# Training document for the company-wide automation solution Totally Integrated Automation (T I A)

### MODULE D3

### **PROFIBUS DP** with

### Master CPU 315-2DP / Slave ET 200L

This document was provided by Siemens A&D SCE (automation and drive technology, Siemens A&D Cooperates with Education) for training purposes. Siemens does not make any type of guarantee regarding its contents.

The passing on or duplication of this document, including the use and report of its contents, is only permitted within public and training facilities.

Exceptions require written permission by Siemens A&D SCE (Mr. Knust: E-Mail: michael.knust@hvr.siemens.de). Offences are subject to possible payment for damages caused. All rights are reserved for translation and any case of patenting or GM entry.

We thank the company Michael Dziallas Engineering and the instructors of vocational schools as well as further persons for the support with the production of the document.

### PAGE:

1.	Forward	4
2.	Notes for the Operation of the CPU 315-2DP	6
3.	Notes for the Operation of the ET 200L	6
4.	Commissioning the Profibus ( Master CPU 315-2DP / Slave ET200L)	7

The following symbols stand for the specified modules:



FORWARD

1.

SIEMENS

The module D3 is assigned content wise to Industrial field bus systems.



#### Learning goal:

In this module, the reader should learn how the PROFIBUS DP is taken into operation with the CPU 315-2DP as a master and the ET 200L as a slave. The module shows the principle procedure by means of a short example.

#### **Requirements:**

For the successful use of this module, the following knowledge is assumed:

- Knowledge in the use of Windows 95/98/2000/ME/NT4.0
- Basics of PLC- Programming with STEP 7 (e.g. Module A3 'Startup' PLC programming with STEP 7)
- Basics of the PROFIBUS DP (e.g. Appendix IV Basics of field bus systems with SIMATIC S7-300)

	Forward	Notes	Commission	
--	---------	-------	------------	--

#### Required hardware and software

- 1 PC, Operating system Windows 95/98/2000/ME/NT4.0 with
  - Minimal: 133MHz and 64MB RAM, approx. 65 MB free hard disk space
  - Optimal: 500MHz and 128MB RAM, approx. 65 MB free hard disk space
- 2 Software STEP 7 V 5.x
- 3 MPI- Interface for the PC (e.g. PC- Adapter)
- 4 PLC SIMATIC S7-300 with the CPU 315-2DP
  - Example configuration:
    - Network: PS 307 2A
    - CPU: CPU 315-2DP
- 5 Distributed I/O ET 200L with 16 digital In- and outputs
- 6 PROFIBUS cable with 2 PROFIBUS slots



Forward	Notes	Commission	

i

### 2. NOTES FOR THE OPERATION OF THE CPU 315-2DP

The CPU 315-2DP is a CPU that is made available with an integrated PROFIBUS DP interface. For the CPU 315-2DP, the following PROFIBUS protocol profiles are available at your disposal:

DP- Interface as a master or slave in accordance with EN 50170. PROFIBUS-DP (Distributed I/O) is the protocol profile for the connection of distributed I/O/Field equipment with fast reaction time.

A further characteristic is that the addresses of the in- and output modules can be parameterized by this CPU.

The CPU capability is given with the following data:

- 16K Statements. 48Kbyte RAM (integrated) 80Kbyte RAM
- 1024 Byte DI/DO
- 128 Byte Al/AO
- 0,3 ms / 1K Instructions
- 64 Counters
- 128 Timers
- 2048 Memory bits



Note: The CPU 315-2DP is appointed here on the PROFIBUS as a master.

#### 3. NOTES FOR THE OPERATION OF THE ET 200L



The ET 200L is a distributed I/O system with a small, compact configuration. The ET 200L is a passive participator (Slave) on the PROFIBUS-DP.

The PROFIBUS address is adjusted with two rotary switches.

Another possible adjustment of the PROFIBUS address is with a power recovery. Therefore, the ET 200L must be turned off and then back on.

