GUIDE TO CONFIGURATION AND NETWORK INSTALLATION

PROFIBUS

Code: **80018C** - **ENGLISH**
Edition: **04** - **12/09**
Profibus firmware version: **01.1x**

CONTENTS

1 INTRODUCTION

The **2400** series of Fast Displays / Alarm Units and the **2500** series of High Performance Controllers with **PROFIBUS-DP** Fieldbus interface provide quick integration of typical instrument functions in advanced automation systems (such as PLC, Supervision Systems, etc.) interconnected via communication networks and standard EN50170 "**PROFIBUS"** protocols.

This guide does not describe the "PROFIBUS" Fieldbus: it is assumed that the user is already informed and that he will refer to the above-mentioned standard or to the official website of the P.N.O. (Profibus Network Organization): www.profibus.com for any updates.
It is also assumed that the user already has knowledge of the technical characteristics of the 2400/2500, contained in user manuals enclosed with the products or downloadable from GEFRAN S.P.A.'s website: www.gefran.com.

2 TECHNICAL CHARACTERISTICS

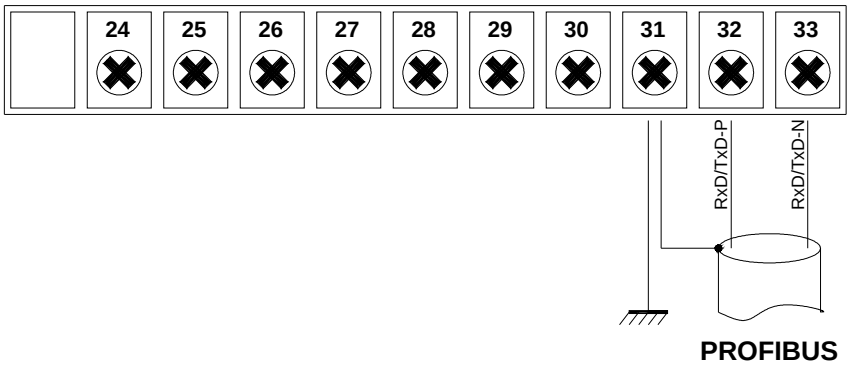
- PROFIBUS-DP V0 Slave
- Data exchange with PROFIBUS Master 16 I/O process words, configurable, with 35msec minimum refresh rate.
- Automatic identification of communication speed of PROFIBUS network from 9600Baud to 12Mbaud.
- Hardware selection of network address via rotary switch (1…99).
- Software selection of network address via *"SET_SLAVE_ADD"* telegram (as alternative to hardware selection).
- LEDs for diagnostics and state of PROFIBUS network.
- Standard RS485 interface in accordance with EN50170, galvanically isolated from power supply.

Additional technical details on PROFIBUS specifications may be found in the attached file **25000A40.gsd or 24000A40.gsd .**

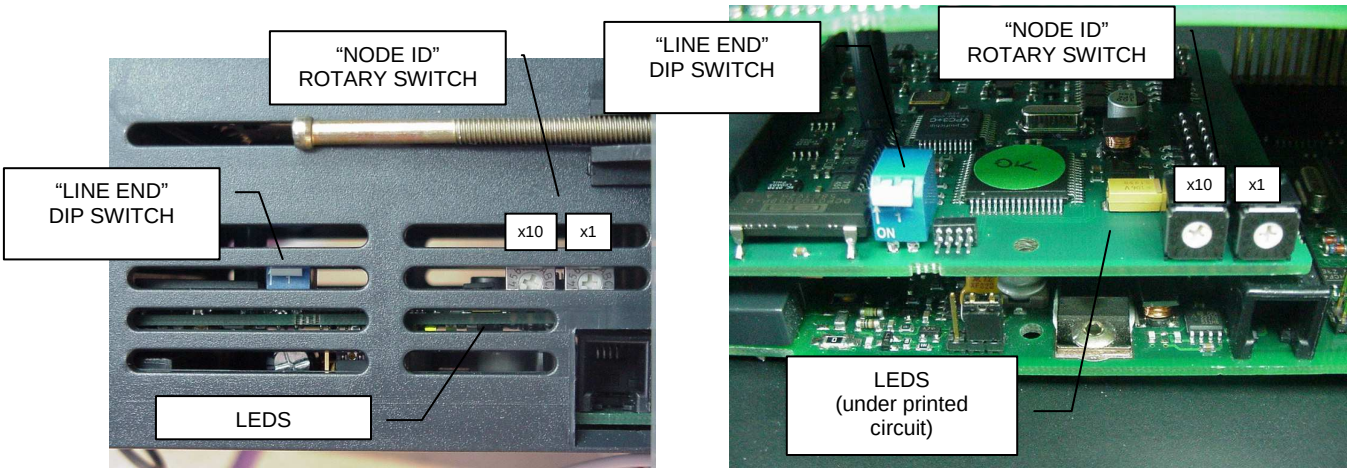
3 INSTALLATION

For a complete description of installation procedures and electrical connections, see the **"USER AND WARNINGS"** manual for the **2400** or **2500**, enclosed with the products.

3.1 ELECTRICAL CONNECTIONS TO PROFIBUS NETWORKS



When the instrument is the last node of the PROFIBUS network you have to terminate the line end by activating the dip-switch in the module.



In accordance with EN50170, the shielded cable must have special characteristics to guarantee correct communication between PROFIBUS devices up to 12Mbaud:

PARAMETER	TYPE "A" CABLE
Impedance in Ω	135…165
Capacity in pF/m	< 60
Loop resistance in Ω/Km	< 110
Nucleus diameter in mm	> 0.64
Nucleus section in mm^2	> 0.34 (AWG22)

By using cables with these characteristics, you can have the following line length:

Baudrate in Kbit/sec	9.6	19.2	45.45	93.75	187.5	500	1500	3000	6000	12000
Max. length in mt.	1200	1200	1200	1200	1000	400	200	100	100	100

GEFRAN S.p.A. supplies cables and PROFIBUS-approved connection systems as accessories.

DESCRIZIONE LED

"STATUS" (GREEN)	**PROFIBUS Operative state**
OFF	No communication with Master PROFIBUS
Flash 1000msec	"AUTOMATIC BAUDRATE RESEARCH" State
Flash 250msec	"WAIT FOR PARAMETRIZATION" State
Flash 50msec	"WAIT FOR CONFIGURATION" State
Ignited fixed	"DATA EXCHANGE" State

"ERROR" (RED)	**PROFIBUS Communication errors**
OFF	No communication errors
Flash 1000msec	"States not possible" Error
Flash 250msec	"DP_State not possible" Error
Flash 50msec	"WD_State not possible" Error
Ignited fixed	Out of order card

"DATA EXCHANGE" (YELLOW)	**ASIC State**
OFF	"DATA EXCHANGE" State
Ignited fixed	Other operating states

3.2 CONFIGURATION OF PROFIBUS NETWORK ADDRESS

3.2.1 CONFIGURATION OF PROFIBUS NETWORK ADDRESS VIA HARDWARE

The hexadecimal rotary switches on the 2400/2500 PROFIBUS module show the PROFIBUS network address node that is acquired when the instrument is switched on (see figure on previous page).
2400/2500 instruments come from the factory with the rotary switch in position "00." The user has to assign the correct position, considering that only "01" to "99" are valid positions.
The other rotary switch positions are for the special procedures described in the chapter "Installation of the MODBUS network."

3.2.2 CONFIGURATION OF PROFIBUS NETWORK ADDRESS VIA SOFTWARE

With the appropriate telegram (see paragraph 4.1), you can give the node address (1…124) and deactivate the address function of the rotary switch on the module. To restore the normal function of the rotary switch, send node address 125: the node address will immediately be reassigned via the rotary switch.
With this characteristic, you can expand the number of 2400/2500 instruments in a Profibus network by using addresses 100 to 124.

Note:
Check that the Profibus Master hardware supports transmission of the above-described telegram.

Example of software configuration:

1. **Rotary-Switch of instrument "x10" in position 1 and "x1" in position 0.**
   The Profibus network address is 10.

2. **Address 2 is sent to instrument via PROFIBUS software.**
   The Profibus network address becomes 2.

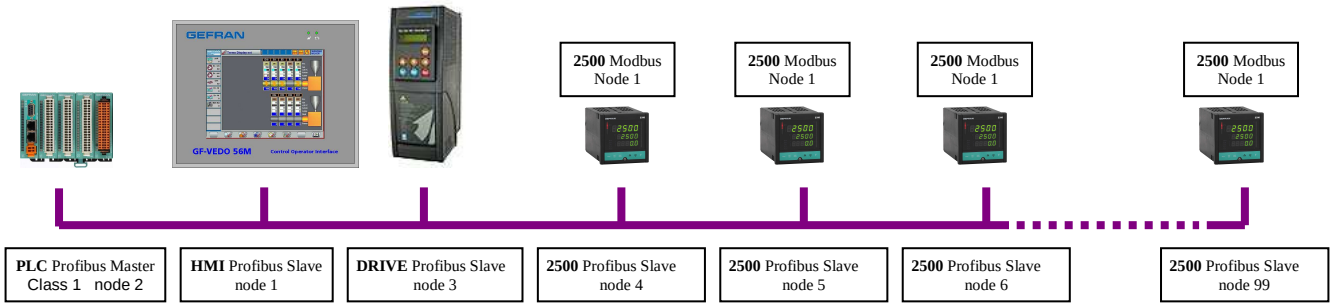
3. **Rotary-Switch of instrument "x10" in position 4 and "x1" in position 1.**
   Any change of the rotary-switch is insignificant for node addressing.
   The Profibus network address remains 2.

4. **Address 125 is sent to instrument via software.**
   The rotary-switch can now set the Profibus network address.
   The Profibus network address becomes 41.

3.2.3 CONFIGURATION PARAMETERS

The following parameters contained in the menu "Ser" must be set-up:
Cod = 1
bAu = 4
Par = 0
For the functionalities to make reference the relative user's manuals.

