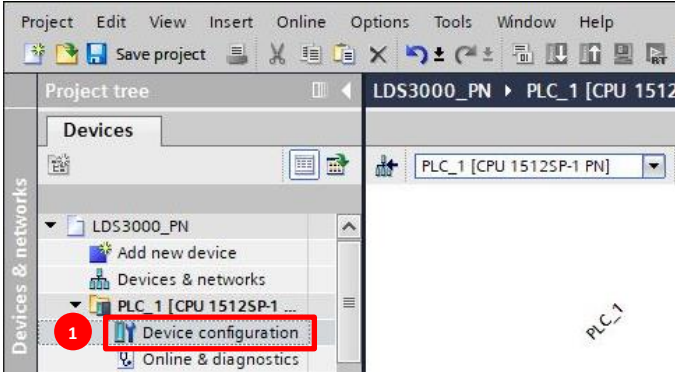
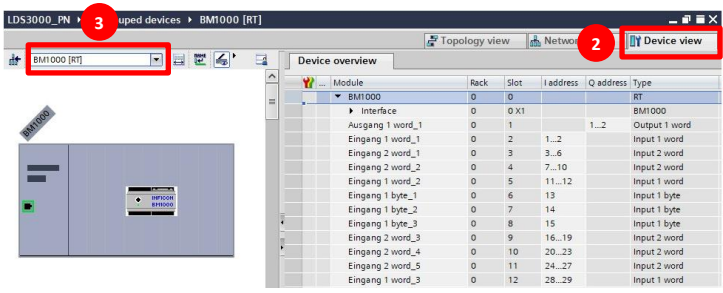
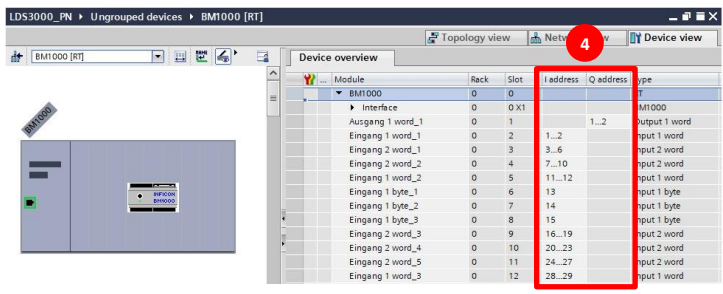
1. Open <b><i>“Device configuration”</i></b>	
2. Select <b><i>“Network view”</i></b> 3. Open <b><i>“Hardware catalog”</i></b>	
4. Deselect <b><i>“Filter”</i></b>	

<p>5. Search for text "<b>bm1000</b>"</p> <p>6. Select "<b>Search down</b>" button</p>	
<p>7. Select "<b>RT</b>" module</p>	 <div data-bbox="598 1512 1356 1668" style="border: 1px solid black; padding: 5px;"> <p><b>Attention!</b></p> <p>Please do <u>not</u> select the RT module from the subfolder "<b>Migration</b>". In this case the cyclic data exchange does not work correctly.</p> </div>

<p>8. Drag and drop the RT module into the device configuration</p>	
<p>9. Select the Port of the BM1000</p> <p>10. Move the connection line to the PROFINET-IO network in order to connect the BM1000 bus module with the PROFINET-IO network</p>	
<p>11. The BM1000 bus module is now connected with the PROFINET-IO system</p>	

### 3.3 Change I/O addresses of BM1000 PROFINET-IO module

If required, the input or output addresses of the BM1000 PROFINET-IO bus module can be adapted for cyclic data exchange.

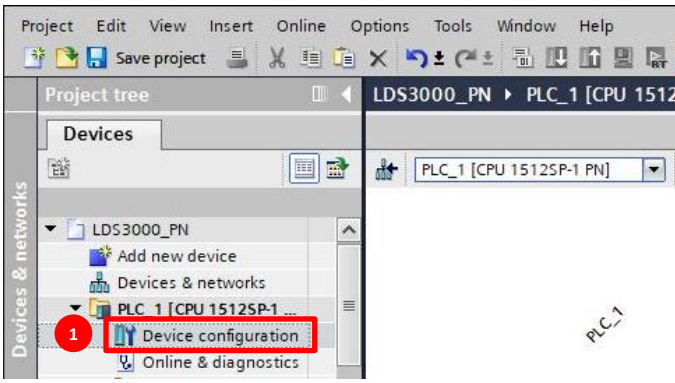
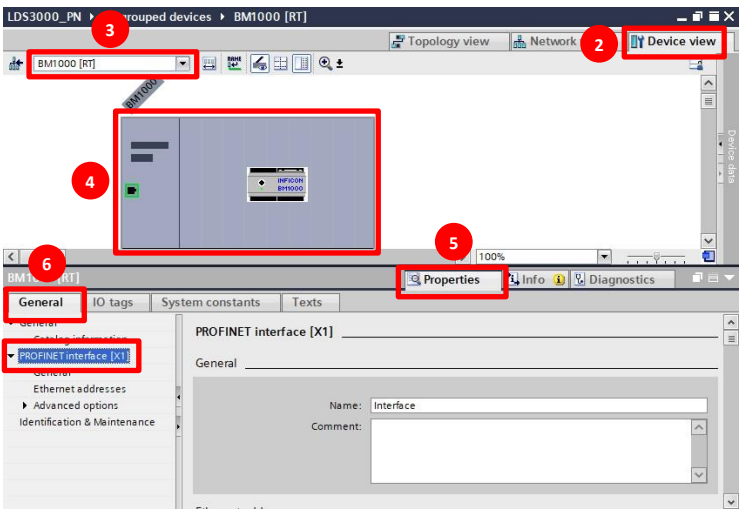
<p>1. Open <b>"Device configuration"</b></p>																																																																																											
<p>2. Select <b>"Device view"</b> 3. Select <b>"BM1000 [RT]"</b></p>																																																																																											
<p>4. Change the input (I address) and output (Q address) addresses</p>	 <table border="1"> <thead> <tr> <th>Module</th> <th>Rack</th> <th>Slot</th> <th>I address</th> <th>Q address</th> <th>Type</th> </tr> </thead> <tbody> <tr> <td>BM1000</td> <td>0</td> <td>0</td> <td></td> <td></td> <td>RT</td> </tr> <tr> <td>Interface</td> <td>0</td> <td>0 X1</td> <td></td> <td>1..2</td> <td>Output 1 word</td> </tr> <tr> <td>Ausgang 1 word_1</td> <td>0</td> <td>1</td> <td></td> <td>1..2</td> <td>Output 1 word</td> </tr> <tr> <td>Eingang 1 word_1</td> <td>0</td> <td>2</td> <td>1..2</td> <td></td> <td>Input 1 word</td> </tr> <tr> <td>Eingang 2 word_1</td> <td>0</td> <td>3</td> <td>3..6</td> <td></td> <td>Input 2 word</td> </tr> <tr> <td>Eingang 2 word_2</td> <td>0</td> <td>4</td> <td>7..10</td> <td></td> <td>Input 2 word</td> </tr> <tr> <td>Eingang 1 word_2</td> <td>0</td> <td>5</td> <td>11..12</td> <td></td> <td>Input 1 word</td> </tr> <tr> <td>Eingang 1 byte_1</td> <td>0</td> <td>6</td> <td>13</td> <td></td> <td>Input 1 byte</td> </tr> <tr> <td>Eingang 1 byte_2</td> <td>0</td> <td>7</td> <td>14</td> <td></td> <td>Input 1 byte</td> </tr> <tr> <td>Eingang 1 byte_3</td> <td>0</td> <td>8</td> <td>15</td> <td></td> <td>Input 1 byte</td> </tr> <tr> <td>Eingang 2 word_3</td> <td>0</td> <td>9</td> <td>16..19</td> <td></td> <td>Input 2 word</td> </tr> <tr> <td>Eingang 2 word_4</td> <td>0</td> <td>10</td> <td>20..23</td> <td></td> <td>Input 2 word</td> </tr> <tr> <td>Eingang 2 word_5</td> <td>0</td> <td>11</td> <td>24..27</td> <td></td> <td>Input 2 word</td> </tr> <tr> <td>Eingang 1 word_3</td> <td>0</td> <td>12</td> <td>28..29</td> <td></td> <td>Input 1 word</td> </tr> </tbody> </table>	Module	Rack	Slot	I address	Q address	Type	BM1000	0	0			RT	Interface	0	0 X1		1..2	Output 1 word	Ausgang 1 word_1	0	1		1..2	Output 1 word	Eingang 1 word_1	0	2	1..2		Input 1 word	Eingang 2 word_1	0	3	3..6		Input 2 word	Eingang 2 word_2	0	4	7..10		Input 2 word	Eingang 1 word_2	0	5	11..12		Input 1 word	Eingang 1 byte_1	0	6	13		Input 1 byte	Eingang 1 byte_2	0	7	14		Input 1 byte	Eingang 1 byte_3	0	8	15		Input 1 byte	Eingang 2 word_3	0	9	16..19		Input 2 word	Eingang 2 word_4	0	10	20..23		Input 2 word	Eingang 2 word_5	0	11	24..27		Input 2 word	Eingang 1 word_3	0	12	28..29		Input 1 word
Module	Rack	Slot	I address	Q address	Type																																																																																						
BM1000	0	0			RT																																																																																						
Interface	0	0 X1		1..2	Output 1 word																																																																																						
Ausgang 1 word_1	0	1		1..2	Output 1 word																																																																																						
Eingang 1 word_1	0	2	1..2		Input 1 word																																																																																						
Eingang 2 word_1	0	3	3..6		Input 2 word																																																																																						
Eingang 2 word_2	0	4	7..10		Input 2 word																																																																																						
Eingang 1 word_2	0	5	11..12		Input 1 word																																																																																						
Eingang 1 byte_1	0	6	13		Input 1 byte																																																																																						
Eingang 1 byte_2	0	7	14		Input 1 byte																																																																																						
Eingang 1 byte_3	0	8	15		Input 1 byte																																																																																						
Eingang 2 word_3	0	9	16..19		Input 2 word																																																																																						
Eingang 2 word_4	0	10	20..23		Input 2 word																																																																																						
Eingang 2 word_5	0	11	24..27		Input 2 word																																																																																						
Eingang 1 word_3	0	12	28..29		Input 1 word																																																																																						

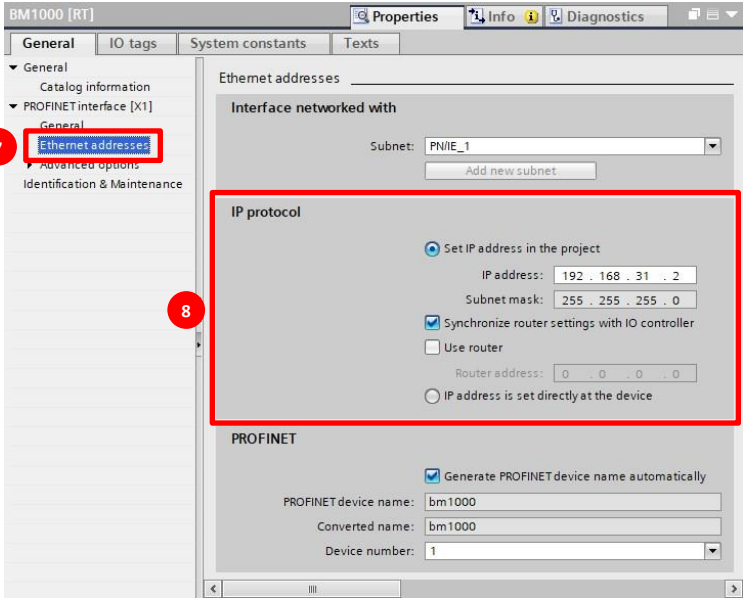



### 3.4 Set IP address of BM1000 PROFINET-IO module

The IP address of the BM1000 PROFINET-IO module is set by the PROFINET-IO master and cannot be set manually at the leak detector itself.

Thus, the IP address needs to be set up inside the TIA project.

<ol style="list-style-type: none"> <li>1. Open <b><i>“Device configuration”</i></b></li> </ol>	
<ol style="list-style-type: none"> <li>2. Select <b><i>“Device view”</i></b></li> <li>3. Select <b><i>“BM1000 [RT]”</i></b></li> <li>4. Select the BM1000 bus module</li> <li>5. Select <b><i>“Properties”</i></b></li> <li>6. Select <b><i>“General”</i></b></li> <li>7. Select <b><i>“PROFINET interface [X1]”</i></b></li> </ol>	

<p>8. Select in the drop down menu <b><i>"PROFIENT interface [X1]"</i></b> <b><i>"Ethernet addresses"</i></b></p> <p>9. Set the IP address of the BM1000</p>	
<p>10. Select <b><i>"Save project"</i></b></p> <p>11. Download the project into the PLC controller</p>	

### Attention!

Address and profile do not come into effect until a restart of the leak detector (power off/power on)!

Please look at chapter 2.4

### 3.5 Change device name of BM1000 Bus module

Depending on the application it could be necessary to change the name of the BM1000 Bus module. The device name of the BM1000 Bus module is set by factory default to **"BM1000"**.

#### Attention!

It should be noted that the name of the device must be unambiguous. If several BM1000 PROFINET-IO modules are used, each module must be assigned a unique device name. Within the PROFINET-IO system, the device name may only occur once.

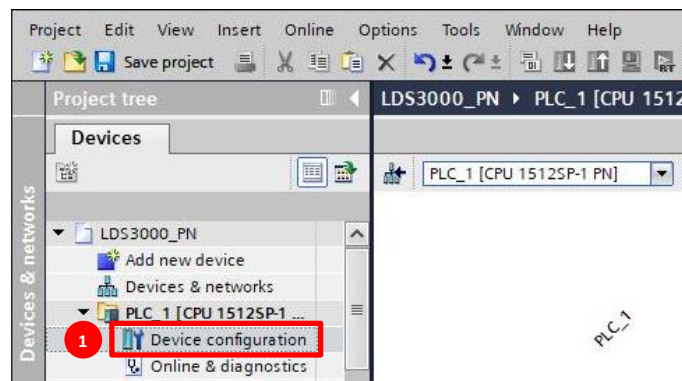
If the configured device name is different than the name of the device itself no PROFINET-IO communication will be established between the PROFINET-IO master and the PROFINET-IO slave. The configured device name needs to be equal to the name of the device.