Forward	Notes	Commission	

#### 4. COMMISSIONING THE PROFIBUS (MASTER CPU315-2DP / SLAVE ET200L)

In the following example, the commissioning of a mono master system with the CPU315-2DP as a master and an ET 200L as a slave is described. For the testing of the configuration, a program will be written in which a display lamp H1 is triggered by the simultaneous activation of two buttons S0 and S1.

#### Assignment list:

10.0	S0	Button selection 1
10.1	S1	Button selection 2
Q0.0	H1	Display lamp



 The central tool in STEP 7 is the SIMATIC Manager, which is opened here with a double click (→ SIMATIC Manager).



2. STEP 7- Programs are administered in projects . Such a project will be created (  $\rightarrow$  File  $\rightarrow$  New).

SIMATIC Man	ager					
<u>File</u> P <u>L</u> C ⊻iew	<u>O</u> ptions	<u>W</u> indow	<u>H</u> elp			
<u>N</u> ew				Ctrl+N		
'New Project' Wi <u>a</u> Open Open Versjon 1 F	ard Iroject			Ctrl+O		
S7 Memory Card Memory Card <u>F</u> ile				) }		
<u>D</u> elete R <u>e</u> organize <u>M</u> anage						
<u>A</u> rchive Retrie <u>v</u> e						
Page Setup Labeling fields P <u>r</u> int Setup						
<u>1</u> tester (Project) <u>2</u> Convert (Project <u>3</u> Testproject_FB <u>4</u> Testproject_DB	- C:\Siem t) C:\Sie (Project) (Project)	ens\Step7 emens\Ste - C:\Sieme C:\Sieme	/\S7proj\tester .p7\S7proj\Convert ens\Step7\S7proj\Tes ens\Step7\S7proj\Tes	tpr_1 stproj		
E <u>x</u> it				Alt+F4		
		19				
Ureates a new proje	ct or a new	v library.			Steel and	Without the second

Fo	rward Notes	Commission	
TIA Training document	Daga 7 of 1	0	Modulo



3. Give the **Name ET200L** to the project (  $\rightarrow$  ET200L  $\rightarrow$  OK).

New			×
User proje	cts Librar	ies	
Name		Storage path	
Abscherv Convert Cutting a Cutting a Cutting a startup tester Testproje Testproje	orrichtung oparatus oparatus oparatus ct_FB kt_FB	C:\Siemens\Step7\S7pro C:\Siemens\Step7\S7pro C:\Siemens\Step7\S7pro C:\Siemens\Step7\S7pro C:\Siemens\Step7\S7pro C:\Siemens\Step7\S7pro C:\Siemens\Step7\S7pro C:\Siemens\Step7\S7pro C:\Siemens\Step7\S7pro	yi\ABSCHERV yi\Convert yi\Couting_2 yi\Cutting_ yi\Cuttest yi\STARTUP yi\Testpr_1 yi\Testpr_1 yi\Testproj
Na <u>m</u> e:			<u>T</u> ype:
ЕТ200Ц			Project
, <u>S</u> torage loc C:\Siemens	ation (path) s\Step7\S7	:  proj	<u>B</u> rowse
OK			Cancel Help

4. Highlight your project and insert a **PROFIBUS Subnet** ( $\rightarrow$  ET200L  $\rightarrow$  Insert  $\rightarrow$  Subnet  $\rightarrow$  PROFIBUS).

SIMATIC Mana	ager - ET200L					_ 🗆 ×
<u>File E</u> dit <u>Insert</u>	PLC View Options	<u>W</u> indow <u>H</u> elp				
C C Statio	n ▶[	PI	8-8- III 🗰	No Filter >	<b>- -</b>	1 🔡 🖲
ET20 Progr S7 Sr S7 Sr S7 Br M7 Sr Sgmb Egter	et ) 1 M am ) 2 P ftware ) 3 In Jock ) oftware ) of Table ral Source	PI ROFIBUS dustrial Ethernet TP				
Inserts PROFIBUS at	the cursor position.					//

Forward	Notes	Commission	



5. Then insert a **SIMATIC 300-Station** ( $\rightarrow$  Insert  $\rightarrow$  Station  $\rightarrow$  SIMATIC 300-Station).