3.3 EXAMPLE OF PROFIBUS NETWORK WITH HARDWARE NODE ADDRESS SELECTION



4 PROFIBUS-DP DATA STRUCTURE

The “Configuration Telegram” (SAP 62) managed by the PROFIBUS Master has to contain the exact configuration of data (number of bytes, format and consistency) exchanged during the “DATA EXCHANGE” operative state (SAP DEFAULT).
By means of an area of 7 consistent bytes, always present, defined ***Parametric Data***, the PROFIBUS Master (PLC or Supervisor) can access any parameter of the instrument’s MODBUS memory map.
A second area contains 32 I/O bytes maximum, defined ***Process data***, that correspond to 16 read variables and 16 write variables of the instrument’s MODBUS memory map.
The user can select the read or write variables to attribute to the ***Process data***, based on the application, by means of the “Parameterization Telegram” (SAP 61).
When the PROFIBUS Master requests diagnostics from the instrument by means of the “Diagnostics Data Request Telegram” (SAP 60), 1 word will be transmitted that it evidences an eventual breakdown in the instrument**.**

4.1 CHANGE NODE ADDRESS TELEGRAM (SAP 55)

Class 2 Profibus Masters can change the address of Slaves with the *“Set_Slave_Add” function.*

BYTE	DESCRIPTION	VALUE (hex)
1	New address	n
2	Identifying number (high byte)	0A
3	Identifying number (low byte)	40
4	Enable (00)\Disable (01) other changes	00

4.2 CONFIGURATION TELEGRAM (SAP 62)

The PROFIBUS Master sends this to all Slave nodes before entering the “DATA EXCHANGE” operative state; in case of incorrect configuration, the instrument will not communicate with the Master.
In the following table the maximum configuration is visualized.

BYTE	DESCRIPTION	VALUE (hex)
0	PARAMETER DATA (7 bytes I/O consistent)	0xB6
1	PROCESS DATA 1 (1 word I/O)	0x70
2	PROCESS DATA 2 (1 word I/O)	0x70
3	PROCESS DATA 3 (1 word I/O)	0x70
4	PROCESS DATA 4 (1 word I/O)	0x70
5	PROCESS DATA 5 (1 word I/O)	0x70
6	PROCESS DATA 6 (1 word I/O)	0x70
7	PROCESS DATA 7 (1 word I/O)	0x70
8	PROCESS DATA 8 (1 word I/O)	0x70
9	PROCESS DATA 9 (1 word I/O)	0x70
10	PROCESS DATA 10 (1 word I/O)	0x70
11	PROCESS DATA 11 (1 word I/O)	0x70
12	PROCESS DATA 12 (1 word I/O)	0x70
13	PROCESS DATA 13 (1 word I/O)	0x70
14	PROCESS DATA 14 (1 word I/O)	0x70
15	PROCESS DATA 15 (1 word I/O)	0x70
16	PROCESS DATA 16 (1 word I/O)	0x70

4.3 PARAMETERISATION TELEGRAM (SAP 61)

The PROFIBUS Master uses this protocol before entering the “DATA EXCHANGE” operative state to identify itself to the instrument and specify how it has to function. See the attached file **24000A40.gsd** or **2500A40.gsd** for standard PROFIBUS parameterisations; the implementations introduced by byte 11 let the user define which instrument variables to read and write in the ***Process data*** of that PROFIBUS node.

INSTRUMENTS		2400		2500	
BYTE	**DESCRIPTION**	**DEFAULT**	**HEX**	**DEFAULT**	**HEX**
1≈7	In accordance with EN50170		-		-
8≈10	Reserved		00		00
11	Process Data Input 1 (MSB)	(530) PV1 LSW	02	(530) PV1 LSW	02
12	Process Data Input 1 (LSB)		12		12
13	Process Data Input 2 (MSB)	(531) PV1 MSW	02	(531) PV1 MSW	02
14	Process Data Input 2 (LSB)		13		13
15	Process Data Input 3 (MSB)	(536) Input 1 LSW	02	(532) Active SetPoint LSW	02
16	Process Data Input 3 (LSB)		18		14
17	Process Data Input 4 (MSB)	(537) Input 1 MSW	02	(533) Active SetPoint MSW	02
18	Process Data Input 4 (LSB)		19		15
19	Process Data Input 5 (MSB)	(538) Input 2 LSW	02	(534) Deviation SP-PV LSW	02
20	Process Data Input 5 (LSB)		1A		16
21	Process Data Input 6 (MSB)	(539) Input 2 MSW	02	(535) Deviation SP-PV LSW	02
22	Process Data Input 6 (LSB)		1B		17
23	Process Data Input 7 (MSB)	(540) Input 3 LSW	02	(536) Input 1 LSW	02
24	Process Data Input 7 (LSB)		1C		18
25	Process Data Input 8 (MSB)	(541) Input 3 MSW	02	(537) Input 1 MSW	02
26	Process Data Input 8 (LSB)		1D		19
27	Process Data Input 9 (MSB)	(542) Input 4 LSW	02	(538) Input 2 LSW	02
28	Process Data Input 9 (LSB)		1E		1A
29	Process Data Input 10 (MSB)	(543) Input 4 MSW	02	(539) Input 2 MSW	02
30	Process Data Input 10 (LSB)		1F		1B
31	Process Data Input 11 (MSB)	(544) Math funct. A LSW	02	(540) Input 3 LSW	02
32	Process Data Input 11 (LSB)		20		1C
33	Process Data Input 12 (MSB)	(545) Math funct. A MSW	02	(541) Input 3 MSW	02
34	Process Data Input 12 (LSB)		21		1D
35	Process Data Input 13 (MSB)	(546) Math funct. B LSW	02	(542) Input 4 LSW	02
36	Process Data Input 13 (LSB)		22		1E
37	Process Data Input 14 (MSB)	(547) Math funct. B MSW	02	(543) Input 4 MSW	02
38	Process Data Input 14 (LSB)		23		1F
39	Process Data Input 15 (MSB)	(1189) Controller status	04	(544) Math function A LSW	02
40	Process Data Input 15 (LSB)		A5		20
41	Process Data Input 16 (MSB)	(1192) Alarm status	04	(545) Math function A MSW	02
42	Process Data Input 16 (LSB)		A8		21
43	Process Data Output 1 (MSB)	(554) Alarm Point 1 LSW	02	(548) Local Setpoint LSW	02
44	Process Data Output 1 (LSB)		2A		24
45	Process Data Output 2 (MSB)	(555) Alarm Point 1 MSW	02	(549) Local Setpoint MSW	02
46	Process Data Output 2 (LSB)		2B		25
47	Process Data Output 3 (MSB)	(556) Alarm Point 2 LSW	02	(550) Setpoint 1 LSW	02
48	Process Data Output 3 (LSB)		2C		26
49	Process Data Output 4 (MSB)	(557) Alarm Point 2 MSW	02	(551) Setpoint 1 MSW	02
50	Process Data Output 4 (LSB)		2D		27
51	Process Data Output 5 (MSB)	(558) Alarm Point 3 LSW	02	(552) Setpoint 2 LSW	02
52	Process Data Output 5 (LSB)		2E		28
53	Process Data Output 6 (MSB)	(559) Alarm Point 3 MSW	02	(553) Setpoint 2 MSW	02
54	Process Data Output 6 (LSB)		2F		29
55	Process Data Output 7 (MSB)	(560) Alarm Point 4 LSW	02	(554) Alarm Point 1 LSW	02
56	Process Data Output 7 (LSB)		30		2A
57	Process Data Output 8 (MSB)	(561) Alarm Point 4 MSW	02	(555) Alarm Point 1 MSW	02
58	Process Data Output 8 (LSB)		31		2B

59	Process Data Output 9 (MSB)	(556) Alarm Point 5 LSW	02	(556) Alarm Point 2 LSW	02
60	Process Data Output 9 (LSB)		32		2C
61	Process Data Output 10 (MSB)	(557) Alarm Point 5 MSW	02	(557) Alarm Point 2 MSW	02
62	Process Data Output 10 (LSB)		33		2D
63	Process Data Output 11 (MSB)	(558) Alarm Point 6 LSW	02	(558) Alarm Point 3 LSW	02
64	Process Data Output 11 (LSB)		34		2E
65	Process Data Output 12 (MSB)	(559) Alarm Point 6 MSW	02	(559) Alarm Point 3 MSW	02
66	Process Data Output 12 (LSB)		35		2F
67	Process Data Output 13 (MSB)	(560) Alarm Point 7 LSW	02	(560) Alarm Point 4 LSW	02
68	Process Data Output 13 (LSB)		36		30
69	Process Data Output 14 (MSB)	(561) Alarm Point 7 MSW	02	(561) Alarm Point 4 MSW	02
70	Process Data Output 14 (LSB)		37		31
71	Process Data Output 15 (MSB)	(562) Alarm Point 8 LSW	02	(562) Alarm Point 5 LSW	02
72	Process Data Output 15 (LSB)		38		32
73	Process Data Output 16 (MSB)	(563) Alarm Point 8 MSW	02	(563) Alarm Point 5 MSW	02
74	Process Data Output 16 (LSB)		39		33

The “Process Data” are freely configurable and correspond to the MODBUS address of the corresponding variable, shown in the **MODBUS MEMORY MAP** document of the 2400/2500 instruments.

4.4 DIAGNOSTICS DATA REQUEST TELEGRAM (SAP 60)

When the PROFIBUS Master requests diagnostics data from the instrument, the instrument replies with 6 standard data bytes and 3 bytes representing specific product diagnostics.

BYTE	DESCRIPTION	VALUE (hex)
1 ≈ 6	In accordance with standard EN50170	-
7	Length of external diagnosis	2
8	MSB external diagnostics	xx
9	LSB external diagnostics	xx

With “**xx=00**” in absence of alarms and “**xx=FF**” with 2400/2500 in fault state.

4.5 DATA EXCHANGE (SAP DEFAULT)

After checking the correct instrument configuration and parameterisation via the telegrams described above, the PROFIBUS Master activates the "DATA EXCHANGE" protocol in which it cyclically transmits some bytes in output and reads some bytes in input to the PROFIBUS Slaves.
As mentioned above, there is an area of 7 bytes defined "***Parametric Data***" and an area of 32 bytes defined "***Process data***" both in output and in input.