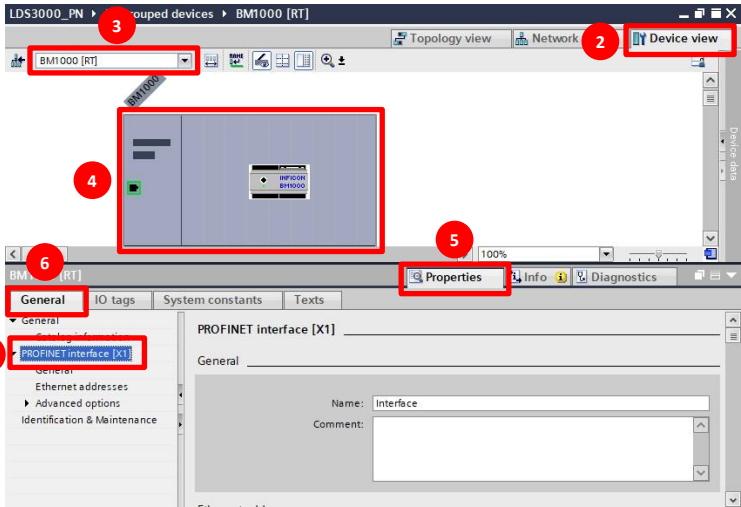
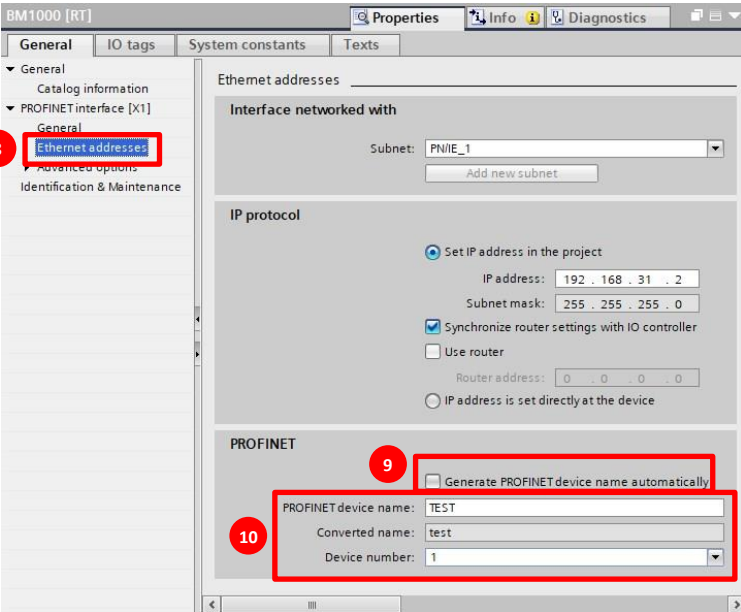

The device name can only be changed via the device configuration. Therefore, are two basic requirements necessary:

- The device configuration is finished and has been downloaded to the PLC controller
- The PROFINET-IO connection between the PLC controller and the BM1000 PROFINET-IO module is established and works without any problems

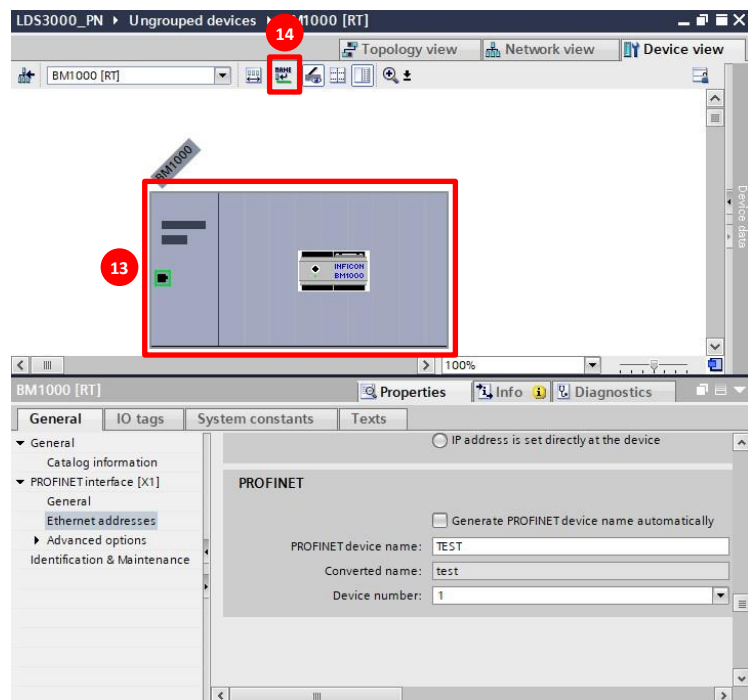
To change the device name following steps are necessary:

#### 1. Open **"Device configuration"**

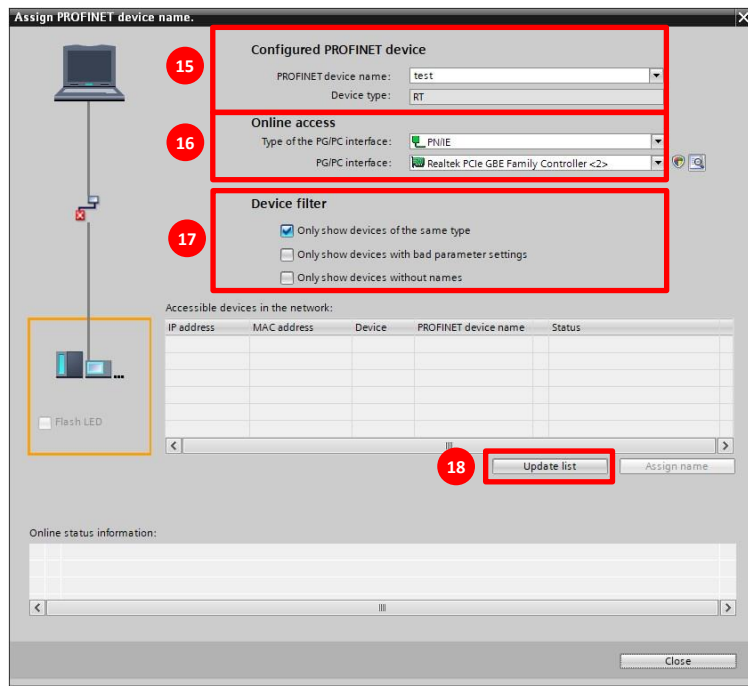


<ol style="list-style-type: none"> <li>2. Select "<b>Device view</b>"</li> <li>3. Select "<b>BM1000 [RT]</b>"</li> <li>4. Select the BM1000 bus module</li> <li>5. Select "<b>Properties</b>"</li> <li>6. Select "<b>General</b>"</li> <li>7. Select "<b>PROFINET interface [X1]</b>"</li> </ol>	
<ol style="list-style-type: none"> <li>8. Select in the drop down menu "<b>PROFINET interface [X1]</b>" "<b>Ethernet addresses</b>"</li> <li>9. Deselect "<b>Generate PROFINET device name automatically</b>"</li> <li>10. Change the PROFINET device name and if needed the device number</li> </ol>	
<ol style="list-style-type: none"> <li>11. Select "<b>Save project</b>"</li> <li>12. Download the project into the PLC controller</li> </ol>	

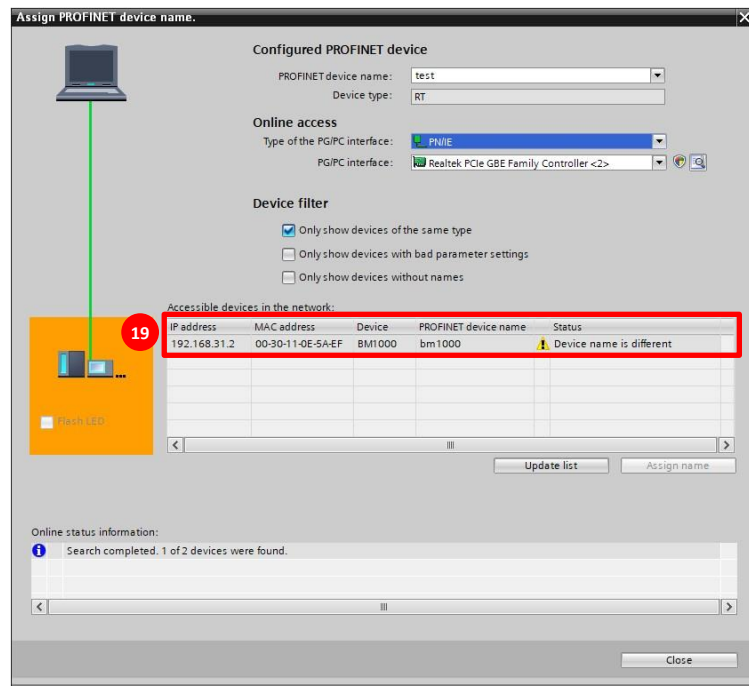
13. Select the BM1000 bus module
14. Select "**Name**" in order to change the name of the bus module itself



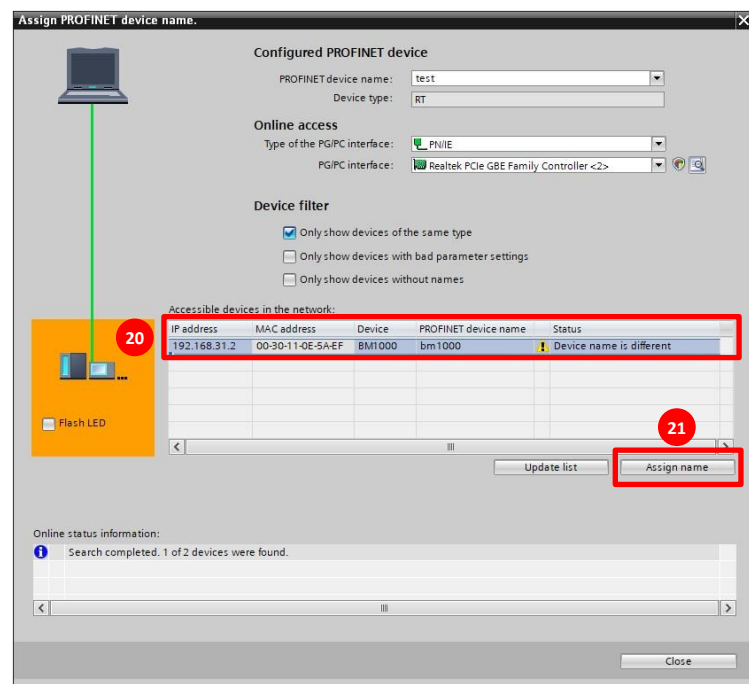
15. Select the "**PROFINET device name**" in the drop down menu, which has been changed before
16. Set the online access parameters to get online to the PLC controller
17. Set the device filter settings to "**Only show devices of the same type**"
18. Select the button "**Update list**" in order to search for devices at the PROFINET-IO network



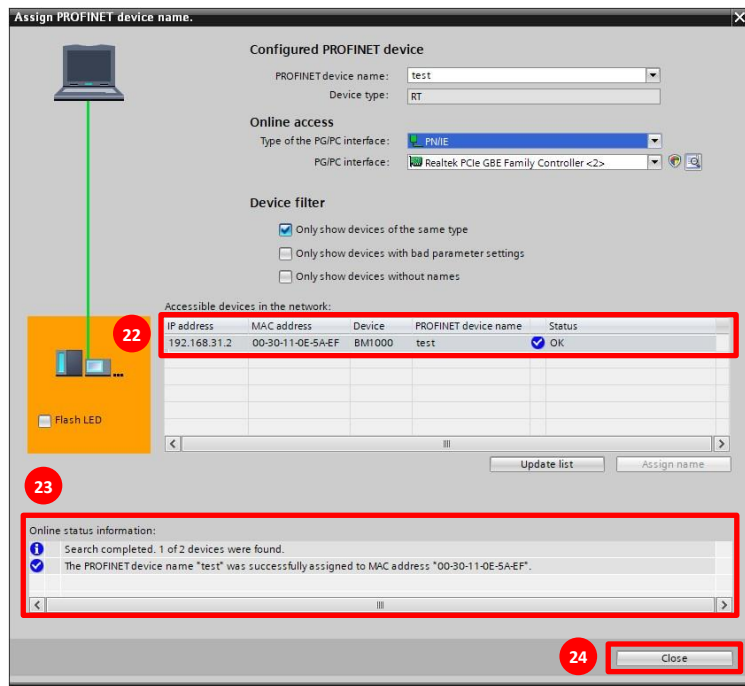
19. The BM1000 bus module with different device name has been found on the PROFINET-IO network. The PROFINET name of the BM1000 bus module is "bm1000" (factory value) and the and the new name projected is "test"



20. Select the device in the list "**Accessible devices in the network**"
21. Select the button "**Assign name**" in order to assign the new PROFINET device name to the BM1000 bus module



22. After the new PROFINET device name has been assigned, the status "**OK**" will be shown
23. Also in the info section the successfully assigned PROFINET device name will be shown
24. Select "**Close**" in order to close the window



### Attention!

The changing of PROFINET device do not come into effect until a restart of the leak detector (power off/power on)!

Please look at chapter 2.4



### 3.6 Cyclic data exchange – PROFINET-IO Master and INFICON BM1000 PROFINET-IO slave

The PROFINET-IO master (e.g. PLC controller) cyclically exchanges data with the slaves on the PROFINET-IO network. Each slave has its own telegram structure.

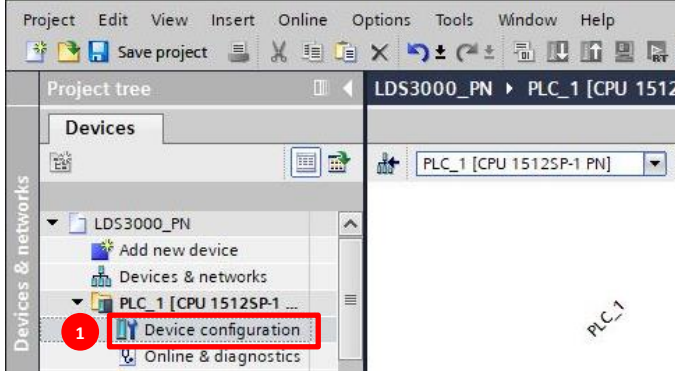
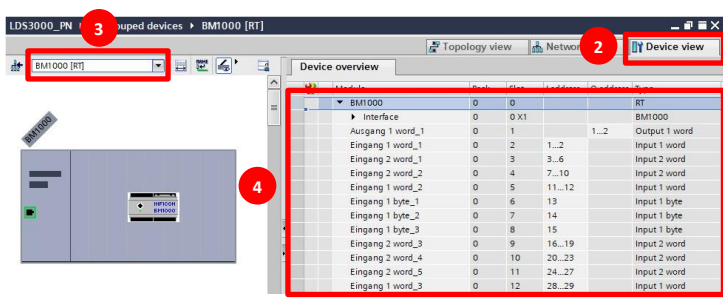
The INFICON profile is a special bus telegram which contains a control word and a status word. The control word sends data to the leak detector, the status word reads data from the leak detector. The control and status word is updated cyclically via the BM1000 PROFINET-IO module.

#### Note:

The structure of the INFICON telegram (control and status word) is identical for the following devices:

- **LDS3000**
- **LDS3000 AQ**
- **LDS3000 XL**
- **XL3000flex**

The cyclic data exchange from the BM1000 PROFINET-IO Module is shown in the device configuration. To see the input and output data's the INFICON BM1000 PROFINET-IO Module needs to be selected.

<p>1. Open <b>“Device configuration”</b></p>																																																									
<p>2. Select <b>“Device view”</b>  3. Select <b>“BM1000 [RT]”</b>  4. Control and status word of the cyclic data exchange</p>	 <table border="1" data-bbox="917 1691 1356 1892"> <thead> <tr> <th></th> <th>I</th> <th>Q</th> <th>RT</th> </tr> </thead> <tbody> <tr> <td>Interface</td> <td>0</td> <td>0 X1</td> <td>BM1000</td> </tr> <tr> <td>Ausgang 1 word_1</td> <td>0</td> <td>1</td> <td>1..2</td> </tr> <tr> <td>Eingang 1 word_1</td> <td>0</td> <td>2</td> <td>1..2</td> </tr> <tr> <td>Eingang 2 word_1</td> <td>0</td> <td>3</td> <td>3..6</td> </tr> <tr> <td>Eingang 2 word_2</td> <td>0</td> <td>4</td> <td>7..10</td> </tr> <tr> <td>Eingang 1 word_2</td> <td>0</td> <td>5</td> <td>11..12</td> </tr> <tr> <td>Eingang 1 byte_1</td> <td>0</td> <td>6</td> <td>13</td> </tr> <tr> <td>Eingang 1 byte_2</td> <td>0</td> <td>7</td> <td>14</td> </tr> <tr> <td>Eingang 1 byte_3</td> <td>0</td> <td>8</td> <td>15</td> </tr> <tr> <td>Eingang 2 word_3</td> <td>0</td> <td>9</td> <td>16..19</td> </tr> <tr> <td>Eingang 2 word_4</td> <td>0</td> <td>10</td> <td>20..23</td> </tr> <tr> <td>Eingang 2 word_5</td> <td>0</td> <td>11</td> <td>24..27</td> </tr> <tr> <td>Eingang 1 word_3</td> <td>0</td> <td>12</td> <td>28..29</td> </tr> </tbody> </table>		I	Q	RT	Interface	0	0 X1	BM1000	Ausgang 1 word_1	0	1	1..2	Eingang 1 word_1	0	2	1..2	Eingang 2 word_1	0	3	3..6	Eingang 2 word_2	0	4	7..10	Eingang 1 word_2	0	5	11..12	Eingang 1 byte_1	0	6	13	Eingang 1 byte_2	0	7	14	Eingang 1 byte_3	0	8	15	Eingang 2 word_3	0	9	16..19	Eingang 2 word_4	0	10	20..23	Eingang 2 word_5	0	11	24..27	Eingang 1 word_3	0	12	28..29
	I	Q	RT																																																						
Interface	0	0 X1	BM1000																																																						
Ausgang 1 word_1	0	1	1..2																																																						
Eingang 1 word_1	0	2	1..2																																																						
Eingang 2 word_1	0	3	3..6																																																						
Eingang 2 word_2	0	4	7..10																																																						
Eingang 1 word_2	0	5	11..12																																																						
Eingang 1 byte_1	0	6	13																																																						
Eingang 1 byte_2	0	7	14																																																						
Eingang 1 byte_3	0	8	15																																																						
Eingang 2 word_3	0	9	16..19																																																						
Eingang 2 word_4	0	10	20..23																																																						
Eingang 2 word_5	0	11	24..27																																																						
Eingang 1 word_3	0	12	28..29																																																						



### 3.6.1 Control word – Write Process Data (PLC → Leak Detector)

The control word (write process data) contains 2 bytes and is send periodically from the PROFINET-IO master (e.g. programmable logic controller) to the leak detector.