SIMATIC	Manager - ET2	200L	_ 🗆 ×
<u>File</u> <u>E</u> dit <u>Ins</u>	sert P <u>L</u> C <u>V</u> iew	<u>O</u> ptions <u>W</u> indow <u>H</u> elp	
	Station Station Brogram 37 Software 57 Block M7 Software Symbol Table External Source.	I SIMATIC 400 Station     SIMATIC 900 Station     SIMATIC PC Station     SIMATIC PC Station     SIMATIC S5     Z PG/PC	<u>y 26</u>
Inserts SIMATIC	C 300 Station at t	he cursor position.	11.

6. Open the configuration tool for the **Hardware** with a double click ( $\rightarrow$  Hardware).

SIMATIC Manager - ET200L	
T ET200L C:\Siemens\Step7\S7proj\Et200I	
Press F1 to get Help.	1.

Forwa	rd Notes	Commission	



```
configuration are made available.
```

Insert a **Rail** with a double click(  $\rightarrow$  SIMATIC 300  $\rightarrow$  RACK-300  $\rightarrow$  Rail).

HW Config - SIMATIC 300(1)	
Station Edit Insert PLC View Options Window Help	
IMATIC 300(1) (Configuration) ET200L	Profile Standard
Image: State of the s	Core         Sendad         ■           ■         PROFILIS PA         ■           ■         SMATIC 300         ■         ■           ●         CP300         ●         □         CP300           ●         CP300         ●         ■         ■           ●         CP300         ●         ●         ■           ●         CP300         ●         ■         ■           ●         FN-300         ●         ●         ■           ●         PS-300         ●         ■         ■           ●         SIMATIC 400         ●         ■         ■           ●         SIMATIC PC Station         ■         ■         ■
	6ES7 390-1???0-04A0 Available in various lengths
/ Insertion possible	Chg //

After the insert, a configurations table for the configuration of the Rack 0 appears automatically.





8. Now all modules can be chosen out of the hardware catalog and inserted into the configuration table and are also inserted into your rack.

To insert, you must click on the name of the respective module, hold the mouse button and Drag & Drop the module into a line of the configurations table. We will begin with the power supply **PS 307 2A** ( $\rightarrow$  SIMATIC 300  $\rightarrow$  PS-300  $\rightarrow$  PS 307 2A).

HW Config - SIMATIC 300(1)	tione Window Halp							
	2 <b>11 11 11 11 11 11</b>	N?						
SIMATIC 300(1) (Configuration	) ET200L						Profile Standard	T
COUR     Course of the second se	Order number EES7 307-1BA00-0AA0	Firmware	MPI address	l address	Q address	Comment 	●         ●         PROFIBUS DP           ●         ■         PROFIBUS PA           ●         ■         SPACE           ●         ■         C7           ●         ■         C7           ●         ■         CPU 300           ●         ■         CPU 300           ●         ■         CPU 300           ●         ■         CPU 300           ●         ■         FS 307           ●         ■         PS 300           ●         ■         PS 300           ●         ■         SMATIC 400           ●         ■         SIMATIC PC 8:           ●         ■         SIMATIC PC 8:	SION 10A 28 56 Sa Sa Sa Sa Sa Sa Sa Sa Sa Sa Sa Sa Sa
							6ES7 307-1BA00-0AA0 Load supply voltage 120 VDC / 2 A	D/230 VAC: 24
Insertion possible								Chg



**Note:** If your hardware differs from what is shown above, then you must select the appropriate modules from the catalog and insert them into the rack. The part numbers of the individual modules, which are found on the components, are indicated in the footer of the catalog.

Forward	Notes	Commission	
			Madula D2



 In the next step, we drop the CPU 315-2DP into the second card location. This allows for the part number and version of the CPU to be read off (→ SIMATIC 300 → CPU-300 → CPU 315-2DP → 6ES7 315-2AF03-0AB0 → V1.1 ).

