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Application Leak Detection

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July 2023

LDS3000 platform – BM1000 PROFIBUS configuration with SIMATIC STEP 7

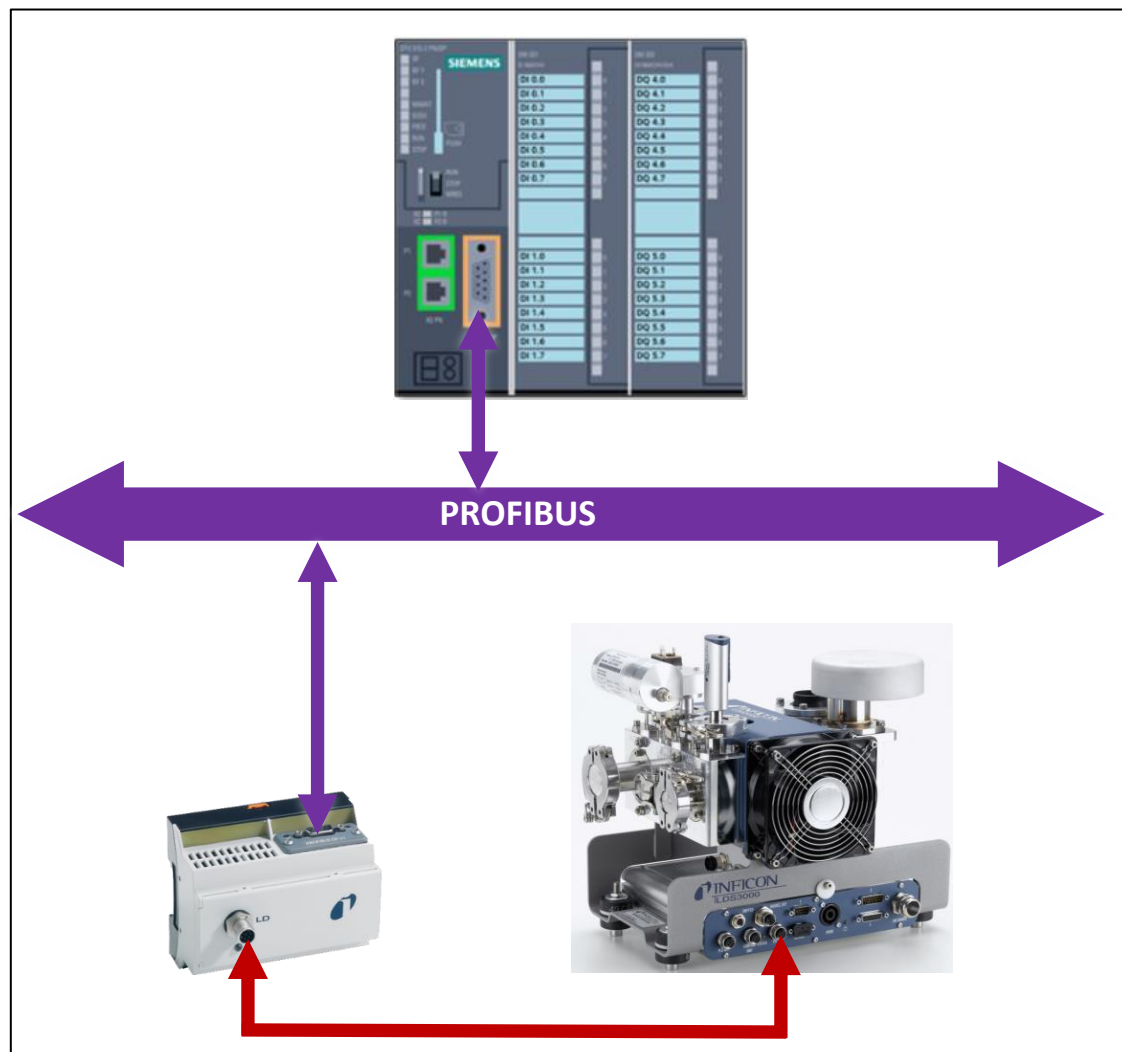


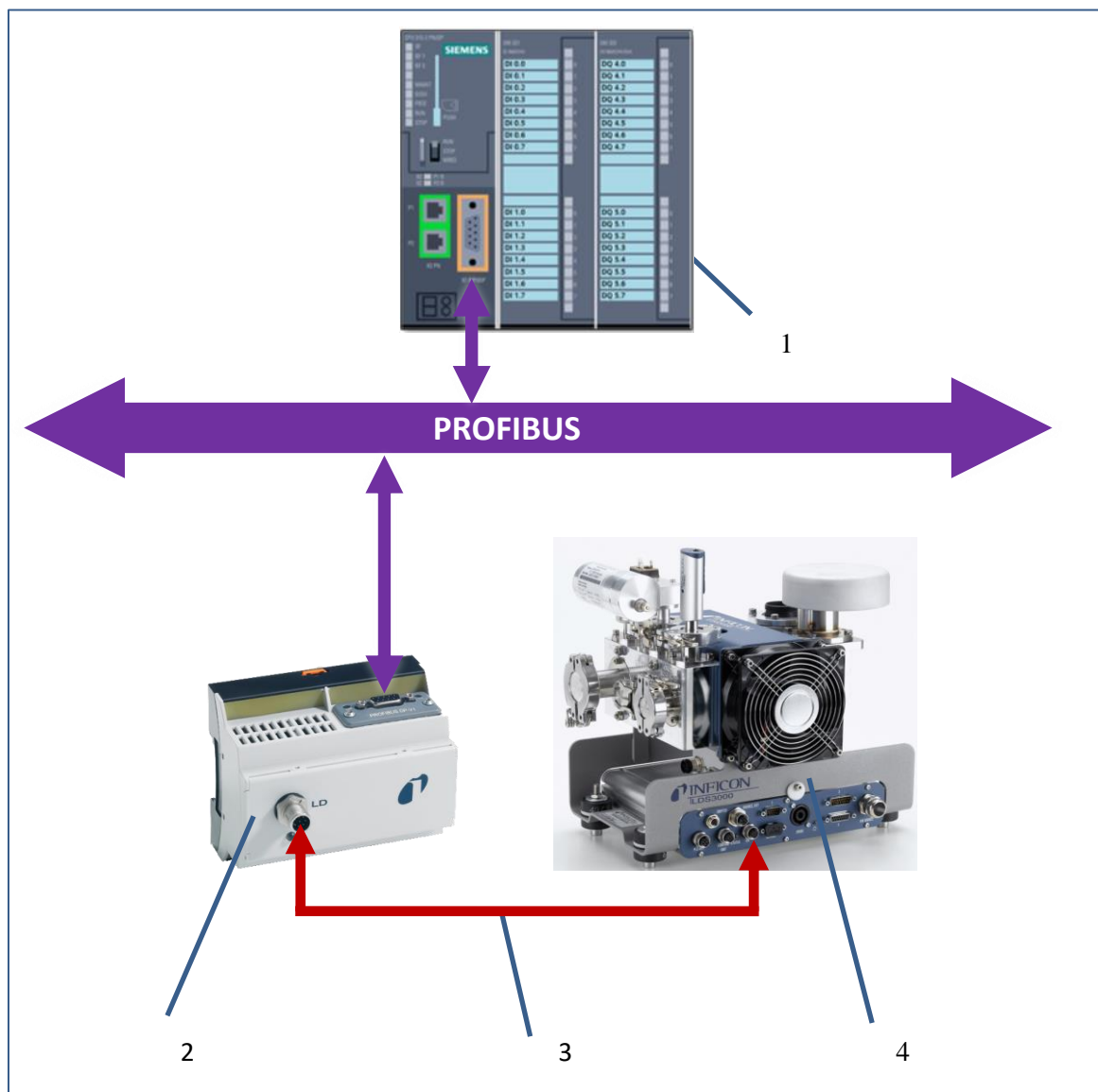
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1 Preface

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



POS	Catalog number	
1	PROFIBUS Master (e.g. S7-300)	---
2	BM1000 PROFIBUS module	560-315 BM1000 PROFIBUS 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. GSD files for the PROFIBUS field bus system.

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

**\\LDS3000(AQ)-Documentation-V~~xx~~\Manuals\LDS3000 Interface Description\Profibus\GSD
INFICON Profile**
xx = version number

The LDS3000 platform contains the following devices:

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

This manual is valid for all the devices listed above.

This manual is based on the following version numbers:

POS		Version
1	LDS3000	MSB v2.72 or higher
2	CU1000	v2.72 or higher
3	BM1000 PROFIBUS	
4	LDS3000 Protocol Description	jira54en1-07 (1803) or higher
5	SIMATIC Step 7	V5.5

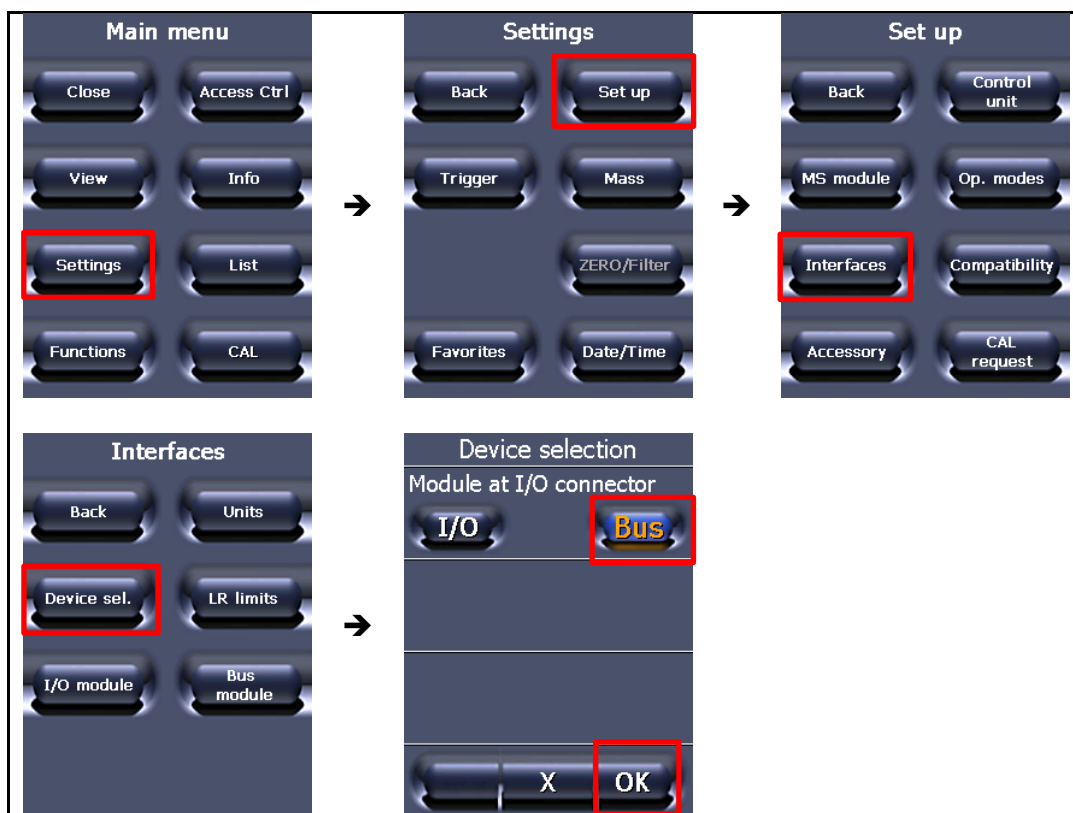
If using the devices listed above with the installed software versions or higher all explained functions in this document should be possible.

2 Set up BM1000 PROFIBUS configuration of the LDS3000 platform

In order to set up the PROFIBUS 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 PROFIBUS address

Please set the PROFIBUS address to the same address which was configured in the SIMATIC Step 7 device configuration.

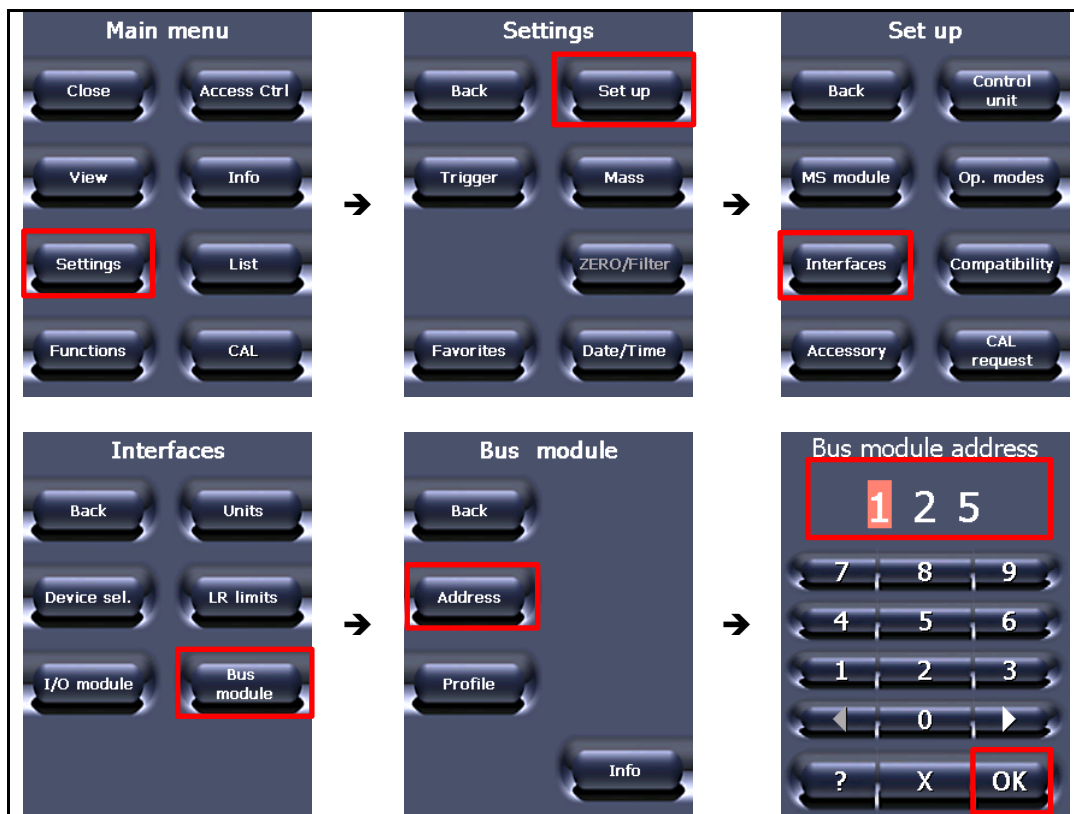


Figure 1 Set up BM1000 PROFIBUS address 1

After the PROFIBUS address was set the parameters needs to be stored.

Attention:

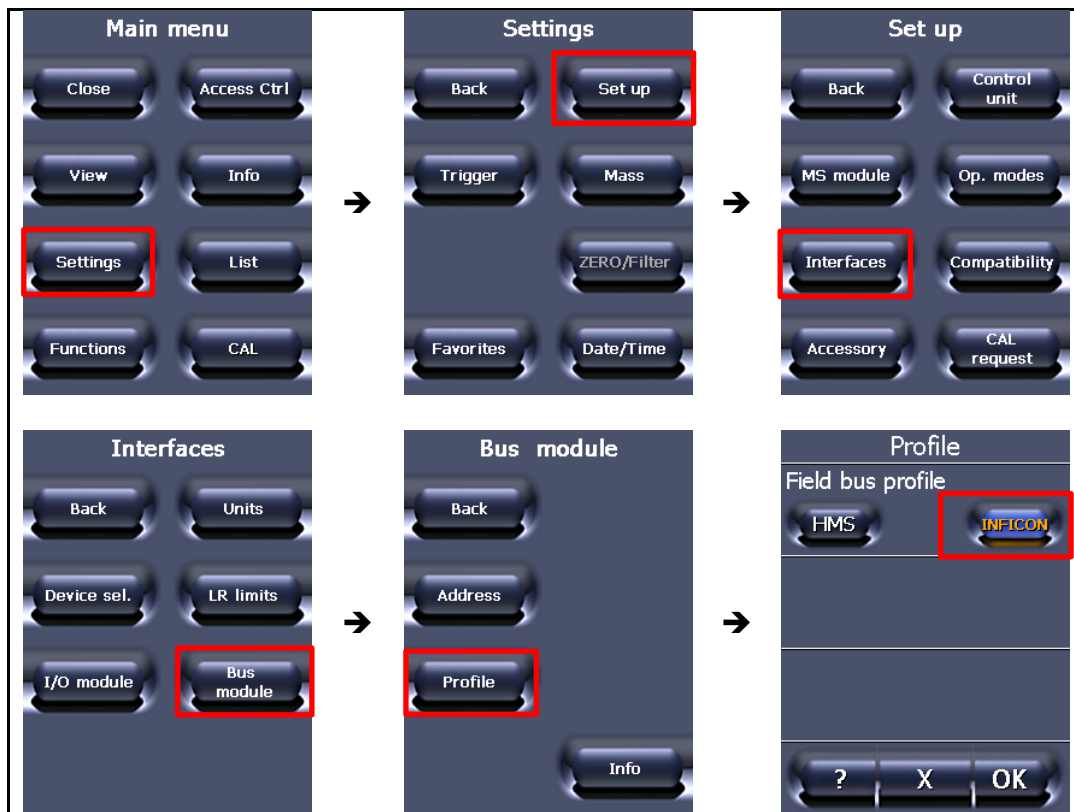
The BM1000 Bus module address needs to be set to the same address like in the SIMATIC Step 7 device configuration!

Attention!

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

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.



The BM1000 field bus profile needs to be set to the same profile like the BM1000 GSD file was installed in the SIMATIC configuration manager.

- If INFICON GSD File (IFCN0E8D.GSD file) was installed and also select as DP-Slave please choose “INFICON” as field bus profile
- If HMS GSD File (HMSB1811.GSD file) was installed and also select as DP-Slave please choose “HMS” as field bus profile

Attention:

For the PROFIBUS field bus you can select between two different profiles:

- INFICON (IFCN0E8D.GSD file)
- HMS (HMSB1811.GSD file)

It is strongly recommended to use the **INFICON** profile, because the setup process in your fieldbus configuration tool (e.g. SIMATIC Step 7) will be much easier.

2.4 Activate BM1000 PROFIBUS 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.

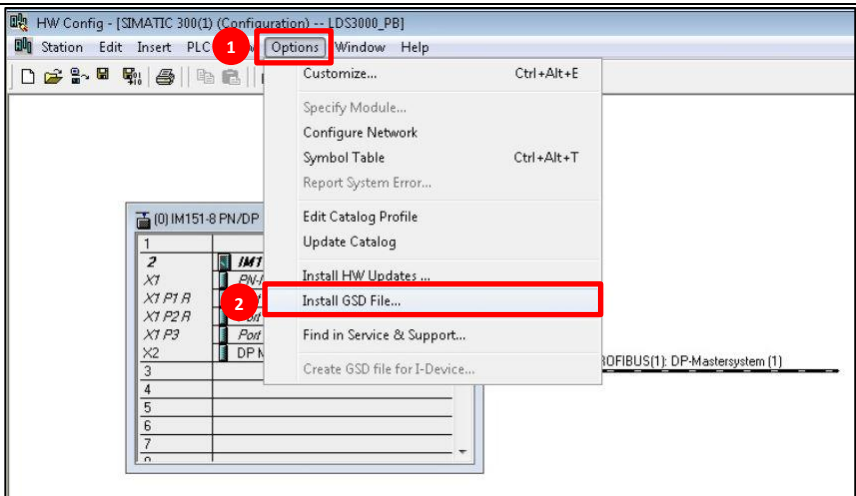
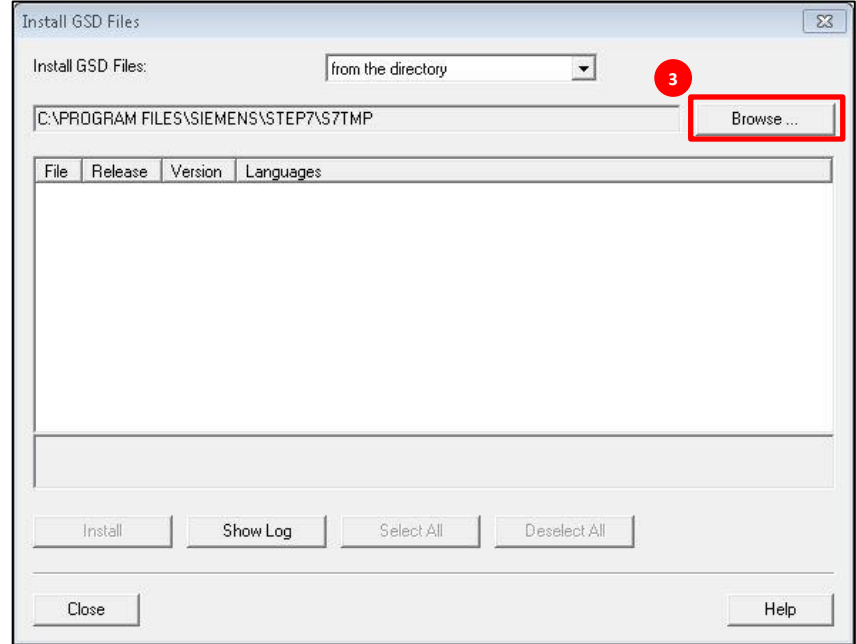
Attention!

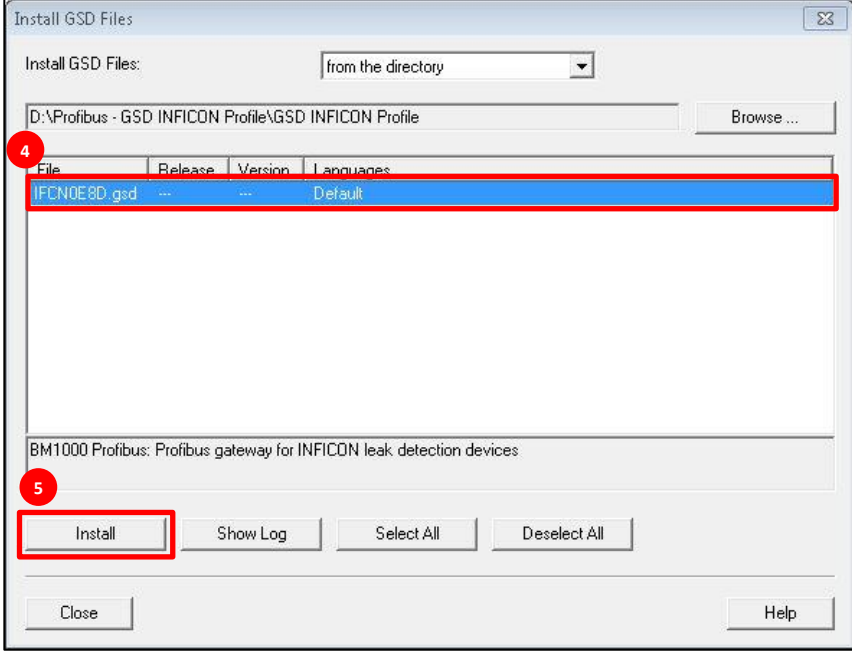

After each change of the fieldbus profile or the configuration of the BM1000 in the device configuration of the SIMATIC Step 7, the device must be restarted!