These 2 bytes contains 16 bits with different kind of functions in order to control the leak detector by the PLC controller via the PROFINET-IO system.

The next figure shows the bitwise structure of the control word in detail. This information is taken out of the protocol description.

Byte	Bit	Name	Meaning
1 (high byte)	0	(not used)	
	1	Zero	Transition 0 -> 1: 0x02 = Zero on Transition 1 -> 0: 0x00 = Zero off
	2	Clear	Transition 0 -> 1: 0x04=Clears errors and warnings
	3	Start/Stop	Transition 0 -> 1: 0x08= Start Transition 1 -> 0: 0x00= Stop
	4	CAL intern	Transition to 0: 0x00 = Cancel internal calibration
	5		Transition to 1: 0x10 = Start internal calibration
	6	CAL extern	Transition to 0: 0x00 = Cancel external or dyn. calibration
	7		Transition to 1: 0x40 = Start external or. dyn. calibration Transition to 2: 0x80 = Acknowledge closed test leak
2 (low byte)	0	Gas ballast	Transition 0 -> 1: 0x01 = Gasballast on
	1		Transition 1 -> 0: 0x00 = Gasballast off (if Gasballast mode != GASBALLAST_ON)
	2	Zero mode	0 = normal
	3		0x04 = 1 ... 2 dec.
			0x08 = 2 ... 3 dec.
	4	CAL mode	0 = external CAL
	5		0x10 = dyn. CAL 0x20 = not used 0x30 = Peak find (AQ mode only)
	6	Sniff/Vac	0 = VAC
	7		0x40 = SNIF 0x80 = according to PLC-Input 0xC0 = not used

The assignment of the bitwise control word to the output address of the BM1000 PROFINET-IO module is as follows:

Byte	Bit	Name	Meaning
1 (high byte)	0	(not used)	
	1	Zero	Transition 0 -> 1: 0x02 = Zero on Transition 1 -> 0: 0x00 = Zero off
	2	Clear	Transition 0 -> 1: 0x04 = Clears errors and warnings
	3	Start/Stop	Transition 0 -> 1: 0x08 = Start Transition 1 -> 0: 0x00 = Stop
	4	CAL intern	Transition to 0: 0x00 = Cancel internal calibration
	5		Transition to 1: 0x10 = Start internal calibration
	6	CAL extern	Transition to 0: 0x00 = Cancel external or dyn. calibration
	7		Transition to 1: 0x40 = Start external or. dyn. calibration Transition to 2: 0x80 = Acknowledge closed test leak
2 (low byte)	0	Gas ballast	Transition 0 -> 1: 0x01 = Gasballast on Transition 1 -> 0: 0x00 = Gasballast off (if Gasballast mode != GASBALLAST_ON)
	1		
	2	Zero mode	0 = normal 0x04 = 1 ... 2 dec. 0x08 = 2 ... 3 dec. 0x0C = 19/20 part of the value
	3		
	4	CAL mode	0 = external CAL 0x10 = dyn. CAL 0x20 = not used 0x30 = Peak find (AQ mode only)
	5		
	6	Sniff/Vac	0 = VAC 0x40 = SNIF 0x80 = according to PLC-Input 0xC0 = not used
	7		

Module	Rack	Slot	I address	Q address	Type
BM1000	0	0			RT
Interface	0	0 X1			BM1000
Ausgang 1 word_1	0	1		1...2	Output 1 word
Eingang 1 word_1	0	2	1...2		Input 1 word
Eingang 2 word_1	0	3	3...6		Input 2 word
Eingang 2 word_2	0	4	7...10		Input 2 word
Eingang 1 word_2	0	5	11...12		Input 1 word
Eingang 1 byte_1	0	6	13		Input 1 byte
Eingang 1 byte_2	0	7	14		Input 1 byte
Eingang 1 byte_3	0	8	15		Input 1 byte
Eingang 2 word_3	0	9	16...19		Input 2 word
Eingang 2 word_4	0	10	20...23		Input 2 word
Eingang 2 word_5	0	11	24...27		Input 2 word
Eingang 1 word_3	0	12	28...29		Input 1 word

### 3.6.2 Status word – Read Process Data (Leak Detector → PLC)

The status word of the INFICON profile includes 29 bytes in total. The first 2 bytes of the status word are the status information of the leak detector, which contains 16 bits with different kind of status information's from the leak detector.

The next figure shows the bitwise structure of the first 2 bytes of status word in detail. This information is taken out of the protocol description.

Byte	Bit	Name	Meaning
1 (high byte)	0	not used	always 1
	1	Zero active	0 = off 0x02 = on
	2	Error	0 = no error 0x04 = error
	3	Warning	0 = no warning 0x08 = warning
	4	State internal calibration	0 = inactive 0x10 = active 0x20/0x30 = not used
	5		
	6	State external calibration	0 = inactive 1 = 0x40 = active 2 = 0x80 = waiting for test leak closed 3 = 0xC0 = not used
	7		
2 (low byte)	0	Calibration request	0 = CAL request function disabled 1 = 0x01 = CAL request function enabled but no CAL requested 2 = 0x02 = CAL request function enabled and CAL requested 3 = 0x03 = not used
	1		
	2	Emission	0 = 0x00 = Emission off 1 = 0x04 = Cathode 1 fixed 2 = 0x08 = Cathode 2 fixed 3 = 0x0C = Cathode 1 auto 4 = 0x10 = Cathode 2 auto
	3		
	4		
	5	State	0 = 0x00 = Standby 1 = 0x20 = Error 2 = 0x40 = Calibration 3 = 0x60 = Runup 4 = 0x80 = Measure 5 = 0xA0 = Emission Off 6 ... 7 = 0xC0 ... 0xE0 = not used
	6		
	7		

The next bytes 3 to 29 of the status word containing the leak rate, pressure, error codes and so on, which is shown in the next figure.

Title	Byte	Bit	Name	Meaning
leak rate	3 ... 6		Leak rate (mbar*I/s)	Actual leak rate in mbar I/s (IEEE 754 float value)
pressure_or_flow	7 ... 10		Pressure	Pressure p1 in mbar (IEEE 754 float value)
error_code	11 ... 12		Actual error number	Error/warning code (16 bit unsigned integer)
trigger_status	13	0	Status of Trigger 1	0 = Leak rate lower than trigger level 1 = Leak rate higher than trigger level
		1	Status of Trigger 2	
		2	Status of Trigger 3	
		3	Status of Trigger 4	
		4 ... 7	not used	always 0
calibration_status	14		calibration_status	For possible values please refer to command 260 in table 3.4, "Commands," page 26.
leak_detector ID	15		leak_detector ID	always 45 for LDS3000 MSB
device specific float 1	16 ... 19		device specific float 1	Pressure p2 in mbar (IEEE 754 float value)
device specific float 2	20 ... 23		device specific float 2	Pressure p3 in user specific unit (IEEE 754 float value)
device specific float 3	24 ... 27		device specific float 3	Pressure p4 in user specific unit (IEEE 754 float value)
device specific word	28 ... 29		device specific word	reserved for further use, always 0

The assignment of the 29 bytes of the status word to the input addresses of the BM1000 PROFINET-IO module is shown as follows:

#### Status word:

Byte	Bit	Name	Meaning
1 (high byte)	0	not used	always 1
	1	Zero active	0 = off 0x02 = on
	2	Error	0 = no error 0x04 = error
	3	Warning	0 = no warning 0x08 = warning
	4	State internal calibration	0 = inactive 0x10 = active 0x20/0x30 = not used
	6	State external calibration	0 = inactive 1 = 0x40 = active 2 = 0x80 = waiting for test leak closed 3 = 0xC0 = not used
	7		
2 (low byte)	0	Calibration request	0 = CAL request function disabled 1 = 0x01 = CAL request function enabled but no CAL requested 2 = 0x02 = CAL request function enabled and CAL requested 3 = 0x03 = not used
	2	Emission	0 = 0x00 = Emission off 1 = 0x04 = Cathode 1 fixed 2 = 0x08 = Cathode 2 fixed 3 = 0x0C = Cathode 1 auto 4 = 0x10 = Cathode 2 auto
	3		
	4		
	5		
	6	State	0 = 0x00 = Standby 1 = 0x20 = Error 2 = 0x40 = Calibration 3 = 0x60 = Runup 4 = 0x80 = Measure 5 = 0xA0 = Emission Off 6 ... 7 = 0xC0 ... 0xE0 = not used
	7		

Module	Rack	Slot	I address	Q address	Type
BM1000	0	0			RT
Interface	0	0 X1			BM1000
Ausgang 1 word_1	0	1		1..2	Output 1 word
Eingang 1 word_1	0	2	1..2		Input 1 word
Eingang 2 word_1	0	3	3..6		Input 2 word
Eingang 2 word_2	0	4	7..10		Input 2 word
Eingang 1 word_2	0	5	11..12		Input 1 word
Eingang 1 byte_1	0	6	13		Input 1 byte
Eingang 1 byte_2	0	7	14		Input 1 byte
Eingang 1 byte_3	0	8	15		Input 1 byte
Eingang 2 word_3	0	9	16..19		Input 2 word
Eingang 2 word_4	0	10	20..23		Input 2 word
Eingang 2 word_5	0	11	24..27		Input 2 word
Eingang 1 word_3	0	12	28..29		Input 1 word

### Leak rate [mbar\*I/l]:

Title	Byte	Bit	Name	Meaning
leak rate	3 ... 6		Leak rate (mbar*I/l)	Actual leak rate in mbar I/s (IEEE 754 float value)
pressure_or_flow	7 ... 10		Pressure	Pressure p1 in mbar (IEEE 754 float value)
error_code	11 ... 12		Actual error number	Error/warning code (16 bit unsigned integer)
trigger_status	13	0	Status of Trigger 1	0 = Leak rate lower than trigger level 1 = Leak rate higher than trigger level
		1	Status of Trigger 2	
		2	Status of Trigger 3	
		3	Status of Trigger 4	
calibration_status	14	4 ... 7	not used	always 0
			calibration_status	For possible values please refer to command 260 in table 3.4, "Commands," page 26.
leak_detector ID	15		leak_detector ID	always 45 for LDS3000 MSB
device specific float 1	16 ... 19		device specific float 1	Pressure p2 in mbar (IEEE 754 float value)
device specific float 2	20 ... 23		device specific float 2	Pressure p3 in user specific unit (IEEE 754 float value)
device specific float 3	24 ... 27		device specific float 3	Pressure p4 in user specific unit (IEEE 754 float value)
device specific word	28 ... 29		device specific word	reserved for further use, always 0

Module	Rack	Slot	I address	Q address	Type
BM1000	0	0			RT
Interface	0	0 X1			BM1000
Ausgang 1 word_1	0	1		1...2	Output 1 word
Eingang 1 word_1	0	2	1...2		Input 1 word
Eingang 2 word_1	0	3	3...6		Input 2 word
Eingang 2 word_2	0	4	7...10		Input 2 word
Eingang 1 word_2	0	5	11...12		Input 1 word
Eingang 1 byte_1	0	6	13		Input 1 byte
Eingang 1 byte_2	0	7	14		Input 1 byte
Eingang 1 byte_3	0	8	15		Input 1 byte
Eingang 2 word_3	0	9	16...19		Input 2 word
Eingang 2 word_4	0	10	20...23		Input 2 word
Eingang 2 word_5	0	11	24...27		Input 2 word
Eingang 1 word_3	0	12	28...29		Input 1 word

### Pressure or flow:

Title	Byte	Bit	Name	Meaning
leak rate	3 ... 6		Leak rate (mbar*I/l)	Actual leak rate in mbar I/s (IEEE 754 float value)
pressure_or_flow	7 ... 10		Pressure	Pressure p1 in mbar (IEEE 754 float value)
error_code	11 ... 12		Actual error number	Error/warning code (16 bit unsigned integer)
trigger_status	13	0	Status of Trigger 1	0 = Leak rate lower than trigger level 1 = Leak rate higher than trigger level
		1	Status of Trigger 2	
		2	Status of Trigger 3	
		3	Status of Trigger 4	
calibration_status	14	4 ... 7	not used	always 0
			calibration_status	For possible values please refer to command 260 in table 3.4, "Commands," page 26.
leak_detector ID	15		leak_detector ID	always 45 for LDS3000 MSB
device specific float 1	16 ... 19		device specific float 1	Pressure p2 in mbar (IEEE 754 float value)
device specific float 2	20 ... 23		device specific float 2	Pressure p3 in user specific unit (IEEE 754 float value)
device specific float 3	24 ... 27		device specific float 3	Pressure p4 in user specific unit (IEEE 754 float value)
device specific word	28 ... 29		device specific word	reserved for further use, always 0

Module	Rack	Slot	I address	Q address	Type
BM1000	0	0			RT
Interface	0	0 X1			BM1000
Ausgang 1 word_1	0	1		1...2	Output 1 word
Eingang 1 word_1	0	2	1...2		Input 1 word
Eingang 2 word_1	0	3	3...6		Input 2 word
Eingang 2 word_2	0	4	7...10		Input 2 word
Eingang 1 word_2	0	5	11...12		Input 1 word
Eingang 1 byte_1	0	6	13		Input 1 byte
Eingang 1 byte_2	0	7	14		Input 1 byte
Eingang 1 byte_3	0	8	15		Input 1 byte
Eingang 2 word_3	0	9	16...19		Input 2 word
Eingang 2 word_4	0	10	20...23		Input 2 word
Eingang 2 word_5	0	11	24...27		Input 2 word
Eingang 1 word_3	0	12	28...29		Input 1 word

### Error code:

Title	Byte	Bit	Name	Meaning
leak rate	3 ... 6		Leak rate (mbar*I/l)	Actual leak rate in mbar I/s (IEEE 754 float value)
pressure_or_flow	7 ... 10		Pressure	Pressure p1 in mbar (IEEE 754 float value)
error_code	11 ... 12		Actual error number	Error/warning code (16 bit unsigned integer)
trigger_status	13	0	Status of Trigger 1	0 = Leak rate lower than trigger level 1 = Leak rate higher than trigger level
		1	Status of Trigger 2	
		2	Status of Trigger 3	
		3	Status of Trigger 4	
calibration_status	14	4 ... 7	not used	always 0
			calibration_status	For possible values please refer to command 260 in table 3.4, "Commands," page 26.
leak_detector ID	15		leak_detector ID	always 45 for LDS3000 MSB
device specific float 1	16 ... 19		device specific float 1	Pressure p2 in mbar (IEEE 754 float value)
device specific float 2	20 ... 23		device specific float 2	Pressure p3 in user specific unit (IEEE 754 float value)
device specific float 3	24 ... 27		device specific float 3	Pressure p4 in user specific unit (IEEE 754 float value)
device specific word	28 ... 29		device specific word	reserved for further use, always 0

Module	Rack	Slot	I address	Q address	Type
BM1000	0	0			RT
Interface	0	0 X1			BM1000
Ausgang 1 word_1	0	1		1...2	Output 1 word
Eingang 1 word_1	0	2	1...2		Input 1 word
Eingang 2 word_1	0	3	3...6		Input 2 word
Eingang 2 word_2	0	4	7...10		Input 2 word
Eingang 1 word_2	0	5	11...12		Input 1 word
Eingang 1 byte_1	0	6	13		Input 1 byte
Eingang 1 byte_2	0	7	14		Input 1 byte
Eingang 1 byte_3	0	8	15		Input 1 byte
Eingang 2 word_3	0	9	16...19		Input 2 word
Eingang 2 word_4	0	10	20...23		Input 2 word
Eingang 2 word_5	0	11	24...27		Input 2 word
Eingang 1 word_3	0	12	28...29		Input 1 word