📴 HW Config - SIMATIC 300(1)		
Station Edit Insert PUC View Uptions Window Help		
Bly SIMATIC 300(1) (Configuration) ET200L	Pro	file Standard 💌
I     IPS 307 2A       3     IPS 307 2A       4     IPS 307 2A       5     IPS 307 2A       6     IPS 307 2A       7     IPS 307 2A       0     IPS 307 2A	₽  -  -	
Slot 🚺 Module Order number Firmware MPI address I address	Q address Comment	6ES7 315-24F01-04B
1         1 <th1< th=""> <th1< th=""> <th1< th=""> <th1< th=""></th1<></th1<></th1<></th1<>		
Press F1 to net Help	[DF	Practions; MP1+ DP connection Praster or DP slave); multi-tier

10. By the entering of the CPU, the following window appears, in which you assign a PROFIBUS address to the CPU 315-2DP and must already choose the first PROFIBUS net. When you want to alter the parameter of the PROFIBUS net, you must highlight it and then click on **Properties** ( → Properties).

General Parameters			
Address: 4			
Highest address: 126			
Transmission rate: 1.5 Mbps			
<u>S</u> ubnet:			
not networked	1.5 Mb		<u>N</u> ew
	LO MODS		P <u>r</u> operties
			Dejete
04		Abbre	chen Hilfe



11. Now you can choose the **Highest PROFIBUS Address** (here  $\rightarrow$  126), the **Transmission Rate** (here  $\rightarrow$  1,5 Mbit/s) and the **Profile** (here  $\rightarrow$  DP). ( $\rightarrow$  OK ).

Properties - PROFIBUS		×
General Network Settings		
Highest PROFIBUS Address:	126 🔽 🗖 Change	Options
Iransmission Rate:	45.45 (31.25) Kbps 93.75 Kbps 187.5 Kbps 500 Kbps 1.5 Mbps 3 Mbps	
Profile:	DP Standard Universal (DP/FMS) User-Defined	Bus Parameters
 ОК		Abbrechen Hilfe

12. Then a bar chart for the Master system is shown to the right of the CPU315-2DP, in which you can arrange the PROFIBUS. This happens by clicking the desired module (Here the ET 200L with 16DI/16DO) from the hardware catalog in the path PROFIBUS-DP. By Drag & Drop click with the mouse, it can be dropped into the master system. (→ PROFIBUS DP → ET 200L → L-16DI/16DO→ 6ES7 133-1BL00-0XB0 ).

Bit Matter         Bit Mat	
Image: Simple	
Image: Standard         Dote         Standard           1         PS 307 2A         PROFIBUS[1] DP mader system (1)         Profibus[1] DP mader system (1)           2         CP         Standard         PROFIBUS[1] DP mader system (1)         Profibus[1] DP mader system (1)           2         CP         Standard         Profibus[1] DP mader system (1)         Profibus[1] DP mader system (1)           2         CP         Standard         Profibus[1] DP mader system (1)         Profibus[2] DP mader system (1)           2         CP         Standard         Profibus[1] DP mader system (1)         Profibus[2] DP mader system (1)           2         CP         Standard         Profibus[2] DP mader system (1)         Profibus[2] DP mader system (1)           3         Profibus[2] DP mader system (1)           4         Standard         Profibus[2] DP mader system (1)           1         P ps 307 2A         Profibus[2] DP mader system (1)           2         If CPU 315-2 OP         ES 25 307 18600 0AA0         Pro	
Big IMA II C 300(1) [ (contiguration) = E 1200.         DOBE       Standard         DOBE       DESCONSOC24/ Big LSCONSOC24/ Big LSCONSOC24/ Bi	
■ OUR         PROFIBUS(1): DP mader system (1)           1         PS 307 2A         PROFIBUS(1): DP mader system (1)           2         DP         LSC IN 6ADC2AV           3         -         -           4         -         -           5         -         -           -         -         -           6         -         -           7         -         -           6         -         -           7         -         -           6         -         -           7         -         -           6         -         -           7         -         -           7         -         -           8         -         -           160         UR         -           161         DP         -           162         SC 201 30-224V         -           163         DP         -           164         PS 307 2A         SES 7 30718A000A40           1         PS 307 2A         SES 7 30718A000A40           2         P         CP CH 315-2 DP           2         P         CP	•
Stat         Module         Order runber         Firmware         MPI address         Laddress         Q address         Comment           1         P 93 307 2A         6557 307-18400-00A0         P         L1600-1207/42         P         L1600-1207/42           2         N.C.P.U. 195-2 DP         6557 315-2AF03-0A90         V1,1         2         P         E         D         P         L1600-1207/42         P         E         E         E         D         D         P         L1600-1207/42         P         P         E         E         D	4V, 4V, 5A 5A
Image: Part of the state of the s	
Image: Problem in the image in th	
J22 D         DP         1723°         B <sup>+</sup> ⊕ E 1 2000           3         - <td></td>	
3         0	
4 5 5 6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
6 E E E E E E E E E E E E E E E E E E E	
8 PC	
9 NC	
10 Elevation Components	
	<u> </u>
	<u></u>
EST1331EUC+020 Digital (01 Cito) 1200 - 22 Vigital (01 Cito) 24 Voalita, end Sapability for direct communication sapability for direct communication	<u> </u>