3 SIMATIC Step 7

3.1 Installation GSDML-File BM1000 PROFIBUS module

1. Open Siemens SIMATIC Step 7
2. Open or create a new Step 7 project the BM1000 PROFIBUS Module should be used
3. Install GSD File

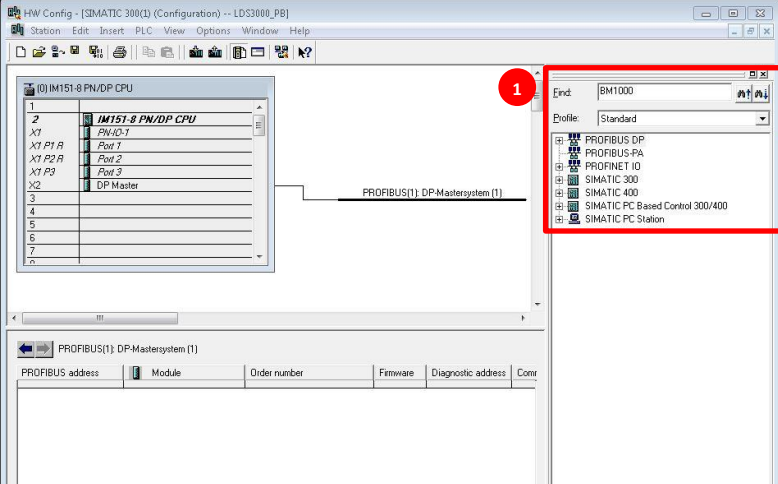
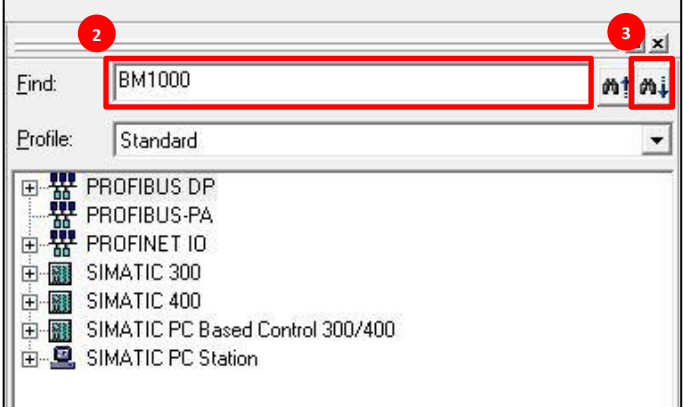
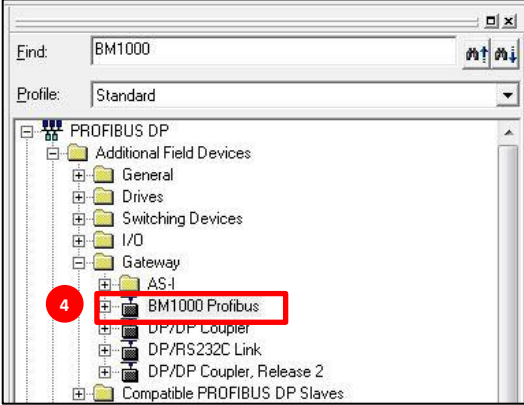
<ol style="list-style-type: none"> 1. Select "Options" 2. Select "Install GSD File..." 	
<ol style="list-style-type: none"> 3. Select the source path of the GSD file and select the file "IFCN0E8D.gsd" 	 <p>The GSD file is on the USB memory stick which is supplied with the BM1000 bus module.</p>

	<p>Source path: LDS3000(AQ)-Documentation-Vxx\Manuals\LDS3000 Interface Description\Profibus\GSD INFICON Profile\ IFCN0E8D.gsd</p> <p>xx = version number</p>
<p>4. Select the GSD file "IFCN0E8D.gsd"</p> <p>5. Press the "Install" button</p>	
<p>6. After installing the GSD press "OK" button</p>	

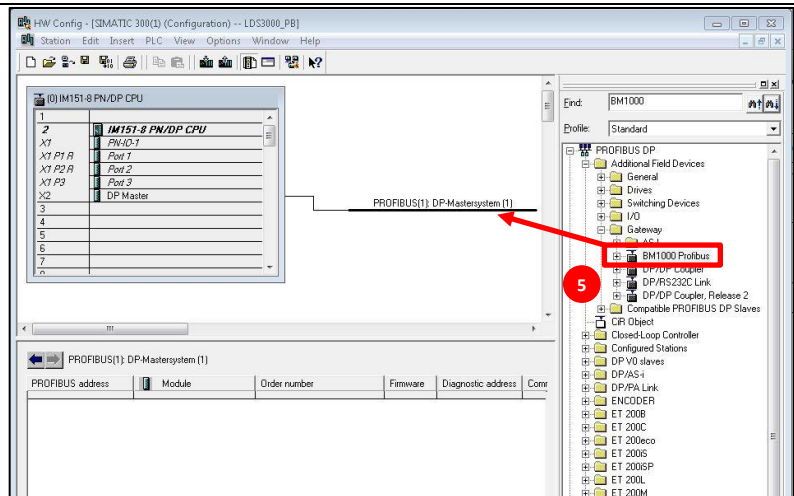
4. The INFICON BM1000 PROFIBUS module is now installed and can be used

3.2 Add BM1000 PROFIBUS module to PROFIBUS network

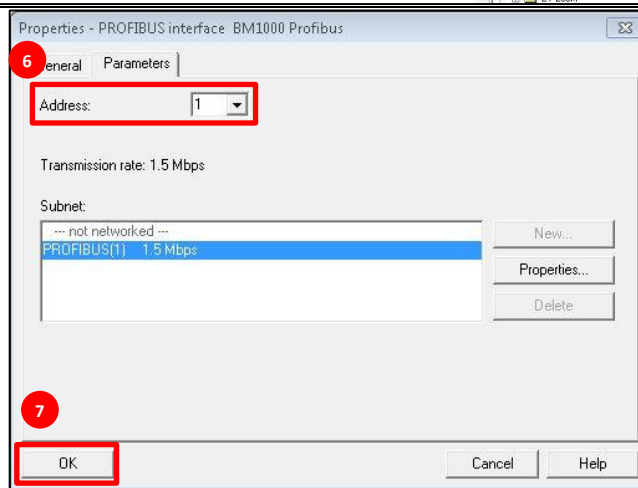
1. Open Siemens SIMATIC Step 7
2. Open or create a new TIA project the BM1000 PROFIBUS Module should be used
3. Open the Hardware Configuration Manager

<ol style="list-style-type: none"> 1. Search for BM1000 PROFIBUS Module in the hardware catalog 	
<ol style="list-style-type: none"> 2. Use the search section of the catalog in order to find the BM1000 PROFIBUS module. Therefore, enter into the "Find" text field "BM1000" 3. Select "Search down" 	
<ol style="list-style-type: none"> 4. Select "BM1000 Profibus" 	

5. Drag and drop the **"BM1000 Profibus"** module to the **"PROFIBUS(1): DP-Mastersystem (1)"**



6. Select the PROFIBUS Address of the BM1000 PROFIBUS Module
7. Press **"OK"** button



Attention!

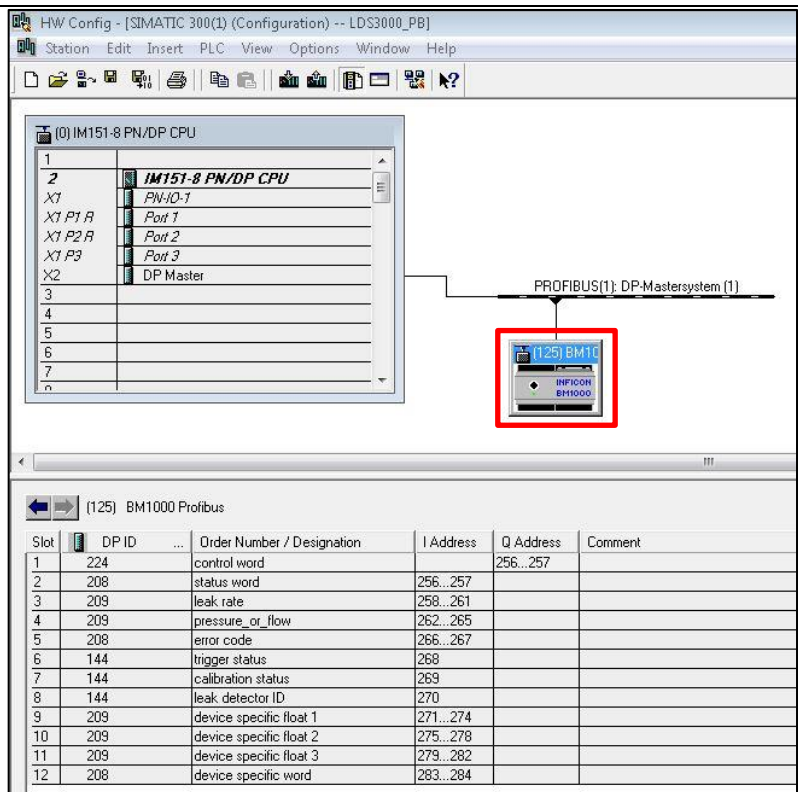
The PROFIBUS address of the BM1000 PROFIBUS module address needs to be set to the **same address** like in the configuration of the leak detector! (Please have a look at chapter 2.2)

Attention!

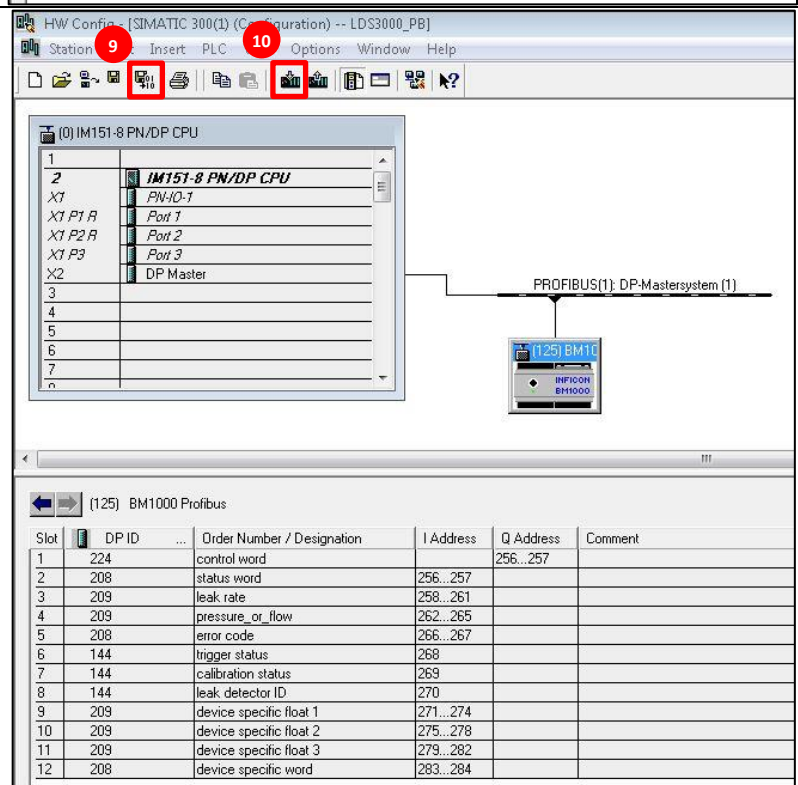
Address and profile do not come into effect until a restart of the leak detector (power off/power on)!

Please have a look at chapter 2.4

8. The BM1000 PROFIBUS module is now inserted as a DP-Slave into the PROFIBUS DP-Mastersystem



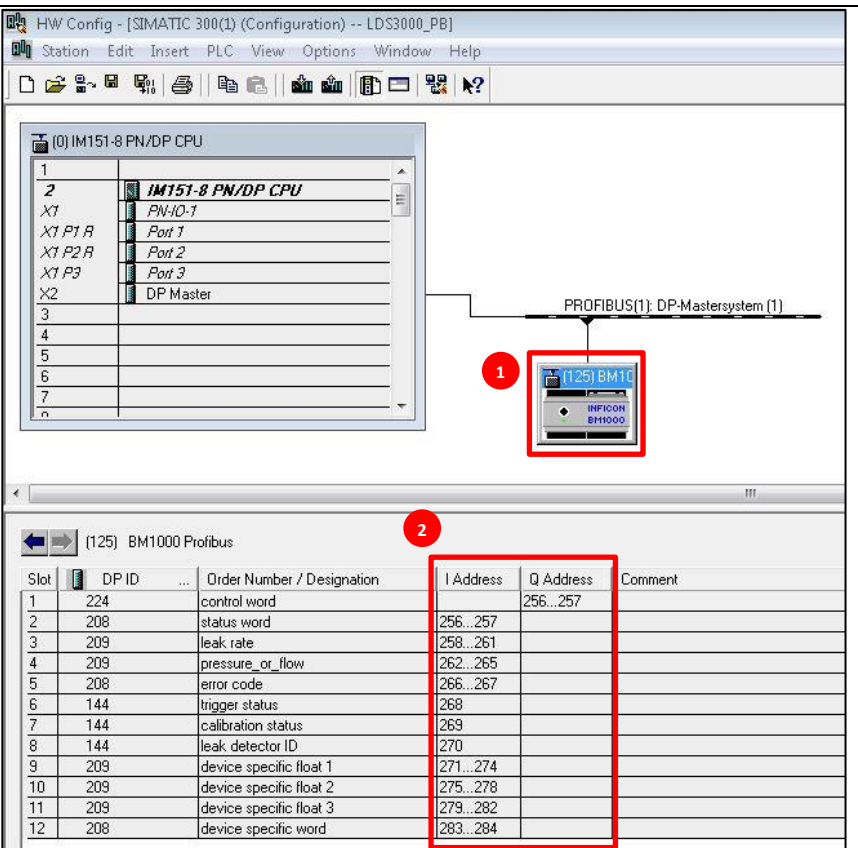
9. Save hardware configuration
10. Download hardware configuration to the PLC controller



3.3 Change I/O addresses of BM1000 PROFIBUS module

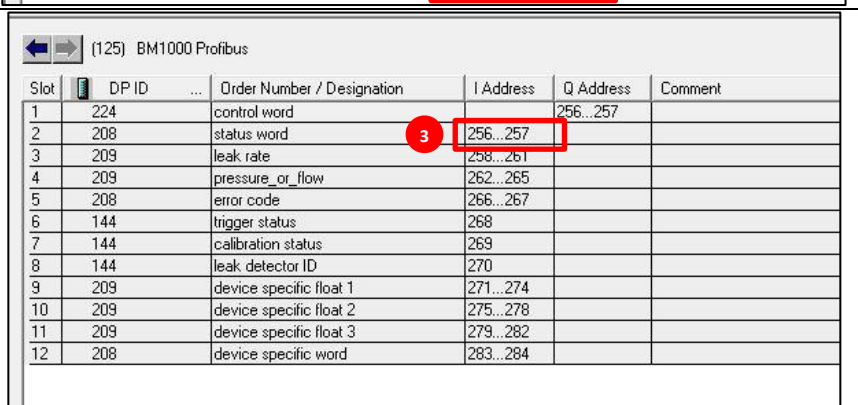
If required, the input or output addresses of the BM1000 PROFIBUS bus module can be adapted for cyclic data exchange. Therefore, open Hardware Configuration Manager of SIMATIC Step 7.

1. Select "**INFICON BM1000**" PROFIBUS module
2. The input and output addresses of each slot of the cyclic data exchange is shown



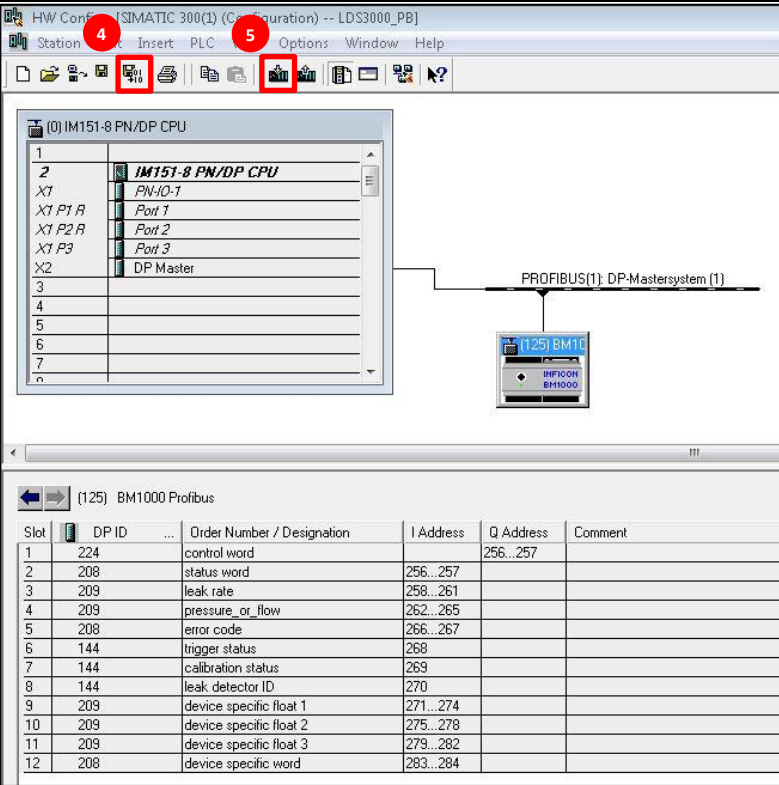
Slot	DP ID	Order Number / Designation	I Address	Q Address	Comment
1	224	control word		256...257	
2	208	status word	256...257		
3	209	leak rate	258...261		
4	209	pressure_or_flow	262...265		
5	208	error code	266...267		
6	144	trigger status	268		
7	144	calibration status	269		
8	144	leak detector ID	270		
9	209	device specific float 1	271...274		
10	209	device specific float 2	275...278		
11	209	device specific float 3	279...282		
12	208	device specific word	283...284		

3. Double click the address (I or Q address) to change the address of an input or output slot



Slot	DP ID	Order Number / Designation	I Address	Q Address	Comment
1	224	control word		256...257	
2	208	status word	256...257		
3	209	leak rate	258...261		
4	209	pressure_or_flow	262...265		
5	208	error code	266...267		
6	144	trigger status	268		
7	144	calibration status	269		
8	144	leak detector ID	270		
9	209	device specific float 1	271...274		
10	209	device specific float 2	275...278		
11	209	device specific float 3	279...282		
12	208	device specific word	283...284		

Note:
The input and output address needs to be in the same address range, if using acyclic data exchange!

	<p>In this example, the input adresse and also the output address are both in the same addresse range 256..257</p>																																																																														
<p>4. Safe hardware configuration</p> <p>5. Download hardware configuration to the PLC controller</p>	 <p>The screenshot shows the SIMATIC Manager HW Config interface. The hardware catalog on the left lists the IM151-8 PN/DP CPU and its ports. The main area shows the connection to the PROFIBUS network. The bottom table lists the PROFIBUS configuration for the BM1000 device.</p> <table border="1"> <thead> <tr> <th>Slot</th> <th>DP ID</th> <th>Order Number / Designation</th> <th>I Address</th> <th>Q Address</th> <th>Comment</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>224</td> <td>control word</td> <td></td> <td>256...257</td> <td></td> </tr> <tr> <td>2</td> <td>208</td> <td>status word</td> <td>256...257</td> <td></td> <td></td> </tr> <tr> <td>3</td> <td>209</td> <td>leak rate</td> <td>258...261</td> <td></td> <td></td> </tr> <tr> <td>4</td> <td>209</td> <td>pressure_or_flow</td> <td>262...265</td> <td></td> <td></td> </tr> <tr> <td>5</td> <td>208</td> <td>error code</td> <td>266...267</td> <td></td> <td></td> </tr> <tr> <td>6</td> <td>144</td> <td>trigger status</td> <td>268</td> <td></td> <td></td> </tr> <tr> <td>7</td> <td>144</td> <td>calibration status</td> <td>269</td> <td></td> <td></td> </tr> <tr> <td>8</td> <td>144</td> <td>leak detector ID</td> <td>270</td> <td></td> <td></td> </tr> <tr> <td>9</td> <td>209</td> <td>device specific float 1</td> <td>271...274</td> <td></td> <td></td> </tr> <tr> <td>10</td> <td>209</td> <td>device specific float 2</td> <td>275...278</td> <td></td> <td></td> </tr> <tr> <td>11</td> <td>209</td> <td>device specific float 3</td> <td>279...282</td> <td></td> <td></td> </tr> <tr> <td>12</td> <td>208</td> <td>device specific word</td> <td>283...284</td> <td></td> <td></td> </tr> </tbody> </table>	Slot	DP ID	Order Number / Designation	I Address	Q Address	Comment	1	224	control word		256...257		2	208	status word	256...257			3	209	leak rate	258...261			4	209	pressure_or_flow	262...265			5	208	error code	266...267			6	144	trigger status	268			7	144	calibration status	269			8	144	leak detector ID	270			9	209	device specific float 1	271...274			10	209	device specific float 2	275...278			11	209	device specific float 3	279...282			12	208	device specific word	283...284		
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3.4 Check PROFIBUS communication between PROFIBUS Master and INFICON BM1000 PROFIBUS slave

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

Therefore, the following steps need to be done:

1. Connect the leak detector with the BM1000 PROFIBUS Module by using the Data cable
2. Connect the BM1000 PROFIBUS Module with the PROFIBUS 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 PROFIBUS communication between the PROFIBUS master (e.g. PLC controller) and the BM1000 PROFIBUS bus module the info section of the CU1000 can be used. Therefore, the following menu needs to be opened:



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

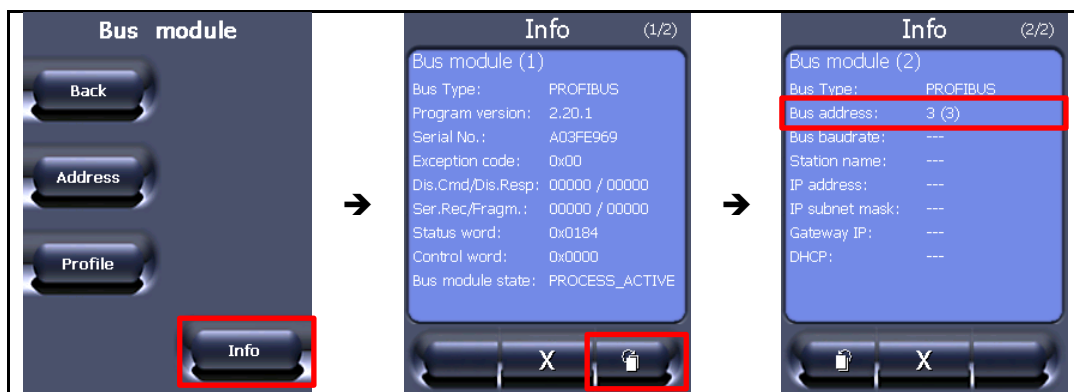
If the status of the "Bus module status" differs from "**PROCESS_ACTIVE**", there is an error in the PROFIBUS communication with the PROFIBUS master (e.g. PLC controller).

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

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

The second info menu displays

- Bus address



3.5 Cyclic data exchange – PROFIBUS Master and INFICON BM1000 PROFIBUS slave

The PROFIBUS master (e.g. PLC controller) cyclically exchanges data with the slaves on the PROFIBUS 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 PROFIBUS module.

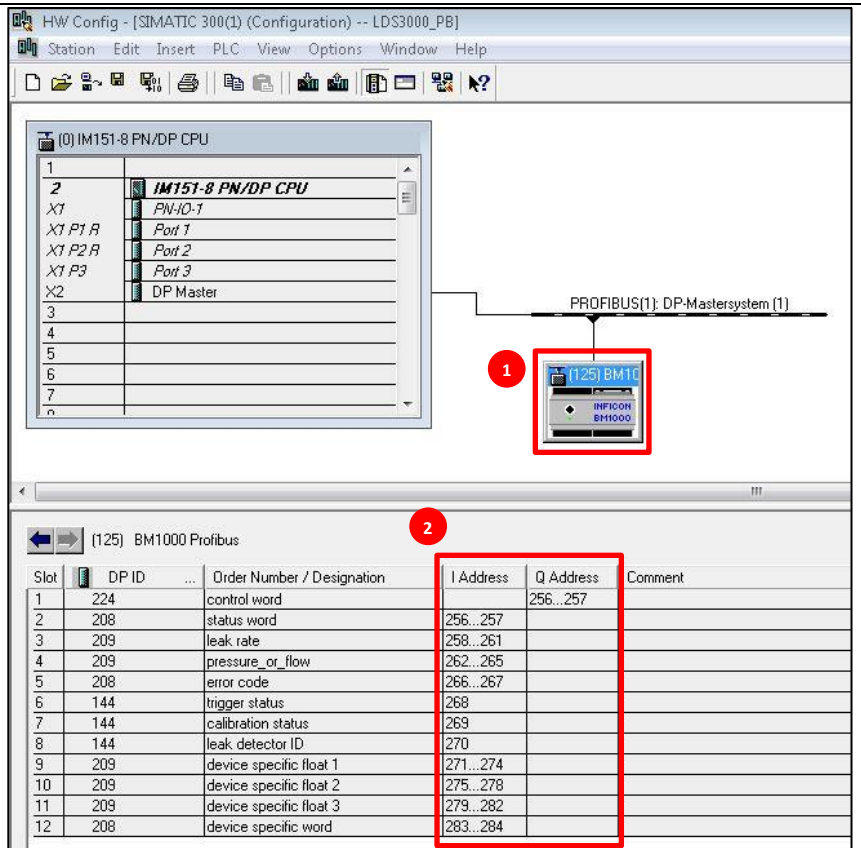
Note:

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 PROFIBUS Module is shown in the hardware configuration. To see the input and output data's the INFICON BM1000 PROFIBUS Module needs to be selected. Therefore, open Hardware Configuration Manager of SIMATIC Step 7.