OUTPUT DATA (from PROFIBUS Master to Slave)																	
PARAMETRIC DATA *"REQUEST"*							**PROCESS DATA**										
							WORD 1		***WORD 2***		***WORD 3***		***WORD 4***		≈	***WORD 16***	
							MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB		MSB	LSB
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		38	39

INPUT DATA (from PROFIBUS Slave to Master)																	
PARAMETRIC DATA *"REPLY"*							**PROCESS DATA**										
							WORD 1		***WORD 2***		***WORD 3***		***WORD 4***		≈	***WORD 16***	
							MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB		MSB	LSB
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		38	39

"***Parametric data***" are "consistent" data that let you read or write any MODBUS variable, in both bit format and in word format, in the 2400/2500 instruments connected to the PROFIBUS node.

PARAMETRIC DATA		
BYTE	**PARAMETER**	**DESCRIPTION**
1	TRG	TRIGGER BYTE: must be incremented by 1 at each new Request. The Reply is correct only when the value is the same.
2	ADD SLAVE	MODBUS address of 2400/2500 instrument (default = 1)
3	FC	Function code to specify process: Bit/Word Read/Write
4	DATUM 1	Depends on FUNCTION CODE
5	DATUM 2	Depends on FUNCTION CODE
6	DATUM 3	Depends on FUNCTION CODE
7	DATUM 4	Depends on FUNCTION CODE

4.5.1 PARAMETRIC DATA: READING A BIT

Request bytes

TRG	**ADD SLAVE**	**FC**	**ADD MSB**	**ADD LSB**	**NB MSB**	**NB LSB**
Trigger	Slave Address	1 or 2	Address Bit to read	Address Bit to read	Number of bit to read. (always 00)	Number of bit to read. (always 01)

Reply bytes

TRG	**ADD SLAVE**	**FC**	**NB**	**BIT**	**#**	**#**
Reply to set trigger	Confirm Slave address	Confirm process code. (1 or 2)	Number of bytes read (always 1)	Value of bit: 0 or FF	Empty	Empty

4.5.2 PARAMETRIC DATA: READING A WORD

Request bytes

TRG	ADD SLAVE	FC	ADD MSB	ADD LSB	NW MSB	NW LSB
Trigger	Slave Address	3 or 4	Address word to read	Address word to read	No. of word to read (always 00)	No. of word to read (always 01)

Reply bytes

TRG	ADD SLAVE	FC	NB	W MSB	W LSB	#
Reply to set trigger	Confirm Slave address	Confirm process code	Number of bytes read (always 2)	Msb value of word	Lsb value of word	Empty

4.5.3 PARAMETRIC DATA: WRITING A BIT

Request bytes

TRG	ADD SLAVE	FC	ADD MSB	ADD LSB	BIT	00
Trigger	Slave Address	5	Address bit to write	Address bit to write	Value bit to write (00 or FF)	Always 00

Reply bytes

TRG	ADD SLAVE	FC	ADD MSB	ADD LSB	BIT	00
Reply to set trigger	Confirm Slave address	Confirm process code	Address bit written	Address bit written	Value bit written (00 or FF)	Always 00

4.5.4 PARAMETRIC DATA: WRITING A WORD

Request bytes

TRG	ADD SLAVE	FC	ADD MSB	ADD LSB	W MSB	W LSB
Trigger	Slave Address	6	Address word to write	Address word to write	Value word to write	Value word to write

Reply bytes

TRG	ADD SLAVE	FC	ADD MSB	ADD LSB	W MSB	W LSB
Reply to set trigger	Confirm Slave address	Confirm process code	Address word written	Address word written	Msb value word written	Lsb value word written

In case of error, 80hex plus the requested process code will be shown instead of the process code. The error code will be shown in the CODE field.

Reply bytes

TRG	ADD SLAVE	FC	CODE	#	#	#
Reply to set trigger	Confirm Slave address	Process code + 80hex	Error code	Empty	Empty	Empty

The error codes are:

1 = Illegal function
2 = Illegal data address
3 = Illegal data value
6 = Slave device busy
9 = Illegal number data
10 = Read only data

4.5.5 PROCESS DATA INPUT

The "***Process data***" Input area lets the operator immediately read the value of some significant variables of the instrument connected to the PROFIBUS node.

PROCESS DATA INPUT			
BYTE	**PARAMETER**	**2400**	**2500**
1	Process Data Input 1 (MSB)	PV1 LSW	PV1 LSW
2	Process Data Input 1 (LSB)		
3	Process Data Input 2 (MSB)	PV1 MSW	PV1 MSW
4	Process Data Input 2 (LSB)		
5	Process Data Input 3 (MSB)	Input 1 LSW	Active SetPoint LSW
6	Process Data Input 3 (LSB)		
7	Process Data Input 4 (MSB)	Input 1 MSW	Active SetPoint MSW
8	Process Data Input 4 (LSB)		
9	Process Data Input 5 (MSB)	Input 2 LSW	Deviation SP-PV LSW
10	Process Data Input 5 (LSB)		
11	Process Data Input 6 (MSB)	Input 2 MSW	Deviation SP-PV LSW
12	Process Data Input 6 (LSB)		
13	Process Data Input 7 (MSB)	Input 3 LSW	Input 1 LSW
14	Process Data Input 7 (LSB)		
15	Process Data Input 8 (MSB)	Input 3 MSW	Input 1 MSW
16	Process Data Input 8 (LSB)		
17	Process Data Input 9 (MSB)	Input 4 LSW	Input 2 LSW
18	Process Data Input 9 (LSB)		
19	Process Data Input 10 (MSB)	Input 4 MSW	Input 2 MSW
20	Process Data Input 10 (LSB)		
21	Process Data Input 11 (MSB)	Math function A LSW	Input 3 LSW
22	Process Data Input 11 (LSB)		
23	Process Data Input 12 (MSB)	Math function A MSW	Input 3 MSW
24	Process Data Input 12 (LSB)		
25	Process Data Input 13 (MSB)	Math function B LSW	Input 4 LSW
26	Process Data Input 13 (LSB)		
27	Process Data Input 14 (MSB)	Math function B MSW	Input 4 MSW
28	Process Data Input 14 (LSB)		
29	Process Data Input 15 (MSB)	Controller status	Math function A LSW
30	Process Data Input 15 (LSB)		
31	Process Data Input 16 (MSB)	Alarm status	Math function A MSW
32	Process Data Input 16 (LSB)		

The "***Process data***" Input show the value of the variable selected via the PARAMETERISATION TELEGRAM described above.

4.5.6 PROCESS DATA OUTPUT

The "***Process data***" Output area lets the operator immediately write the value of some significant variables of the instrument connected to the PROFIBUS node.

PROCESS DATA OUTPUT			
BYTE	**PARAMETER**	**2400**	**2500**
1	Process Data Output 1 (MSB)	Alarm Point 1 LSW	Local Setpoint LSW
2	Process Data Output 1 (LSB)		
3	Process Data Output 2 (MSB)	Alarm Point 1 MSW	Local Setpoint MSW
4	Process Data Output 2 (LSB)		
5	Process Data Output 3 (MSB)	Alarm Point 2 LSW	Setpoint 1 LSW
6	Process Data Output 3 (LSB)		
7	Process Data Output 4 (MSB)	Alarm Point 2 MSW	Setpoint 1 MSW
8	Process Data Output 4 (LSB)		
9	Process Data Output 5 (MSB)	Alarm Point 3 LSW	Setpoint 2 LSW
10	Process Data Output 5 (LSB)		
11	Process Data Output 6 (MSB)	Alarm Point 3 MSW	Setpoint 2 MSW
12	Process Data Output 6 (LSB)		
13	Process Data Output 7 (MSB)	Alarm Point 4 LSW	Alarm Point 1 LSW
14	Process Data Output 7 (LSB)		
15	Process Data Output 8 (MSB)	Alarm Point 4 MSW	Alarm Point 1 MSW
16	Process Data Output 8 (LSB)		
17	Process Data Output 9 (MSB)	Alarm Point 5 LSW	Alarm Point 2 LSW
18	Process Data Output 9 (LSB)		
19	Process Data Output 10 (MSB)	Alarm Point 5 MSW	Alarm Point 2 MSW
20	Process Data Output 10 (LSB)		
21	Process Data Output 11 (MSB)	Alarm Point 6 LSW	Alarm Point 3 LSW
22	Process Data Output 11 (LSB)		
23	Process Data Output 12 (MSB)	Alarm Point 6 MSW	Alarm Point 3 MSW
24	Process Data Output 12 (LSB)		
25	Process Data Output 13 (MSB)	Alarm Point 7 LSW	Alarm Point 4 LSW
26	Process Data Output 13 (LSB)		
27	Process Data Output 14 (MSB)	Alarm Point 7 MSW	Alarm Point 4 MSW
28	Process Data Output 14 (LSB)		
29	Process Data Output 15 (MSB)	Alarm Point 8 LSW	Alarm Point 5 LSW
30	Process Data Output 15 (LSB)		
31	Process Data Output 16 (MSB)	Alarm Point 8 MSW	Alarm Point 5 MSW
32	Process Data Output 16 (LSB)		