Forward Notes Commission





13. By the entering of the slave, the following window is displayed in which you must assign a PROFIBUS address to the slave. This address must be identical with the address that you created in the rotary switch of the ET 200L ( $\rightarrow 5 \rightarrow OK$ ).

Properties - PROFIBUS interface L-16DI/16D0 DP	×
General Parameters	
Address:	
Transmission rate: 1.5 Mbps	
Subnet:	
not networked PROFIBILIS(1) 1.5 Mbox	<u>N</u> ew
	Properties
	Delete
1	- Dollara
	rechen Hilfe

14. The addresses of in- and outputs to the ET 200L can now be modified.

This happens by a double click on the corresponding input and output modules in the ET 200L and is adjusted in the register **Address**.

In any case these addresses should be required. An automatic address allocation takes place in the sequence similar to how the slaves are entered (  $\rightarrow$  16 DO Universal module  $\rightarrow$  Address  $\rightarrow$  OK ).

Address / ID					
I/O Type:	Input	Y		Din	ect Entry
- Input	ess: Length:	Unic	Consistent o	Ver	
Start: 0 End: 1 P <u>r</u> ocess image p	artition	Byte 🔽		Y	
Data for Specific <u>b</u> (Maximum 14 byte	<u>l</u> anufacturer: s hexadecimal, sep 	parated by comma or	blank space)		
				Coursel	Uala

Forward	Notes	Commission

Š.



15. The configuration table should first be saved and compiled with a click on  $\square$  and then downloaded into the PLC with  $\square$ . The mode switch on the CPU must be on STOP! ( $\rightarrow$   $\square$   $\rightarrow$ 

HW Config - SIMATIC 300(1)			
<u>Station Edit Insert PLC View Options Window Help</u>			
			4
💵 SIMATIC 300(1) (Configuration) ET200L	Profile	Standard	-
Image: Display state system (1)       Image: Display state system (1) <t< th=""><th></th><th>ET 2006     ET 2001     ET 2001     ET 2001     ESCIM-SC     L SC-D116x0C24V     ESC-D116x0C24V     ESC-D116x0C24V     ESC-D116x0C24V     ESC-D116x0C24V     ESC-D116x0C24V     ESC-D116x0C16x0C2     ESC-D116x0C16x0C24V      ESC-D116x0C16x0C24V      ESC-D116x0C16x0C24V      ESC-D116x0C16x0C24V       ESC-D116x0C16x0C24V        ESC-D116x0C16x0C24V</th><th>4V, 4V, 5A 5A</th></t<>		ET 2006     ET 2001     ET 2001     ET 2001     ESCIM-SC     L SC-D116x0C24V     ESC-D116x0C24V     ESC-D116x0C24V     ESC-D116x0C24V     ESC-D116x0C24V     ESC-D116x0C24V     ESC-D116x0C16x0C2     ESC-D116x0C16x0C24V      ESC-D116x0C16x0C24V      ESC-D116x0C16x0C24V      ESC-D116x0C16x0C24V       ESC-D116x0C16x0C24V        ESC-D116x0C16x0C24V	4V, 4V, 5A 5A
	-	L-8DI/8D0-120VAC L-8DI/8R0-120VAC	
(5) L-16DI/16D0 DP			
Stot     Image: Comment in the second s	€ € € € € € € € € € € € € €	L-16D0-120VAC     L-1600-120VAC     L-3200 DP     ET 200M     ET 200M     ET 200K     Fr.200K     Function Modules     IDENT     IPC     IDENT     IPC     Network Components     SIMADYN     SIM	