1. Select "**INFICON BM1000**" PROFIBUS module
2. The input and output addresses of each slot of the cyclic data exchange is shown



HW Config - [SIMATIC 300(1) (Configuration) -- LDS3000_PB]

Station Edit Insert PLC View Options Window Help

(0) IM151-8 PN/DP CPU

1	
2	IM151-8 PN/DP CPU
X1	PN-ID-1
X1 P1 R	Port 1
X1 P2 R	Port 2
X1 P3	Port 3
X2	DP Master
3	
4	
5	
6	
7	
8	

PROFIBUS(1): DP-Mastersystem (1)

(125) BM1000 Profibus

Slot	DP ID	...	Order Number / Designation	I Address	Q Address	Comment
1	224		control word		256...257	
2	208		status word	258...257		
3	209		leak rate	262...261		
4	209		pressure_or_flow	266...265		
5	208		error code	271...267		
6	144		trigger status	268		
7	144		calibration status	269		
8	144		leak detector ID	270		
9	209		device specific float 1	271...274		
10	209		device specific float 2	275...278		
11	209		device specific float 3	279...282		
12	208		device specific word	283...284		

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

The control word (write process data) contains 2 bytes and is send periodically from the PROFIBUS 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 PROFIBUS 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.
	4		0x08 = 2 ... 3 dec.
	5	CAL mode	0 = external CAL
	6		0x10 = dyn. CAL
	7	Sniff/Vac	0x20 = not used
	8		0x30 = Peak find (AQ mode only)
	9	Sniff/Vac	0 = VAC
	10		0x40 = SNIF
	11		0x80 = according to PLC-Input
	12		0xC0 = not used

The assignment of the bitwise control word to the output address of the BM1000 PROFIBUS 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
	1		Transition 1 -> 0: 0x00 = Gasballast off (if Gasballast mode != GASBALLAST_ON)
	2	Zero mode	0 = normal
	3		0x04 = 1 ... 2 dec.
	4		0x08 = 2 ... 3 dec.
	5	CAL mode	0x0C = 19/20 part of the value
	6		0 = external CAL
	7	Sniff/Vac	0x10 = dyn. CAL
	8		0x20 = not used
	9		0x30 = Peak find (AQ mode only)
	10		
	11	Sniff/Vac	0 = VAC
	12		0x40 = SNIF
	13		0x80 = according to PLC-Input
	14		0xC0 = not used

Bit	DB ID	Order Number / Designation	I-Address	Q-Address	Comment
1	224	control word	256...257		
2	208	leak rate	258...261		
3	209	leak rate	258...261		
4	209	pressure_or_flow	262...265		
5	209	error code	266...267		
6	144	trigger status	268		
7	144	calibration status	269		
8	144	leak detector ID	270		
9	209	device specific float 1	271...274		
10	209	device specific float 2	275...278		
11	209	device specific float 3	279...282		
12	209	device specific word	283...284		

3.5.2 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	Calibarion 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		

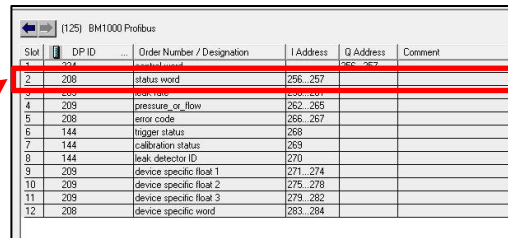
The next bytes 3 to 29 of the status word containing the leak rate, pressure, error codes and so on, which is shown in the next figure.

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 PROFIBUS 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
	5		
	6	State external calibration	0 = inactive 1 = 0x40 = active 2 = 0x80 = waiting for test leak closed 3 = 0xC0 = not used
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	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
	2		
	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		



Slot	DP ID	Order Number / Designation	I Address	Q Address	Comment
1	204	BM1000			
2	208	status word	256..257		
3	209	leak rate	260..261		
4	209	pressure_or_flow	262..265		
5	208	error code	266..267		
6	144	trigger status	268		
7	144	calibration status	269		
8	144	leak_detector ID	270		
9	209	device specific float 1	271..274		
10	209	device specific float 2	275..278		
11	209	device specific float 3	279..282		
12	208	device specific word	283..284		

Leak rate [mbar*l/l]:

Title	Byte	Bit	Name	Meaning
leak rate	3 ... 6		Leak rate (mbar*ls)	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
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

Slot	DP ID	Order Number / Designation	I Address	Q Address	Comment
1	224	control word		256...257	
2	208	status word	256...257		
3	209	leak rate	258...261		
4	209	pressure_or_flow	262...265		
5	208	error code	266...267		
6	144	trigger status	268		
7	144	calibration status	269		
8	144	leak detector ID	270		
9	209	device specific float 1	271...274		
10	209	device specific float 2	275...278		
11	209	device specific float 3	279...282		
12	208	device specific word	283...284		

Pressure or flow:

Title	Byte	Bit	Name	Meaning
leak rate	3 ... 6		Leak rate (mbar*ls)	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
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

Slot	DP ID	Order Number / Designation	I Address	Q Address	Comment
1	224	control word		256...257	
2	208	status word	256...257		
3	209	leak rate	258...261		
4	209	pressure_or_flow	262...265		
5	208	error code	266...267		
6	144	trigger status	268		
7	144	calibration status	269		
8	144	leak detector ID	270		
9	209	device specific float 1	271...274		
10	209	device specific float 2	275...278		
11	209	device specific float 3	279...282		
12	208	device specific word	283...284		

Error code:

Title	Byte	Bit	Name	Meaning
leak rate	3 ... 6		Leak rate (mbar*ls)	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
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

Slot	DP ID	Order Number / Designation	I Address	Q Address	Comment
1	224	control word		256...257	
2	208	status word	256...257		
3	209	leak rate	258...261		
4	209	pressure_or_flow	262...265		
5	208	error code	266...267		
6	144	trigger status	268		
7	144	calibration status	269		
8	144	leak detector ID	270		
9	209	device specific float 1	271...274		
10	209	device specific float 2	275...278		
11	209	device specific float 3	279...282		
12	208	device specific word	283...284		

Trigger status:

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	
		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

Slot	DP ID	Order Number / Designation	I Address	Q Address	Comment
1	224	control word		256...257	
2	208	status word	256...257		
3	209	leak rate	258...261		
4	209	pressure_or_flow	262...265		
5	209	error code	266...267		
6	144	trigger status	268		
7	144	calibration status	269		
8	144	leak detector ID	270		
9	209	device specific float 1	271...274		
10	209	device specific float 2	275...278		
11	209	device specific float 3	279...282		
12	208	device specific word	283...284		

Calibration status:

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	
		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

Slot	DP ID	Order Number / Designation	I Address	Q Address	Comment
1	224	control word		256...257	
2	208	status word	256...257		
3	209	leak rate	258...261		
4	209	pressure_or_flow	262...265		
5	209	error code	266...267		
6	144	trigger status	268		
7	144	calibration status	269		
8	144	leak detector ID	270		
9	209	device specific float 1	271...274		
10	209	device specific float 2	275...278		
11	209	device specific float 3	279...282		
12	208	device specific word	283...284		


Leak detector ID:

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	
		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

Slot	DP ID	Order Number / Designation	I Address	Q Address	Comment
1	224	control word		256...257	
2	208	status word	256...257		
3	209	leak rate	258...261		
4	209	pressure_or_flow	262...265		
5	209	error code	266...267		
6	144	trigger status	268		
7	144	calibration status	269		
8	144	leak detector ID	270		
9	209	device specific float 1	271...274		
10	209	device specific float 2	275...278		
11	209	device specific float 3	279...282		
12	208	device specific word	283...284		

Device specific float 1:


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



Slot	DP ID	Order Number / Designation	I Address	Q Address	Comment
1	224	control word		256...257	
2	208	status word	256...257		
3	209	leak_rate	258...261		
4	209	pressure_or_flow	262...265		
5	208	error_code	266...267		
6	144	trigger_status	268		
7	144	calibration_status	269		
8	144	leak_detector ID	270		
9	209	device specific float 1	271...274		
10	209	device specific float 2	275...278		
11	209	device specific float 3	279...282		
12	208	device specific word	283...284		

Device specific float 2:


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



Slot	DP ID	Order Number / Designation	I Address	Q Address	Comment
1	224	control word		256...257	
2	208	status word	256...257		
3	209	leak_rate	258...261		
4	209	pressure_or_flow	262...265		
5	208	error_code	266...267		
6	144	trigger_status	268		
7	144	calibration_status	269		
8	144	leak_detector ID	270		
9	209	device specific float 1	271...274		
10	209	device specific float 2	275...278		
11	209	device specific float 3	279...282		
12	208	device specific word	283...284		

Device specific float 3:

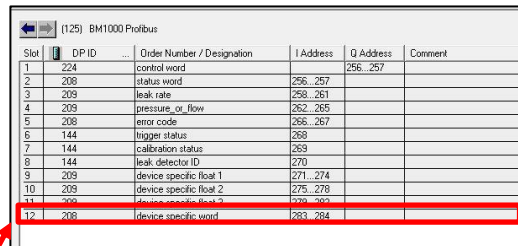
Title	Byte	Bit	Name	Meaning
leak_rate	3 ... 6		Leak rate (mbar/l/s)	Actual leak rate in mbar l/s (IEEE 754 float value)
pressure_or_flow	7 ... 10		Pressure	Pressure p1 in mbar (IEEE 754 float value)
error_code	11 ... 12		Actual error number	Error/warning code (16 bit unsigned integer)
trigger_status	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



Slot	DP ID	Order Number / Designation	I Address	Q Address	Comment
1	224	control word		256...257	
2	208	status word	256...257		
3	209	leak_rate	258...261		
4	209	pressure_or_flow	262...265		
5	208	error_code	266...267		
6	144	trigger_status	268		
7	144	calibration_status	269		
8	144	leak_detector ID	270		
9	209	device specific float 1	271...274		
10	209	device specific float 2	275...278		
11	209	device specific float 3	279...282		
12	208	device specific word	283...284		

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



Slot	DP ID	Order Number / Designation	I Address	Q Address	Comment
1	224	control word		256...257	
2	208	status word	266...267		
3	209	leak rate	268...269		
4	209	pressure_or_flow	262...265		
5	208	error code	266...267		
6	144	trigger status	268		
7	144	calibration status	269		
8	144	leak_detector ID	270		
9	209	device specific float 1	271...274		
10	209	device specific float 2	275...278		
11	209	device specific float 3	279...282		
12	208	device specific word	283...284		

3.6 Acyclic data exchange – PROFIBUS Master and INFICON BM1000 PROFIBUS slave

Attention:

If acyclic data transfer with PROFIBUS is needed, a PROFIBUS master which supports DPV1 data transfers has to be used. A PROFIBUS master which supports DPV0 only, can only use cyclic data transfer.

Acyclic data exchange between PROFIBUS DP-Master (e.g. PLC controller) and the INFICON BM1000 PROFIBUS 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 PROFIBUS DP-Master (e.g. PLC controller) and the INFICON BM1000 PROFIBUS 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 PROFIBUS 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**" of the protocol description.

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

3.6.1 Acyclic data exchange addressing rules

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

$$\text{LD command number} = \text{Slot} * 255 + \text{Index} + 1$$

In order to read or write a parameter by using the LD command numbers the **Slot** and also the **Index** needs to be calculated:

- ⇒ **Slot** = (LD command number – 1) DIV 255 (integer division)
- ⇒ **Index** = (LD command number – 1) MOD 255

Attention:

The calculation of the Slot has to be done by division using integers

$$\text{Slot} = (\text{LD command number} - 1) \text{ DIV } 255$$

3.6.2 Reading data from leak detector acyclically

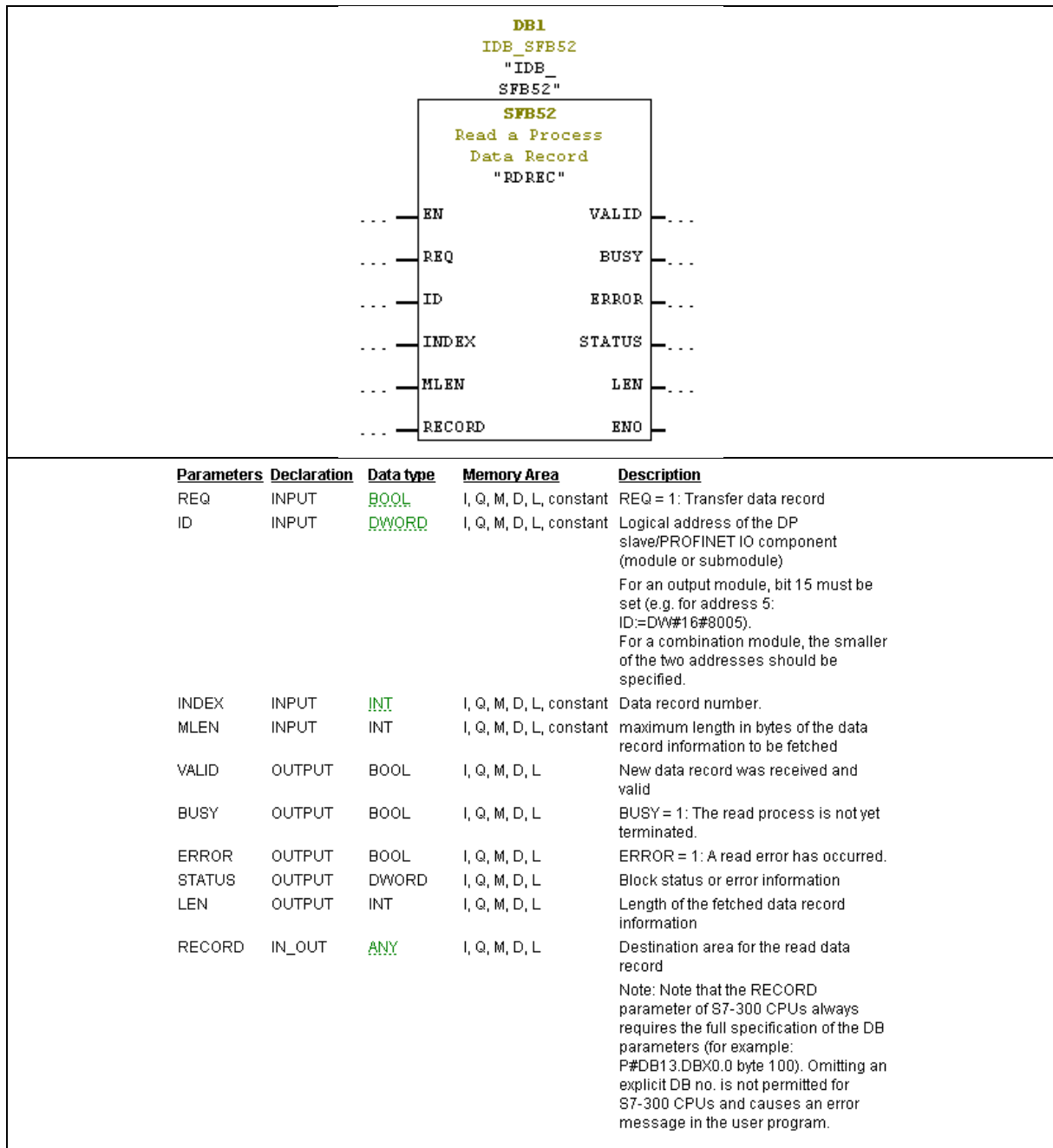
Acyclic reading and writing of parameters is limited, depending on the PLC controller of type S7-300.

SFB No.	SFB Name	Description	Execution Time in μs			
			312	31x, 147, 151, 154	317	319
52	RDREC	Read Data set from DP slave, PROFINET IO-Device or central module	500		272 μs + 6.4 μs / Bytes	214 μs + 6.25 μs / Byte
		concurrent running requests to different modules, max.	4 requests together with SFC 59 requests		8 requests together with SFC 59 requests	
53	WRREC	Write Data set to DP slave, PROFINET IO-Device or central module	1400 μs + 32 μs / Byte		248 μs + 5.25 μs / Byte	181 μs + 5.11 μs / Byte
		concurrent running requests to different modules, max.	4 requests together with SFC 58 requests		8 requests together with SFC 58 requests	

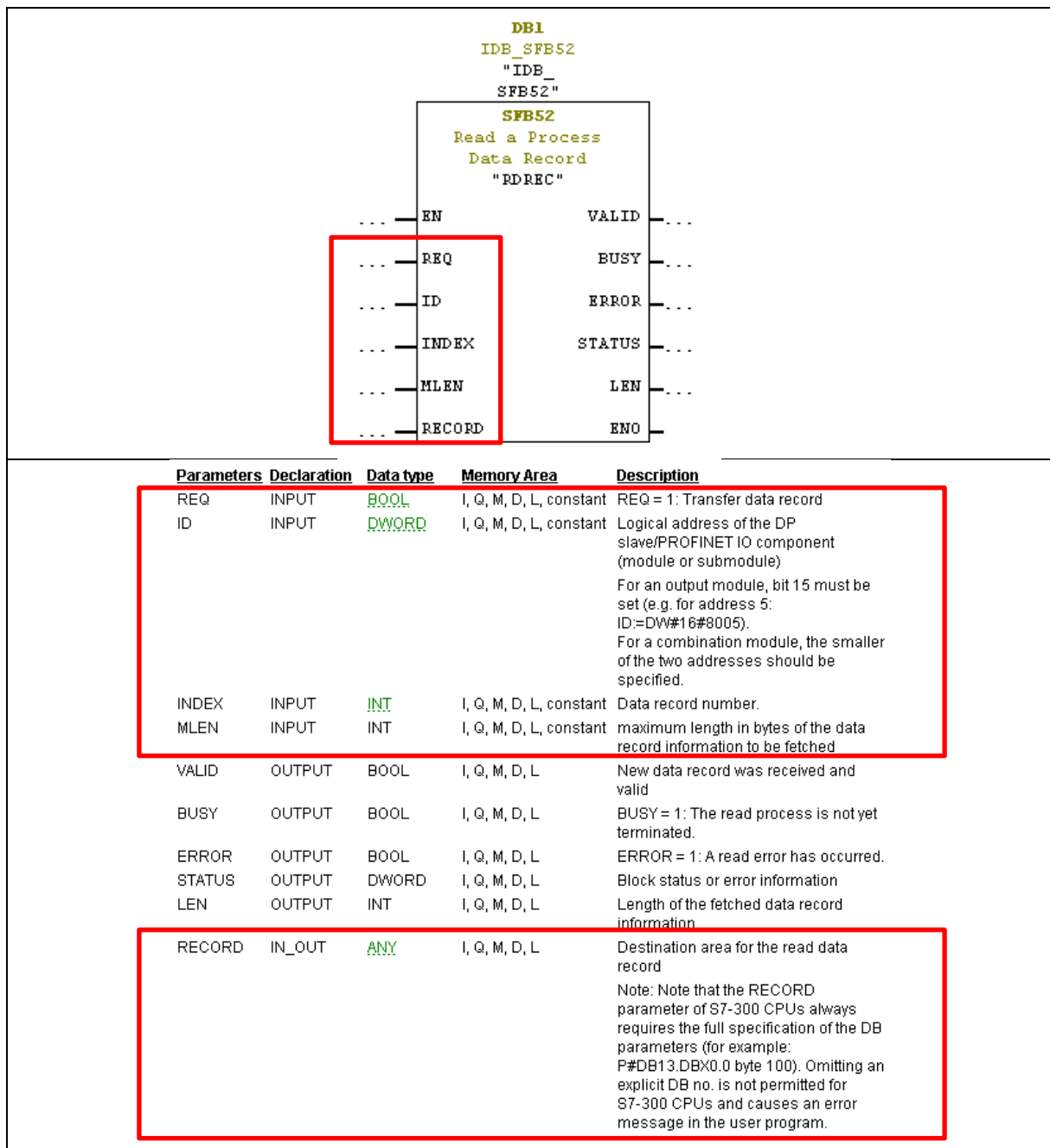
This information is taken out of the Siemens manual “**S7-300 Instruction List**” with the document number “**A5E00105517-10**”.

3.6.2.1 Using Siemens standard function block SFB52 "RDREC"

In order to read a data record acyclically from a PROFIBUS Slave, Siemens offers the Standard Function Block **SFB52 "RDREC"** in the library of the SIMATIC Step 7.



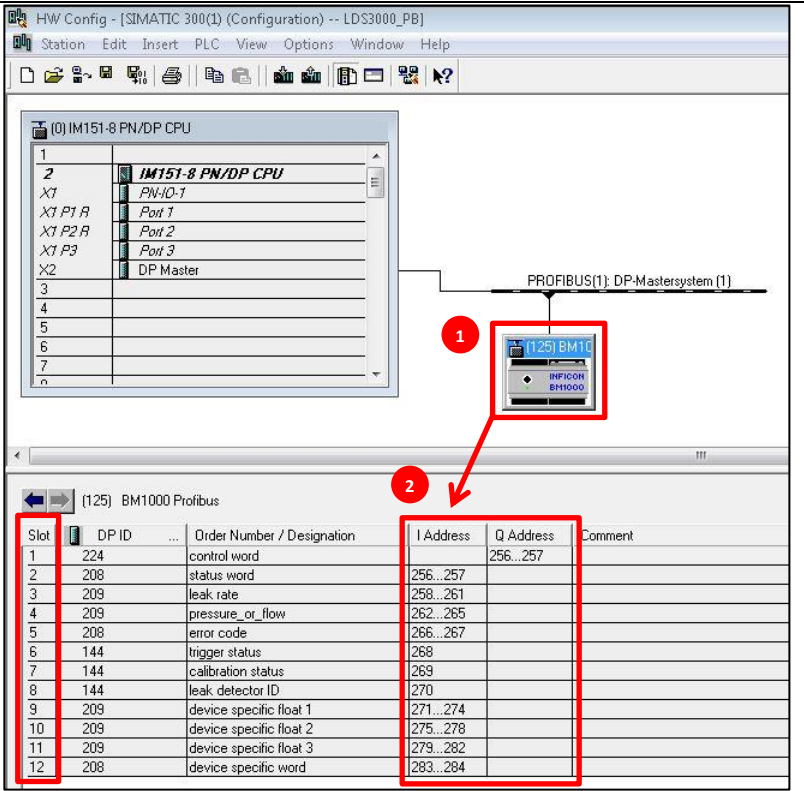
To read a parameter acyclically from the leak detector via the BM1000 PROFIBUS Module, the following input parameters of **SFB52 "RDREC"** needs to be set correspondingly to the LD command to be read:



3.6.2.1.1 Parameter ID

The parameter **ID** represents the logical address of the DP-Slave. To get the **ID** of an PROFIBUS DP-Slave the hardware configuration needs to be opened and the corresponding DP-Slave needs to be selected (e.g. BM1000 PROFIBUS Module).

1. Select "**INFICON BM1000**" PROFIBUS module
2. The starting address of the input and output addresses of each slot are representing the **ID**



Slot	DP ID	Order Number / Designation	I Address	Q Address	Comment
1	224	control word		256...257	
2	208	status word	256...257		
3	209	leak rate	258...261		
4	209	pressure_or_flow	262...265		
5	208	error code	266...267		
6	144	trigger status	268		
7	144	calibration status	269		
8	144	leak detector ID	270		
9	209	device specific float 1	271...274		
10	209	device specific float 2	275...278		
11	209	device specific float 3	279...282		
12	208	device specific word	283...284		

Each slot of the PROFIBUS slave has its own logical address range **ID**. The logical address ranges of the PROFIBUS BM1000 Module are shown above.

The logical address range of slot 1 in the given example begins at **Q Address 256**. Q Address means in this case, that the module type of slot 1 is an output module.

Depending on the slot module type (input or output module) the parameter **ID** needs to be set with the following rule:

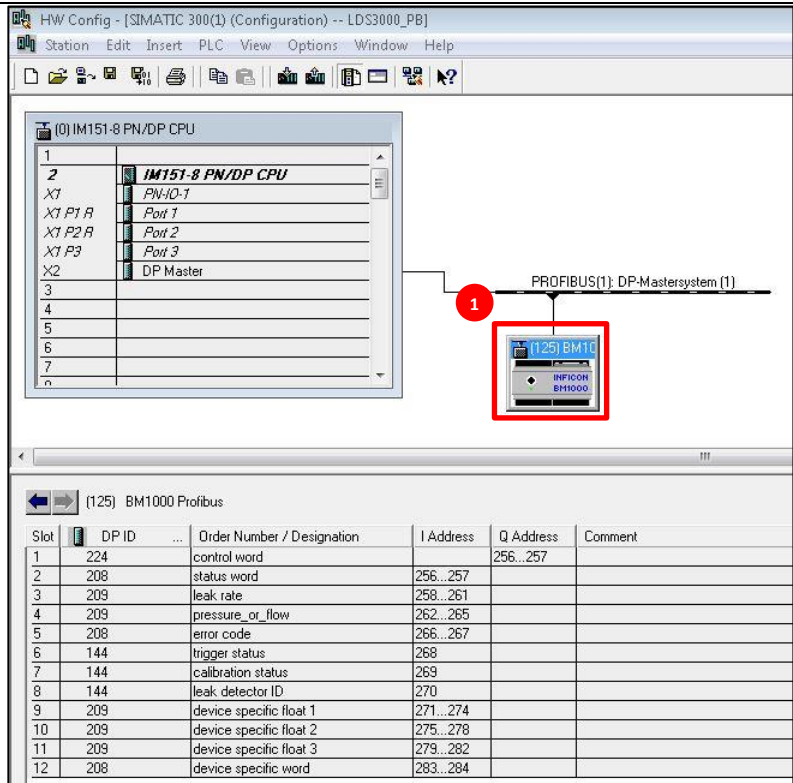
- If the module of the calculated slot is an **input module** then the **ID** needs to be set to the logical input address.
- If the module of the calculated slot is an **output module** then the **ID** needs to be set to the logical output address with additionally set bit 15 to "1".