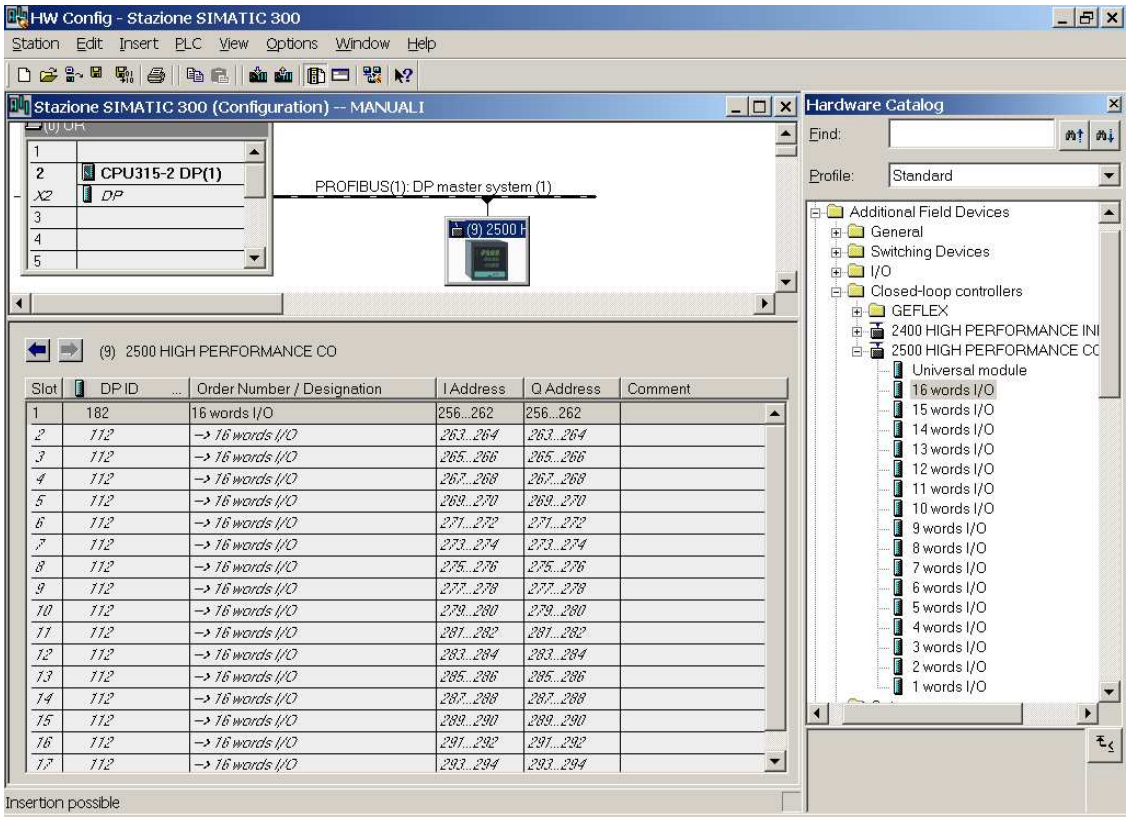
The "***Process data***" Output show the value of the variable selected via the PARAMETERISATION TELEGRAM described above.

5 USING PROFIBUS 2400/2500 INSTRUMENTS WITH SIEMENS STEP7

5.1 CONFIGURATION

Files **24000A40.gsd** and **25000A40.gsd** contain the information needed to operate a PROFIBUS DP Slave instrument. These files have to be installed in SIEMENS Step7 programming environment in order to insert the 2400/2500 instruments in the PROFIBUS network hardware configuration.

1. Open the project hardware configuration.
2. Select *Station/Close* on the menu.
3. Select *Instrument/Install new GSD file*.
4. In the window, look for the file on the support on which it is saved (Floppy or Hard Disk).
5. Press Open.
6. The item "**2500 HIGH PERFORMANCE CONTROLLER**" (with file 25000a40.gsd) or "**2400 HIGH PERFORMANCE INDICATOR"** (with file 24000a40.gsd) has now been added to the catalog. To find it, expand the item "Profibus", then expand the folder "Other field devices", and finally expand "Controller."
7. Reopen the project station configuration.
8. Drag the **2500 HIGH PERFORMANCE CONTROLLER** icon with the mouse and drop it on the Profibus bus line of the project. A new Profibus Slave will be created.
9. Assign the PROFIBUS node to the new Slave. The PROFIBUS node must conform to the one set on the instrument by means of the rotary switch. The dedicated memory areas will appear automatically.
10. To select an element from the section "2500HIGH PERFORMANCES CONTROLLER", according to the number of word of data of process wished. The dedicated areas of memory will appear automatically.



The first 7 read bytes and the first 7 write bytes are called "Consistent," and correspond to addresses PEB256..PEB262; PAB256..PAB262 in the figure. The next bytes (PEB263..PEB294;PAB263..PAB294) represent the contents of the instrument's variables parameterized via the "DP Slave Properties" window.

Note:
If you decide to use both FC "CFG 2400_2500" (see par. 5.3.1) and FC "PD_2400_2500" (see par. 5.3.2) it is necessary to check that the Hardware configurator assigned memory addresses close to all memory areas. In case of "holes" or "jumps" in the sequence, manually assign the first address in an area known to be free. If FCs are used, E addresses (inputs) must be equal to A addresses (output).

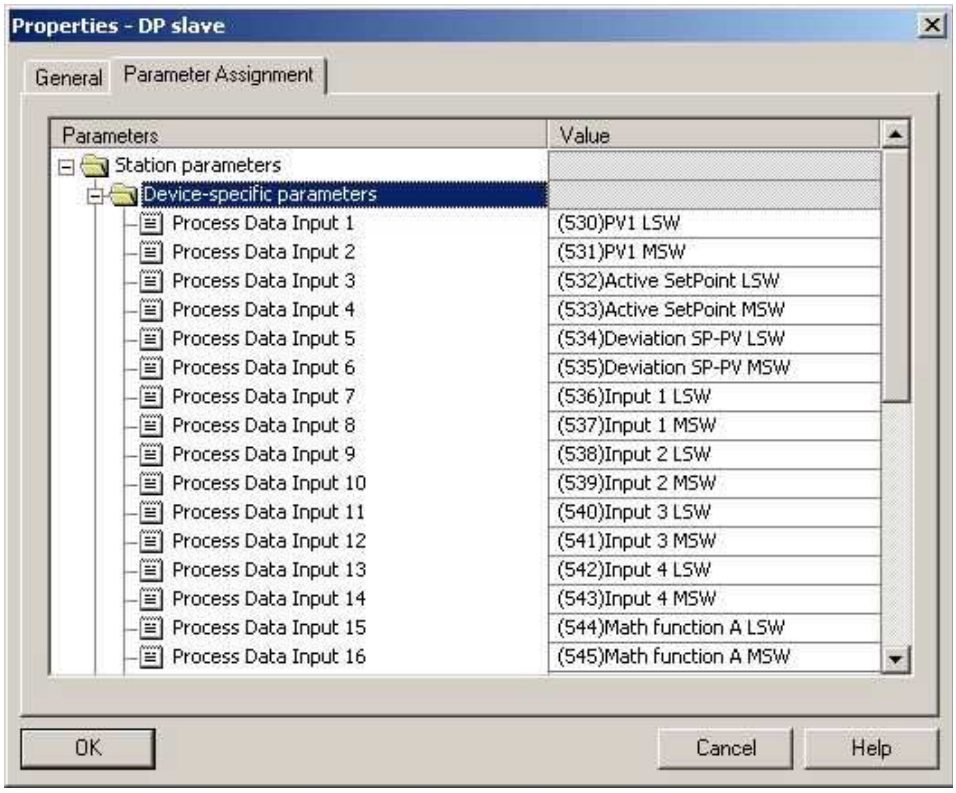
5.2 PARAMETERISATION

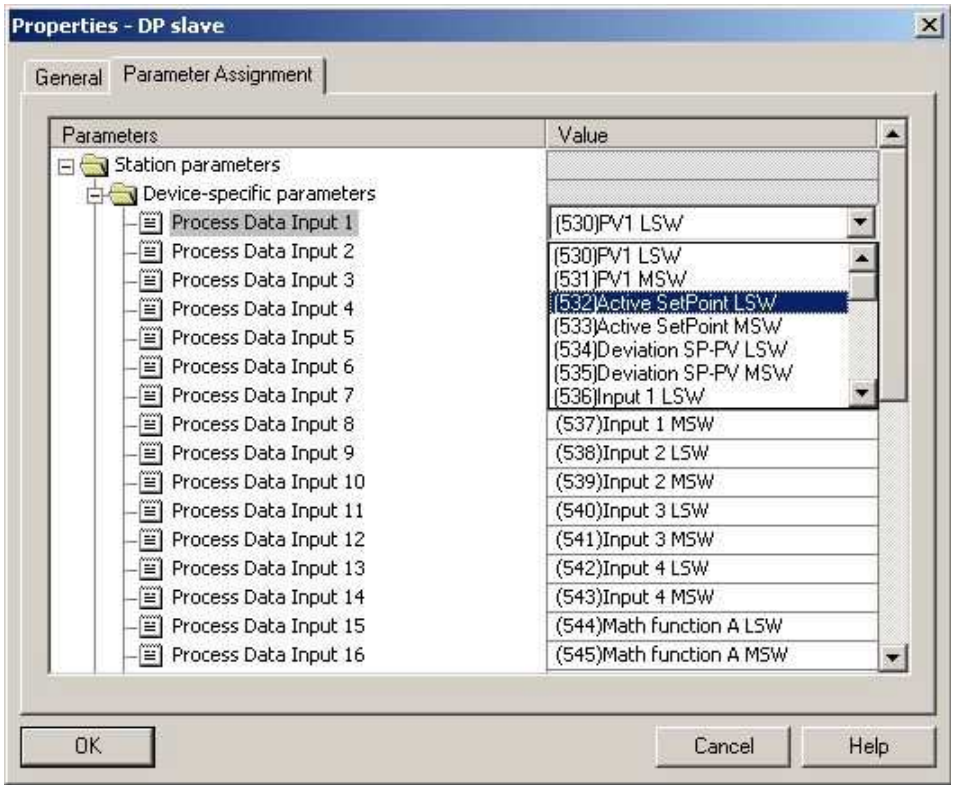
Select the preferred process data by selecting the DP slave properties on the hardware configuration page (16 word input and 16 word output as described in paragraphs **4.5.5** and **4.5.6**); the selected “Value” represents:

(530) PV1 LSW

Variable description

Variable numerical index in the instrument Modbus Map





Clicking the fields in the "Value" column (on the right) lets you modify the default parameter as required by opening a pull-down menu to choose preset variables.

Use the vertical scroll bar to display the "Process Data Output" variables and thereby change the default value by choosing one of the alternatives provided.

Note:
If you decide to use FC "PD_2400_2500" (see paragraph 5.3.2), the process data of the INPUT area are ciclically read and written in the assigned data block, while the process data of the OUTPUT area are written in the instrument at the same time if at least one datum is changed in the assigned data block.

5.2.1 DATA IN WHOLE DOUBLE FORMAT

Process data in whole double format are represented with bits from 0 to 15 in the word with LSW suffix and with bits from 16 to 31 in the word with MSW suffix.
Siemens uses byte addressing for the various memory areas: in a word, the most significant byte is the one with the lowest address, in a double word the most significant word is the one with the lowest address.