### Trigger status:

Title	Byte	Bit	Name	Meaning
leak rate	3 ... 6		Leak rate (mbar*Vs)	Actual leak rate in mbar Vs (IEEE 754 float value)
pressure_or_flow	7 ... 10		Pressure	Pressure p1 in mbar (IEEE 754 float value)
error_code	11 ... 12		Actual error number	Error/warning code (16 bit unsigned integer)
trigger_status	13	0	Status of Trigger 1	0 = Leak rate lower than trigger level 1 = Leak rate higher than trigger level
		1	Status of Trigger 2	
		2	Status of Trigger 3	
		3	Status of Trigger 4	
	4 ... 7	not used		always 0
calibration_status	14		calibration_status	For possible values please refer to command 260 in table 3.4, "Commands," page 26.
leak_detector ID	15		leak_detector ID	always 45 for LDS3000 MSB
device specific float 1	16 ... 19		device specific float 1	Pressure p2 in mbar (IEEE 754 float value)
device specific float 2	20 ... 23		device specific float 2	Pressure p3 in user specific unit (IEEE 754 float value)
device specific float 3	24 ... 27		device specific float 3	Pressure p4 in user specific unit (IEEE 754 float value)
device specific word	28 ... 29		device specific word	reserved for further use, always 0

Module	Rack	Slot	I address	Q address	Type
BM1000	0	0			RT
Interface	0	0 X1			BM1000
Ausgang 1 word_1	0	1		1...2	Output 1 word
Eingang 1 word_1	0	2	1...2		Input 1 word
Eingang 2 word_1	0	3	3...6		Input 2 word
Eingang 2 word_2	0	4	7...10		Input 2 word
Eingang 1 word_2	0	5	11...12		Input 1 word
Eingang 1 byte_1	0	6	13		Input 1 byte
Eingang 1 byte_2	0	7	14		Input 1 byte
Eingang 1 byte_3	0	8	15		Input 1 byte
Eingang 2 word_3	0	9	16...19		Input 2 word
Eingang 2 word_4	0	10	20...23		Input 2 word
Eingang 2 word_5	0	11	24...27		Input 2 word
Eingang 1 word_3	0	12	28...29		Input 1 word

### Calibration status:

Title	Byte	Bit	Name	Meaning
leak rate	3 ... 6		Leak rate (mbar*Vs)	Actual leak rate in mbar Vs (IEEE 754 float value)
pressure_or_flow	7 ... 10		Pressure	Pressure p1 in mbar (IEEE 754 float value)
error_code	11 ... 12		Actual error number	Error/warning code (16 bit unsigned integer)
trigger_status	13	0	Status of Trigger 1	0 = Leak rate lower than trigger level 1 = Leak rate higher than trigger level
		1	Status of Trigger 2	
		2	Status of Trigger 3	
		3	Status of Trigger 4	
	4 ... 7	not used		always 0
calibration_status	14		calibration_status	For possible values please refer to command 260 in table 3.4, "Commands," page 26.
leak_detector ID	15		leak_detector ID	always 45 for LDS3000 MSB
device specific float 1	16 ... 19		device specific float 1	Pressure p2 in mbar (IEEE 754 float value)
device specific float 2	20 ... 23		device specific float 2	Pressure p3 in user specific unit (IEEE 754 float value)
device specific float 3	24 ... 27		device specific float 3	Pressure p4 in user specific unit (IEEE 754 float value)
device specific word	28 ... 29		device specific word	reserved for further use, always 0

Module	Rack	Slot	I address	Q address	Type
BM1000	0	0			RT
Interface	0	0 X1			BM1000
Ausgang 1 word_1	0	1		1...2	Output 1 word
Eingang 1 word_1	0	2	1...2		Input 1 word
Eingang 2 word_1	0	3	3...6		Input 2 word
Eingang 2 word_2	0	4	7...10		Input 2 word
Eingang 1 word_2	0	5	11...12		Input 1 word
Eingang 1 byte_1	0	6	13		Input 1 byte
Eingang 1 byte_2	0	7	14		Input 1 byte
Eingang 1 byte_3	0	8	15		Input 1 byte
Eingang 2 word_3	0	9	16...19		Input 2 word
Eingang 2 word_4	0	10	20...23		Input 2 word
Eingang 2 word_5	0	11	24...27		Input 2 word
Eingang 1 word_3	0	12	28...29		Input 1 word

### Leak detector ID:

Title	Byte	Bit	Name	Meaning
leak rate	3 ... 6		Leak rate (mbar*Vs)	Actual leak rate in mbar Vs (IEEE 754 float value)
pressure_or_flow	7 ... 10		Pressure	Pressure p1 in mbar (IEEE 754 float value)
error_code	11 ... 12		Actual error number	Error/warning code (16 bit unsigned integer)
trigger_status	13	0	Status of Trigger 1	0 = Leak rate lower than trigger level 1 = Leak rate higher than trigger level
		1	Status of Trigger 2	
		2	Status of Trigger 3	
		3	Status of Trigger 4	
	4 ... 7	not used		always 0
calibration_status	14		calibration_status	For possible values please refer to command 260 in table 3.4, "Commands," page 26.
leak_detector ID	15		leak_detector ID	always 45 for LDS3000 MSB
device specific float 1	16 ... 19		device specific float 1	Pressure p2 in mbar (IEEE 754 float value)
device specific float 2	20 ... 23		device specific float 2	Pressure p3 in user specific unit (IEEE 754 float value)
device specific float 3	24 ... 27		device specific float 3	Pressure p4 in user specific unit (IEEE 754 float value)
device specific word	28 ... 29		device specific word	reserved for further use, always 0

Module	Rack	Slot	I address	Q address	Type
BM1000	0	0			RT
Interface	0	0 X1			BM1000
Ausgang 1 word_1	0	1		1...2	Output 1 word
Eingang 1 word_1	0	2	1...2		Input 1 word
Eingang 2 word_1	0	3	3...6		Input 2 word
Eingang 2 word_2	0	4	7...10		Input 2 word
Eingang 1 word_2	0	5	11...12		Input 1 word
Eingang 1 byte_1	0	6	13		Input 1 byte
Eingang 1 byte_2	0	7	14		Input 1 byte
Eingang 1 byte_3	0	8	15		Input 1 byte
Eingang 2 word_3	0	9	16...19		Input 2 word
Eingang 2 word_4	0	10	20...23		Input 2 word
Eingang 2 word_5	0	11	24...27		Input 2 word
Eingang 1 word_3	0	12	28...29		Input 1 word



### Device specific float 1:

Title	Byte	Bit	Name	Meaning
leak rate	3 ... 6		Leak rate (mbar*Vs)	Actual leak rate in mbar Vs (IEEE 754 float value)
pressure_or_flow	7 ... 10		Pressure	Pressure p1 in mbar (IEEE 754 float value)
error_code	11 ... 12		Actual error number	Error/warning code (16 bit unsigned integer)
trigger_status	13	0	Status of Trigger 1	0 = Leak rate lower than trigger level 1 = Leak rate higher than trigger level
		1	Status of Trigger 2	
		2	Status of Trigger 3	
		3	Status of Trigger 4	
calibration_status	14	4 ... 7	not used	always 0
			calibration_status	For possible values please refer to command 260 in table 3.4, "Commands," page 26.
leak_detector ID	15		leak_detector ID	always 45 for LDS3000 MSB
device specific float 1	16 ... 19		device specific float 1	Pressure p2 in mbar (IEEE 754 float value)
device specific float 2	20 ... 23		device specific float 2	Pressure p3 in user specific unit (IEEE 754 float value)
device specific float 3	24 ... 27		device specific float 3	Pressure p4 in user specific unit (IEEE 754 float value)
device specific word	28 ... 29		device specific word	reserved for further use, always 0

Module	Rack	Slot	I address	Q address	Type
BM1000	0	0			RT
Interface	0	0 X1			BM1000
Ausgang 1 word_1	0	1		1...2	Output 1 word
Eingang 1 word_1	0	2	1...2		Input 1 word
Eingang 2 word_1	0	3	3...6		Input 2 word
Eingang 2 word_2	0	4	7...10		Input 2 word
Eingang 1 word_2	0	5	11...12		Input 1 word
Eingang 1 byte_1	0	6	13		Input 1 byte
Eingang 1 byte_2	0	7	14		Input 1 byte
Eingang 1 byte_3	0	8	15		Input 1 byte
Eingang 2 word_3	0	9	16...19		Input 2 word
Eingang 2 word_4	0	10	20...23		Input 2 word
Eingang 2 word_5	0	11	24...27		Input 2 word
Eingang 1 word_3	0	12	28...29		Input 1 word

### Device specific float 2:

Title	Byte	Bit	Name	Meaning
leak rate	3 ... 6		Leak rate (mbar*Vs)	Actual leak rate in mbar Vs (IEEE 754 float value)
pressure_or_flow	7 ... 10		Pressure	Pressure p1 in mbar (IEEE 754 float value)
error_code	11 ... 12		Actual error number	Error/warning code (16 bit unsigned integer)
trigger_status	13	0	Status of Trigger 1	0 = Leak rate lower than trigger level 1 = Leak rate higher than trigger level
		1	Status of Trigger 2	
		2	Status of Trigger 3	
		3	Status of Trigger 4	
calibration_status	14	4 ... 7	not used	always 0
			calibration_status	For possible values please refer to command 260 in table 3.4, "Commands," page 26.
leak_detector ID	15		leak_detector ID	always 45 for LDS3000 MSB
device specific float 1	16 ... 19		device specific float 1	Pressure p2 in mbar (IEEE 754 float value)
device specific float 2	20 ... 23		device specific float 2	Pressure p3 in user specific unit (IEEE 754 float value)
device specific float 3	24 ... 27		device specific float 3	Pressure p4 in user specific unit (IEEE 754 float value)
device specific word	28 ... 29		device specific word	reserved for further use, always 0

Module	Rack	Slot	I address	Q address	Type
BM1000	0	0			RT
Interface	0	0 X1			BM1000
Ausgang 1 word_1	0	1		1...2	Output 1 word
Eingang 1 word_1	0	2	1...2		Input 1 word
Eingang 2 word_1	0	3	3...6		Input 2 word
Eingang 2 word_2	0	4	7...10		Input 2 word
Eingang 1 word_2	0	5	11...12		Input 1 word
Eingang 1 byte_1	0	6	13		Input 1 byte
Eingang 1 byte_2	0	7	14		Input 1 byte
Eingang 1 byte_3	0	8	15		Input 1 byte
Eingang 2 word_3	0	9	16...19		Input 2 word
Eingang 2 word_4	0	10	20...23		Input 2 word
Eingang 2 word_5	0	11	24...27		Input 2 word
Eingang 1 word_3	0	12	28...29		Input 1 word

### Device specific float 3:

Title	Byte	Bit	Name	Meaning
leak rate	3 ... 6		Leak rate (mbar*Vs)	Actual leak rate in mbar Vs (IEEE 754 float value)
pressure_or_flow	7 ... 10		Pressure	Pressure p1 in mbar (IEEE 754 float value)
error_code	11 ... 12		Actual error number	Error/warning code (16 bit unsigned integer)
trigger_status	13	0	Status of Trigger 1	0 = Leak rate lower than trigger level 1 = Leak rate higher than trigger level
		1	Status of Trigger 2	
		2	Status of Trigger 3	
		3	Status of Trigger 4	
calibration_status	14	4 ... 7	not used	always 0
			calibration_status	For possible values please refer to command 260 in table 3.4, "Commands," page 26.
leak_detector ID	15		leak_detector ID	always 45 for LDS3000 MSB
device specific float 1	16 ... 19		device specific float 1	Pressure p2 in mbar (IEEE 754 float value)
device specific float 2	20 ... 23		device specific float 2	Pressure p3 in user specific unit (IEEE 754 float value)
device specific float 3	24 ... 27		device specific float 3	Pressure p4 in user specific unit (IEEE 754 float value)
device specific word	28 ... 29		device specific word	reserved for further use, always 0

Module	Rack	Slot	I address	Q address	Type
BM1000	0	0			RT
Interface	0	0 X1			BM1000
Ausgang 1 word_1	0	1		1...2	Output 1 word
Eingang 1 word_1	0	2	1...2		Input 1 word
Eingang 2 word_1	0	3	3...6		Input 2 word
Eingang 2 word_2	0	4	7...10		Input 2 word
Eingang 1 word_2	0	5	11...12		Input 1 word
Eingang 1 byte_1	0	6	13		Input 1 byte
Eingang 1 byte_2	0	7	14		Input 1 byte
Eingang 1 byte_3	0	8	15		Input 1 byte
Eingang 2 word_3	0	9	16...19		Input 2 word
Eingang 2 word_4	0	10	20...23		Input 2 word
Eingang 2 word_5	0	11	24...27		Input 2 word
Eingang 1 word_3	0	12	28...29		Input 1 word

**Device specific word:**

Title	Byte	Bit	Name	Meaning
leak_rate	3 ... 6		Leak rate (mbar/l/s)	Actual leak rate in mbar l/s (IEEE 754 float value)
pressure_or_flow	7 ... 10		Pressure	Pressure p1 in mbar (IEEE 754 float value)
error_code	11 ... 12		Actual error number	Error/warning code (16 bit unsigned integer)
trigger_status	13	0	Status of Trigger 1	0 = Leak rate lower than trigger level 1 = Leak rate higher than trigger level
		1	Status of Trigger 2	
		2	Status of Trigger 3	
		3	Status of Trigger 4	
calibration_status	14	4 ... 7	not used	always 0
			calibration_status	For possible values please refer to command 260 in table 3.4, "Commands," page 26.
leak_detector ID	15		leak_detector ID	always 45 for LDS3000 MSB
device specific float 1	16 ... 19		device specific float 1	Pressure p2 in mbar (IEEE 754 float value)
device specific float 2	20 ... 23		device specific float 2	Pressure p3 in user specific unit (IEEE 754 float value)
device specific float 3	24 ... 27		device specific float 3	Pressure p4 in user specific unit (IEEE 754 float value)
device specific word	28 ... 29		device specific word	reserved for further use, always 0

Module	Rack	Slot	I address	Q address	Type
BM1000	0	0			RT
Interface	0	0 X1			BM1000
Ausgang 1 word_1	0	1		1...2	Output 1 word
Eingang 1 word_1	0	2	1...2		Input 1 word
Eingang 2 word_1	0	3	3...6		Input 2 word
Eingang 2 word_2	0	4	7...10		Input 2 word
Eingang 1 word_2	0	5	11...12		Input 1 word
Eingang 1 byte_1	0	6	13		Input 1 byte
Eingang 1 byte_2	0	7	14		Input 1 byte
Eingang 1 byte_3	0	8	15		Input 1 byte
Eingang 2 word_3	0	9	16...19		Input 2 word
Eingang 2 word_4	0	10	20...23		Input 2 word
Eingang 2 word_5	0	11	24...27		Input 2 word
Eingang 1 word_3	0	12	28...29		Input 1 word



### 3.7 Acyclic data exchange – PROFINET-IO Master and INFICON BM1000 PROFINET-IO slave

Acyclic data exchange between PROFINET-IO Master (e.g. PLC controller) and the INFICON BM1000 PROFINET-IO Module slaves is supported. If parameters should be read or write, which are not included inside the cyclic data, an acyclic data exchange needs to be done.

The acyclic data exchange between PROFINET-IO Master (e.g. PLC controller) and the INFICON BM1000 PROFINET-IO Module is based on the LD Protocol and the LD command numbers.

Almost all parameter of the leak detector could be read or write via the BM1000 PROFINET-IO Module. The data records and their structure are explained in the protocol descriptions of the used leak detector. Detailed information's can be found in the chapter "**LD Protocol**".

All parameters of the leak detector are listed down in the LD command table. Parameters, which cannot be read or write acyclically are marked with "**No fieldbus support**" in the LD Protocol table.

3.4 Commands								
Command		Class	Name	R/W	Data type	Min-, Def., Max- value LDS3000	LDS3000 MSB	No fieldbus support
dez	hex							
0	0	Control	NOP	R	NO_DATA		"No operation", replies without data	X

Description	
<b>Command</b>	LD command number in decimal or hexadecimal notation
<b>Class</b>	Class of the LD command
<b>Name</b>	Name of the LD command
<b>R/W</b>	Access possibility to the parameter (read/write) R = parameter can be read W= parameter can be write
<b>Data type</b>	Data type of the parameter
<b>Min-, Def., Max-Value LDS3000</b>	Factory setting (Def.) and limit values (min max) and of the LD command
<b>LDS3000 MSB</b>	Description of the LD command
<b>No fieldbus support</b>	X = LD command is not able to be read or write acyclically

### 3.7.1 Acyclic data exchange addressing rules

The LD command numbers will be mapped to the PROFINET-IO master (e.g. PLC controller) via the INFICON BM1000 PROFINET-IO module by the following addressing rule:

- **Application Process Instance (API) = 0**
- **Slot = 0**
- **Subslot = 1**
- **Index = LD\_command\_number**

### 3.7.2 Reading data from leak detector acyclically

Acyclic reading of parameters is limited. A maximum of 20 acyclic calls can be made simultaneously with a PLC control of type S7-1500.