Attention:

If the module of a slot is an **output module**, bit 15 needs to be set to “1” additionally to the logical output address

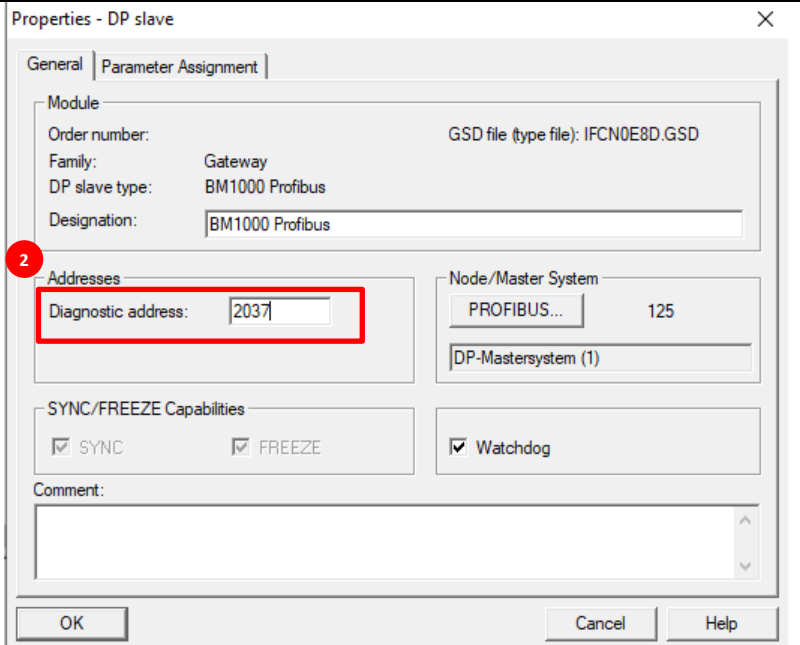
If the calculated slot number is 0, the **ID** must be set to the **diagnostic address** of the PROFIBUS module "**INFICON BM1000**" instead of the logical address of the slot of the input or output address.

1. Select and double click on the “**INFICON BM1000**” PROFIBUS module



Slot	DP ID	...	Order Number / Designation	I Address	Q Address	Comment
1	224		control word		256...257	
2	208		status word	256...257		
3	209		leak rate	258...261		
4	209		pressure_or_flow	262...265		
5	208		error code	266...267		
6	144		trigger status	268		
7	144		calibration status	269		
8	144		leak detector ID	270		
9	209		device specific float 1	271...274		
10	209		device specific float 2	275...278		
11	209		device specific float 3	279...282		
12	208		device specific word	283...284		

- Set ID to the diagnostic address of the “**INFICON BM1000**” PROFIBUS module



ID = 2037_{Dec} = 7F5_{Hex}

Example 1 = Slot number = 1:

The calculated slot number (Slot = (LD command number – 1) DIV 255) is 1, then the corresponding **ID** is 256. Furthermore, the module of slot 1 is an output module, so that bit 15 of the output address needs to be set to “**1**” additionally.

ID = logical address + bit 15 “1”

ID = 256_{dec} + bit 15 “1”

ID = 00000000_00000000_00000001_00000000_{bin} + bit 15 = “1”

ID = 00000000_00000000_10000001_00000000_{bin} = 8100_{Hex} = 33024_{dec}

↑
Bit 15 = „1“

ID = 8100_{Hex}

If setting bit 15 additionally to “**1**”, the ID changes from 256_{dec} to 33024_{dec}.

Example 2 – Slot number = 2:

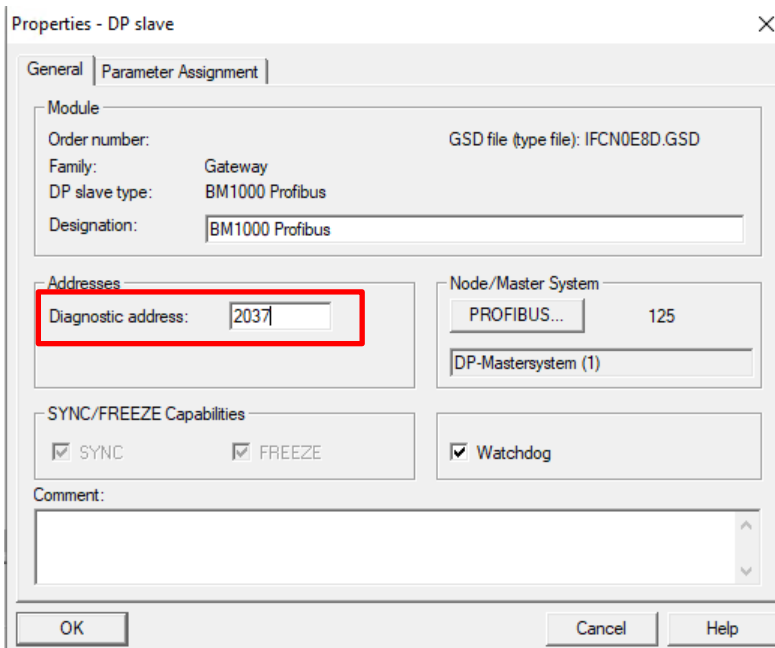
The calculated slot number (Slot = (LD command number – 1) DIV 255) is 2, than the corresponding ID is also 256. But in this case, the module of slot number 2 is an input module instead of an output module. Now, the logical address of slot number 2 needs to be used for the parameter ID.

ID = logical address

ID = 256_{dec} = 100_{Hex}

Example 3 – Slot number = 0:

The calculated slot number (Slot = (LD command number – 1) DIV 255) is 0, than the corresponding ID needs to be set to the diagnostic address of the “**INFICON BM1000**” PROFIBUS module.



The screenshot shows the 'Properties - DP slave' dialog box with the 'Parameter Assignment' tab selected. The 'Module' section shows 'Order number: Gateway', 'Family: BM1000 Profibus', 'DP slave type: BM1000 Profibus', and 'Designation: BM1000 Profibus'. The 'Addresses' section has 'Diagnostic address: 2037' highlighted with a red box. The 'Node/Master System' section shows 'PROFIBUS...' and '125'. The 'SYNC/FREEZE Capabilities' section has 'SYNC', 'FREEZE', and 'Watchdog' all checked. The 'Comment' field is empty. The 'OK', 'Cancel', and 'Help' buttons are at the bottom.

ID = 2037_{Dec} = 7F5_{Hex}

3.6.2.1.2 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)	

3.6.2.1.3 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]
SINT8	Signed 8 bit integer	1
SINT16	Signed 16 bit integer	2
SINT32	Signed 32 bit integer	4
UINT8	Unsigned 8 bit integer	1
UINT16	Unsigned 16 bit integer	2
UINT32	Unsigned 32 bit integer	4
FLOAT	Floating point / real number	4
CHAR	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:

520	208	Calibration factors vacuum	R/W	<div style="border: 2px solid red; padding: 2px;">FLOAT[3]</div>	Calibration factors for vacuum mode (and for AQ-mode) Index 0: mass 2 Index 1: mass 3 Index 2: mass 4
-----	-----	----------------------------	-----	--	---

The LD command 520 "Cal factors vacuum" 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 elements. It must be always read the whole array with all array elements.

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

3.6.2.1.4 Parameter **RECORD**

The parameter **RECORD** specifies the target for the data to be read. For this reason, the data type of the parameter **RECORD** needs 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 SIMATIC Step 7
SINT8	Signed 8 bit integer	Byte (INT)
SINT16	Signed 16 bit integer	INT
SINT32	Signed 32 bit integer	DINT
UINT8	Unsigned 8 bit integer	INT
UINT16	Unsigned 16 bit integer	WORD
UINT32	Unsigned 32 bit integer	DWORD
FLOAT	Floating point / real number	REAL
CHAR	Character	CHAR

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:

The calibration factor vacuum should be read or write. The corresponding LD command is 520, shown in the next figure.

520	208	Calibration factors vacuum	R/W	FLOAT[3]	Calibration factors for vacuum mode (and for AQ-mode) Index 0: mass 2 Index 1: mass 3 Index 2: mass 4
-----	-----	----------------------------	-----	----------	---

The LD command 520 "Calibration factors vacuum" is an array with 3 array elements of data type FLOAT. The data type FLOAT corresponds to the data type REAL in the SIMATIC Step 7.

Please use as **RECORD** value: Array[0..2] of REAL as shown in the next figure.

LD520_CAL_factors_VAC	ARRAY[0..2]		LD 520: Calibration factors vacuum
	REAL		

3.6.2.2 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 of 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)	

Calculation of the **Slot** and **Index** numbers based on the LD command number:

- **Calculation of the Slot number:**

Slot = (LD command number – 1) DIV 255 (integer division)

Slot = (506 – 1) DIV 255

Slot = 1

- **Calculation of the Index number:**

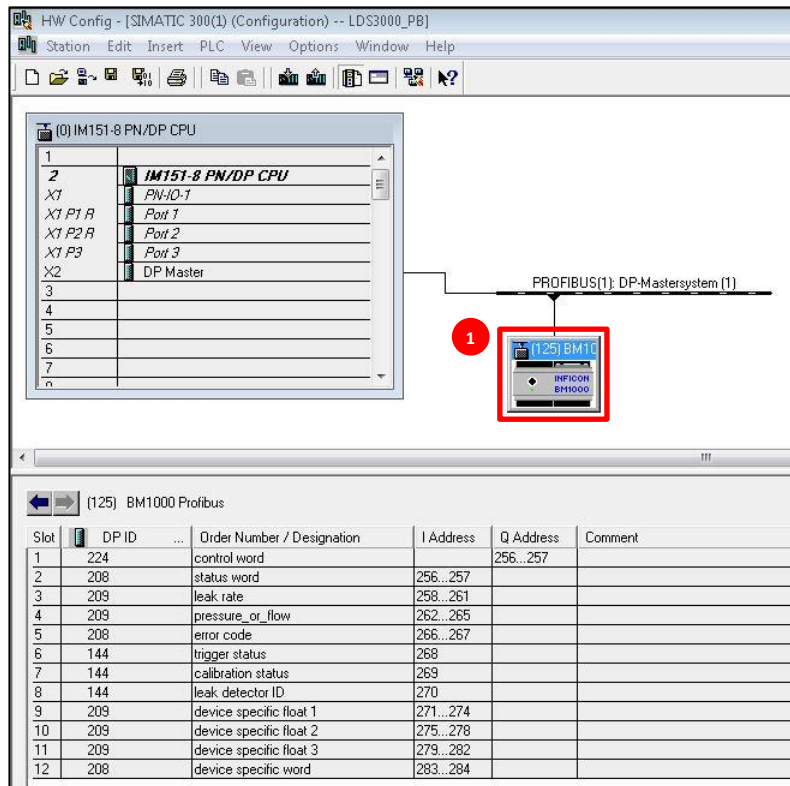
Index = (LD command number – 1) MOD 255

Index = (506 – 1) MOD 255

Index = 250

Based on the calculated Slot number, the parameter **ID** of the SFB52 “RDREC” function needs to be set. Therefore, the hardware configuration needs to be opened and the INFICON BM1000 PROFIBUS Module needs to be selected.

1. Select “**INFICON BM1000**” PROFIBUS module



HW Config - [SIMATIC 300(1) (Configuration) -- LDS3000_PB]

Station Edit Insert PLC View Options Window Help

(0) IM151-8 PN/DP CPU

1	
2	IM151-8 PN/DP CPU
X1	PN-IO-1
X1 P1 R	Port 1
X1 P2 R	Port 2
X1 P3	Port 3
X2	DP Master
3	
4	
5	
6	
7	
8	

PROFIBUS(1): DP-Mastersystem (1)

1

(125) BM1000 Profibus

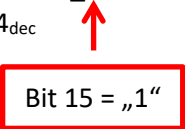
Slot	DP ID	Order Number / Designation	I Address	Q Address	Comment
1	224	control word		256...257	
2	208	status word	256...257		
3	209	leak rate	258...261		
4	209	pressure_or_flow	262...265		
5	208	error code	266...267		
6	144	trigger status	268		
7	144	calibration status	269		
8	144	leak detector ID	270		
9	209	device specific float 1	271...274		
10	209	device specific float 2	275...278		
11	209	device specific float 3	279...282		
12	208	device specific word	283...284		

2. Get Input / Output address based on the calculated **slot number**

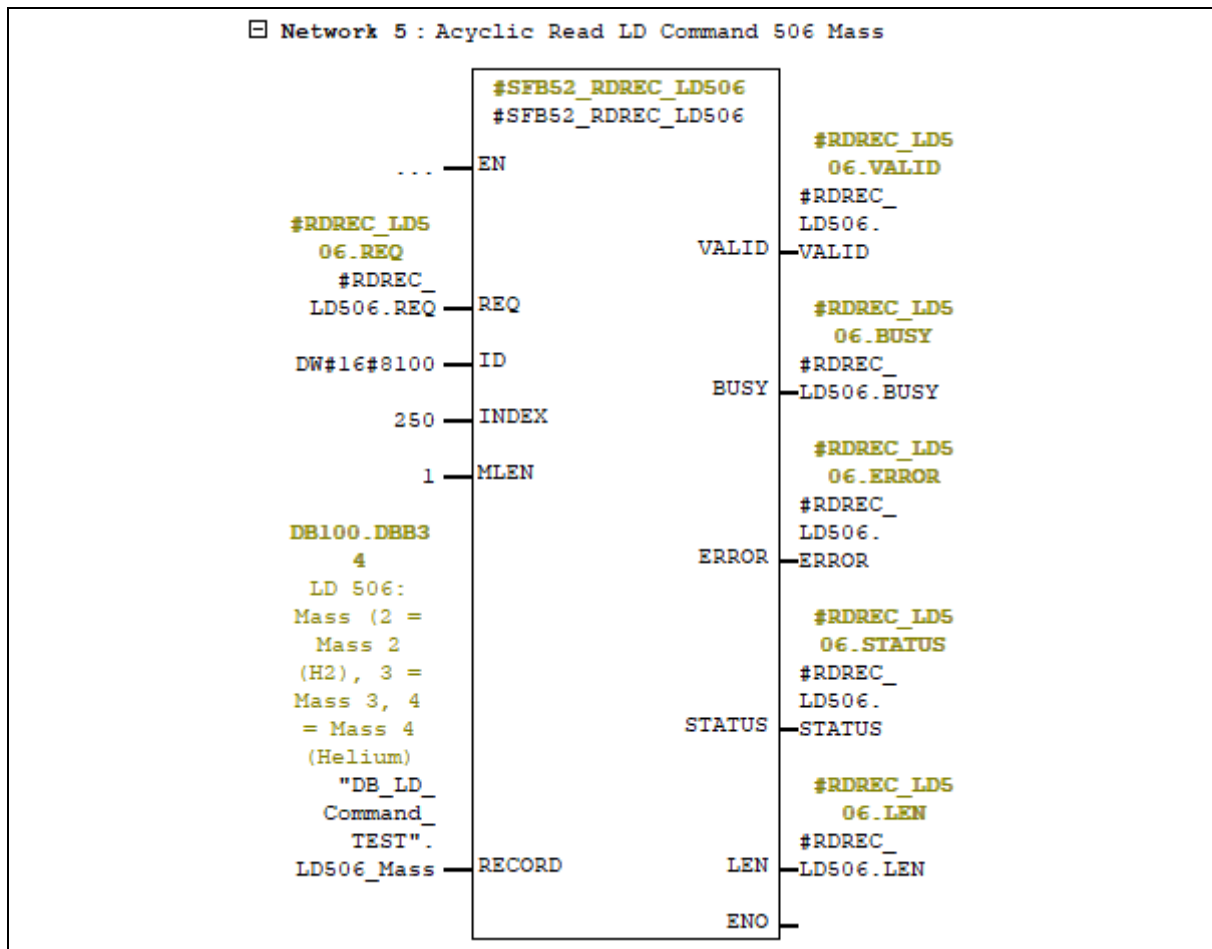
(125) BM1000 Profibus

Slot	DP ID	Order Number / Designation	I Address	Q Address	Comment
1	224	control word		256...257	
2	208	status word	256...257		
3	209	leak rate	258...261		
4	209	pressure_or_flow	262...265		
5	208	error code	266...267		
6	144	trigger status	268		
7	144	calibration status	269		
8	144	leak detector ID	270		
9	209	device specific float 1	271...274		
10	209	device specific float 2	275...278		
11	209	device specific float 3	279...282		
12	208	device specific word	283...284		

In this example, slot number 1 was calculated. Slot number 1 has the **Q Address 256...257**. Only the starting address needs to be taken, in this case the starting Q address **256**.

3. Set the parameter " ID "	<p>Since slot 1 is an output module type, the ID need to be calculate by taking the starting address of slot 1 (256) and setting bit 15 of the starting address additionally to "1".</p> <p> $ID = 256_{dec} + \text{bit 15} = "1"$ $ID = 00000000_00000000_00000001_00000000_{bin} + \text{bit 15} = "1"$ $ID = 00000000_00000000_10000001_00000000_{bin}$ $ID = 8100_{Hex} = 33024_{dec}$ </p> <div style="text-align: center;">  </div> <p>ID = 8100_{Hex}</p> <p>If setting bit 15 additionally to "1", the ID changes from 256_{dec} to 33024_{dec} (8100_{Hex}).</p>
4. Set parameter " MLEN "	<p>The parameter "MLEN" represents the length of the data to be read in bytes.</p> <p>The length of the LD command to be read needs to be taken out of the LD command table, based on the data type.</p> <p>LD command 506 is from data type UINT8, which corresponds to a length of 1 byte. So the parameter "MLEN" needs to be set to 1.</p> <p>MLEN = 1</p>

Based on the calculated **Slot / Index** numbers and the **ID** the parameters of the SFB52 "RDREC" Function needs to be set:



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	DW#16#8100	<p>The parameter ID represents the logical address of the DP-Slave BM1000 PROFIBUS bus module based on the calculated slot number</p> <p> $ID = 256_{dec} + \text{bit } 15 = "1"$ $ID = 00000000_00000000_00000001_00000000_{bin} + \text{bit } 15 = "1"$ $ID = 00000000_00000000_10000001_00000000_{bin}$ $ID = 8100_{Hex} = 33024_{dec}$ </p> <p>↑</p> <p>Bit 15 = „1“</p> <p>ID = 8100_{Hex}</p>
INDEX	250	<p>Index, based on the calculated index number</p> <p> Index = (LD command number – 1) MOD 255 Index = (506 – 1) MOD 255 = 250 </p>

MLEN	1	Length to be read in bytes Data type = UINT8 = 1 byte					
RECORD	BYTE	<p>The parameter “RECORD” represents the target path, where the data to be read should be stored. This parameter must have the same data type and the same dimensions like the LD command to be read.</p> <p>In this case, LD command 506 is from data type UINT8 with a length of 1 byte, so the corresponding STEP 7 data type is BYTE.</p> <table><tr><td>+34.0</td><td>LD506_Mass</td><td>BYTE</td><td>B#16#0</td><td>LD 506: Mass (2 = Mass 2 (H2), 3 = Mass 3, 4 = Mass 4 (Helium))</td></tr></table>	+34.0	LD506_Mass	BYTE	B#16#0	LD 506: Mass (2 = Mass 2 (H2), 3 = Mass 3, 4 = Mass 4 (Helium))
+34.0	LD506_Mass	BYTE	B#16#0	LD 506: Mass (2 = Mass 2 (H2), 3 = Mass 3, 4 = Mass 4 (Helium))			

All other parameters are set user-dependently.

3.6.2.3 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		Name	R/W	Data type	Meaning	No fieldbus support
dez	hex					
506	1FA	Mass	R/W	UINT8	2 = Mass 2 (H2) 3 = Mass 3 4 = Mass 4 (Helium)	
508	1FC	Amplifier control location	R/W	UINT8	Amplifier control location 1 = automatic on (default) 0 = automatic off Write access only possible if "Manual control for service" is active	
519	207	Cal factors sniff high flow	R/W	FLOAT[3]	Calibration factors for sniff mode high flow. LDS3000(AQ)/XL3000flex only. Index 0: mass 2 Index 1: mass 3 Index 2: mass 4	
520	208	Calibration factors vacuum	R/W	FLOAT[3]	Calibration factors for vacuum mode (and for AQ-mode) Index 0: mass 2 Index 1: mass 3 Index 2: mass 4	

Calculation of the **Slot** and **Index** numbers based on the LD command number

- **Calculation of the Slot number:**
Slot = (LD command number – 1) DIV 255 (integer division)
Slot = (520 – 1) DIV 255
Slot = 2

- **Calculation of the Index number:**

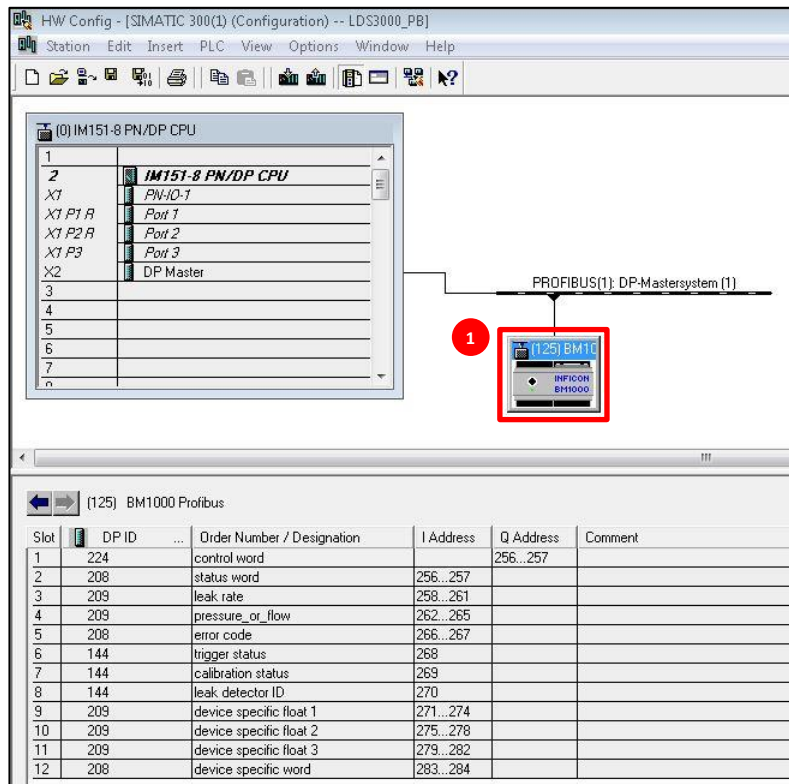
Index = (LD command number – 1) MOD 255

Index = (520 – 1) MOD 255

Index = 9

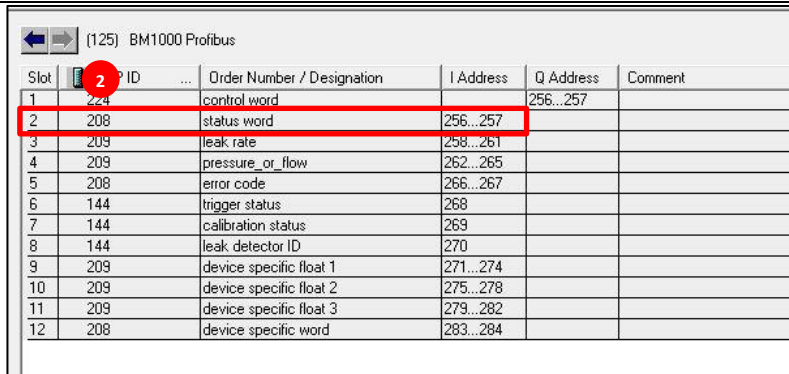
Based on the calculated Slot number, the parameter **ID** of the SFB52 “RDREC” function needs to be set. Therefore, the hardware configuration needs to be opened and the INFICON BM1000 PROFIBUS Module needs to be selected.