16. The CPU 315-2DP is then activated as the target module for the download activity ( $\rightarrow$  OK).

S	elect Target Module			×
	Target Modules:			
	Module	Racks	Slot	
	CPU 315-2 DP	0	2	
	Select <u>A</u> ll			
	ОК	Cano	el H	elp

For	vard Notes	Commission	



17. The station address of the CPU in the MPI net is then chosen. You are only connected with the CPU so you can accept with **OK** ( $\rightarrow$  OK).

Select Static	n Address 🛛 🗙					
Over which s	Over which station address is the programming device connected to the module CPU 315-2 DP?					
<u>R</u> ack:	0 =					
<u>S</u> lot:	2 =					
Target Statio	n Classi					
Target Statio	<ul> <li>Can be reached by means of gateway</li> </ul>					
Connec	ction to target station					
Туре	Address					
MPI	2					
13						
OK	Cancel Help					

18. From the SIMATIC Manager, you can open the block **OB1** with a double click in the editor LAD, STL, FBD: Program blocks ( $\rightarrow$  OB1).

SIMATIC Manager - ET200L		
	: <u>Window H</u> eip   😨 🗣 🕒 🔛 🇱 🏢 🔁 🔍 No Filter >	- - - - - - - - - - - 
ET200L C:\Siemens\Step7\S	7proj\Et2001	
ET200L SIMATIC 300(1) CPU 315-2 DP CPU 31	System data	
Press F1 to get Help.		

Fo	orward	Notes	Commission



19. Optional: Enter the properties of the OB1 for documentation and accept with OK (  $\rightarrow$  OK).

Properties - Organization Block						
General - Part 1 General						
<u>N</u> ame:	OB1			0		
<u>S</u> ymbolic Name:						
Symbol <u>C</u> omment:						
Created in <u>L</u> anguage:	FBD					
Project path:						
Storage location of project:	C:\Siemens\Step7\S7proj\Et2001					
Data availad	Code	Interface				
Last modified:	07/02/2001 03:03:43	15/02/1996 04:51:12				
C <u>o</u> mment:	"Main Program Sweep (Cycle)"		A.			
ОК			Cancel	Help		

Forward Notes Commission



20. With **LAD**, **STL**, **FBD**: **Program blocks**, you now have an editor which gives you the possibility to generate your STEP 7- Program. Here the organization block OB1 was already opened with the first network. In order to generate your first logical operation, you must highlight the first network. Now you can write your first STEP 7- Program. Several programs can usually be divided into

networks. Open a new network by clicking on the network symbol **F**. The STEP 7- Program to be tested can now be downloaded into the PLC.

In our case, the OB1 is the only block. Save the organization block with  $\square$  and click on download  $\square$ . The mode switch of the CPU must be on STOP! ( $\rightarrow \square \rightarrow \square$ )

K LAD/STL/FBD - OB1		
File Edit Insert PLC Debug View Options Window Help		
B 0B1 ET200L\SIMATIC 300(1)\CPU 315-2 DP		
OB1 : "Main Program Sweep (Cycle)" Comment:		
Network 1: Title:		
Comment:		E - International States Floating-point fct. E - A Move E - International States Floating-point for the states of the states
		Books     FC blocks
		SFB blocks
2: Info		
Press F1 to get Help.	🗟 offline	Abs Nw 1

21. Through the switching of the mode switch to RUN, the program is started and after a click on the symbol  $\boxed{60^{\circ}}$  for monitoring, the program in the **OB1** can be monitored ( $\rightarrow$   $\boxed{60^{\circ}}$ ).

Forward		Notes	Commission	Commission	
<b>TIAT</b>		D 40 (40			