If more than 20 parameters must be read acyclically, the access must be programmed accordingly in the PLC program so that the maximum number of simultaneous read accesses is not exceeded.

#### Extended instructions: maximum number of simultaneously running jobs

Table: Maximum number of simultaneous jobs for asynchronous extended instructions and lower-level instructions used

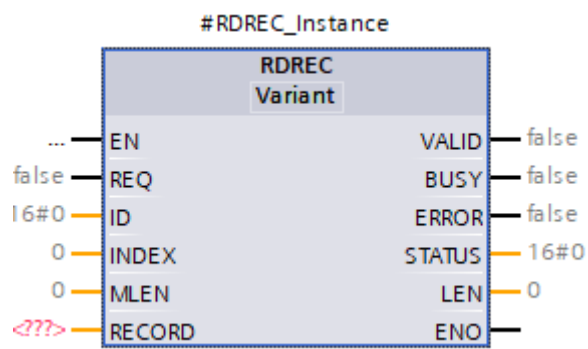
Extended instructions	1505SP (F) 1505SP T(F)	1511(F) 1511C 1511T(F)	1507S(F) 1512C 1513(F)	1515(F) 1515T(F)	1516(F) 1516T(F)	1517(F) 1517T(F)	1518(F) 1518(F) MFP
Distributed I/O							
RDREC	20						
RD_REC	10						
WRREC	20						

This information is taken from:

<https://support.industry.siemens.com/cs/mdm/59191792?c=126916719115&lc=en-AO>

### 3.7.2.1 Using Siemens standard function block "RDREC"

In order to read a data record acyclically from a PROFINET-IO Slave, Siemens offers the Standard Function Block "RDREC" in the library of the TIA Portal.



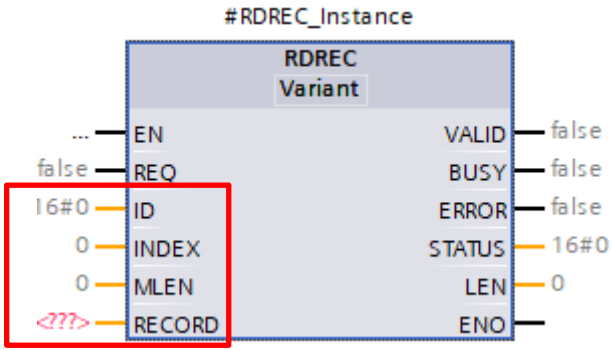
The diagram shows the RDREC function block with the following connections:  
 Inputs: EN (blue), REQ (false, blue), ID (16#0, orange), INDEX (0, orange), MLEN (0, orange), RECORD (red with question mark).  
 Outputs: VALID (false, blue), BUSY (false, blue), ERROR (false, blue), STATUS (16#0, orange), LEN (0, orange), ENO (blue).  
 The block is labeled #RDREC\_Instance and has a Variant input.

**Parameter**  
 The following table shows the parameters of the "RDREC" instruction:

Parameter	Declaration	Data type*	Memory area	Description
REQ	Input	BOOL	I, Q, M, D, L, T**, C** or constant	REQ = 1: Transfer data record
ID	Input	HW_IO	I, Q, M, D, L or constant	Hardware identifier of the hardware module (DP/PROFINET IO) The number is assigned automatically and is stored in the properties of the module or of the interface in the hardware configuration.
INDEX	Input	DINT	I, Q, M, D, L or constant	Data record number
MLEN	Input	UINT	I, Q, M, D, L or constant	Maximum length in bytes of the data record information to be read
VALID	Output	BOOL	I, Q, M, D, L	New data record was received and is valid.
BUSY	Output	BOOL	I, Q, M, D, L	BUSY = 1: The reading process is not yet complete.
ERROR	Output	BOOL	I, Q, M, D, L	ERROR = 1: An error occurred during the reading process.
STATUS	Output	DWORD	I, Q, M, D, L	Block status or error information
LEN	Output	UINT	I, Q, M, D, L	Length of the read data record information
RECORD	InOut	VARIANT	I, Q, M, D, L	Target range for the data record read. If you are using the NREF system data type for the target range in a data block with optimized access, no values are written to the target range.

\* There is no implicit conversion in STL, which is why the range of valid data types may be limited. During programming in STL, note the permissible data types in each case in the tooltip of the parameter  
 \*\* For S7-1500 only.

To read a parameter acyclically from the leak detector via the BM1000 PROFINET-IO Module, the following input parameters of the “RDREC” needs to be set correspondingly to the LD command to be read:



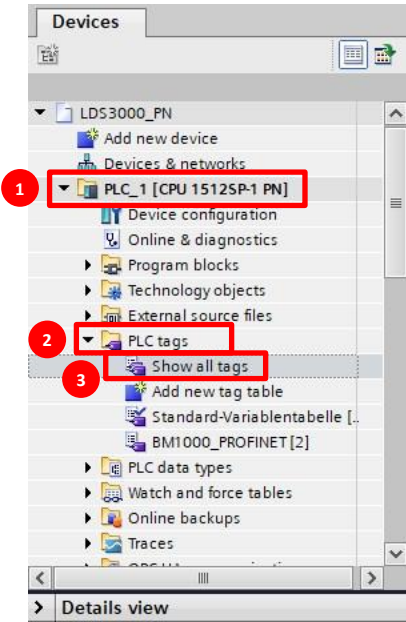
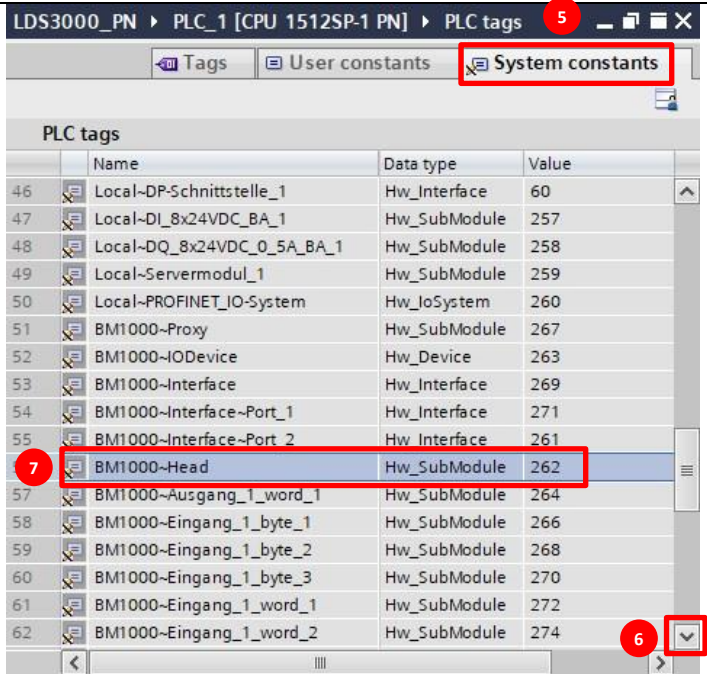
**Parameter**  
The following table shows the parameters of the “RDREC” instruction:

Parameter	Declaration	Data type*	Memory area	Description
REQ	Input	BOOL	I, Q, M, D, L, T**, C** or constant	REQ = 1: Transfer data record
ID	Input	HW_IO	I, Q, M, D, L or constant	Hardware identifier of the hardware module (DP/PROFINET IO) The number is assigned automatically and is stored in the properties of the module or of the interface in the hardware configuration.
INDEX	Input	DINT	I, Q, M, D, L or constant	Data record number
MLEN	Input	UINT	I, Q, M, D, L or constant	Maximum length in bytes of the data record information to be read
VALID	Output	BOOL	I, Q, M, D, L	New data record was received and is valid.
BUSY	Output	BOOL	I, Q, M, D, L	BUSY = 1: The reading process is not yet complete.
ERROR	Output	BOOL	I, Q, M, D, L	ERROR = 1: An error occurred during the reading process.
STATUS	Output	DWORD	I, Q, M, D, L	Block status or error information
LEN	Output	UINT	I, Q, M, D, L	Length of the read data record information
RECORD	InOut	VARIANT	I, Q, M, D, L	Target range for the data record read. If you are using the NREF system data type for the target range in a data block with optimized access, no values are written to the target range.

\* There is no implicit conversion in STL, which is why the range of valid data types may be limited. During programming in STL, note the permissible data types in each case in the tooltip of the parameter  
\*\* For S7-1500 only.

### 3.7.2.1.1 Parameter ID

The hardware identifier (ID) of the BM1000 PROFINET-IO module is displayed in the system constants.

<ol style="list-style-type: none"> <li>1. Open <b>"PLC_1"</b></li> <li>2. Open <b>"PLC tags"</b></li> <li>3. Select <b>"Show all tags"</b></li> </ol>	
<ol style="list-style-type: none"> <li>4. Open <b>"System constants"</b></li> <li>5. Scroll down till <b>"BM1000~..."</b></li> <li>6. Use the PLC tag <b>"BM1000~Head"</b></li> </ol>	 <div data-bbox="603 1854 1401 1964" style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Attention!</b> The value of the <b>"BM1000~Head"</b> tag could vary in your application</p> </div>

### 3.7.2.1.2 Parameter INDEX

The parameter INDEX needs to be set to the decimal LD command number to be read, based on the LD Protocol taken from the LD command table of the protocol descriptions.

**INDEX = decimal LD command number**

Command		Class	Name	R/W	Data type	Min-, Def-, Max- value LDS3000	LDS3000 MSB	No fieldbus support
dez	hex							
502	1F6	Param	Amplifier range	R/W	UINT8	0, 3, 3	Amplifier range Amplifier control location 508 automatically set (not auto) 0 = 13 MOhm 1 = 470 MOhm 2 = 15 GOhm 3 = 500 GOhm	
504	1F8	Param	500GOhm value	R/W	FLOAT	4.5E1, 5E11, 5.5E11Ohm	500GOhm value	
506	1FA	Param	Mass	R/W	UINT8	2, 4, 4	2 = Mass 2 (H2) 3 = Mass 3 4 = Mass 4 (Helium)	

### 3.7.2.1.3 Parameter MLEN

The parameter **MLEN** specifies the length of the data to be read in bytes. The length of the LD command to be read based on the LD Protocol is taken from the LD command table of the protocol descriptions.

The parameter **MLEN** needs to be calculated based on the data type of the LD command to be read.

Command		Class	Name	R/W	Data type	Min-, Def-, Max- value LDS3000	LDS3000 MSB	No fieldbus support
dez	hex							
502	1F6	Param	Amplifier range	R/W	UINT8	0, 3, 3	Amplifier range Amplifier control location 508 automatically set (not auto) 0 = 13 MOhm 1 = 470 MOhm 2 = 15 GOhm 3 = 500 GOhm	
504	1F8	Param	500GOhm value	R/W	FLOAT	4.5E1, 5E11, 5.5E11Ohm	500GOhm value	
506	1FA	Param	Mass	R/W	UINT8	2, 4, 4	2 = Mass 2 (H2) 3 = Mass 3 4 = Mass 4 (Helium)	

Data type	Meaning	MLEN [bytes]
<b>SINT8</b>	Signed 8 bit integer	1
<b>SINT16</b>	Signed 16 bit integer	2
<b>SINT32</b>	Signed 32 bit integer	4
<b>UINT8</b>	Unsigned 8 bit integer	1
<b>UINT16</b>	Unsigned 16 bit integer	2
<b>UINT32</b>	Unsigned 32 bit integer	4
<b>FLOAT</b>	Floating point / real number	4
<b>CHAR</b>	Character	1

Some LD commands are of the array data type. This is indicated by a square bracket after the data type itself (e.g. FLOAT[3]). The number in the brackets indicates the number of array elements (e.g. [3] = 3 array elements).

If the LD command is of the array data type, the parameter **MLEN** needs to be calculated by the following rule:

**MLEN = Data type length in bytes \* number of array elements**

Example:

519	207	Param	Cal factors sniff high flow	R/W	<div style="border: 2px solid red; padding: 2px;">FLOAT[3]</div>	0.01, 1, 100	Calibration factors for sniff mode high flow Index [0] = mass 2 Index [1] = mass 3 Index [2] = mass 4
-----	-----	-------	-----------------------------	-----	--	--------------	--

The LD command 519 "Cal factors sniff high flow" is an array with 3 array elements of data type FLOAT. The data type FLOAT has a length of 4 bytes.

In order to calculate the parameter **MLEN**, the length of the data type needs to be multiplied by the number of array elements:

**MLEN = 4 bytes \* 3 = 12 bytes**

#### **Attention!**

If the data type of the LD command to be read is an array, it is not possible to read only one of the array element. It must be always read the whole array with all array elements.

The index of arrays always starts with index[0].

### 3.7.2.1.4 Parameter RECORD

The parameter **RECORD** specifies the target for the data to be read. For this reason, the data type of the parameter **RECORD** need to be the same like the data type of the LD command.

Please use the data types in the corresponding list below.

Data type leak detector	Meaning	Data type TIA Portal
<b>SINT8</b>	Signed 8 bit integer	<b>SINT</b>
<b>SINT16</b>	Signed 16 bit integer	<b>INT</b>
<b>SINT32</b>	Signed 32 bit integer	<b>DINT</b>
<b>UINT8</b>	Unsigned 8 bit integer	<b>USINT</b>
<b>UINT16</b>	Unsigned 16 bit integer	<b>UINT</b>
<b>UINT32</b>	Unsigned 32 bit integer	<b>UDINT</b>
<b>FLOAT</b>	Floating point / real number	<b>REAL</b>
<b>CHAR</b>	Character	<b>CHAR</b>

If the LD command to be read is an array, please also use an array with the same array dimensions and the corresponding data type.

Example:

519	207	Param	Cal factors sniff high flow	R/W	FLOAT[3]	0.01, 1, 100	Calibration factors for sniff mode high flow Index [0] = mass 2 Index [1] = mass 3 Index [2] = mass 4
-----	-----	-------	-----------------------------	-----	----------	--------------	--

The LD command 519 "Cal factors sniff high flow" is an array with 3 array elements of data type FLOAT. The data type FLOAT corresponds to the data type REAL in the TIA portal.