1. Select “**INFICON BM1000**” PROFIBUS module



Slot	DP ID	Order Number / Designation	I Address	Q Address	Comment
1	224	control word		256...257	
2	208	status word	256...257		
3	209	leak rate	258...261		
4	209	pressure_or_flow	262...265		
5	208	error code	266...267		
6	144	trigger status	268		
7	144	calibration status	269		
8	144	leak detector ID	270		
9	209	device specific float 1	271...274		
10	209	device specific float 2	275...278		
11	209	device specific float 3	279...282		
12	208	device specific word	283...284		

2. Get Input / Output address based on the calculated **slot number**

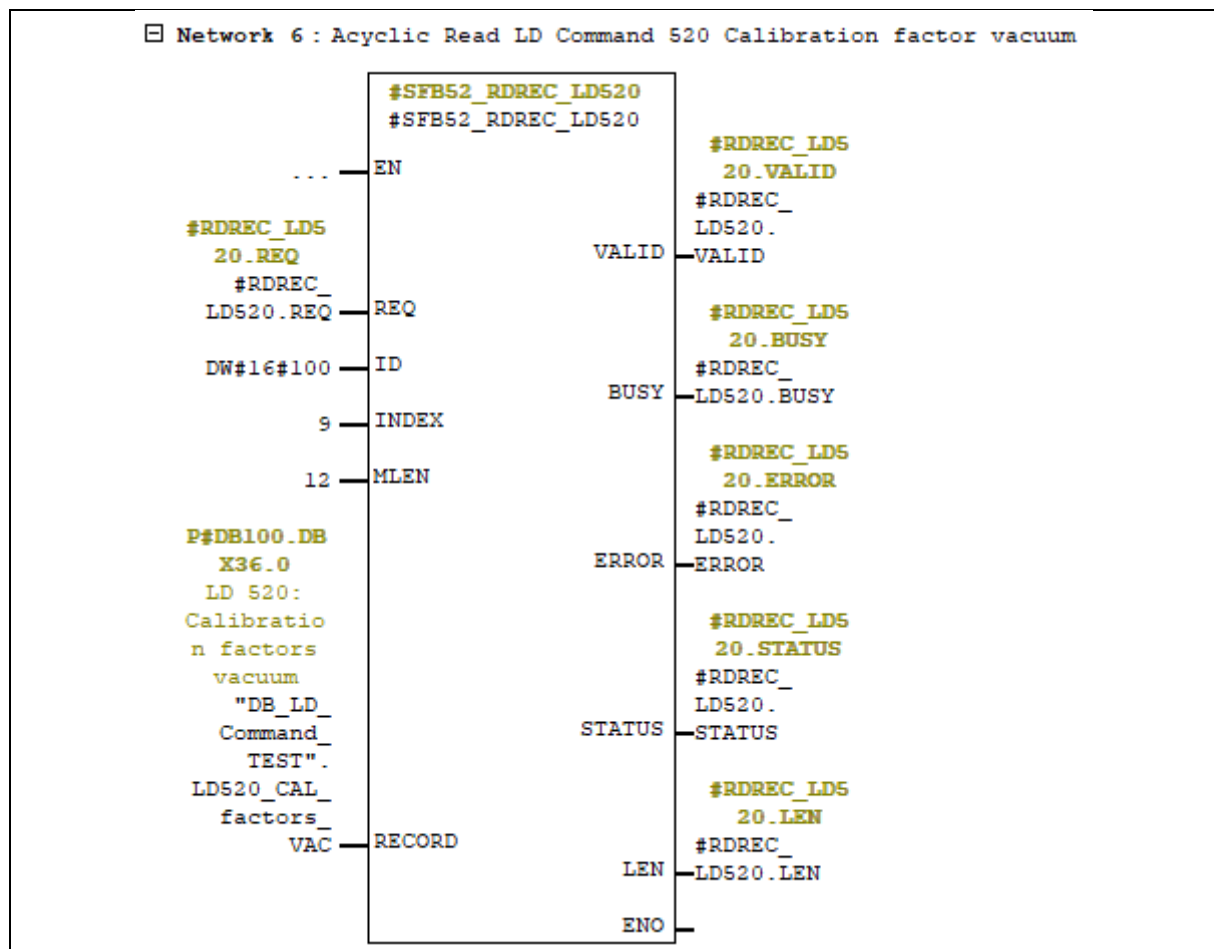


Slot	DP ID	Order Number / Designation	I Address	Q Address	Comment
1	224	control word		256...257	
2	208	status word	256...257		
3	209	leak rate	258...261		
4	209	pressure_or_flow	262...265		
5	208	error code	266...267		
6	144	trigger status	268		
7	144	calibration status	269		
8	144	leak detector ID	270		
9	209	device specific float 1	271...274		
10	209	device specific float 2	275...278		
11	209	device specific float 3	279...282		
12	208	device specific word	283...284		

In this example, slot number 2 was calculated. Slot number 2 has the **I Address 256...257**. Only the starting address needs to be taken, in this case the starting I Address **256**.

3. Set the parameter " ID "	<p>Since slot 2 is an input module type, the ID is equal to the start address of the input address.</p> <p>ID = 256_{dec} = 100_{Hex}</p>
4. Set parameter " MLEN "	<p>The parameter "MLEN" represents the length of the data to be read in bytes.</p> <p>The length of the LD command to be read needs to be taken out of the LD command table, based on the data type.</p> <p>LD command 520 is from data type FLOAT[3], which represents an array with 3 array elements of data type FLOAT. The data type FLOAT corresponds to the data type REAL in STEP7. The data type REAL has a length of 4 bytes.</p> <p>MLEN = FLOAT[3] = REAL[3] = 3 * 4 bytes = 12 bytes</p> <p>So the parameter "MLEN" needs to be set to 12</p>

Based on the calculated **Slot / Index** numbers and the **ID** the parameters of the SFB52 "RDREC" Function needs to be set:



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	DW#16#100	<p>The parameter ID represents the logical address of the DP-Slave BM1000 PROFIBUS bus module based on the calculated slot number</p> <p>$ID = 256_{dec} = 100_{Hex}$</p> <p>ID = 100_{Hex}</p>										
INDEX	9	<p>Index, based on the calculated index number</p> <p>Index = (LD command number – 1) MOD 255 Index = (520 – 1) MOD 255 = 9</p>										
MLEN	12	<p>Length to be read in bytes</p> <p>Data type = FLOAT[3] = REAL[3] = 3 * 4 bytes = 12 bytes</p>										
RECORD	Array[0..2] of REAL	<p>The parameter “RECORD” represents the target path, where the data to be read should be stored. This parameter must have the same data type and the same dimensions like the LD command to be read.</p> <p>In this case, LD command 520 is from data type FLOAT[3] with a total length of 12 byte, so the corresponding STEP 7 data type is Array[0..2] of REAL.</p> <table><tr><td>+36.0</td><td>LDS20_CAL_factors_VAC</td><td>ARRAY[0..2]</td><td></td><td>LD 520: Calibration factors vacuum</td></tr><tr><td>*4.0</td><td></td><td>REAL</td><td></td><td></td></tr></table>	+36.0	LDS20_CAL_factors_VAC	ARRAY[0..2]		LD 520: Calibration factors vacuum	*4.0		REAL		
+36.0	LDS20_CAL_factors_VAC	ARRAY[0..2]		LD 520: Calibration factors vacuum								
*4.0		REAL										

All other parameters are set user-dependently.

3.6.2.4 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:

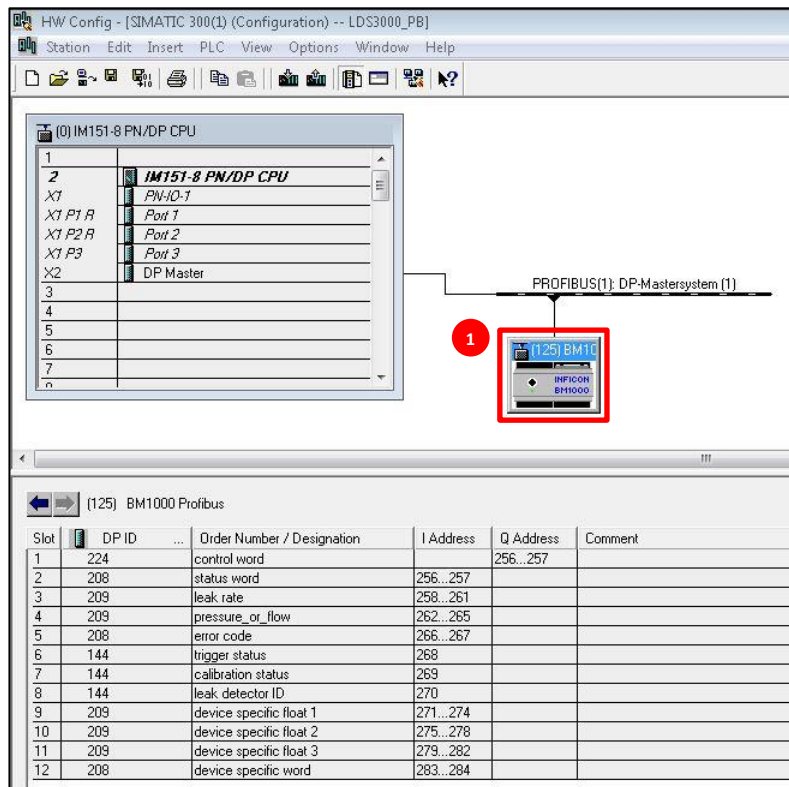
Command		Name	R/W	Data type	Meaning	No fieldbus support
dez	hex					
385	181	Trigger [mbar*l/s]	R/W	FLOAT[4]	Trigger in mbar*l/s Index 0: Trigger 1 Index 1: Trigger 2 Index 2: Trigger 3 Index 3: Trigger 4	

Calculation of the **Slot** and **Index** numbers based on the LD command number

- Calculation of the Slot number:**
 $\text{Slot} = (\text{LD command number} - 1) \text{ DIV } 255 \text{ (integer division)}$
 $\text{Slot} = (385 - 1) \text{ DIV } 255$
Slot = 1
- Calculation of the Index number:**
 $\text{Index} = (\text{LD command number} - 1) \text{ MOD } 255$
 $\text{Index} = (385 - 1) \text{ MOD } 255$
Index = 129

Based on the calculated Slot number, the parameter **ID** of the SFB52 “RDREC” function needs to be set. Therefore, the hardware configuration needs to be opened and the INFICON BM1000 PROFIBUS Module needs to be selected.

1. Select “**INFICON BM1000**” PROFIBUS module



HW Config - [SIMATIC 300(1) (Configuration) -- LDS3000_PB]

Station Edit Insert PLC View Options Window Help

(0) IM151-8 PN/DP CPU

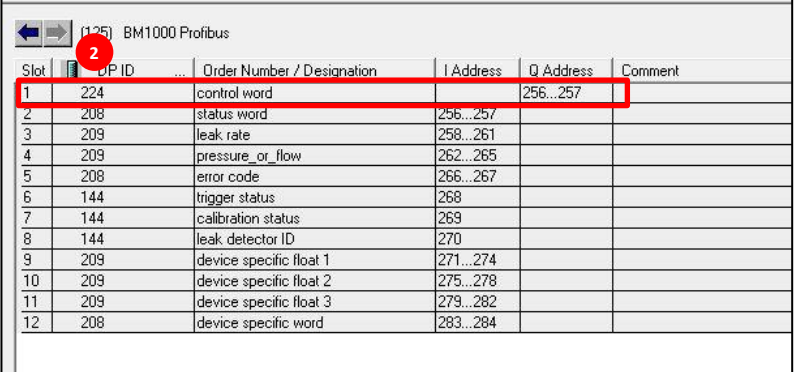
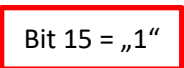
1	
2	IM151-8 PN/DP CPU
X1	PN-IO-1
X1 P1 R	Port 1
X1 P2 R	Port 2
X1 P3	Port 3
X2	DP Master
3	
4	
5	
6	
7	
n	

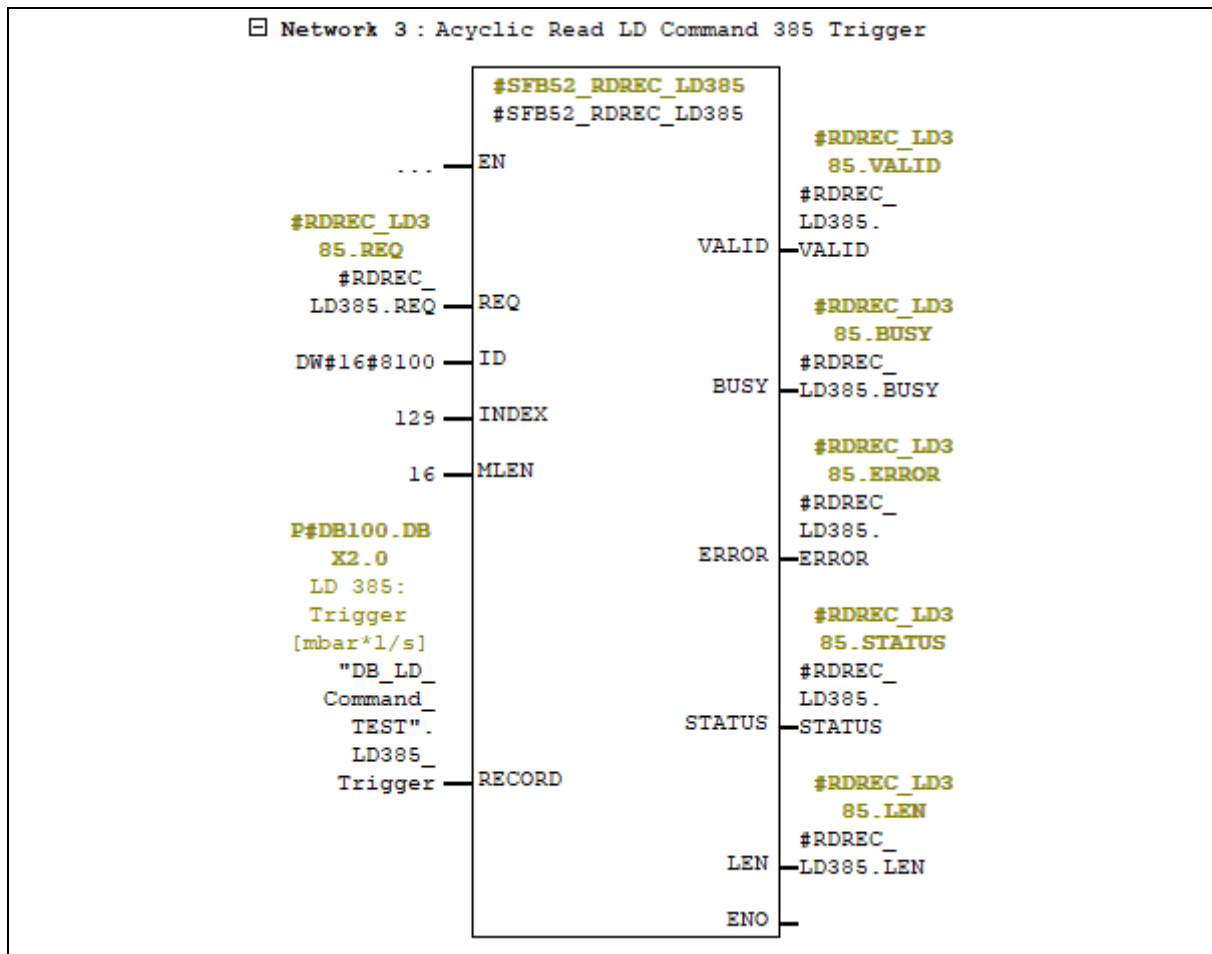
PROFIBUS(1): DP-Mastersystem (1)


1

(125) BM1000 Profibus

Slot	DP ID	Order Number / Designation	I Address	Q Address	Comment
1	224	control word		256...257	
2	208	status word	256...257		
3	209	leak rate	258...261		
4	209	pressure_or_flow	262...265		
5	208	error code	266...267		
6	144	trigger status	268		
7	144	calibration status	269		
8	144	leak detector ID	270		
9	209	device specific float 1	271...274		
10	209	device specific float 2	275...278		
11	209	device specific float 3	279...282		
12	208	device specific word	283...284		

<p>2. Get Input / Output address based on the calculated slot number</p>	 <p>In this example, slot number 1 was calculated. Slot number 1 has the Q Address 256...257. Only the starting address needs to be taken, in this case the starting Q address 256.</p>
<p>3. Set the parameter "ID"</p>	<p>Since slot 1 is an output module type, the ID need to be calculate by taking the starting address of slot 1 (256) and setting bit 15 of the starting address additionally to "1".</p> <p> $ID = 256_{dec} + \text{bit } 15 = "1"$ $ID = 00000000_00000000_00000001_00000000_{bin} + \text{bit } 15 = "1"$ $ID = 00000000_00000000_10000001_00000000_{bin}$ $ID = 8100_{Hex} = 33024_{dec}$ </p> <p style="text-align: center;">  </p> <p>ID = 8100_{Hex}</p> <p>If setting bit 15 additionally to "1", the ID changes from 256_{dec} to 33024_{dec} (8100_{Hex}).</p>
<p>4. Set parameter "MLEN"</p>	<p>The parameter "MLEN" represents the length of the data to be read in bytes.</p> <p>The length of the LD command to be read needs to be taken out of the LD command table, based on the data type.</p> <p>LD command 385 is from data type FLOAT[4], which represents an array with 4 array elements of data type FLOAT. The data type FLOAT corresponds to the data type REAL in STEP7. The data type REAL has a length of 4 bytes.</p> <p>MLEN = FLOAT[4] = REAL[4] = 4 * 4 bytes = 16 bytes</p> <p>So the parameter "MLEN" needs to be set to 16.</p>



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	DW#16#8100	<p>The parameter ID represents the logical address of the DP-Slave BM1000 PROFIBUS bus module based on the calculated slot number</p> <p> $ID = 256_{dec} + \text{bit 15} = "1"$ $ID = 00000000_00000000_00000001_00000000_{bin} + \text{bit 15} = "1"$ $ID = 00000000_00000000_10000001_00000000_{bin}$ $ID = 8100_{Hex} = 33024_{dec}$ </p> <p style="text-align: center;">  <div style="border: 1px solid red; padding: 2px; display: inline-block;">Bit 15 = „1“</div> </p> <p>ID = 8100_{Hex}</p>
INDEX	129	<p>Index, based on the calculated index number</p> <p> Index = (LD command number – 1) MOD 255 Index = (385 – 1) MOD 255 = 129 </p>

MLEN	16	Length to be read in bytes Data type = FLOAT[4] = 4 bytes * 4 = 16 bytes										
RECORD	Array[0..3] of REAL	<p>The parameter “RECORD” represents the target path, where the data to be read should be stored. This parameter must have the same data type and the same dimensions like the LD command to be read.</p> <p>In this case, LD command 385 is from data type FLOAT[4] with a total length of 16 byte, so the corresponding STEP 7 data type is Array[0..3] of REAL.</p> <table><tr><td>+2.0</td><td>LD385_Trigger</td><td>ARRAY[0..3]</td><td></td><td>LD 385: Trigger [mbar*1/s]</td></tr><tr><td>*4.0</td><td></td><td>REAL</td><td></td><td></td></tr></table>	+2.0	LD385_Trigger	ARRAY[0..3]		LD 385: Trigger [mbar*1/s]	*4.0		REAL		
+2.0	LD385_Trigger	ARRAY[0..3]		LD 385: Trigger [mbar*1/s]								
*4.0		REAL										

All other parameters are set user-dependently.

3.6.2.5 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:

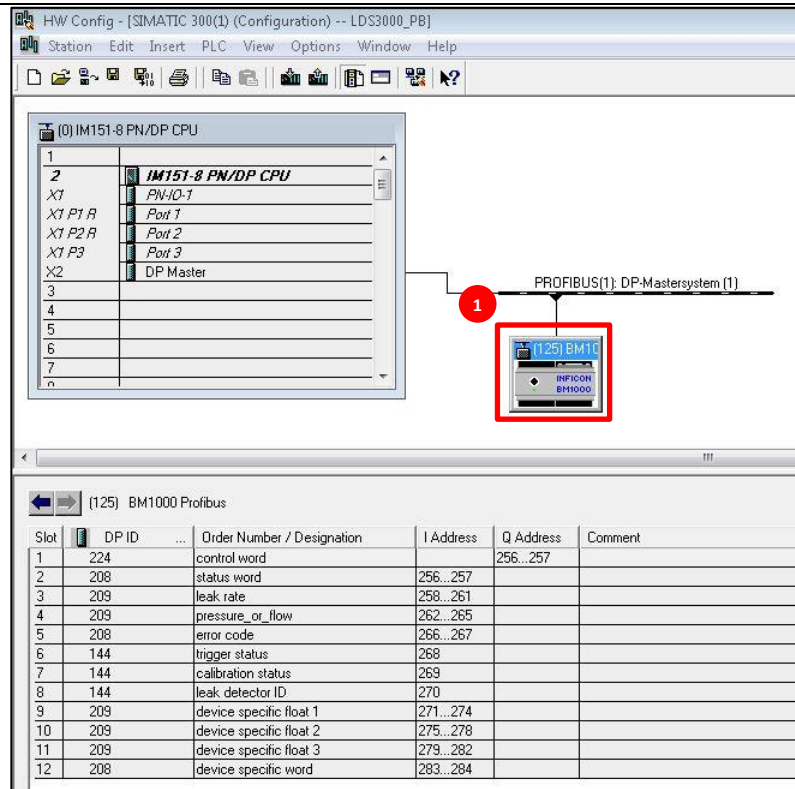
Command		Name	R/W	Data type	Meaning	No fieldbus support
dez	hex					
229	E5	Flow control	R/W	UINT8	0 = 25 sccm 1 = 300 sccm (low) 2 = 3000 sccm high flow 3 = standby flow LDS3000(AQ)/XL3000flex only	

Calculation of the **Slot** and **Index** numbers based on the LD command number

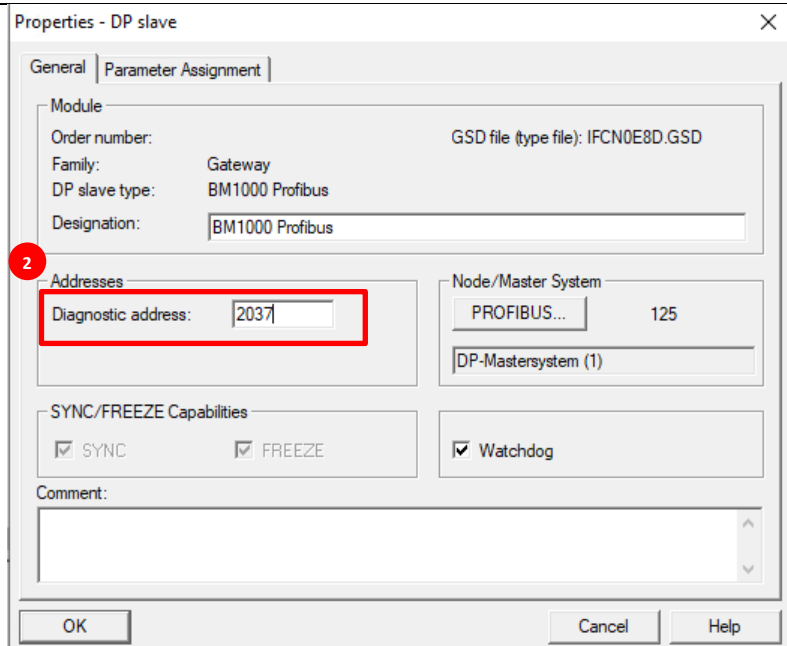
- Calculation of the Slot number:**
Slot = (LD command number – 1) DIV 255 (integer division)
Slot = (229 – 1) DIV 255
Slot = 0
- Calculation of the Index number:**
Index = (LD command number – 1) MOD 255
Index = (229 – 1) MOD 255
Index = 228

Based on the calculated Slot number, the parameter **ID** of the SFB52 "RDREC" function needs to be set. Therefore, the hardware configuration needs to be opened and the INFICON BM1000 PROFIBUS Module needs to be selected.