For example if we want to read the process variable 1 (PV1) associated to instrument PDI 1 and 2, we will have to assign the word "(531)PV1 MSW" to PDI 1 and the word "(530)PV1 LSW " to PDI 2 so that the reading of the double word is correct:

PED 263 = PV1

Bytes in the PED have the following order:

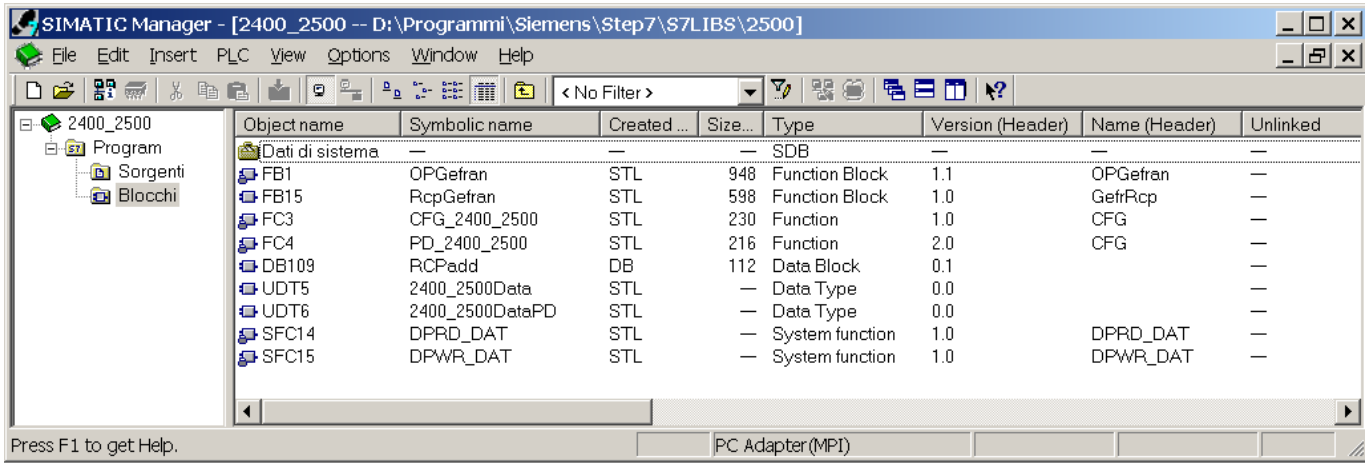
	PEB 263	**PEB 264**	**PEB 265**	**PEB 266**
Bit:	31..24	23..16	15..8	7..0

In this way the word containing PDI 1 and PDI 2 will be placet as follows:

PEW 263 = PV1 MSW
PEW 265 = PV1 LSW

5.3 S7 BLOCKS FOR THE MANAGING OF INSTRUMENTS 2400 AND 2500 IN PROFIBUS

In the instruments documentation the following files are supplied:



Function Call “FC3” makes the “Parametrical data” of the instrument available in a Data Block (see paragraphs 4.5.1, 4.5.2, 4.5.3, 4.5.4) used together with the FB1 to read and write all the variables contained in the instrument memory map.
Function Call “FC4” makes the “Process data” of the instrument available in a Data Block (see paragraphs 4.5.5, 4.5.6).
The two FCs can be used at the same time. Please refer to paragraph 5.3.1 for the choice of the UDT to be used.

Note:
*Insert the **OB82** (even empty) in the project for the managing of the peripheral diagnostics. Instruments use the slave Profibus standard diagnostics; when there is no OB82 and there are diagnostics messages, CPU would stop. (please refer to the section Slave diagnostics standard area in chapter 5.4)*

5.3.1 UDT5 “2400_2500DATA” AND UDT6 “2400_2500DATAPD” (USER DATA TYPE)

UDTs create the data block containing the whole peripheral area of an instrument.
Templates (UDT) have to be used only with the following criteria:

- If you want to use **FC3** but **not FC4** it is advisable to create the DB with UDT “2400_2500Data”
- If you want to use **both FCs** or **only FC4** it is necessary to use UDT “2400_2500DataPD”

If **UDT “2400_2500Data** “ is used the resulting data block will have the following composition:

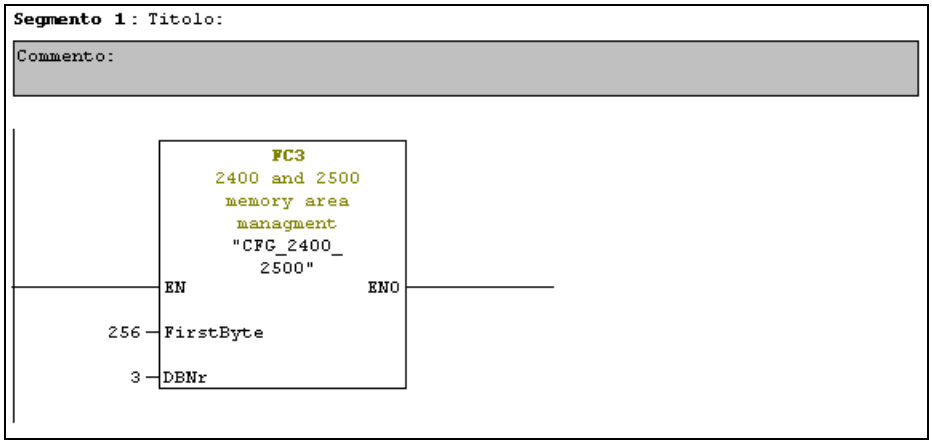
DBx.DBB0	Trigger (reserved)
DBx.DBB0	Counter (reserved)
DBx.DBB2 .. ..DBx.DBB8	Request of PARAMETRICAL DATA
DBx.DBB9 .. ..DBx.DBB15	Reply of PARAMETRICAL DATA
DBx.DBW16	Error word in the writing operation of the consistency area *(SFC15, DPWR_DAT)(please refer to SIEMENS STEP7 manual for error codes)*
DBx.DBW18	Error word in the reading operation of the consistency area *(SFC14, DPRD_DAT)(please refer to SIEMENS STEP7 manual for error codes)*

If **UDT "2400_2500DataPD "** is used the resulting data block will have the following composition:

DBx.DBB0	Trigger (reserved)
DBx.DBB0	Counter (reserved)
DBx.DBB2 .. ..DBx.DBB8	Request of PARAMETRICAL DATA
DBx.DBB9 .. ..DBx.DBB15	Reply of PARAMETRICAL DATA
DBx.DBW16	Error word in the writing operation of the consistency area (SFC15, DPWR_DAT)(please refer to SIEMENS STEP7 manual for error codes)
DBx.DBW18	Error word in the reading operation of the consistency area (SFC14, DPRD_DAT)(please refer to SIEMENS STEP7 manual for error codes)
DBx.DBW20	INPUT 1 PROCESS DATUM
DBx.DBW22	INPUT 2 PROCESS DATUM
≈	≈
DBx.DBW50	INPUT 16 PROCESS DATUM
DBx.DBW52	OUTPUT 1 PROCESS DATUM
DBx.DBW54	OUTPUT 2 PROCESS DATUM
≈	≈
DBx.DBW82	OUTPUT 16 PROCESS DATUM

5.3.2 FC3 "CFG 2400 2500"

This function makes available, in the data block created with UDT described in the previous paragraph, the instrument Parametrical Data necessary for the FB1 operation (see paragraph 5.3.4)

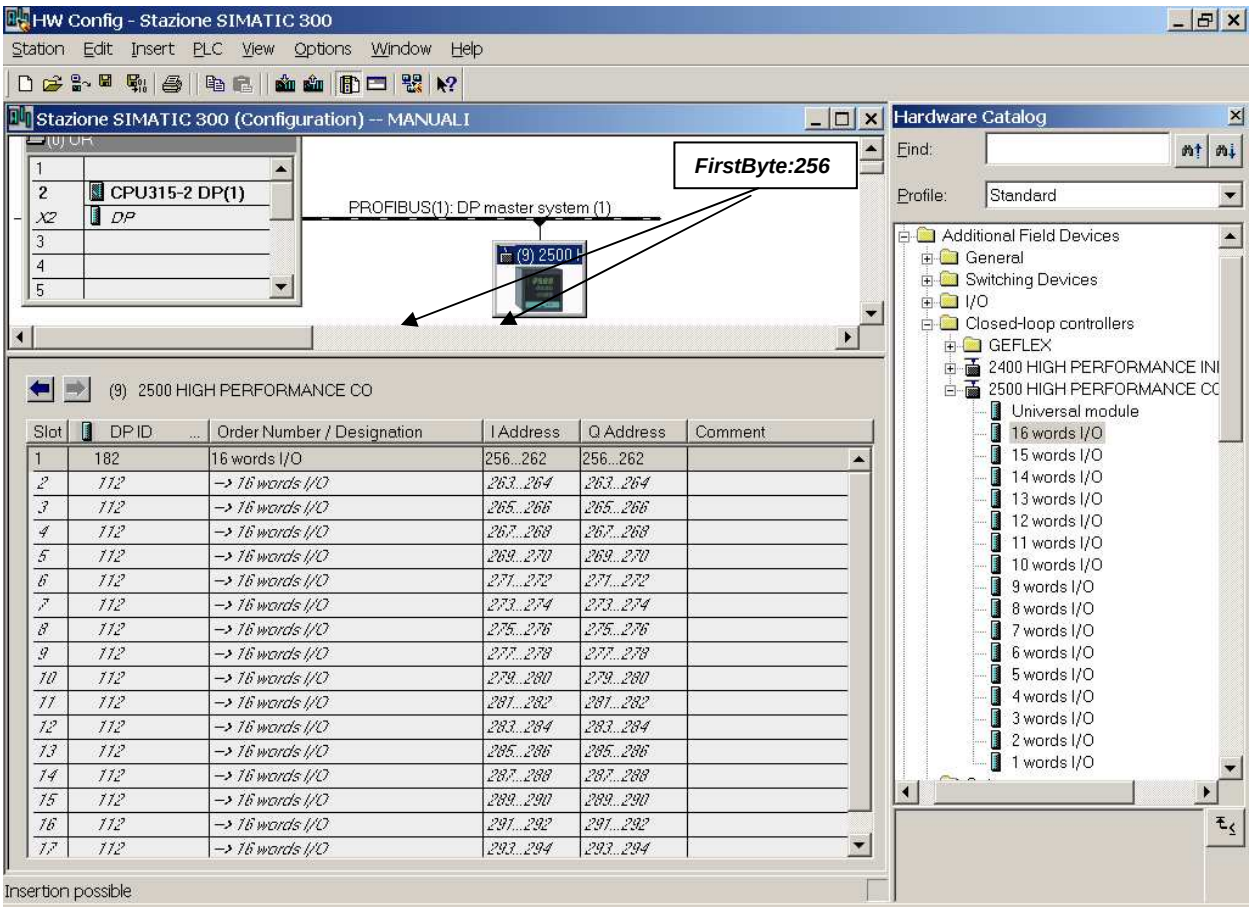


FC must be called up in the OB1, without conditions, so that each scanning updates data.