Please use as **RECORD** value: Array[0..2] of Real

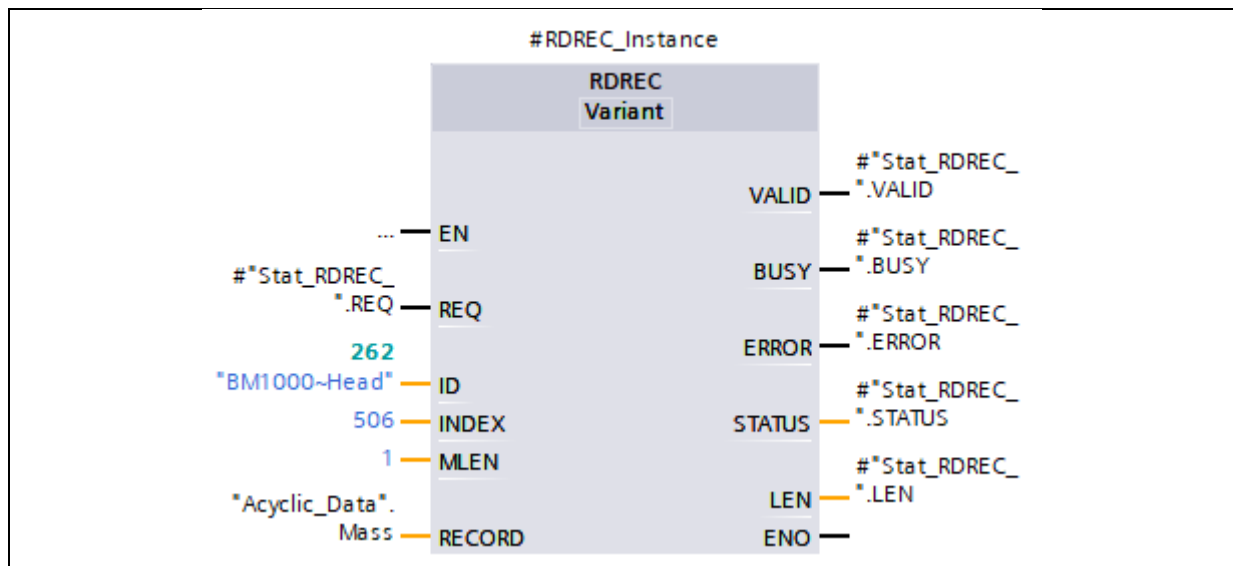
	Name	Data type	Start value
1	Static		
2	Cal_factors_sniff_high_flow	Array[0..2] of Real	
3	Cal_factors_sniff_high_flow[0]	Real	0.0
4	Cal_factors_sniff_high_flow[1]	Real	0.0
5	Cal_factors_sniff_high_flow[2]	Real	0.0




### 3.7.2.2 Example 1: read Mass using LD command 506

To read the parameter “**Mass**” from the leak detector to the PLC controller acyclically, use LD command table in the protocol description with the parameter to be read:

Command		Class	Name	R/W	Data type	Min-, Def-, Max- value LDS3000	LDS3000 MSB	No fieldbus support
dez	hex							
502	1F6	Param	Amplifier range	R/W	UINT8	0, 3, 3	Amplifier range Amplifier control location 508 automatically set (not auto) 0 = 13 MOhm 1 = 470 MOhm 2 = 15 GOhm 3 = 500 GOhm	
504	1F8	Param	500GOhm value	R/W	FLOAT	4.5E1, 5E11, 5.5E11Ohm	500GOhm value	
506	1FA	Param	Mass	R/W	UINT8	2, 4, 4	2 = Mass 2 (H2) 3 = Mass 3 4 = Mass 4 (Helium)	

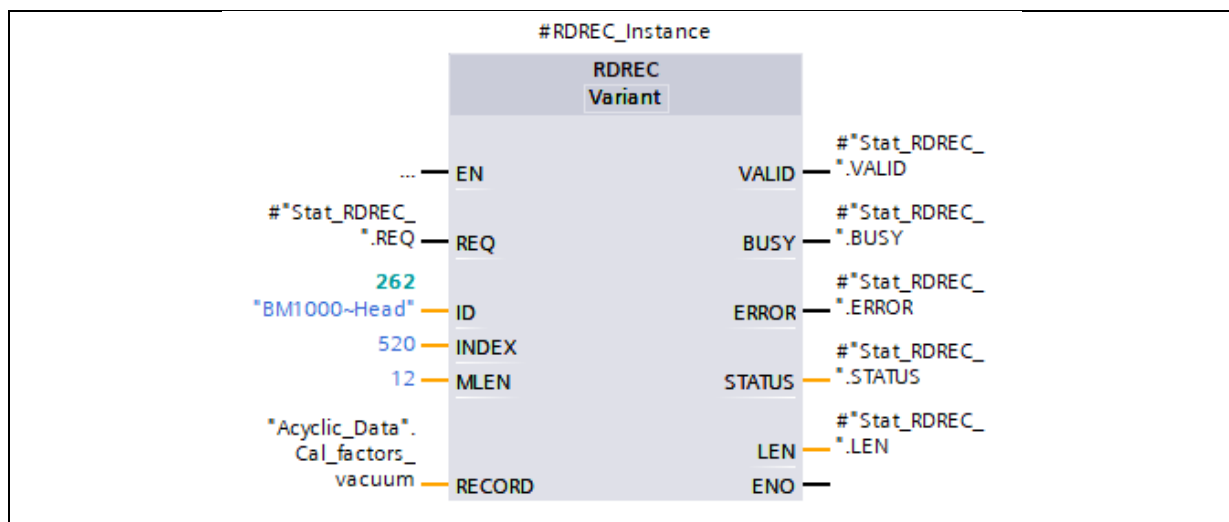


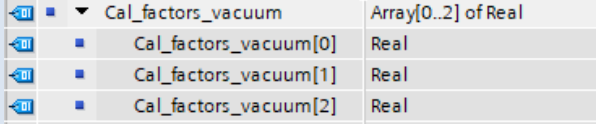
Parameter	Value	Description
REQ	TRUE	Before setting the REQ parameter to TRUE, all other parameters (ID, INDEX, MLEN and RECORD) needs to be set
ID	"BM1000~Head"	Hardware identifier of BM1000 PROFINET-IO bus module
INDEX	506	Decimal LD command number 506
MLEN	1	Length to be read in bytes Data type = UINT8 = 1 byte
RECORD	USINT	<div>  <div> Mass USInt </div> </div>

### 3.7.2.3 Example 2: read Calibration factors vacuum using LD command 520

To read the parameter “**Calibration factors vacuum**” from the leak detector to the PLC controller acyclically, use LD command table in the protocol description with the parameter to be read:

Command		Class	Name	R/W	Data type	Min-, Def-, Max- value LDS3000	LDS3000 MSB	No fieldbus support
dez	hex							
502	1F6	Param	Amplifier range	R/W	UINT8	0, 3, 3	Amplifier range Amplifier control location 508 automatically set (not auto) 0 = 13 MOhm 1 = 470 MOhm 2 = 15 GOhm 3 = 500 GOhm	
504	1F8	Param	500GOhm value	R/W	FLOAT	4.5E1, 5E11, 5.5E11Ohm	500GOhm value	
506	1FA	Param	Mass	R/W	UINT8	2, 4, 4	2 = Mass 2 (H2) 3 = Mass 3 4 = Mass 4 (Helium)	
508	1FC	Param	Amplifier control location	R/W	UINT8	0, 1, 1	Amplifier control location 1 = automatic on (default) 0 = automatic off Write access only possible if "Manual control for service" is active	
519	207	Param	Cal factors sniff high flow	R/W	FLOAT[3]	0.01, 1, 100	Calibration factors for sniff mode high flow Index [0] = mass 2 Index [1] = mass 3 Index [2] = mass 4	
520	208	Param	Calibration factors vacuum	R/W	FLOAT[3]	0.01, 1, 5000	Calibration factors for vacuum mode (and for AQ-mode) Index 0: mass 2 Index 1: mass 3 Index 2: mass 4	
521	209	Param	Calibration factors sniff	R/W	FLOAT[3]	0.01, 1, 100	Calibration factors for sniff mode Index [0] = mass 2 Index [1] = mass 3 Index [2] = mass 4	
522	20A	Param	Machine factors vacuum	R/W	FLOAT[3]	1E-4, 1, 1E5	Machine factors for vacuum mode Index [0] = mass 2 Index [1] = mass 3 Index [2] = mass 4	

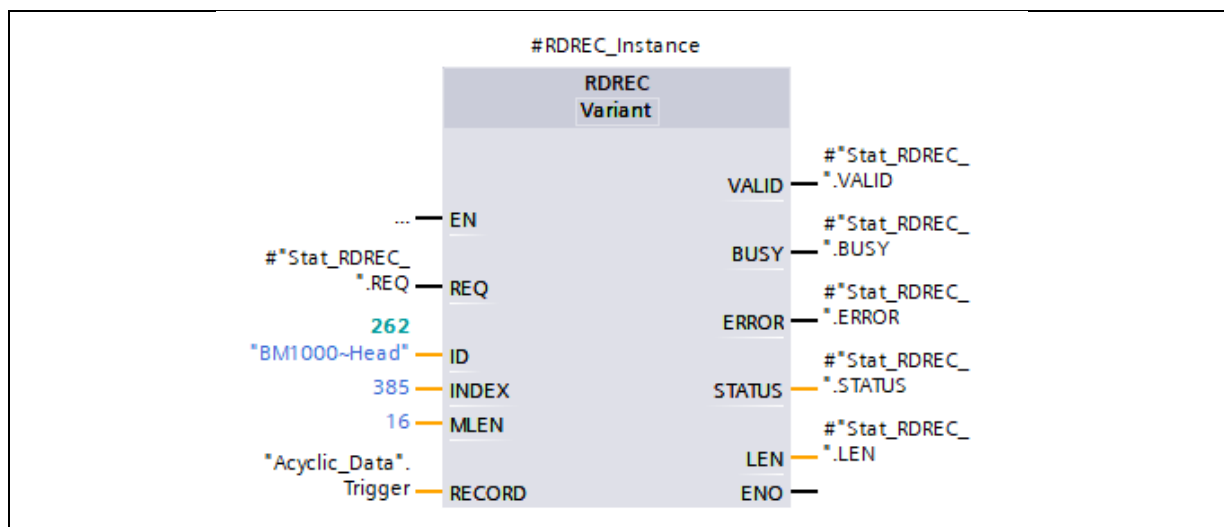


Parameter	Value	Description
<b>REQ</b>	TRUE	Before setting the REQ parameter to TRUE, all other parameters (ID, INDEX, MLEN and RECORD) needs to be set
<b>ID</b>	"BM1000~Head"	Hardware identifier of BM1000 PROFINET-IO bus module
<b>INDEX</b>	520	Decimal LD command number 520
<b>MLEN</b>	12	Length to be read in bytes Data type = FLOAT[3] = 4 bytes * 3 = <b>12</b> bytes
<b>RECORD</b>	Array[0..2] of REAL	

### 3.7.2.4 Example 3: read Trigger using LD command 385

To read the parameter "**Trigger**" from the leak detector to the PLC controller acyclically, use LD command table in the protocol description with the parameter to be read:

Command		Class	Name	R/W	Data type	Min-, Def., Max- value LDS3000	LDS3000 MSB	No fieldbus support
dez	hex							
370	172	Param	Amp test	R/W	UINT8		0 = no test with calibration 1 = test with calibration	
371	173	Status	Run Amp test	R/W	UINT8		write: 1 = test now read: 0 = Ready 1 ... 13 test running	
380	17C	Param	Search active	R/W	UINT8	0, 0, 1	0 = Off 1 = ON trigger2 for search in HIGHFLOW SL3000XL only	
385	181	Param	Trigger [mbar"/l/s]	R/W	FLOAT[4]	1E-12, 1E-5, 1E3	Trigger in mbar"/l/s	
387	183	Status	Trigger status	R	UINT8		Trigger status: 0 = Leak rate < trigger level 1 = Leak rate > trigger level Bit 0 = Trigger1 Bit 1 = Trigger2 Bit 2 = Trigger3 Bit 3 = Trigger4	
390	186	Param	Test leak extern vacuum [mbar"/l/s]	R/W	FLOAT[3]	1E-9, 9.9E-1, 9.9E-1	Test leak extern Vacuum [mbar"/l/s] (Also valid for AQ mode) Index 0: Mass 2 Index 1: Mass 3 Index 2: Mass 4 Helium	
392	188	Param	Test leak extern sniff [mbar"/l/s]	R/W	FLOAT[3]	5.0E-6, 9.9E-1, 9.9E-1	Test leak extern for sniff mode in mbar"/l/s Index [0] = Mass2 forming gas 5/95 Index [1] = Mass 3 Index [2] = Mass 4 Helium	X
394	18A	Param	Testleak intern [mbar"/l/s]	R/W	FLOAT	1E-9, 9.9E-1, 9.9E-1	Testleak intern in mbar"/l/s	

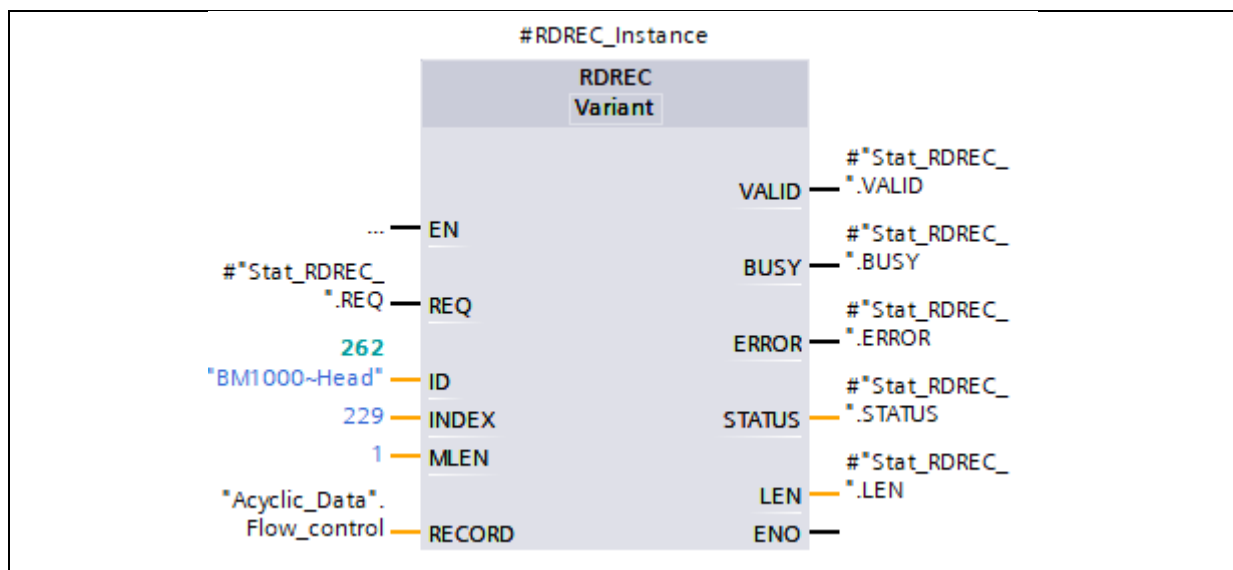


Parameter	Value	Description
REQ	TRUE	Before setting the REQ parameter to TRUE, all other parameters (ID, INDEX, MLEN and RECORD) needs to be set
ID	“BM1000~Head”	Hardware identifier of BM1000 PROFINET-IO bus module
INDEX	385	Decimal LD command number 385
MLEN	16	Length to be read in bytes Data type = FLOAT[4] = 4 bytes * 4 = <b>16</b> bytes
RECORD	Array[0..3] of REAL	<div><div><div>Trigger</div><div><div>Trigger[0]</div><div>Trigger[1]</div><div>Trigger[2]</div><div>Trigger[3]</div></div></div><div><div>Array[0..3] of Real</div><div>Real</div><div>Real</div><div>Real</div><div>Real</div></div></div>

### 3.7.2.5 Example 4: read Flow control using LD command 229

To read the parameter “**Flow control**” from the leak detector to the PLC controller acyclically, use LD command table in the protocol description with the parameter to be read:

Command		Class	Name	R/W	Data type	Min-, Def-, Max- value LDS3000	LDS3000 MSB	No fieldbus support
dez	hex							
226	E2	Param	Leakrate limits vac	R/W	FLOAT[2]	1E-12, 1E-11, 1E4	Upper and lower leak rate limit. Valid for vacuum and AQ-mode. Index 0: lower limit [mbar"/s] Index 1: upper limit [mbar"/s] Valid for command 128 "Leak rate [sel. unit]" and analog outputs	X
227	E3	Param	Leakrate limits sniff	R/W	FLOAT[2]	1E-8, 1E-7, 1E4	Index [0]: lower limit [mbar"/s] Index [1]: upper limit [mbar"/s] Valid for command 128 "Leak rate [sel. unit]" and analog outputs	X
228	E4	Param	Gasballast mode	R/W	UINT8	0, 0, 2	0 = off, 1 = on, 2 = on (continuous on, not PLC controlled)	
229	E5	Param	Flow control	R/W	UINT8	0, 0, 3	0 = 25 sccm 1 = 300 sccm (low) 2 = 3000 sccm high flow 3 = standby flow	