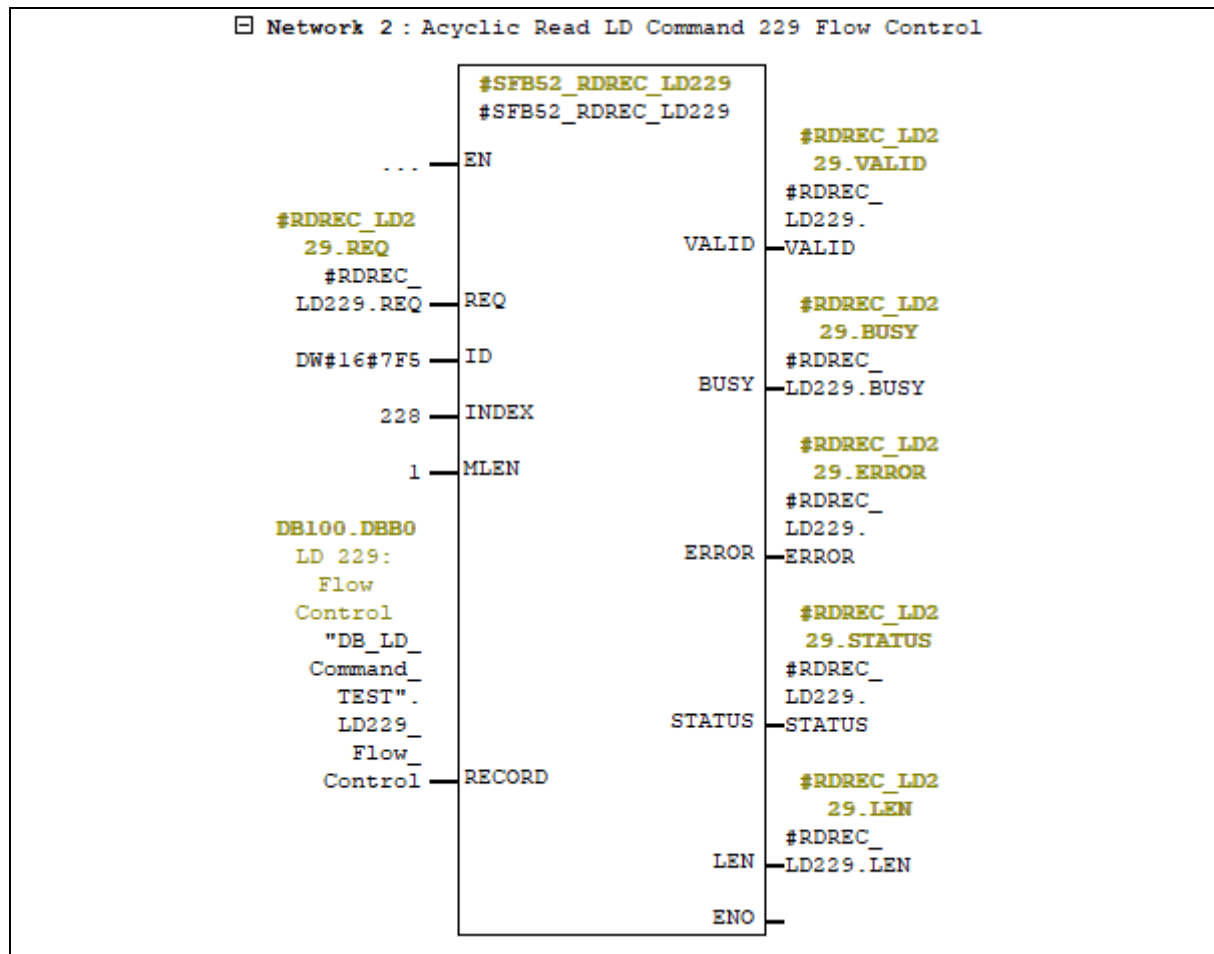
1. Select and double click on the "**INFICON BM1000**" PROFIBUS module, because the calculated slot number is **0**



2. Set ID to the diagnostic address of the "**INFICON BM1000**" PROFIBUS module



ID = 2037_{Dec} = 7F5_{Hex}



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	DW#16#7F5	<p>Hardware identifier of BM1000 PROFIBUS bus module based on the calculated slot number</p> <p>Slot = (229 – 1) DIV 255 = 0</p> <p>Slot 0 → set ID to the diagnostic address of the <i>INFICON BM1000</i> PROFIBUS module</p> <p>ID = 2037_{Dec} = 7F5_{Hex}</p>
INDEX	228	<p>Index, based on the calculated index number</p> <p>Index = (LD command number – 1) MOD 255</p> <p>Index = (229 – 1) MOD 255 = 228</p>
MLEN	1	<p>Length to be read in bytes</p> <p>Data type = UINT8 = 1 byte</p>

RECORD	BYTE	<p>The parameter “RECORD” represents the target path, where the data to be read should be stored. This parameter must have the same data type and the same dimensions like the LD command to be read.</p> <p>In this case, LD command 229 is from data type UINT8 with a length of 1 byte, so the corresponding STEP 7 data type is BYTE</p> <table><tr><td>LD229_Flow_Control</td><td>BYTE</td><td>B#16#0</td><td>LD 229: Flow Control</td></tr></table>	LD229_Flow_Control	BYTE	B#16#0	LD 229: Flow Control
LD229_Flow_Control	BYTE	B#16#0	LD 229: Flow Control			

3.6.2.6 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:

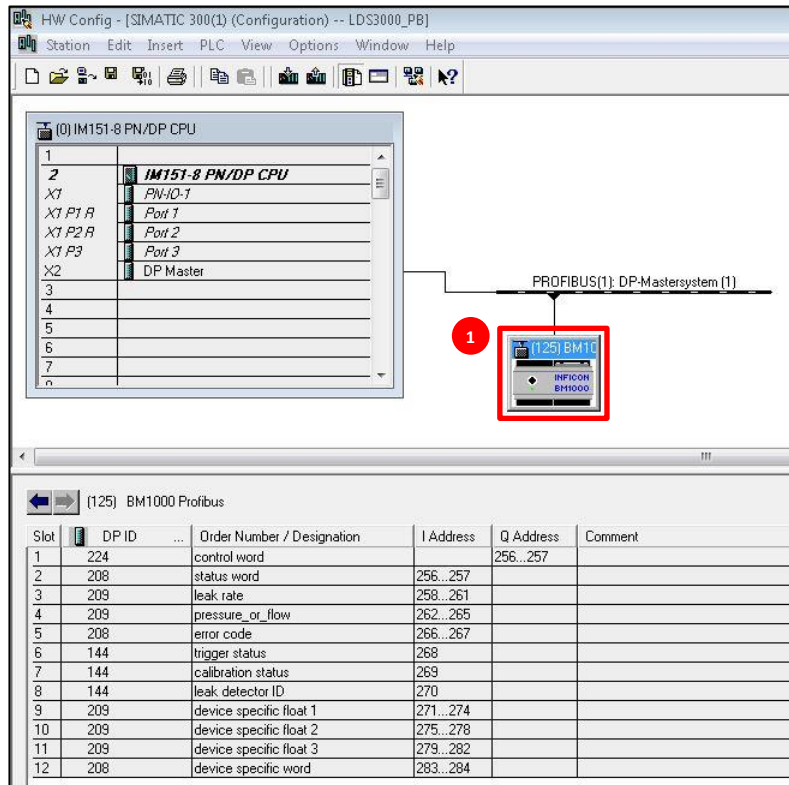
Command		Class	Name	R/W	Data type	Min-, Def-, Max- value LDS3000	LDS3000 MSB	No fieldbus support
dez	hex							
1565	61D	Meas	Value changed flag	R/W	UINT8		Value changed flag Read: Same value as Statusword Bit 11 Bit will be set if one or more value changed reason flags (see commando 1564) are set. Write: Write 0 to clear the value changed flag. This will also clear all value changed reason flags (see commando 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	

Calculation of the **Slot** and **Index** numbers based on the LD command number

- Calculation of the Slot number:**
 Slot = (LD command number – 1) DIV 255 (integer division)
 Slot = (1568 – 1) DIV 255
Slot = 6
- Calculation of the Index number:**
 Index = (LD command number – 1) MOD 255
 Index = (1568 – 1) MOD 255
Index = 37

Based on the calculated Slot number, the parameter **ID** of the SFB52 “RDREC” function needs to be set. Therefore, the hardware configuration needs to be opened and the INFICON BM1000 PROFIBUS Module needs to be selected.

1. Select "**INFICON BM1000**" PROFIBUS module



HW Config - [SIMATIC 300(1) (Configuration) -- LDS3000_PB]

Station Edit Insert PLC View Options Window Help

(0) IM151-8 PN/DP CPU

Slot	Module
1	
2	IM151-8 PN/DP CPU
X1	PN-ID-1
X1 P1 R	Port 1
X1 P2 R	Port 2
X1 P3	Port 3
X2	DP Master
3	
4	
5	
6	
7	
8	

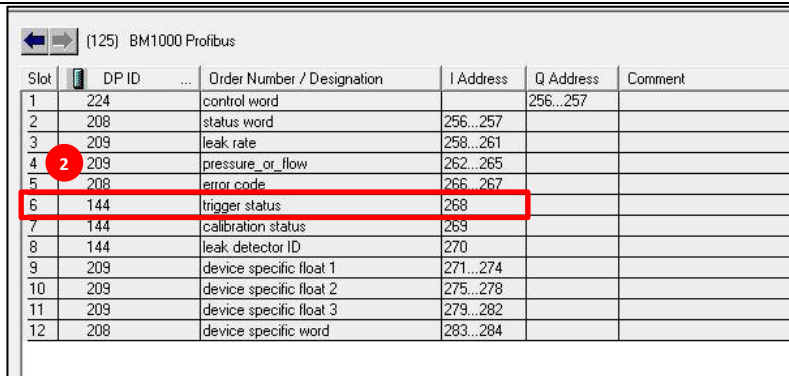
PROFIBUS(1): DP-Mastersystem (1)

1

(125) BM1000 Profibus

Slot	DP ID	Order Number / Designation	I Address	Q Address	Comment
1	224	control word		256...257	
2	208	status word	256...257		
3	209	leak rate	258...261		
4	209	pressure_or_flow	262...265		
5	208	error code	266...267		
6	144	trigger status	268		
7	144	calibration status	269		
8	144	leak detector ID	270		
9	209	device specific float 1	271...274		
10	209	device specific float 2	275...278		
11	209	device specific float 3	279...282		
12	208	device specific word	283...284		

2. Get Input / Output address based on the calculated **slot number**



(125) BM1000 Profibus

Slot	DP ID	Order Number / Designation	I Address	Q Address	Comment
1	224	control word		256...257	
2	208	status word	256...257		
3	209	leak rate	258...261		
4	209	pressure_or_flow	262...265		
5	208	error code	266...267		
6	144	trigger status	268		
7	144	calibration status	269		
8	144	leak detector ID	270		
9	209	device specific float 1	271...274		
10	209	device specific float 2	275...278		
11	209	device specific float 3	279...282		
12	208	device specific word	283...284		

In this example, slot number 6 was calculated. Slot number 6 has the **I Address 268**.

3. Set the parameter "**ID**"

Since slot 2 is an input module type, the ID is equal to the start address of the input address.

$$ID = 268_{dec} = 10C_{Hex}$$

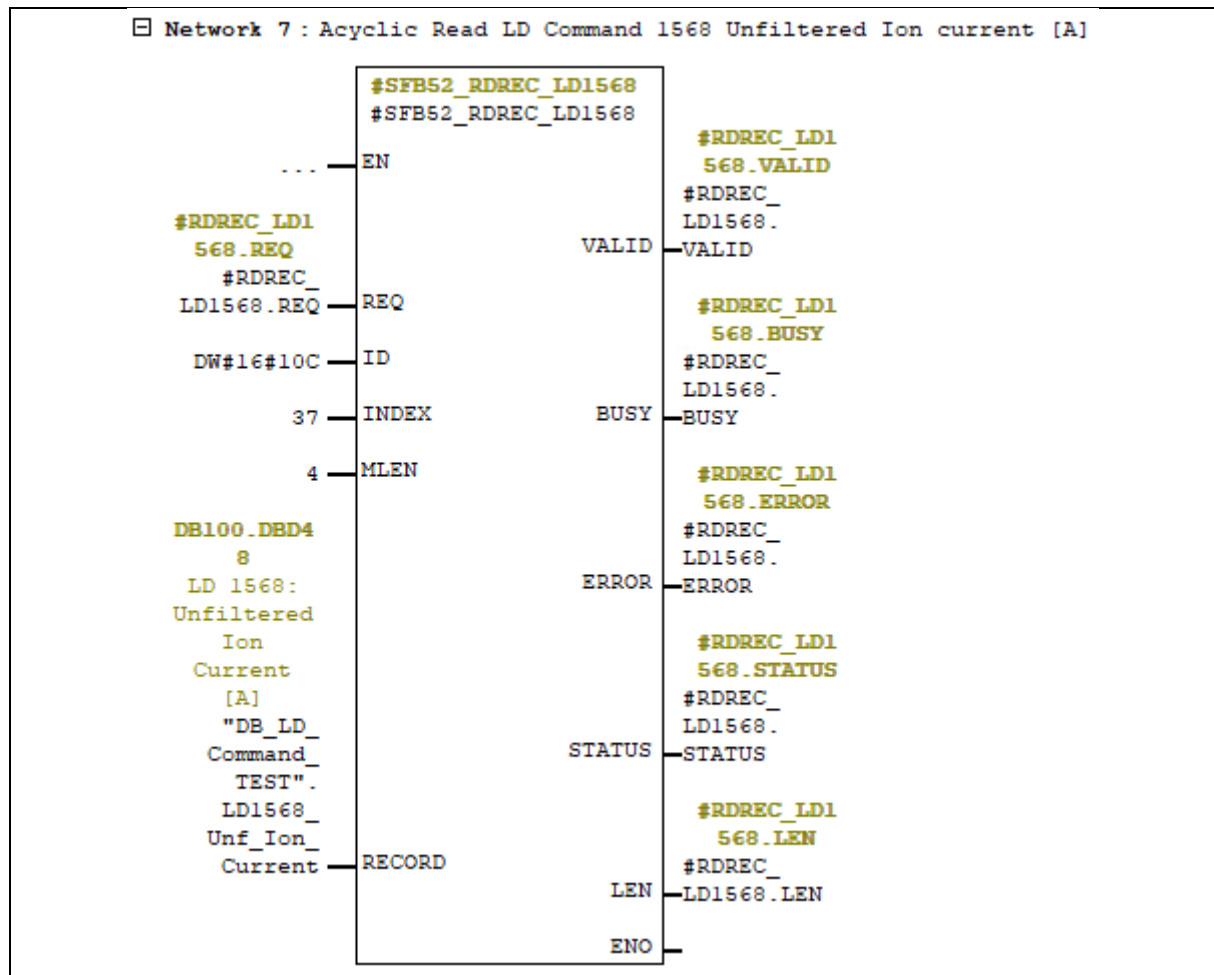
4. Set parameter "**MLEN**"

The parameter "**MLEN**" represents the length of the data to be read in bytes.

The length of the LD command to be read needs to be taken out of the LD command table, based on the data type.

LD command 1568 is from data type FLOAT. The data type FLOAT corresponds to the data type REAL in STEP7. The data type REAL has a length of 4 bytes.

	<p>MLEN = FLOAT = REAL = 4 bytes</p> <p>So the parameter "MLEN" needs to be set to 4</p>
--	---



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	DW#16#10C	<p>The parameter ID represents the logical address of the DP-Slave BM1000 PROFIBUS bus module based on the calculated slot number</p> <p>$ID = 268_{dec} = 10C_{Hex}$</p> <p>ID = 10C_{Hex}</p>
INDEX	9	Index, based on the calculated index number

		Index = (LD command number – 1) MOD 255 Index = (1568 – 1) MOD 255 = 37				
MLEN	12	Length to be read in bytes Data type = FLOAT = REAL= 4 bytes				
RECORD	REAL	<p>The parameter “RECORD” represents the target path, where the data to be read should be stored. This parameter must have the same data type and the same dimensions like the LD command to be read. In this case, LD command 1568 is from data type FLOAT with a total length of 4 bytes, so the corresponding STEP 7 data type is REAL.</p> <table><tr><td>LD1568_Unf_Ion_Current</td><td>REAL</td><td>0.000000e+000</td><td>LD 1568: Unfiltered Ion Current [A]</td></tr></table>	LD1568_Unf_Ion_Current	REAL	0.000000e+000	LD 1568: Unfiltered Ion Current [A]
LD1568_Unf_Ion_Current	REAL	0.000000e+000	LD 1568: Unfiltered Ion Current [A]			

3.6.3 Writing data to leak detector acyclically

Acyclic reading and writing of parameters is limited, depending on the PLC controller of type S7-300.

SFB No.	SFB Name	Description	Execution Time in μs			
			312	31x, 147, 151, 154	317	319
52	RDREC	Read Data set from DP slave, PROFINET IO-Device or central module	500		272 μs + 6.4 μs / Bytes	214 μs + 6.25 μs / Byte
		concurrent running requests to different modules, max.	4 requests together with SFC 59 requests		8 requests together with SFC 59 requests	
53	WRREC	Write Data set to DP slave, PROFINET IO-Device or central module	1400 μs + 32 μs / Byte		248 μs + 5.25 μs / Byte	181 μs + 5.11 μs / Byte
		concurrent running requests to different modules, max.	4 requests together with SFC 58 requests		8 requests together with SFC 58 requests	

This information is taken out of the Siemens manual “**S7-300 Instruction List**” with the document number “**A5E00105517-10**”.

3.6.3.1 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.

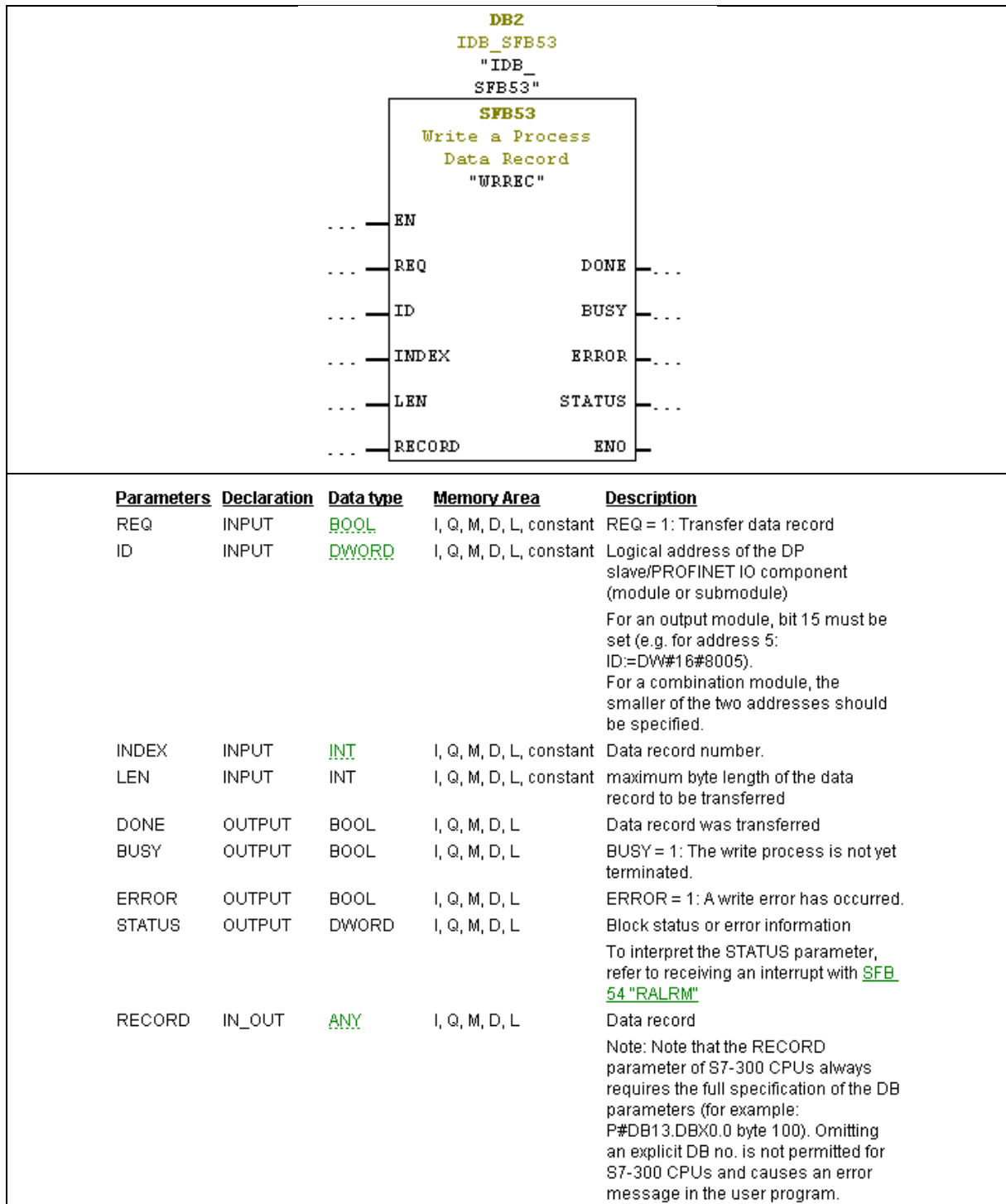
To protect the EEPROM of the leak detector's MSB, unnecessary write operations from a higher-level control system (e.g. PLC controller) to the leak detector should be avoided (under any circumstances).

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

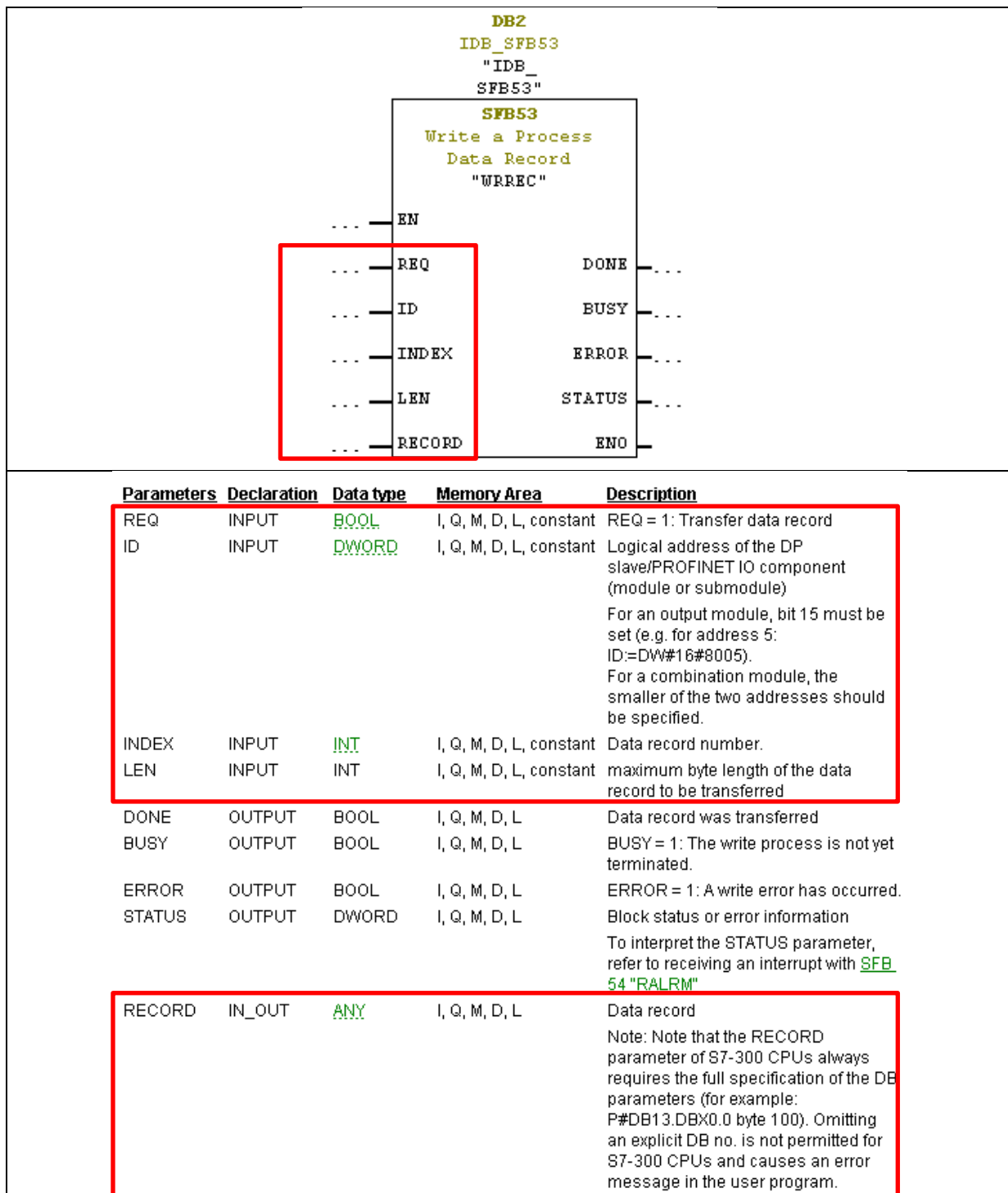
- **Do not send a list of parameters where not all parameter values may have been changed. Only send parameters that have actually been changed.**
- **Do not send parameters that have not been changed**
- **Only send parameters that really need to be changed.**
- **Set the time interval between each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

3.6.3.2 Using Siemens standard function block SFB53 "WRREC"

In order to write a data record acyclically to a PROFIBUS Slave, Siemens offers the Standard Function Block **SFB53 "WRREC"** in the library of the SIMATIC Step 7.