Two input parameters are requested:

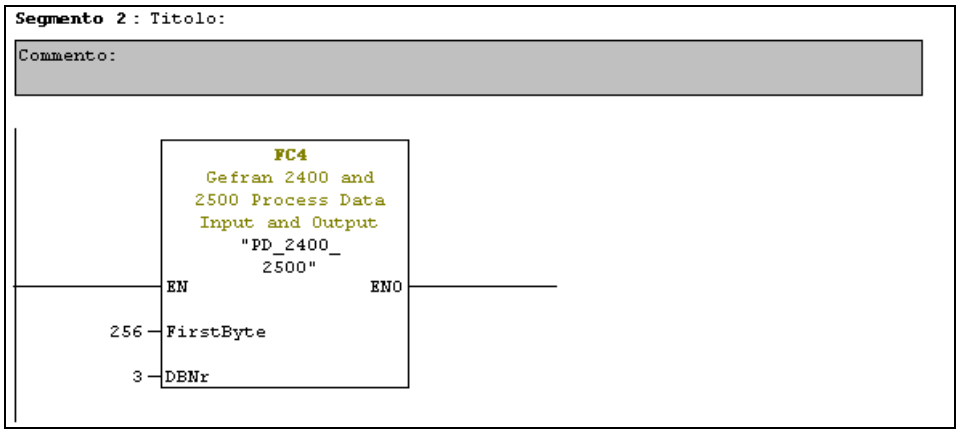
- **FirstByte (INT):**
  It is the first memory address assigned in the instrument hardware configuration

- **DBNr (INT):**
  It is the number of data block created with UDT4 or UDT5 in order to keep the whole area of exchange data.



5.3.3 FC4 “PD 2400 2500”

This function (FC) makes available, in the data block created with UDT described in paragraph 5.3.1, the instrument Process Data.
Each time FC is called up, both reading and writing process data are updated.

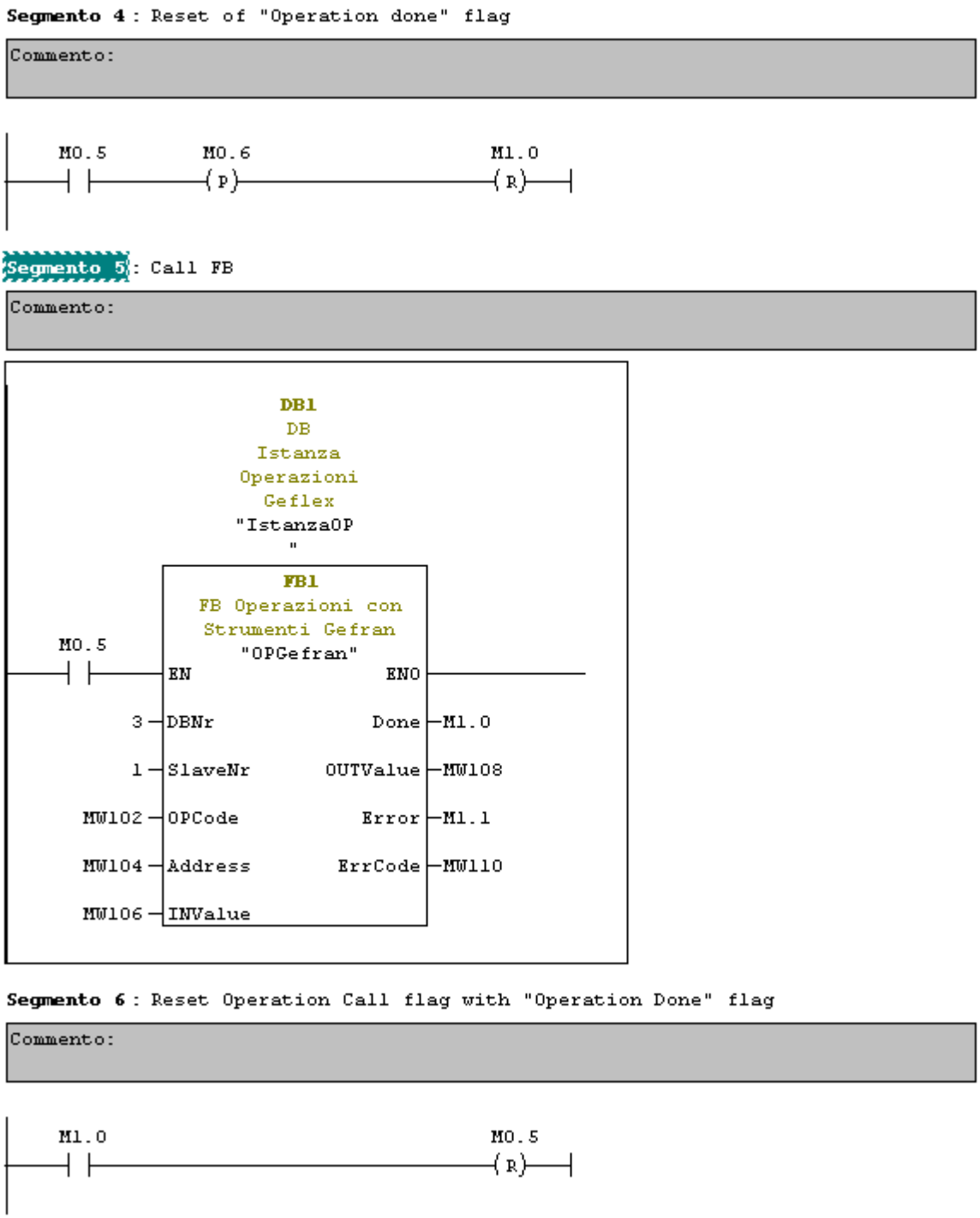


As for FC3, it must be called up in the OB1, without conditions, so that each scanning updates data and three input parameters are requested:

- **FirstByte (INT) :** as for FC3
- **DBNr (INT):** as for FC3
- **Word_Nr(INT):** number of word I/O selected in configuration HW
  (0 = 1 word I/O …. 15 = 16 word I/O

5.3.4 FB1 “OP GEFRAN”

This function block (FB) manages the fundamental operations of communicating and configurating Gefran instruments. Bit or word reading or writing operations are available for the user.



FB needs one freely assignable istance DB.
Branch enabling must be kept high for the necessary time. It is advisable to reset it with “Operation done” flag.

The block needs 5 input parameters and replies with 4 output parameters.

Input parameters:

- **DBNr (INT) :**
  It is the number of the data block assigned to the instrument to be asked or controlled.
  (In the picture the associated DB is DB3)

- **SlaveNr (INT) :**
  It is the slave MODBUS address with which to operate.
  In instruments 2400 and 2500 it is fixed at 1

- **OPCode (INT) :**
  It is the operation code enabling the function to know if you want to read or write one word or one bit. The operation code are:

1	Bit reading
3	Word reading
5	Bit writing
6	Word writing

- **Address (INT) :**
  It is the address of the word or of the bit we want to read or write. (Please refer to the manual or the modbus map of the instrument that can find word or bit MODBUS addresses)

- **INValue (INT):**
  It is the value we want to write in the chosen word or bit. If we want to write a bit it is clear only the values 1 and 0 are can be chosen.
  In reading operations this parameter is ignored.

Output parameters:

- **Done (BOOL) :**
  It is a flag indicating that the operation ended.

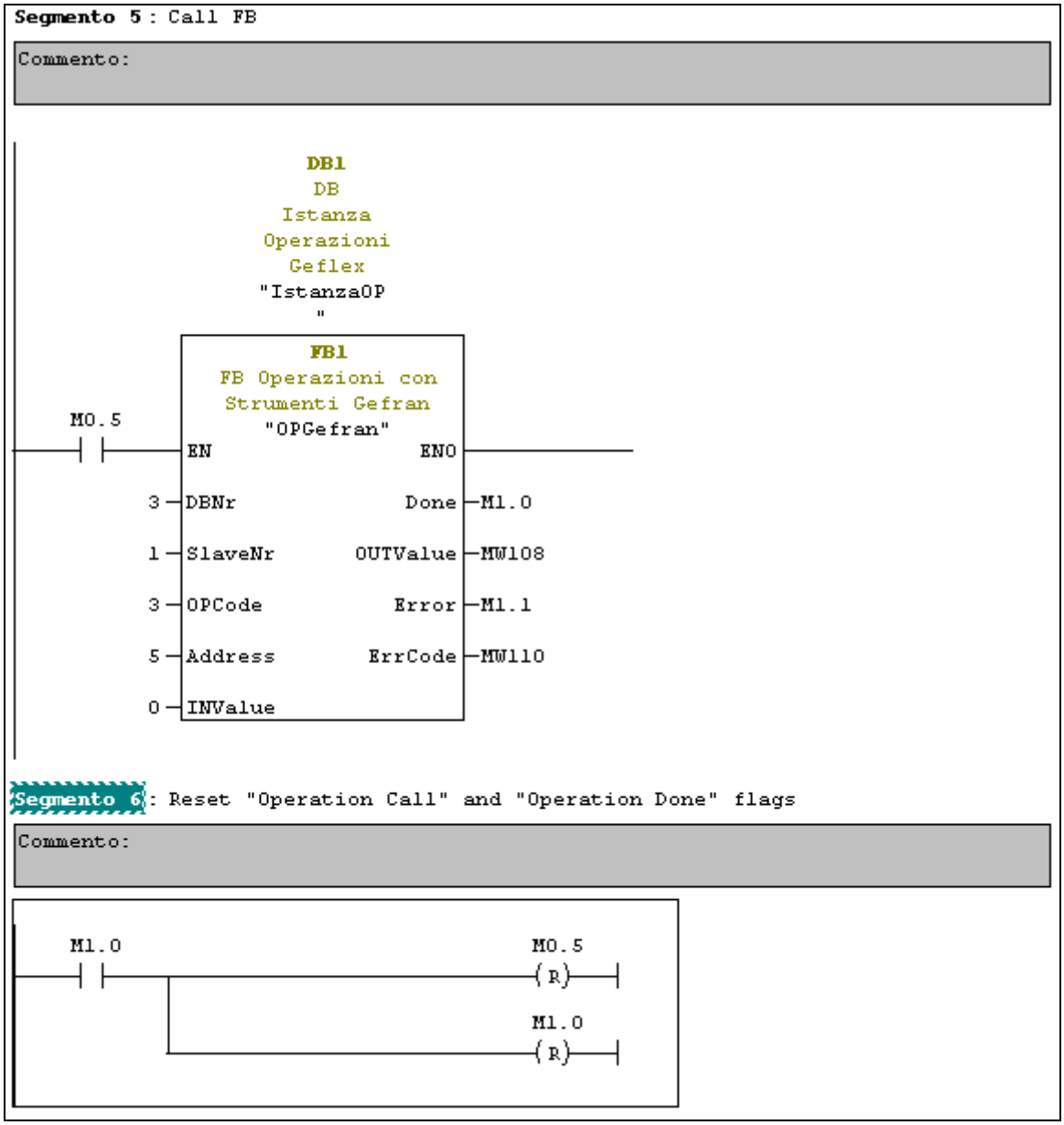
- **OUTValue (INT):**
  It is the value read in the specified word or bit.
  In writing operations 1 is written if the action went well, and 0 if an error took place