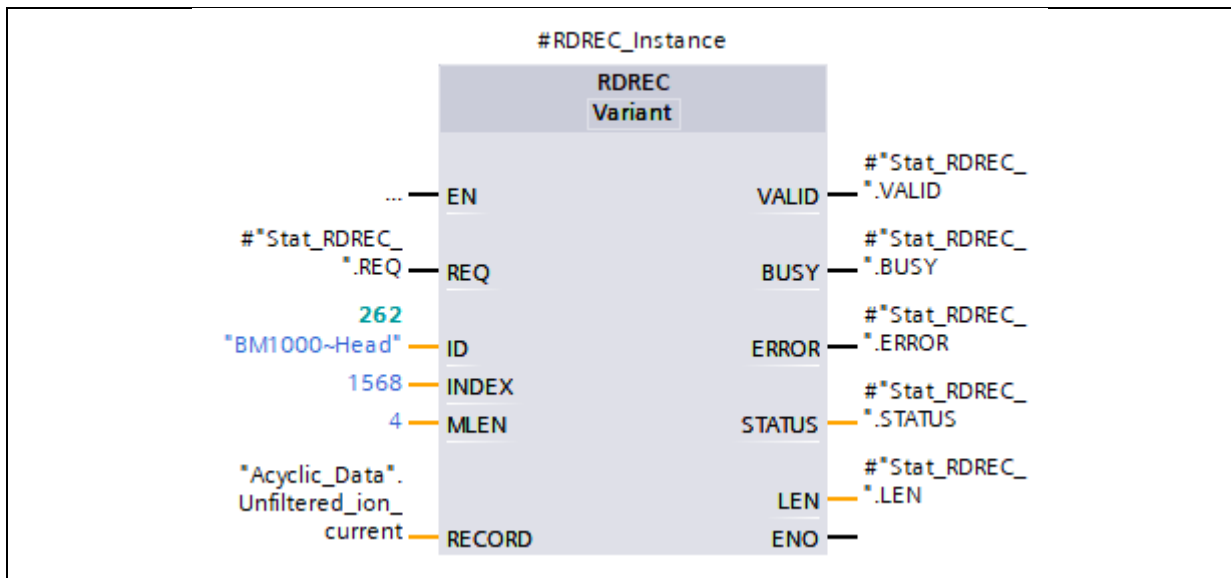
Parameter	Value	Description
<b>REQ</b>	TRUE	Before setting the REQ parameter to TRUE, all other parameters (ID, INDEX, MLEN and RECORD) needs to be set
<b>ID</b>	"BM1000~Head"	Hardware identifier of BM1000 PROFINET-IO bus module
<b>INDEX</b>	229	Decimal LD command number 229
<b>MLEN</b>	1	Length to be read in bytes Data type = UINT8 = 1 byte

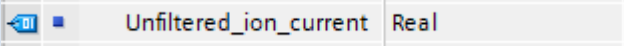
RECORD	USINT	 Flow_control	USInt
--------	-------	--	-------

### 3.7.2.6 Example 5: read Unfiltered ion current [A] using LD command 1568

To read the parameter “**Unfiltered ion current [A]**” from the leak detector to the PLC controller acyclically, use LD command table in the protocol description with the parameter to be read:

Command		Class	Name	R/W	Data type	Min-, Def., Max- value LDS3000	LDS3000 MSB	No fieldbus support
dez	hex							
1565	61D	Meas	Value changed flag	R/W	UINT8		Value changed flag Read: Same value as Statusword Bit 11 Bit will be set if one or more value changed reason flags (see command 1564) are set.  Write: Write 0 to clear the value changed flag. This will also clear all value changed reason flags (see command 1564).	
1567	61F	Meas	Offset current amplifier [A]	R	FLOAT		Zero offset of amplifier	
1568	620	Meas	Unfiltered ion current [A]	R	FLOAT		Unfiltered ion current in A	
1573	625	Meas	Filtered ion current [A]	R	FLOAT		Filtered ion current in A	



Parameter	Value	Description
<b>REQ</b>	TRUE	Before setting the REQ parameter to TRUE, all other parameters (ID, INDEX, MLEN and RECORD) needs to be set
<b>ID</b>	"BM1000~Head"	Hardware identifier of BM1000 PROFINET-IO bus module
<b>INDEX</b>	1568	Decimal LD command number 1568
<b>MLEN</b>	4	Length to be read in bytes Data type = FLOAT = REAL = 4 byte
<b>RECORD</b>	REAL	

### 3.7.3 Writing data to leak detector acyclically

Acyclic writing of parameters is limited. A maximum of 20 acyclic calls can be made simultaneously with a PLC control of type S7-1500.

If more than 20 parameters must be write acyclically, the access must be programmed accordingly in the PLC program so that the maximum number of simultaneous read accesses is not exceeded.

#### Extended instructions: maximum number of simultaneously running jobs

Table: Maximum number of simultaneous jobs for asynchronous extended instructions and lower-level instructions used

Extended instructions	1505SP (F) 1505SP T(F)	1511(F) 1511C 1511T(F)	1507S(F) 1512C 1513(F)	1515(F) 1515T(F)	1516(F) 1516T(F)	1517(F) 1517T(F)	1518(F) 1518(F) MFP
Distributed I/O							
RDREC	20						
RD_REC	10						
WRREC	20						

This information is taken from:

<https://support.industry.siemens.com/cs/mdm/59191792?c=126916719115&lc=en-AO>

### **3.7.3.1** *Limited write operations to leak detectors*

The writing of parameters from a higher-level control system (e.g. PLC controller) to the leak detector is limited. Each parameter sent to the leak detector by a higher-level control system is stored directly in the EEPROM (Memory) of the leak detector's MSB, even if the parameter value has not been changed.

The EEPROM manufacturer guarantees 1.000.000 write cycles per memory address at room temperature.

If more write operations per memory address have been performed, there's no guarantee that the EEPROM continues to store the parameters correctly.

This may cause the leak detector to become unusable for your application.

If memory locations in the EEPROM are defective, the leak detector reports this via a warning message immediately after power on.

To protect the EEPROM of the leak detector's MSB, unnecessary write operations from a higher-level control system (e.g. PLC controller) to the leak detector should be avoided (under any circumstances).

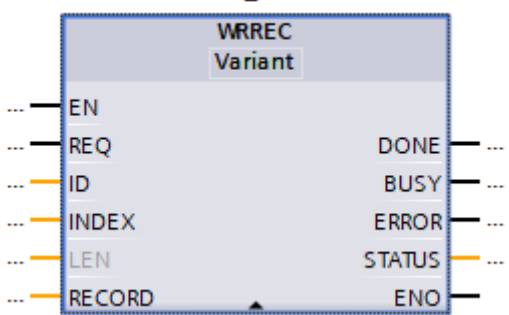
Please find below some rules that must be observed when transferring parameters from a higher-level controller to the leak detector:

- Do not send a list of parameters where not all parameter values may have been changed. Only send parameters that have actually been changed.
- Do not send parameters that have not been changed
- Only send parameters that really need to be changed.
- Set the time interval between each transmission as long as possible. A good rule of thumb is not to write parameters more often than every 6 minutes.



### 3.7.3.2 Using Siemens standard function block "WRREC"

In order to write a data record acyclically to a PROFINET-IO Slave, Siemens offers the Standard Function Block "WRREC" in the library of the TIA Portal.



**Parameter**

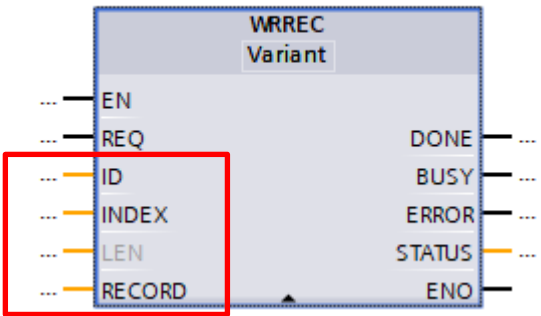
The following table shows the parameters of the "WRREC" instruction:

Parameter	Declaration	Data type**	Memory area	Description
REQ	Input	BOOL	I, Q, M, D, L, T*, C* or constant	REQ = 1: Transfer data record
ID	Input	HW_IO	I, Q, M, D, L or constant	ID number of the hardware component (DP/PROFINET IO) The number is assigned automatically and is stored in the properties of the component or of the interface in the hardware configuration.
INDEX	Input	DINT	I, Q, M, D, L or constant	Data record number
LEN	Input	UINT	I, Q, M, D, L or constant	(hidden) Maximum length of the data record to be transferred in bytes
DONE	Output	BOOL	I, Q, M, D, L	Data record was transferred
BUSY	Output	BOOL	I, Q, M, D, L	BUSY = 1: The writing process is not yet complete.
ERROR	Output	BOOL	I, Q, M, D, L	ERROR = 1: An error occurred during the writing process.
STATUS	Output	DWORD	I, Q, M, D, L	Block status or error information For interpretation of the STATUS parameter, see <a href="#">Parameter STATUS</a> .
RECORD	InOut	VARIANT	I, Q, M, D, L	Data record

\* For S7-1500 only.

\*\* There is no implicit conversion in STL, which is why the range of valid data types may be limited. During programming in STL, please note the valid data types. These are displayed in the parameter tooltip.

To write a parameter acyclically to the leak detector via the BM1000 PROFINET-IO Module, the following input parameters of the “WRREC” needs to be set correspondingly to the LD command to be write:



**Parameter**

The following table shows the parameters of the “WRREC” instruction:

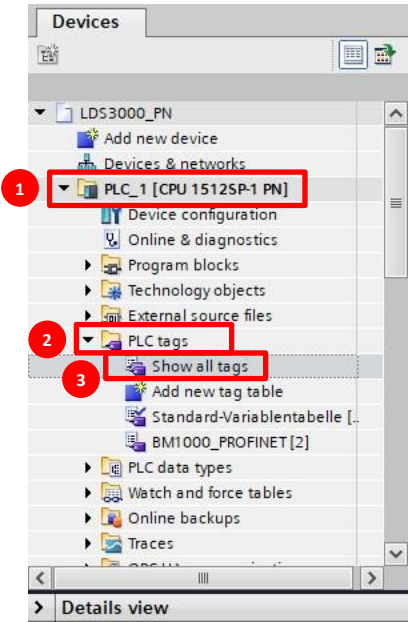
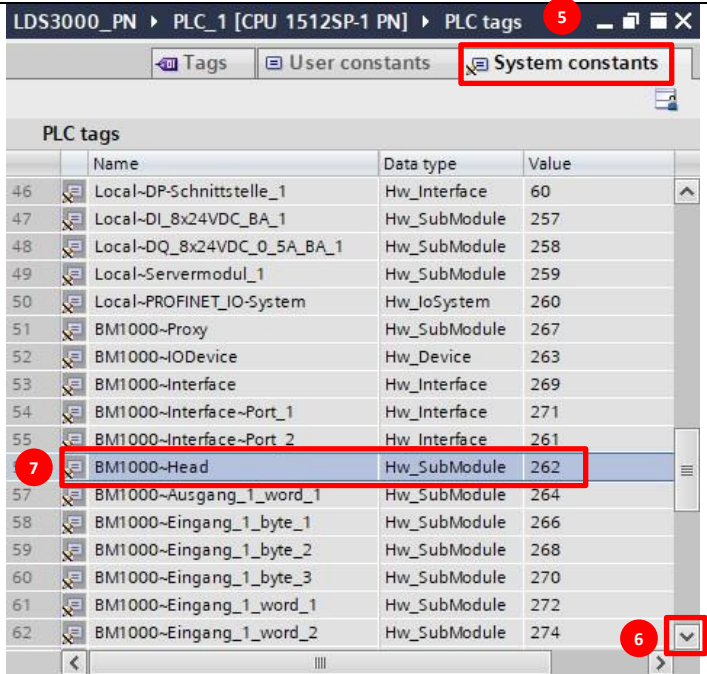
Parameter	Declaration	Data type**	Memory area	Description
REQ	Input	BOOL	I, Q, M, D, L, T*, C* or constant	REQ = 1: Transfer data record
ID	Input	HW_IO	I, Q, M, D, L or constant	ID number of the hardware component (DP/PROFINET IO) The number is assigned automatically and is stored in the properties of the component or of the interface in the hardware configuration.
INDEX	Input	DINT	I, Q, M, D, L or constant	Data record number
LEN	Input	UINT	I, Q, M, D, L or constant	(hidden) Maximum length of the data record to be transferred in bytes
DONE	Output	BOOL	I, Q, M, D, L	Data record was transferred
BUSY	Output	BOOL	I, Q, M, D, L	BUSY = 1: The writing process is not yet complete.
ERROR	Output	BOOL	I, Q, M, D, L	ERROR = 1: An error occurred during the writing process.
STATUS	Output	DWORD	I, Q, M, D, L	Block status or error information For interpretation of the STATUS parameter, see <a href="#">Parameter STATUS</a> .
RECORD	InOut	VARIANT	I, Q, M, D, L	Data record

\* For S7-1500 only.

\*\* There is no implicit conversion in STL, which is why the range of valid data types may be limited. During programming in STL, please note the valid data types. These are displayed in the parameter tooltip.

### 3.7.3.2.1 Parameter ID

The hardware identifier (ID) of the BM1000 PROFINET-IO module is displayed in the system constants.

<ol style="list-style-type: none"> <li>1. Open <b>"PLC_1"</b></li> <li>2. Open <b>"PLC tags"</b></li> <li>3. Select <b>"Show all tags"</b></li> </ol>	
<ol style="list-style-type: none"> <li>4. Open <b>"System constants"</b></li> <li>5. Scroll down till <b>"BM1000~..."</b></li> <li>6. Use the PLC tag <b>"BM1000~Head"</b></li> </ol>	 <div data-bbox="603 1854 1393 1964" style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>Attention!</b> The value of the <b>"BM1000~Head"</b> tag could vary in your application</p> </div>

### 3.7.3.2.2 Parameter INDEX

The parameter INDEX needs to be set to the decimal LD command number to be write, based on the LD Protocol taken from the LD command table of the protocol descriptions.

**INDEX = decimal LD command number**

Command		Class	Name	R/W	Data type	Min-, Def-, Max- value LDS3000	LDS3000 MSB	No fieldbus support
dez	hex							
502	1F6	Param	Amplifier range	R/W	UINT8	0, 3, 3	Amplifier range Amplifier control location 508 automatically set (not auto) 0 = 13 MOhm 1 = 470 MOhm 2 = 15 GOhm 3 = 500 GOhm	
504	1F8	Param	500GOhm value	R/W	FLOAT	4.5E1, 5E11, 5.5E11Ohm	500GOhm value	
506	1FA	Param	Mass	R/W	UINT8	2, 4, 4	2 = Mass 2 (H2) 3 = Mass 3 4 = Mass 4 (Helium)	

### 3.7.3.2.3 Parameter LEN

The parameter **LEN** specifies the length of the data to be write in bytes. The length of the LD command to be write based on the LD Protocol is taken from the LD command table of the protocol descriptions.

The parameter **LEN** needs to be calculated based on the data type of the LD command to be write.

Command		Class	Name	R/W	Data type	Min-, Def-, Max- value LDS3000	LDS3000 MSB	No fieldbus support
dez	hex							
502	1F6	Param	Amplifier range	R/W	UINT8	0, 3, 3	Amplifier range Amplifier control location 508 automatically set (not auto) 0 = 13 MOhm 1 = 470 MOhm 2 = 15 GOhm 3 = 500 GOhm	
504	1F8	Param	500GOhm value	R/W	FLOAT	4.5E1, 5E11, 5.5E11Ohm	500GOhm value	
506	1FA	Param	Mass	R/W	UINT8	2, 4, 4	2 = Mass 2 (H2) 3 = Mass 3 4 = Mass 4 (Helium)	

Data type	Meaning	LEN [bytes]
<b>SINT8</b>	Signed 8 bit integer	1
<b>SINT16</b>	Signed 16 bit integer	2
<b>SINT32</b>	Signed 32 bit integer	4
<b>UINT8</b>	Unsigned 8 bit integer	1
<b>UINT16</b>	Unsigned 16 bit integer	2
<b>UINT32</b>	Unsigned 32 bit integer	4
<b>FLOAT</b>	Floating point / real number	4
<b>CHAR</b>	Character	1

Some LD commands are of the array data type. This is indicated by a square bracket after the data type itself (e.g. FLOAT[3]). The number in the brackets indicates the number of array elements (e.g. [3] = 3 array elements).

If the LD command is of the array data type, the parameter **LEN** needs to be calculated by the following rule:

**LEN = Data type length in bytes \* number of array elements**

Example:

519	207	Param	Cal factors sniff high flow	R/W	<div style="border: 2px solid red; padding: 2px;">FLOAT[3]</div>	0.01, 1, 100	Calibration factors for sniff mode high flow Index [0] = mass 2 Index [1] = mass 3 Index [2] = mass 4
-----	-----	-------	-----------------------------	-----	--	--------------	--

The LD command 519 "Cal factors sniff high flow" is an array with 3 array elements of data type FLOAT. The data type FLOAT has a length of 4 bytes.