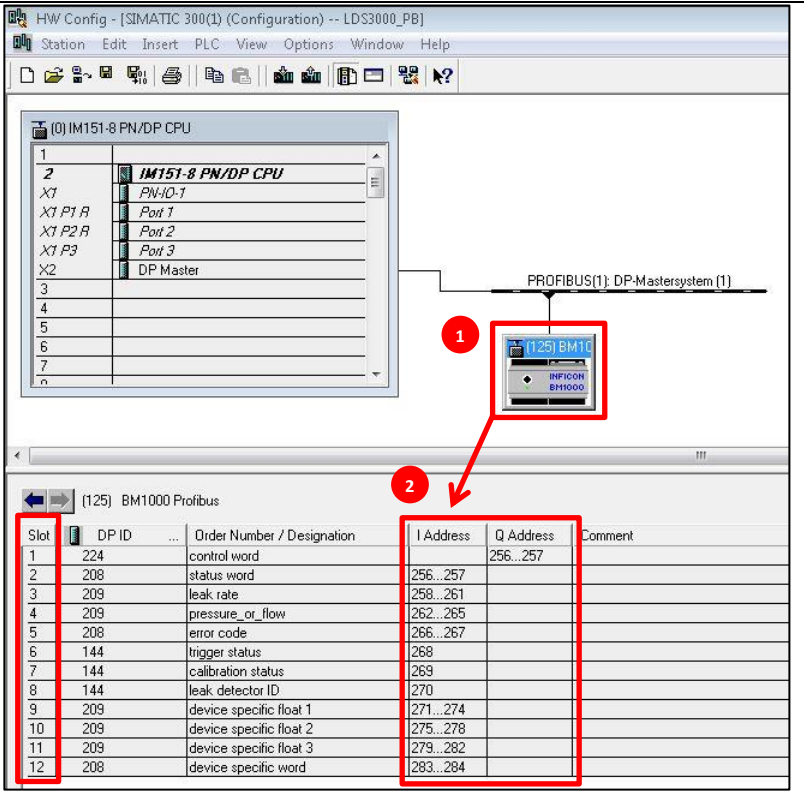
To write a parameter acyclically to the leak detector via the BM1000 PROFIBUS Module, the following input parameters of the **SFB53 "WRREC"** needs to be set correspondingly to the LD command to be write:



3.6.3.2.1 Parameter ID

The parameter **ID** represents the logical address of the DP-Slave. To get the **ID** of an PROFIBUS DP-Slave the hardware configuration needs to be opened and the corresponding DP-Slave needs to be selected (e.g. BM1000 PROFIBUS Module).

3. Select "**INFICON BM1000**" PROFIBUS module
4. The starting address of the input and output addresses of each slot are representing the **ID**



Slot	DP ID	Order Number / Designation	I Address	Q Address	Comment
1	224	control word		256...257	
2	208	status word	256...257		
3	209	leak rate	258...261		
4	209	pressure_or_flow	262...265		
5	208	error code	266...267		
6	144	trigger status	268		
7	144	calibration status	269		
8	144	leak detector ID	270		
9	209	device specific float 1	271...274		
10	209	device specific float 2	275...278		
11	209	device specific float 3	279...282		
12	208	device specific word	283...284		

Each slot of the PROFIBUS slave has its own logical address range **ID**. The logical address ranges of the PROFIBUS BM1000 Module are shown above.

The logical address range of slot 1 in the given example begins at **Q Address 256**. Q Address means in this case, that the module type of slot 1 is an output module.

Depending on the slot module type (input or output module) the parameter **ID** needs to be set with the following rule:

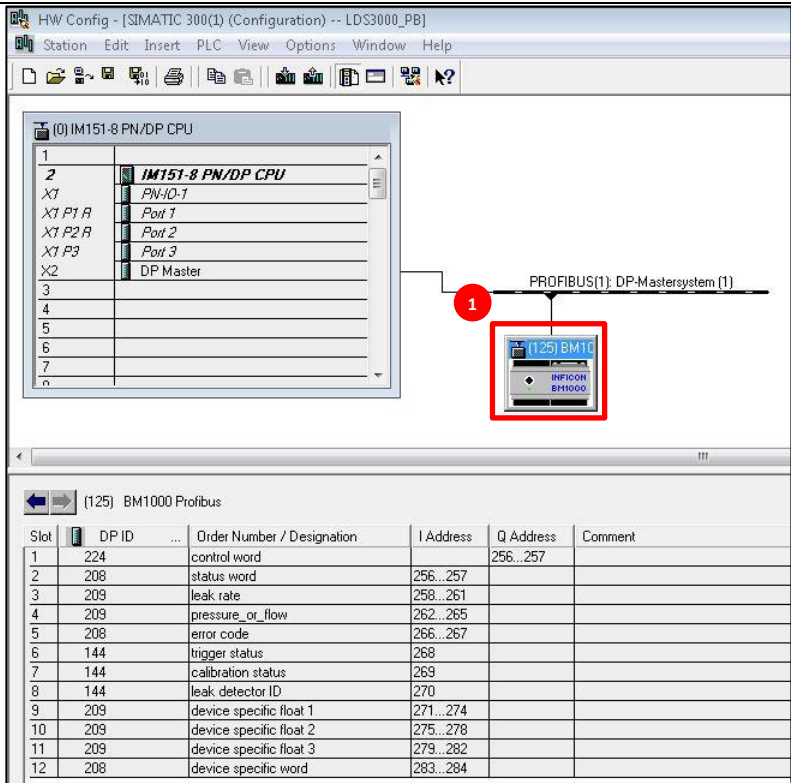
- If the module of the calculated slot is an **input module** then the **ID** needs to be set to the logical input address.
- If the module of the calculated slot is an **output module** then the **ID** needs to be set to the logical output address with additionally set bit 15 to "1".

Attention:

If the module of a slot is an **output module**, bit 15 needs to be set to “1” additionally to the logical output address

If the calculated slot number is 0, the **ID** must be set to the **diagnostic address** of the PROFIBUS module "**INFICON BM1000**" instead of the logical address of the slot of the input or output address.

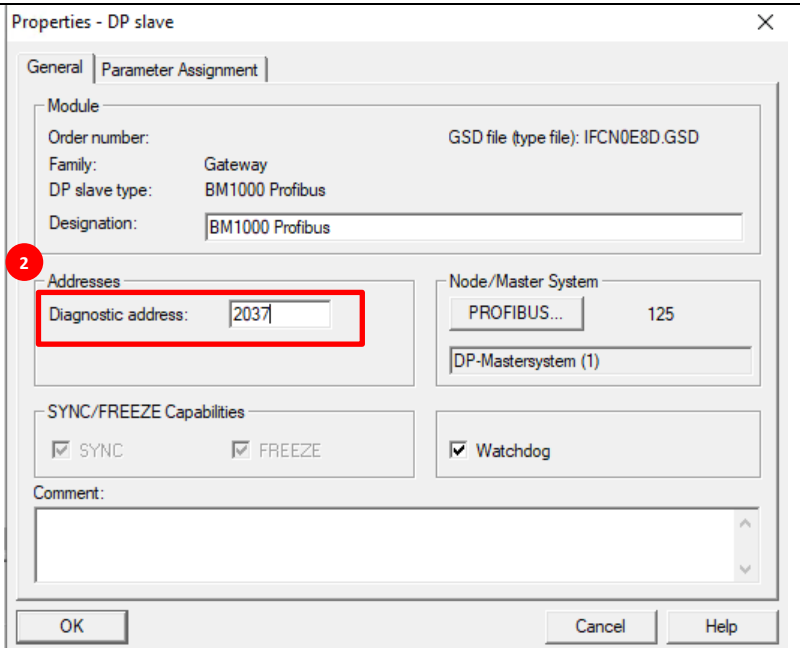
3. Select and double click on the “**INFICON BM1000**” PROFIBUS module



The screenshot shows the SIMATIC Manager HW Config interface. The top part displays the hardware configuration tree for the IM151-8 PN/DP CPU, including slots for PN+IO-1, Port 1, Port 2, Port 3, and DP Master. The bottom part shows the PROFIBUS network configuration, where the INFICON BM1000 module is being added to the network. A red box highlights the module, and a red circle with the number 1 indicates the selection point.

Slot	DP ID	...	Order Number / Designation	I Address	Q Address	Comment
1	224		control word		256...257	
2	208		status word	256...257		
3	209		leak rate	258...261		
4	209		pressure_or_flow	262...265		
5	208		error code	266...267		
6	144		trigger status	268		
7	144		calibration status	269		
8	144		leak detector ID	270		
9	209		device specific float 1	271...274		
10	209		device specific float 2	275...278		
11	209		device specific float 3	279...282		
12	208		device specific word	283...284		

4. Set ID to the diagnostic address of the "**INFICON BM1000**" PROFIBUS module



ID = 2037_{Dec} = 7F5_{Hex}

Example 1 = Slot number = 1:

The calculated slot number (Slot = (LD command number – 1) DIV 255) is 1, then the corresponding **ID** is 256. Furthermore, the module of slot 1 is an output module, so that bit 15 of the output address needs to be set to "**1**" additionally.

ID = logical address + bit 15 "1"

ID = 256_{dec} + bit 15 "1"

ID = 00000000_00000000_00000001_00000000_{bin} + bit 15 ="1"

ID = 00000000_00000000_**1**00000001_00000000_{bin} = 8100_{Hex} = 33024_{dec}

↑
Bit 15 = „1“

ID = 8100_{Hex}

If setting bit 15 additionally to "**1**", the ID changes from 256_{dec} to 33024_{dec}.

Example 2 – Slot number = 2:

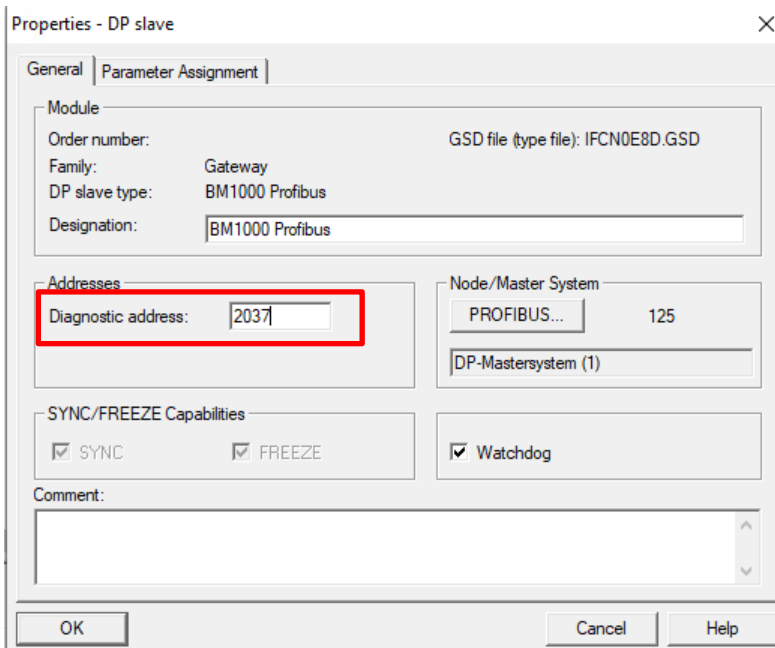
The calculated slot number (Slot = (LD command number – 1) DIV 255) is 2, than the corresponding ID is also 256. But in this case, the module of slot number 2 is an input module instead of an output module. Now, the logical address of slot number 2 needs to be used for the parameter ID.

ID = logical address

ID = 256_{dec} = 100_{Hex}

Example 3 – Slot number = 0:

The calculated slot number (Slot = (LD command number – 1) DIV 255) is 0, than the corresponding ID needs to be set to the diagnostic address of the “**INFICON BM1000**” PROFIBUS module.



The screenshot shows the 'Properties - DP slave' dialog box with the 'Parameter Assignment' tab selected. The 'Module' section shows 'Order number: Gateway', 'Family: BM1000 Profibus', 'DP slave type: BM1000 Profibus', and 'Designation: BM1000 Profibus'. The 'Addresses' section has 'Diagnostic address: 2037' highlighted with a red box. The 'Node/Master System' section shows 'PROFIBUS...' and '125'. The 'SYNC/FREEZE Capabilities' section has 'SYNC', 'FREEZE', and 'Watchdog' all checked. The 'Comment' field is empty. The 'OK', 'Cancel', and 'Help' buttons are at the bottom.

ID = 2037_{Dec} = 7F5_{Hex}

3.6.3.2.2 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)	

3.6.3.2.3 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	MLEN [bytes]
SINT8	Signed 8 bit integer	1
SINT16	Signed 16 bit integer	2
SINT32	Signed 32 bit integer	4
UINT8	Unsigned 8 bit integer	1
UINT16	Unsigned 16 bit integer	2
UINT32	Unsigned 32 bit integer	4
FLOAT	Floating point / real number	4
CHAR	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:

520	208	Calibration factors vacuum	R/W	<div style="border: 2px solid red; padding: 2px;">FLOAT[3]</div>	Calibration factors for vacuum mode (and for AQ-mode) Index 0: mass 2 Index 1: mass 3 Index 2: mass 4
-----	-----	----------------------------	-----	--	---

The LD command 520 "Cal factors vacuum" 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 elements. It must be always written the whole array with all array elements.

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

3.6.3.2.4 Parameter **RECORD**

The parameter **RECORD** specifies the source path for the data to be written. For this reason, the data type of the parameter **RECORD** needs 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 SIMATIC Step 7
SINT8	Signed 8 bit integer	Byte (INT)
SINT16	Signed 16 bit integer	INT
SINT32	Signed 32 bit integer	DINT
UINT8	Unsigned 8 bit integer	INT
UINT16	Unsigned 16 bit integer	WORD
UINT32	Unsigned 32 bit integer	DWORD
FLOAT	Floating point / real number	REAL
CHAR	Character	CHAR

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:

The calibration factor vacuum should be write. The corresponding LD command is 520, shown in the next figure.

520	208	Calibration factors vacuum	R/W	FLOAT[3]	Calibration factors for vacuum mode (and for AQ-mode) Index 0: mass 2 Index 1: mass 3 Index 2: mass 4
-----	-----	----------------------------	-----	----------	---

The LD command 520 "Calibration factors vacuum" is an array with 3 array elements of data type FLOAT. The data type FLOAT corresponds to the data type REAL in the SIMATIC Step 7.

Please use as **RECORD** value: Array[0..2] of REAL as shown in the next figure.

LD520_CAL_factors_VAC	ARRAY[0..2]		LD 520: Calibration factors vacuum
	REAL		

3.6.3.3 Example 1: write Trigger by 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:

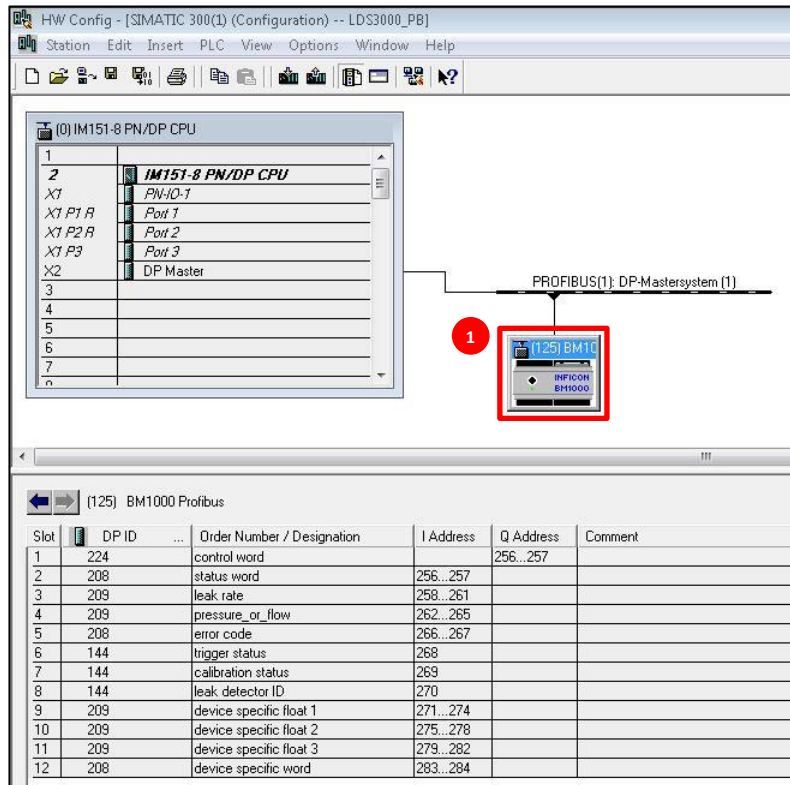
Command		Name	R/W	Data type	Meaning	No fieldbus support
dez	hex					
385	181	Trigger [mbar*l/s]	R/W	FLOAT[4]	Trigger in mbar*l/s Index 0: Trigger 1 Index 1: Trigger 2 Index 2: Trigger 3 Index 3: Trigger 4	

Calculation of the **Slot** and **Index** numbers based on the LD command number

- Calculation of the Slot number:**
 Slot = (LD command number – 1) DIV 255 (integer division)
 Slot = (385 – 1) DIV 255
Slot = 1
- Calculation of the Index number:**
 Index = (LD command number – 1) MOD 255
 Index = (385 – 1) MOD 255
Index = 129

Based on the calculated Slot number, the parameter **ID** of the SFB53 “WRREC” function needs to be set. Therefore, the hardware configuration needs to be opened and the INFICON BM1000 PROFIBUS Module needs to be selected.

1. Select “**INFICON BM1000**” PROFIBUS module



HW Config - [SIMATIC 300(1) (Configuration) -- LDS3000_PB]

Station Edit Insert PLC View Options Window Help

(0) IM151-8 PN/DP CPU

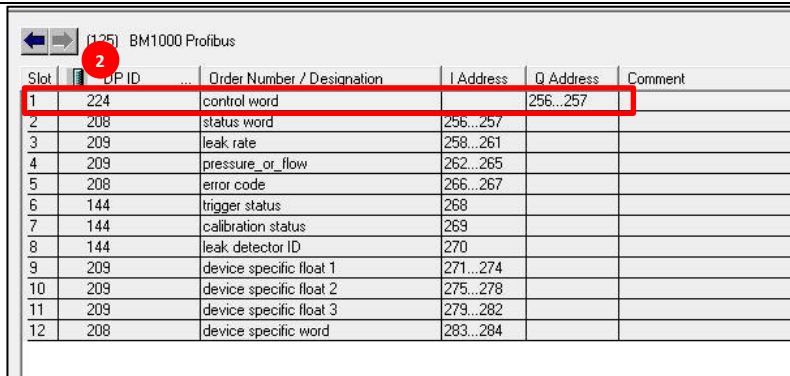
Slot	Module
1	
2	IM151-8 PN/DP CPU
X1	PN-ID-1
X1 P1 R	Port 1
X1 P2 R	Port 2
X1 P3	Port 3
X2	DP Master
3	
4	
5	
6	
7	
8	

PROFIBUS(1): DP-Mastersystem (1)

(125) BM1000 Profibus

Slot	DP ID	Order Number / Designation	I Address	Q Address	Comment
1	224	control word		256...257	
2	208	status word	256...257		
3	209	leak rate	258...261		
4	209	pressure_or_flow	262...265		
5	208	error code	266...267		
6	144	trigger status	268		
7	144	calibration status	269		
8	144	leak detector ID	270		
9	209	device specific float 1	271...274		
10	209	device specific float 2	275...278		
11	209	device specific float 3	279...282		
12	208	device specific word	283...284		

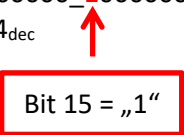
2. Get Input / Output address based on the calculated **slot number**

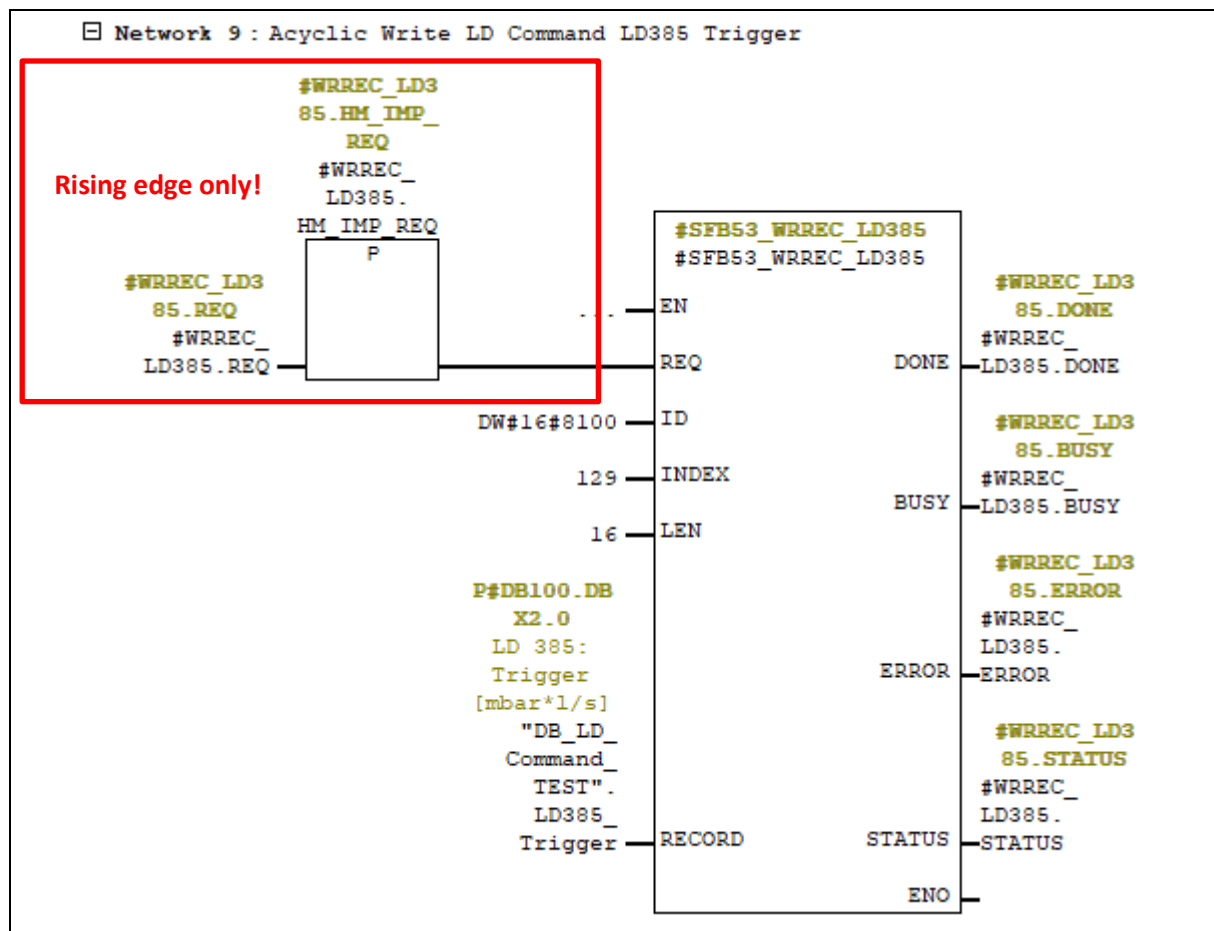


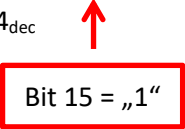
(125) BM1000 Profibus

Slot	DP ID	Order Number / Designation	I Address	Q Address	Comment
1	224	control word		256...257	
2	208	status word	256...257		
3	209	leak rate	258...261		
4	209	pressure_or_flow	262...265		
5	208	error code	266...267		
6	144	trigger status	268		
7	144	calibration status	269		
8	144	leak detector ID	270		
9	209	device specific float 1	271...274		
10	209	device specific float 2	275...278		
11	209	device specific float 3	279...282		
12	208	device specific word	283...284		

In this example, slot number 1 was calculated. Slot number 1 has the **Q Address 256...257**. Only the starting address needs to be taken, in this case the starting Q address **256**.