- **Error (BOOL):**
  It is a flag indicating that the operation ended with an error.

- **ErrCode (INT):**
  It is the error code found:

1	Illegal function
2	Illegal data address
3	Illegal data value
6	Slave device busy
9	Illegal number data
10	Read only data
20	Timeout Communication
21	Input value error

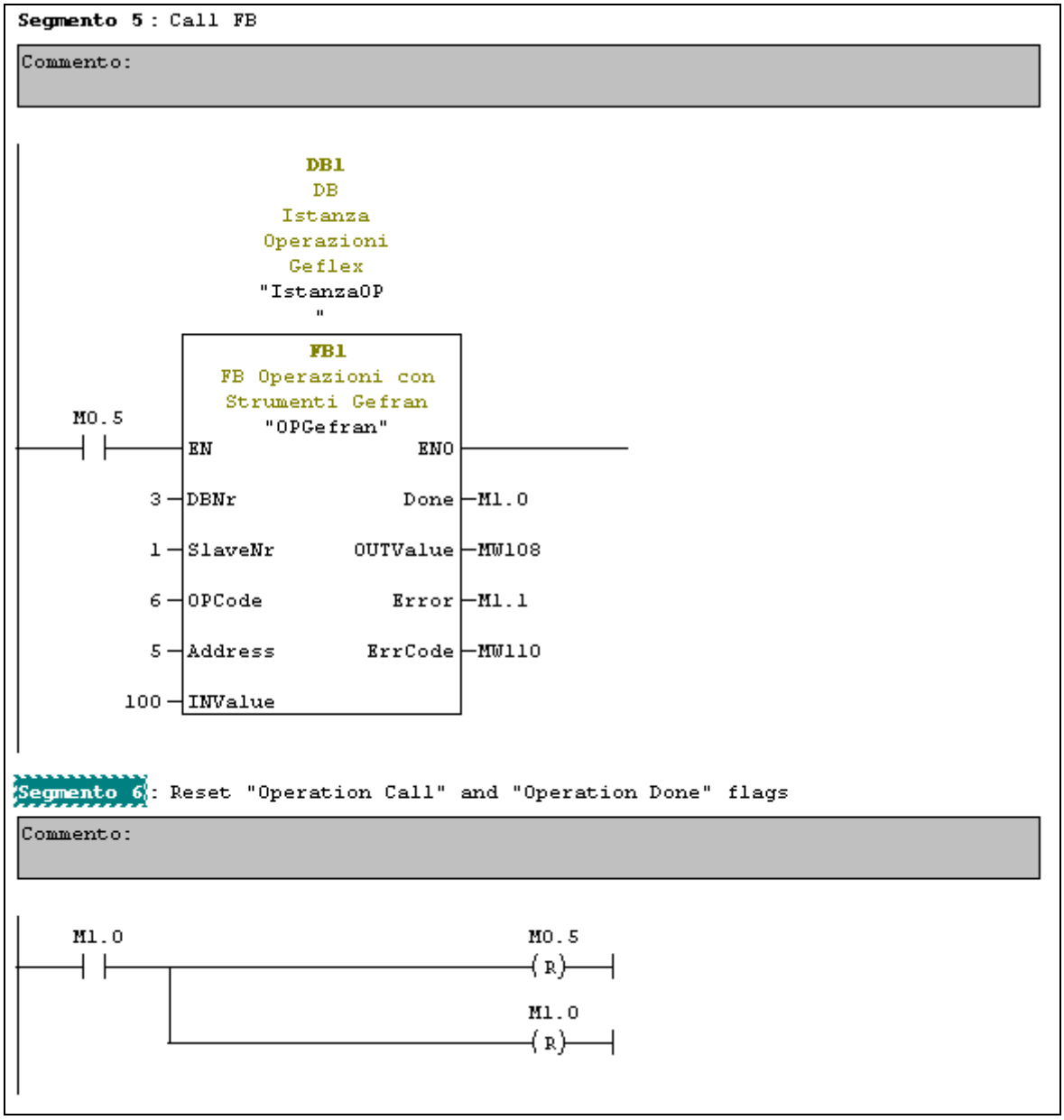
Example 1



In this example the “group 1 proportional band” with modbus address 5 is read.
DB associated to the instrument is DB 3, created with UDT5 or 6, and it is specified at the first input parameter “DBNr”.
The instrument MODBUS address to call is 1.
The word reading operation code is 3
The word address to be read is 5.
The INValue parameter for this operation is indifferent.

When the bit M1.0 associated to the “Done” flag goes to 1, in the word MW108, associated to the OUTValue output parameter, there will be the active setpoint value.
The request must be reset only when the “Done” flag goes to 1.
If there were errors the bit M1.1 would go to 1 and in the word MW110 we would have the error code.

Example 2



In this example the writing of the group 1 proportional band with modbus address 5 is made.
DB associated to the instrument is DB 3, created with UDT5 or 6, and it is specified at the first input parameter “DBNr”.
The instrument MODBUS address to call is 1.
The word writing operation is 6.
The word address to be read is 5.
The band value to set is 10.0%, therefore we will assign 100 to the INValue parameter.

When the bit M1.0 goes to 1 the operation has been carried out. In the word MW108 we will find 1 if the operation went well, otherwise we will find 0.
The error signal and the request managing is the same as for the previoius example.

5.3.5 FB15 “RCP GEFRAN”

The FB15 function block saves or writes a pre-definded parameter set.

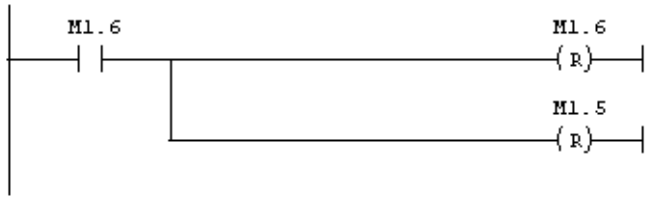
FB15 nees an istance DB.

It must be called up only upon request and kept active until the operation is completed. It is tipically set on a Bit that enables the branch and that is reset with the “Job done” flag.

In the FB15 it is request to set, apart from the instrument system DB (the one assigned with FC3 or FC4) also the istance DV used for the FB1 “OPGefran” of the interested instrument.

In case of error the function is interrupted even if it is not complete and the Error bit is set. In the Output parameters “ErrorCode” and “ErrorParamNr” it is possible to find the error code and the address of the 2500 that caused it (always 1).

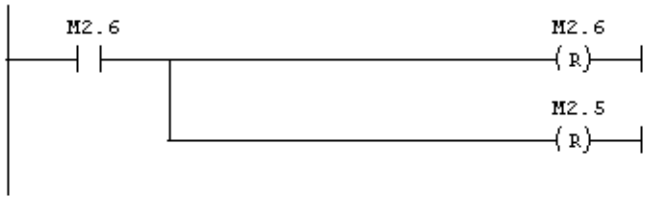
```
Segmento 7: Store Recipe
Commento:

      UN    M      1.5
      SPB   FS7

      CALL  FB     15 , DB15          RcpGefran / FB15Inst      -- Gefran Configuration recipes
       DBNr        :=3
       DBIST       :=DB1              FB1Inst                   -- Istance DB for FB1
       SlaveNr     :=1
       RCP_DB      :=20
       Funct       :=FALSE
       ParamNr     :=39
       ParamListDB:=109
       Done        :=M1.6
       Error       :=M1.7
       ErrCode     :=MW112
       ErrParamNr  :=MW114


FS7:  NOP   0

Segmento 8: Titolo:
Commento:
```



```
Segmento 9 : Load Recipe
Commento:

      UN    M      2.5
      SPB   FS9

      CALL  FB    15 , DB15            RcpGefran / FB15Inst       -- Gefran Configuration recipes
       DBNr       :=3
       DBIST      :=DB1                FB1Inst                    -- Istance DB for FB1
       SlaveNr    :=1
       RCP_DB     :=21
       Funct      :=TRUE
       ParamNr    :=39
       ParamListDB:=109
       Done       :=M2.6
       Error      :=M2.7
       ErrCode    :=MW116
       ErrParamNr :=MW118


FS9:  NOP   0
```

Segmento 10 : Titolo:

Commento:



Input parameters:

- **DBNr (INT) :**
  In this field you have to specify the number (only the number in figures or a INT variable that contains the valued) of the DB associated to the instrument to be operated. The association is the one made at FC3 or FC4 call up.
- **DBIST (BLOCK_DB):**
  In this field you have to specify the name (please use the symbolic name of the DB or the full indication “DBxx”) of the FB1 istance DB “OPGefran” given to this instrument.
- **SlaveNr (INT):**
  It is the Geflex address to be operated. In the case of the instrument the address is modbus 1
- **RCP_DB (INT):**
  It is the number of the DB to be written or from which you want to read the data set
- **Funct (BOOL):**
  It specifies the type of operation we want to carry out:
  False = Store (it saves the instrument parameters in the)
  True = Load (it downoads the parameters saved in the instrument DB).
- **ParamNr (INT):**
  It is the number of parameters to be saved-read.
- **ParamListDB (INT):**
  It is the number of the DB in which in each line the modbus address of the parameters to be read-written is specified

Output parameters:

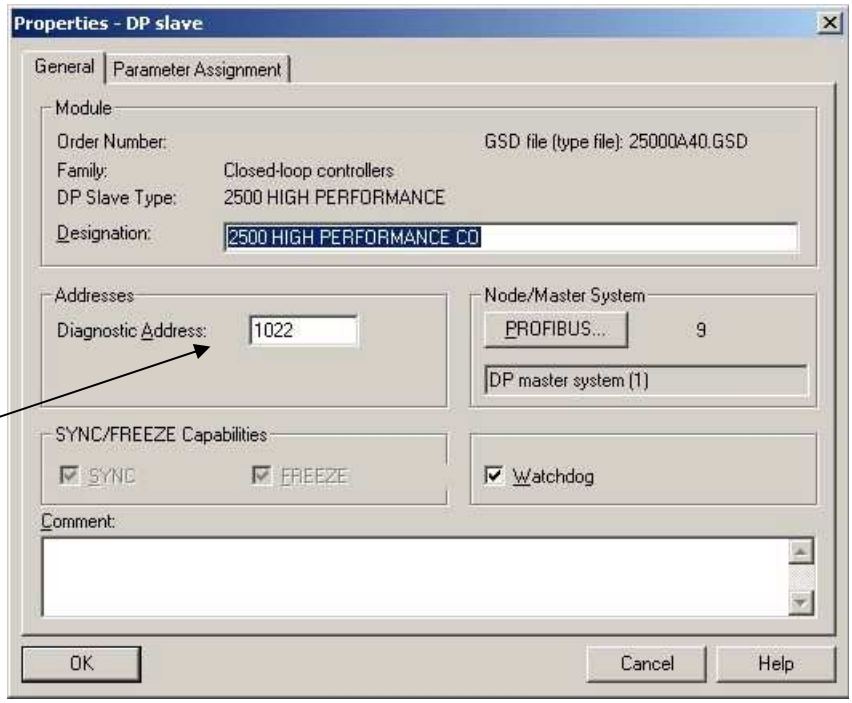
- **Done (BOOL) :**
  In this parameter the function writes 1 when the operation has ended
- **Error (BOOL) :**
  In this parameter the function writes 1 when an error took place during the writing operation.
- **ErrorCode (INT):**
  In this parameter the function gives the error code found in case of error
- **ErrorParamNr (INT):**
  In this parameter, in case of error, the function writes the ordinal number in the DB with the list of the parameter addresses that caused the error.

Example of DB with the list of the parameter of a 2500 instrument and relative addresses (in the exampleDB109):

Address	Name	Type	Value	Comment
5	Pb.1	INT	1000	Proportional band of group 1
7	It.1	INT	40	Integral time of group 1
8	dt.1	INT	0	Derivative time of group 1
10	LoS.1	INT	0	Min limit scale of input 1 LSW
11	HiS.1	INT	3500	Max limit scale of input 1 LSW
12	AL.1	INT	100	Alarm threshold 1 LSW
13	AL.2	INT	200	Alarm threshold 2 LSW
16	Set.P	INT	0	Local setpoint LSW
27	Hy.1	INT	0	Hysteresis alarm 1
30	Hy.2	INT	-1	Hysteresis alarm 2
31	S.tu	INT	0	Enabling selftuning, autotuning and softstart
42	Hi.P	INT	1000	Max power limit
43	Lo.P	INT	0	Min power limit
45	bAu	INT	4	Select baud rate
46	Cod	INT	1	Unit identification code
47	Par	INT	0	Parity selection
49	Pro	INT	0	Protection code
52	AL.3	INT	300	Alarm threshold 3 LSW
53	Hy.3	INT	-1	Hysteresis alarm 3
54	At.3	INT	0	Alarm 3 type
55	AL.4	INT	400	Alarm threshold 4 LSW
56	Hy.4	INT	-1	Hysteresis alarm 4
57	At.4	INT	0	Alarm 4 type
62	At.1	INT	0	Alarm 1 type
63	At.2	INT	0	Alarm 2 type
65	P.On.t	INT	0	Power-on mode
66	TypC.1	INT	1	Type of analog output C1
67	L.r.t	INT	0	Local/remote setpoint switching mode
68	MA.t	INT	0	Manual/automatic switching mode
69	A.M.t	INT	0	Automatic/manual switching mode
70	Ctr	INT	0	Control type
133	but.1	INT	8	Function of PEAK key
134	but.2	INT	15	Function of CAL/RST key
135	but.3	INT	13	Function of M/A key
136	tyP.3	INT	1	Input 3 type
155	tyP.2	INT	0	Input 2 type
400	tyP.1	INT	14	Input 1 type
403	dPS.1	INT	0	Decimal point position for input 1 scale

5.4 STANDARD AREA FOR SLAVE DIAGNOSTICS

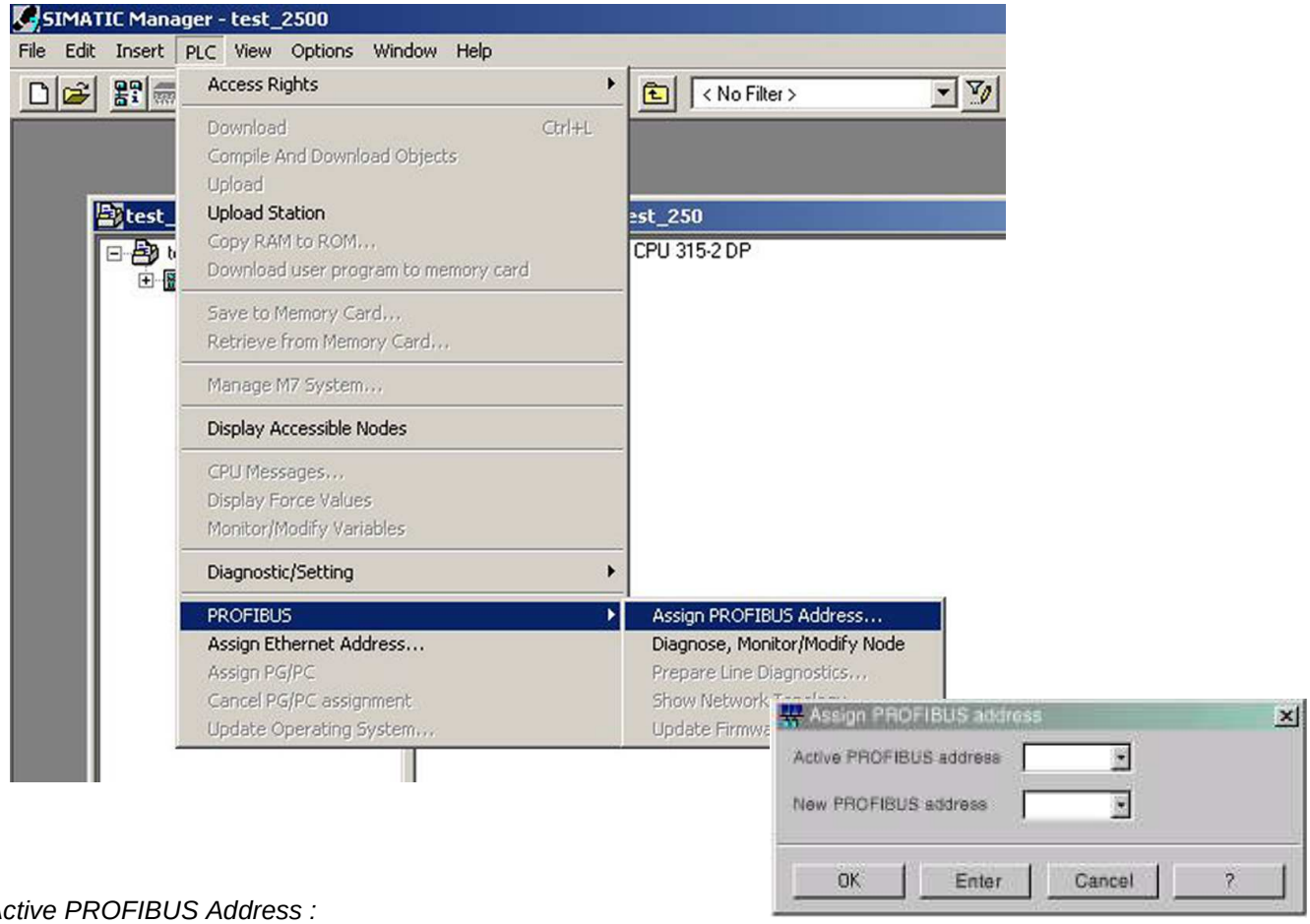
Click Slave Properties to identify the address of the global diagnostics area of the slave.



This area is readable with SFC 13 “DPNRM_DG”. See the Siemens Step 7 user manual.
In addition to standard bytes, the slave supplies extended diagnostics data with a word.

5.5 CHANGING NODE ADDRESS

You can change the address of the Profibus Slave by selecting the “Assign Profibus address” command.
Attention: check that your hardware for communication with the Profibus Master supports this function.
If you are not sure of your network configuration, connect one Slave at a time and change their address.



Active PROFIBUS Address :

Use this field to select one of the existing nodes.

New PROFIBUS address:

Use this field to assign the new address to the node selected above.

Note:
The node change procedure can be run only if the network Master is switched off or if the Profibus cable is not connected to the Master. In either situation, you can connect the work station (PC or PG) cable and assign the address.

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GEFRAN spa
Via Sebina, 74
25050 Provaglio d'Iseo (Brescia) – Italy
Tel. +39 030 9888.1
Fax +39 030 9839063
http://www.gefran.com
mail: info@gefran.com