In order to calculate the parameter **LEN**, the length of the data type needs to be multiplied by the number of array elements:

**LEN = 4 bytes \* 3 = 12 bytes**

#### **Attention!**

If the data type of the LD command to be write is an array, it is not possible to write only one of the array element. It must be always write the whole array with all array elements.

The index of arrays always starts with index[0].

### 3.7.3.2.4 Parameter RECORD

The parameter **RECORD** specifies the source of the data to be write. For this reason, the data type of the parameter **RECORD** need to be the same like the data type of the LD command.

Please use the data types in the corresponding list below.

Data type leak detector	Meaning	Data type TIA Portal
<b>SINT8</b>	Signed 8 bit integer	<b>SINT</b>
<b>SINT16</b>	Signed 16 bit integer	<b>INT</b>
<b>SINT32</b>	Signed 32 bit integer	<b>DINT</b>
<b>UINT8</b>	Unsigned 8 bit integer	<b>USINT</b>
<b>UINT16</b>	Unsigned 16 bit integer	<b>UINT</b>
<b>UINT32</b>	Unsigned 32 bit integer	<b>UDINT</b>
<b>FLOAT</b>	Floating point / real number	<b>REAL</b>
<b>CHAR</b>	Character	<b>CHAR</b>

If the LD command to be write is an array, please also use an array with the same array dimensions and the corresponding data type.

Example:

519	207	Param	Cal factors sniff high flow	R/W	FLOAT[3]	0.01, 1, 100	Calibration factors for sniff mode high flow Index [0] = mass 2 Index [1] = mass 3 Index [2] = mass 4
-----	-----	-------	-----------------------------	-----	----------	--------------	--

The LD command 519 "Cal factors sniff high flow" is an array with 3 array elements of data type FLOAT. The data type FLOAT corresponds to the data type REAL in the TIA portal.

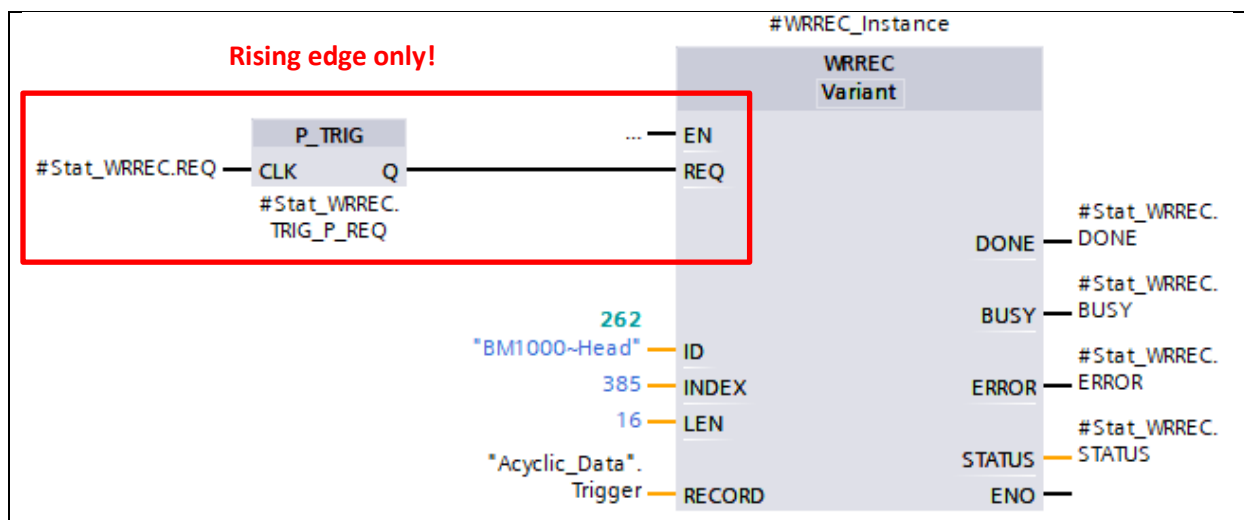
Please use as **RECORD** value: Array[0..2] of Real

	Name	Data type	Start value
1	Static		
2	Cal_factors_sniff_high_flow	Array[0..2] of Real	
3	Cal_factors_sniff_high_flow[0]	Real	0.0
4	Cal_factors_sniff_high_flow[1]	Real	0.0
5	Cal_factors_sniff_high_flow[2]	Real	0.0

### 3.7.3.3 Example 1: write Trigger by using LD command 385

To write the parameter “**Trigger**” from the PLC controller to the leak detector acyclically, use LD command table in the protocol description with the parameter to be write:

Command		Class	Name	R/W	Data type	Min-, Def., Max- value LDS3000	LDS3000 MSB	No fieldbus support
dez	hex							
370	172	Param	Amp test	R/W	UINT8		0 = no test with calibration 1 = test with calibration	
371	173	Status	Run Amp test	R/W	UINT8		write: 1 = test now read: 0 = Ready 1 ... 13 test running	
380	17C	Param	Search active	R/W	UINT8	0, 0, 1	0 = Off 1 = ON trigger2 for search in HIGHFLOW SL3000XL only	
385	181	Param	Trigger [mbar"/s]	R/W	FLOAT[4]	1E-12, 1E-5, 1E3	Trigger in mbar"/s	
387	183	Status	Trigger status	R	UINT8		Trigger status: 0 = Leak rate < trigger level 1 = Leak rate > trigger level Bit 0 = Trigger1 Bit 1 = Trigger2 Bit 2 = Trigger3 Bit 3 = Trigger4	
390	186	Param	Test leak extern vacuum [mbar"/s]	R/W	FLOAT[3]	1E-9, 9.9E-1, 9.9E-1	Test leak extern Vacuum [mbar"/s] (Also valid for AQ mode) Index 0: Mass 2 Index 1: Mass 3 Index 2: Mass 4 Helium	
392	188	Param	Test leak extern sniff [mbar"/s]	R/W	FLOAT[3]	5.0E-6, 9.9E-1, 9.9E-1	Test leak extern for sniff mode in mbar"/s Index [0] = Mass2 forming gas 5/95 Index [1] = Mass 3 Index [2] = Mass 4 Helium	X
394	18A	Param	Testleak intern [mbar"/s]	R/W	FLOAT	1E-9, 9.9E-1, 9.9E-1	Testleak intern in mbar"/s	



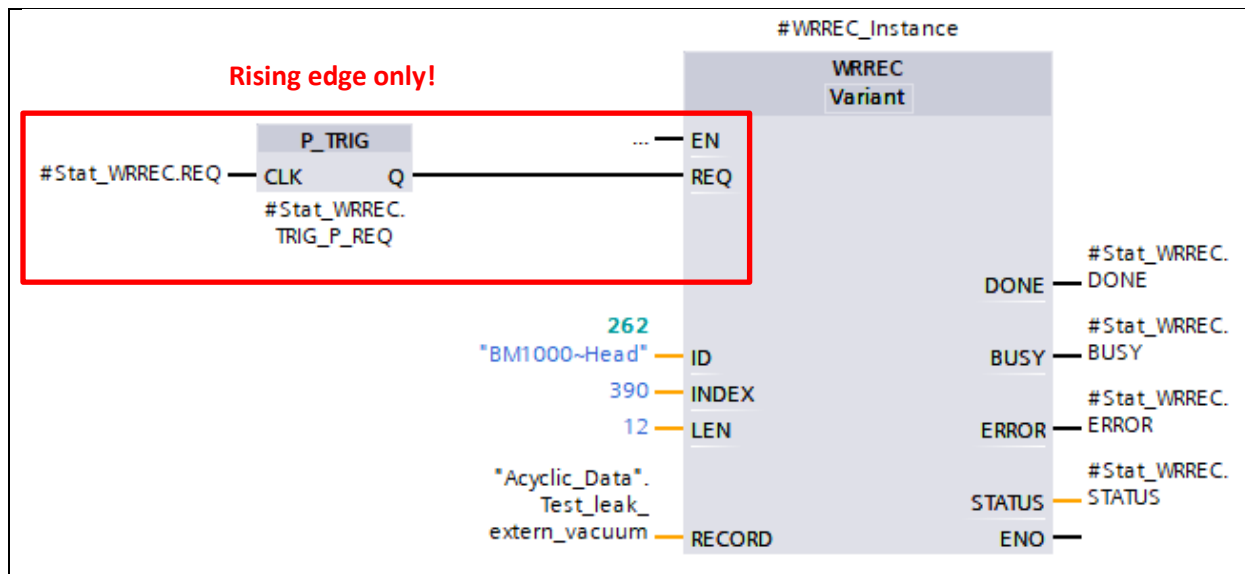
Parameter	Value	Description										
REQ	Rising edge	Before setting the REQ parameter to TRUE, all other parameters (ID, INDEX, LEN and RECORD) needs to be set  <b>Attention!</b> <b>Use only one rising edge to transfer data to the leak detector. Otherwise, the parameter will be transferred several times!</b>										
ID	“BM1000~Head”	Hardware identifier of BM1000 PROFINET-IO bus module										
INDEX	385	Decimal LD command number 385										
LEN	16	Length to be write in bytes Data type = FLOAT[4] = 4 bytes * 4 = <b>16</b> bytes										
RECORD	Array[0..3] of REAL	<table><tr><td>Trigger</td><td>Array[0..3] of Real</td></tr><tr><td>Trigger[0]</td><td>Real</td></tr><tr><td>Trigger[1]</td><td>Real</td></tr><tr><td>Trigger[2]</td><td>Real</td></tr><tr><td>Trigger[3]</td><td>Real</td></tr></table>	Trigger	Array[0..3] of Real	Trigger[0]	Real	Trigger[1]	Real	Trigger[2]	Real	Trigger[3]	Real
Trigger	Array[0..3] of Real											
Trigger[0]	Real											
Trigger[1]	Real											
Trigger[2]	Real											
Trigger[3]	Real											

### 3.7.3.4 Example 2: write Test leak extern vacuum by using LD command 390

To write the parameter "**Test leak extern vacuum**" from the PLC controller to the leak detector acyclically, use LD command table in the protocol description with the parameter to be write:

Command		Class	Name	R/W	Data type	Min-, Def-, Max- value LDS3000	LDS3000 MSB	No fieldbus support
dez	hex							
350	15E	Status	Serial number control unit	R	CHAR[11]		Serial number control unit Write for internal use only.	
357	165	Status	Control unit OS build date [YMD]	R/W	UINT8[3]		Build date of operating system of control unit. Index 0: Year (1..99) Index 1: Month Index 2: Day Write for internal use only.	
370	172	Param	Amp test	R/W	UINT8		0 = no test with calibration 1 = test with calibration	
371	173	Status	Run Amp test	R/W	UINT8		write: 1 = test now read: 0 = Ready 1 ... 13 test running	
380	17C	Param	Search active	R/W	UINT8	0, 0, 1	0 = Off 1 = ON trigger2 for search in HIGHFLOW SL3000XL only	
385	181	Param	Trigger [mbar*/s]	R/W	FLOAT[4]	1E-12, 1E-5, 1E3	Trigger in mbar*/s	
387	183	Status	Trigger status	R	UINT8		Trigger status: 0 = Leak rate < trigger level 1 = Leak rate > trigger level Bit 0 = Trigger1 Bit 1 = Trigger2 Bit 2 = Trigger3 Bit 3 = Trigger4	
390	186	Param	Test leak extern vacuum [mbar*/s]	R/W	FLOAT[3]	1E-9, 9.9E-1, 9.9E-1	Test leak extern Vacuum [mbar*/s] (Also valid for AQ mode) Index 0: Mass 2 Index 1: Mass 3 Index 2: Mass 4 Helium	



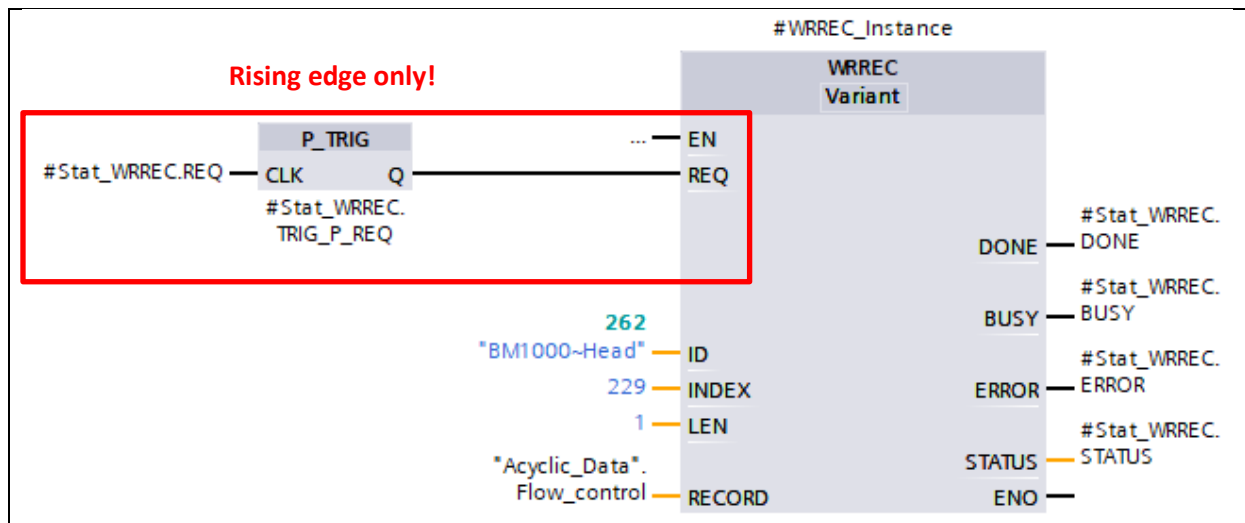


Parameter	Value	Description
REQ	Rising edge	Before setting the REQ parameter to TRUE, all other parameters (ID, INDEX, LEN and RECORD) needs to be set  <b>Attention!</b> <b>Use only one rising edge to transfer data to the leak detector. Otherwise, the parameter will be transferred several times!</b>
ID	"BM1000~Head"	Hardware identifier of BM1000 PROFINET-IO bus module
INDEX	390	Decimal LD command number 385
LEN	12	Length to be write in bytes Data type = FLOAT[3] = 4 bytes * 3 = <b>12 bytes</b>
RECORD	Array[0..2] of REAL	<div> <div> Test_leak_extern_vacuum </div> <div> Array[0..2] of Real </div> </div> <div> <div> Test_leak_extern_vacuum[0] </div> <div> Real </div> </div> <div> <div> Test_leak_extern_vacuum[1] </div> <div> Real </div> </div> <div> <div> Test_leak_extern_vacuum[2] </div> <div> Real </div> </div>

### 3.7.3.5 Example 3: write Flow control by using LD command 229

To write the parameter “**Flow control**” from the PLC controller to the leak detector acyclically, use LD command table in the protocol description with the parameter to be write:

Command		Class	Name	R/W	Data type	Min-, Def-, Max- value LDS3000	LDS3000 MSB	No fieldbus support
dez	hex							
226	E2	Param	Leakrate limits vac	R/W	FLOAT[2]	1E-12, 1E-11, 1E4	Upper and lower leak rate limit. Valid for vacuum and AQ-mode. Index 0: lower limit [mbar*l/s] Index 1: upper limit [mbar*l/s] Valid for command 128 “Leak rate [sel. unit]” and analog outputs	X
227	E3	Param	Leakrate limits sniff	R/W	FLOAT[2]	1E-8, 1E-7, 1E4	Index [0]: lower limit [mbar*l/s] Index [1]: upper limit [mbar*l/s] Valid for command 128 “Leak rate [sel. unit]” and analog outputs	X
228	E4	Param	Gasballast mode	R/W	UINT8	0, 0, 2	0 = off, 1 = on, 2 = on (continuous on, not PLC controlled)	
229	E5	Param	Flow control	R/W	UINT8	0, 0, 3	0 = 25 sccm 1 = 300 sccm (low) 2 = 3000 sccm high flow 3 = standby flow	



Parameter	Value	Description
REQ	Rising edge	Before setting the REQ parameter to TRUE, all other parameters (ID, INDEX, LEN and RECORD) needs to be set  <b>Attention!</b> <b>Use only one rising edge to transfer data to the leak detector. Otherwise, the parameter will be transferred several times!</b>
ID	“BM1000~Head”	Hardware identifier of BM1000 PROFINET-IO bus module
INDEX	229	Decimal LD command number 229

<b>LEN</b>	1	Length to be write in bytes Data type = UINT8 = <b>1</b> byte
<b>RECORD</b>	USINT	