<p>3. Set the parameter "ID"</p>	<p>Since slot 1 is an output module type, the ID need to be calculate by taking the starting address of slot 1 (256) and setting bit 15 of the starting address additionally to "1".</p> <p> $ID = 256_{dec} + \text{bit 15} = "1"$ $ID = 00000000_00000000_00000001_00000000_{bin} + \text{bit 15} = "1"$ $ID = 00000000_00000000_10000001_00000000_{bin}$ $ID = 8100_{Hex} = 33024_{dec}$ </p> <div style="text-align: center;">  <p>Bit 15 = „1“</p> </div> <p>ID = 8100_{Hex}</p> <p>If setting bit 15 additionally to "1", the ID changes from 256_{dec} to 33024_{dec} (8100_{Hex}).</p>
<p>4. Set parameter "LEN"</p>	<p>The parameter "LEN" represents the length of the data to be write in bytes.</p> <p>The length of the LD command to be write needs to be taken out of the LD command table, based on the data type.</p> <p>LD command 385 is from data type FLOAT[4], which represents an array with 4 array elements of data type FLOAT. The data type FLOAT corresponds to the data type REAL in STEP7. The data type REAL has a length of 4 bytes.</p> <p>LEN = FLOAT[4] = REAL[4] = 4 * 4 bytes = 16 bytes</p> <p>So the parameter "LEN" needs to be set to 16.</p>



Parameter	Value	Description
REQ	TRUE	<p>Before setting the REQ parameter to TRUE, all other parameters (ID, INDEX, LEN and RECORD) need to be set</p> <p>Attention! Use only one rising edge to transfer data to the leak detector. Otherwise, the parameter will be transferred several times!</p>
ID	DW#16#8100	<p>The parameter ID represents the logical address of the DP-Slave BM1000 PROFIBUS bus module based on the calculated slot number</p> <p> $ID = 256_{dec} + \text{bit } 15 = "1"$ $ID = 00000000_00000000_00000001_00000000_{bin} + \text{bit } 15 = "1"$ $ID = 00000000_00000000_10000001_00000000_{bin}$ $ID = 8100_{Hex} = 33024_{dec}$ </p> <p style="text-align: center;">  </p> <p>ID = 8100_{Hex}</p>
INDEX	129	Index, based on the calculated index number

		Index = (LD command number – 1) MOD 255 Index = (385 – 1) MOD 255 = 129
LEN	16	Length to be write in bytes Data type = FLOAT[4] = 4 bytes * 4 = 16 bytes
RECORD	Array[0..3] of REAL	The parameter RECORD specifies the source path for the data to be written. This parameter must have the same data type and the same dimensions like the LD command to be write. In this case, LD command 385 is from data type FLOAT[4] with a total length of 16 byte, so the corresponding STEP 7 data type is an Array[0..3] of REAL.

+2.0	LD385_Trigger	ARRAY[0..3]		LD 385: Trigger [mbar*l/s]
*4.0		REAL		

All other parameters are set user-dependently.

3.6.3.4 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		Name	R/W	Data type	Meaning	No fieldbus support
dez	hex					
385	181	Trigger [mbar*l/s]	R/W	FLOAT[4]	Trigger in mbar*l/s Index 0: Trigger 1 Index 1: Trigger 2 Index 2: Trigger 3 Index 3: Trigger 4	
387	183	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	Test leak extern vacuum [mbar*l/s]	R/W	FLOAT[3]	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	

Calculation of the **Slot** and **Index** numbers based on the LD command number

- **Calculation of the Slot number:**

Slot = (LD command number – 1) DIV 255 (integer division)

Slot = (390 – 1) DIV 255

Slot = 1

- **Calculation of the Index number:**

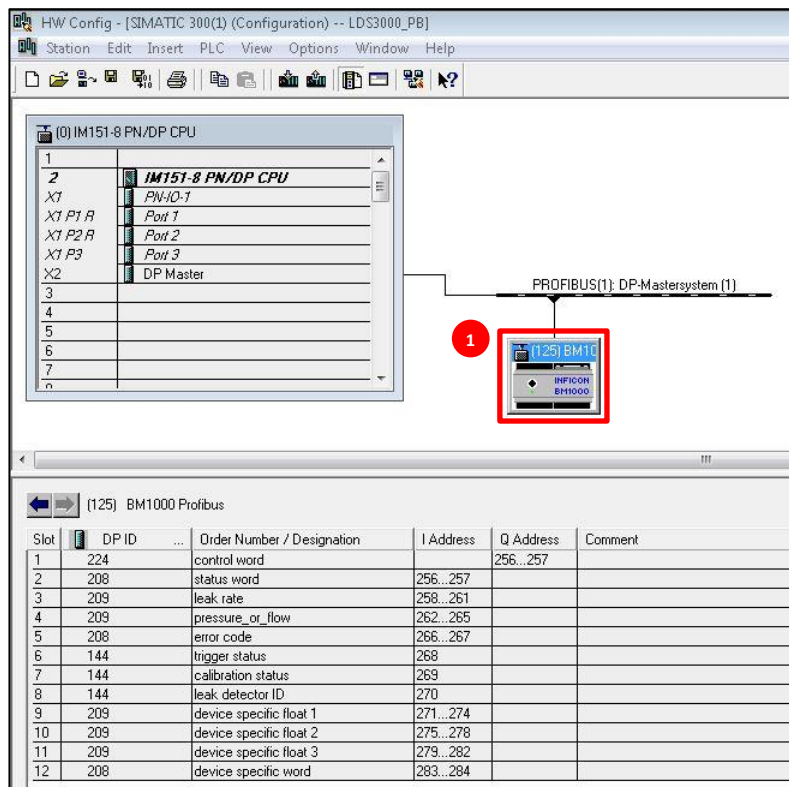
Index = (LD command number – 1) MOD 255

Index = (390 – 1) MOD 255

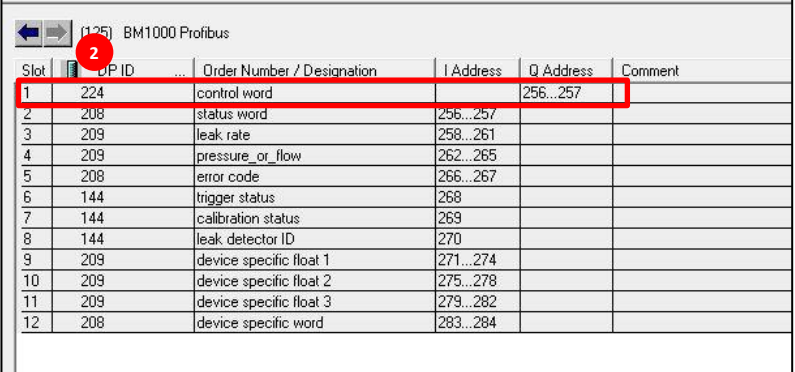
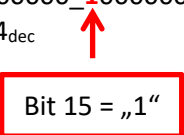
Index = 134

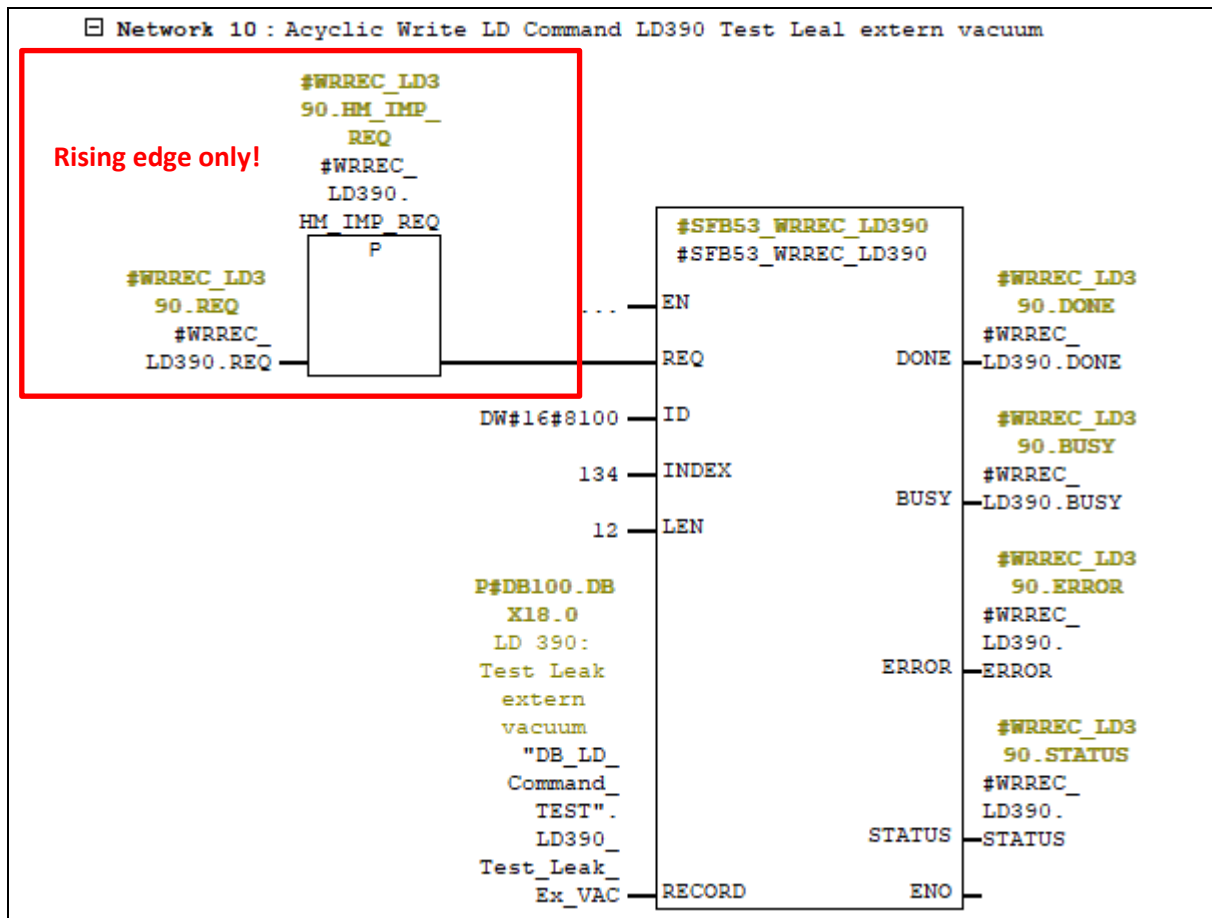
Based on the calculated Slot number, the parameter **ID** of the SFB53 “WRREC” function needs to be set. Therefore, the hardware configuration needs to be opened and the INFICON BM1000 PROFIBUS Module needs to be selected.

1. Select “**INFICON BM1000**” PROFIBUS module



Slot	DP ID	...	Order Number / Designation	I Address	Q Address	Comment
1	224		control word		256...257	
2	208		status word	256...257		
3	209		leak rate	258...261		
4	209		pressure_or_flow	262...265		
5	208		error code	266...267		
6	144		trigger status	268		
7	144		calibration status	269		
8	144		leak detector ID	270		
9	209		device specific float 1	271...274		
10	209		device specific float 2	275...278		
11	209		device specific float 3	279...282		
12	208		device specific word	283...284		

<p>2. Get Input / Output address based on the calculated slot number</p>	 <p>In this example, slot number 1 was calculated. Slot number 1 has the Q Address 256...257. Only the starting address needs to be taken, in this case the starting Q address 256.</p>
<p>3. Set the parameter "ID"</p>	<p>Since slot 1 is an output module type, the ID need to be calculate by taking the starting address of slot 1 (256) and setting bit 15 of the starting address additionally to "1".</p> <p> $ID = 256_{dec} + \text{bit } 15 = "1"$ $ID = 00000000_00000000_00000001_00000000_{bin} + \text{bit } 15 = "1"$ $ID = 00000000_00000000_10000001_00000000_{bin}$ $ID = 8100_{Hex} = 33024_{dec}$ </p> <p style="text-align: center;">  Bit 15 = „1“ </p> <p>ID = 8100_{Hex}</p> <p>If setting bit 15 additionally to "1", the ID changes from 256_{dec} to 33024_{dec} (8100_{Hex}).</p>
<p>4. Set parameter "LEN"</p>	<p>The parameter "LEN" represents the length of the data to be write in bytes.</p> <p>The length of the LD command to be write needs to be taken out of the LD command table, based on the data type.</p> <p>LD command 385 is from data type FLOAT[4], which represents an array with 4 array elements of data type FLOAT. The data type FLOAT corresponds to the data type REAL in STEP7. The data type REAL has a length of 4 bytes.</p> <p>LEN = FLOAT[4] = REAL[4] = 4 * 4 bytes = 16 bytes</p> <p>So the parameter "LEN" needs to be set to 16.</p>



Parameter	Value	Description
REQ	TRUE	Before setting the REQ parameter to TRUE, all other parameters (ID, INDEX, LEN and RECORD) need to be set Attention! Use only one rising edge to transfer data to the leak detector. Otherwise, the parameter will be transferred several times!
ID	DW#16#8100	The parameter ID represents the logical address of the DP-Slave BM1000 PROFIBUS bus module based on the calculated slot number $ID = 256_{dec} + \text{bit } 15 = "1"$ $ID = 00000000_00000000_00000001_00000000_{bin} + \text{bit } 15 = "1"$ $ID = 00000000_00000000_10000001_00000000_{bin}$ $ID = 8100_{Hex} = 33024_{dec}$ <div style="border: 1px solid red; padding: 2px; display: inline-block;">Bit 15 = „1“</div> $ID = 8100_{Hex}$
INDEX	134	Index, based on the calculated index number

		Index = (LD command number – 1) MOD 255 Index = (390 – 1) MOD 255 = 134								
LEN	12	Length to be write in bytes Data type = FLOAT[3] = 4 bytes * 3 = 12 bytes								
RECORD	Array[0..2] of REAL	<p>The parameter RECORD specifies the source path for the data to be written. This parameter must have the same data type and the same dimensions like the LD command to be write.</p> <p>In this case, LD command 390 is from data type FLOAT[3] with a total length of 12 byte, so the corresponding STEP 7 data type is an Array[0..2] of REAL.</p> <table><tr><td>LD390_Test_Leak_Ex_VAC</td><td>ARRAY[0..2]</td><td></td><td>LD 390: Test Leak extern vacuum</td></tr><tr><td></td><td>REAL</td><td></td><td></td></tr></table>	LD390_Test_Leak_Ex_VAC	ARRAY[0..2]		LD 390: Test Leak extern vacuum		REAL		
LD390_Test_Leak_Ex_VAC	ARRAY[0..2]		LD 390: Test Leak extern vacuum							
	REAL									

All other parameters are set user-dependently.

3.6.3.5 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:

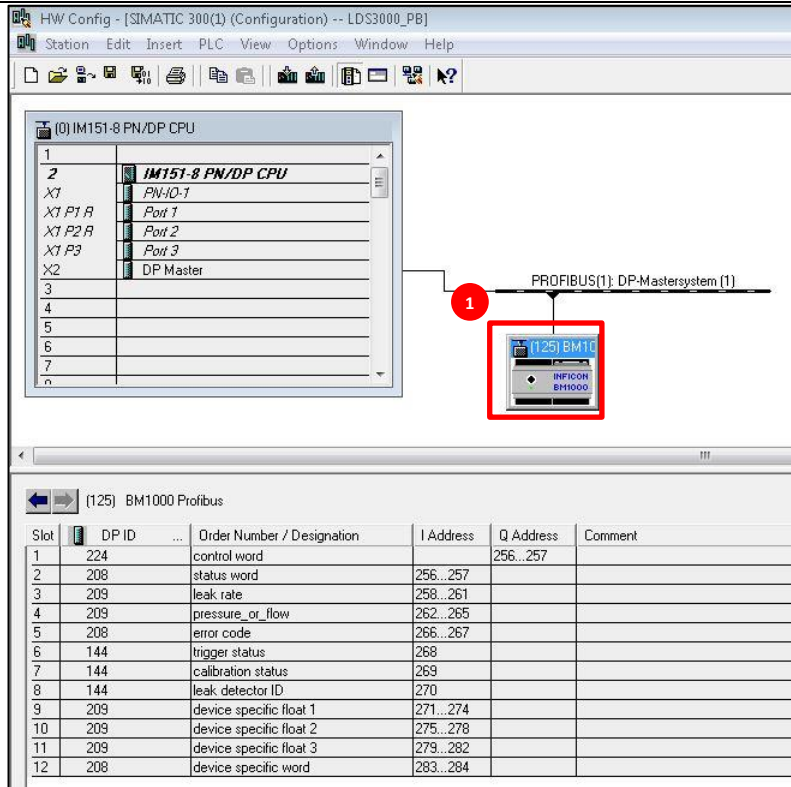
Command		Name	R/W	Data type	Meaning	No fieldbus support
dez	hex					
229	E5	Flow control	R/W	UINT8	0 = 25 sccm 1 = 300 sccm (low) 2 = 3000 sccm high flow 3 = standby flow LDS3000(AQ)/XL3000flex only	

Calculation of the **Slot** and **Index** numbers based on the LD command number

- Calculation of the Slot number:**
Slot = (LD command number – 1) DIV 255 (integer division)
Slot = (229 – 1) DIV 255
Slot = 0
- Calculation of the Index number:**
Index = (LD command number – 1) MOD 255
Index = (229 – 1) MOD 255
Index = 228

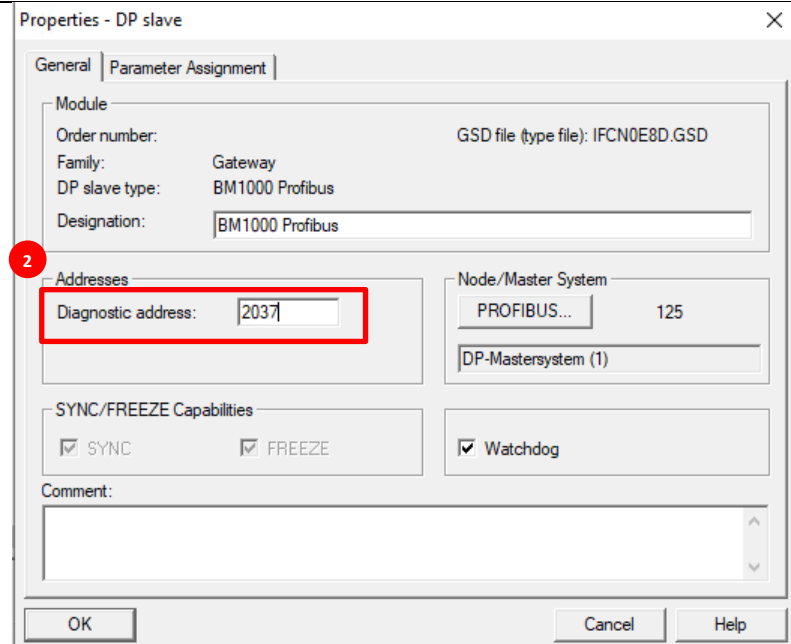
Based on the calculated Slot number, the parameter **ID** of the SFB53 “WRREC” function needs to be set. Therefore, the hardware configuration needs to be opened and the INFICON BM1000 PROFIBUS Module needs to be selected.

1. Select and double click on the “**INFICON BM1000**” PROFIBUS module, because the calculated slot number is **0**

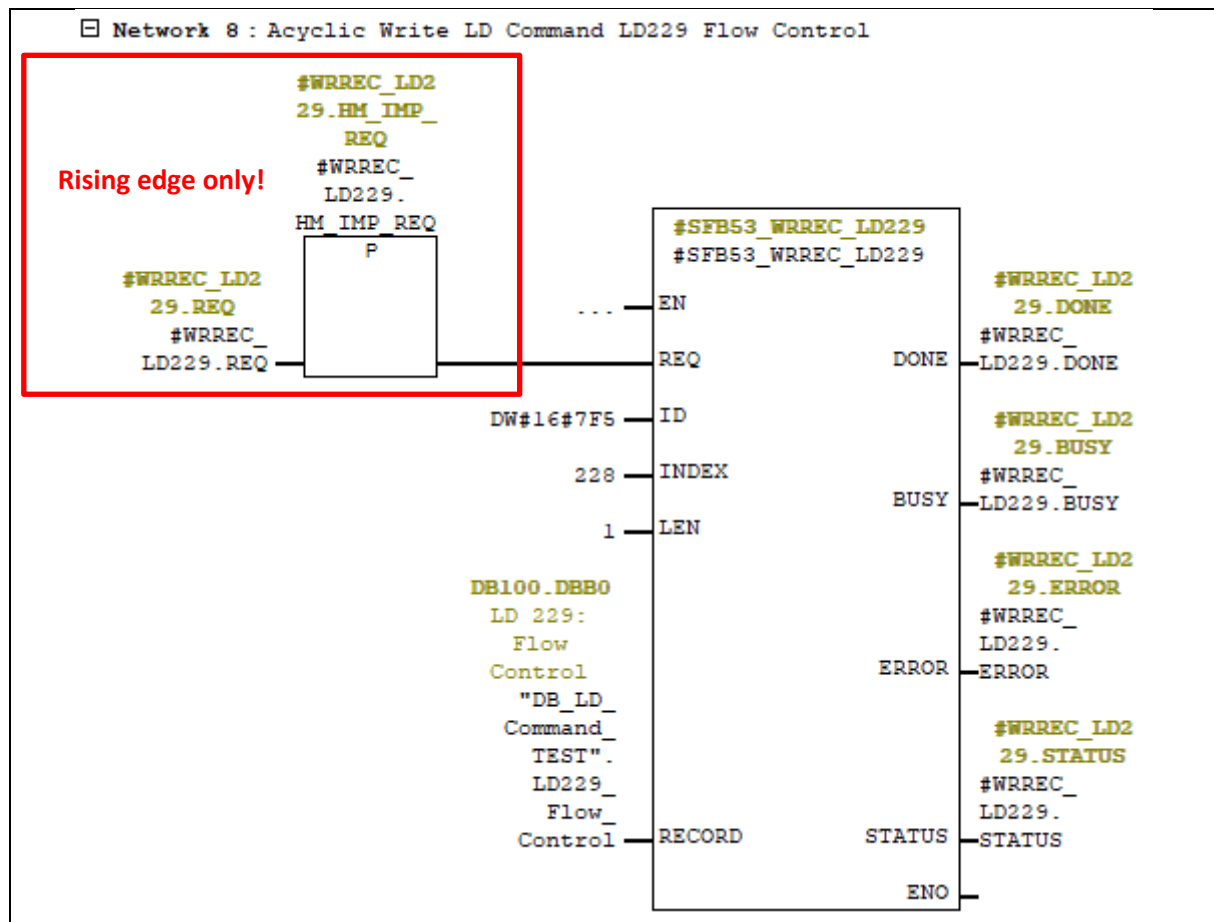


Slot	DP ID	Order Number / Designation	I Address	Q Address	Comment
1	224	control word		256...257	
2	208	status word	256...257		
3	209	leak rate	258...261		
4	209	pressure_or_flow	262...265		
5	208	error code	266...267		
6	144	trigger status	268		
7	144	calibration status	269		
8	144	leak detector ID	270		
9	209	device specific float 1	271...274		
10	209	device specific float 2	275...278		
11	209	device specific float 3	279...282		
12	208	device specific word	283...284		

2. Set ID to the diagnostic address of the “**INFICON BM1000**” PROFIBUS module



ID = 2037_{Dec} = 7F5_{Hex}



Parameter	Value	Description
REQ	Rising edge	<p>Before setting the REQ parameter to TRUE, all other parameters (ID, INDEX, LEN and RECORD) needs to be set</p> <p>Attention! Use only one rising edge to transfer data to the leak detector. Otherwise, the parameter will be transferred several times!</p>
ID	DW#16#7F5	<p>Hardware identifier of BM1000 PROFIBUS bus module based on the calculated slot number</p> <p>Slot = (229 – 1) DIV 255 = 0</p> <p>Slot 0 → set ID to the diagnostic address of the <i>INFICON BM1000</i> PROFIBUS module</p> <p>ID = 2037_{Dec} = 7F5_{Hex}</p>
INDEX	228	Index, based on the calculated index number

		Index = (LD command number – 1) MOD 255 Index = (229 – 1) MOD 255 = 228				
LEN	1	Length to be write in bytes Data type = UINT8 = 1 byte				
RECORD	BYTE	<p>The parameter RECORD specifies the source path for the data to be written. This parameter must have the same data type and the same dimensions like the LD command to be write.</p> <p>In this case, LD command 229 is from data type UINT8 with a length of 1 byte, so the corresponding STEP 7 data type is BYTE</p> <table><tr><td>LD229_Flow_Control</td><td>BYTE</td><td>B#16#0</td><td>LD 229: Flow Control</td></tr></table>	LD229_Flow_Control	BYTE	B#16#0	LD 229: Flow Control
LD229_Flow_Control	BYTE	B#16#0	LD 229: Flow Control			

All other parameters are set user-dependently.