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The SIMATIC S7 System Family





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The SIMATIC S7 System Family





Objectives

Upon completion of the chapter the participant will ...

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...

...

- have an overview of the SIMATIC S7 system family
- be familiar with the S7-300 and S7-400 automation systems
 - have an overview of the modules available for these automation systems
 - understand the concept of "Totally Integrated Automation" (T.I.A.)
 - be familiar with the programming devices
 - be familiar with the PC requirements for working with STEP7
 - be familiar with the tools of the STEP7 basic programming package
 - have an overview of the most important tools used in the T.I.A. concept





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SIMATIC WinAC Basis



SIMATIC C7 – 6xx

SIMATIC S7 - 300







S7-200: Modules / Expansion Modules (EM)





Function Modules (FM)



Communications Processors (CP)



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S7-300: Modules





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Addressing





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S7-400 Automation System





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S7-400: CPU Design









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Installing the STEP 7 Basic Package



		×
SIMATIC Manager (c) STEP 7 S7/M7/C7		
Version:	V5.4 + SP1	
Revision Level:	K5.4.1.0	
Copyright (c) 1995-2006	, Siemens AG. All Rights Reserved.	
Product licensed to:		
SIMATIC Field PG M		
Installed Software:	Display	
	SIMATIC Manager (c) STEP 7 S7/M7/C7 Version: Revision Level: Copyright (c) 1995-2006 Product licensed to: SIMATIC Field PG M Installed Software:	SIMATIC Manager (c) STEP 7: S7/M7/C7 Version: V5.4 + SP1 Revision Level: K5.4.1.0 Copyright (c) 1995-2006, Siemens AG. All Rights Reserved. Product licensed to: SIMATIC Field PG M Installed Software: Display



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STEP 7 Tools





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STEP 7 Software Packages (Examples)



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SIEMENS	Download More Information
<section-header></section-header>	Important and intervention Im
	SIPLUS CPU 315-2 DP CPU 315F-2 DP CPU 315F-2 DP DP Otypinal modules
WILLIAM VILLO	

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Programming Sequence Control Systems with S7- GRAPH

S7-GRAPH: The tool for programming sequence cascades

- Compatible with DIN EN 6.1131-3
- Designed for the requirements of production engineering
- Graphic division of the process into steps and transitions
- Steps contain actions
- Transitions check the conditions for switching to the next step
- The following phases of automation can be optimized with S7-GRAPH:
 - O Planning, Configuring
 - Programming
 - Debugging
 - Commissioning
 - Maintenance, Diagnostics





The State Diagram Method S7- HiGraph

- S7-HiGraph: The tool for programming using State Diagrams
 - Division of the machine into functional units
 - Creating state diagrams for every function unit
 - States contain actions
 - State diagrams communicate using messages
- The following phases of automation can be optimized with S7-HiGraph:
 - Planning, Configuring
 - Programming and Debugging
 - Commissioning
 - Maintenance, Diagnostics
 - Supports reusability





Programming in the High Level Language S7- SCL

FUNCTION BLOCK Integrator □ S7-SCL: High level language for VAR INPUT creating PLC programs : BOOL; // Reset output value Init // Input value : REAL: Х Compatible with DIN EN 6.1131-3 Та // Sampling interval in ms : TIME; (ST=Structured Text)) Ti : TIME; // Integration time in ms : REAL; // Output value upper limit olim • Certified according to "PLC open" ulim : REAL; // Output value lower limit **Base Level** END VAR • Contains all the typical elements of a high level language, such as VAR OUTPUT y : REAL:= 0.0; // Initialize output value with 0 operands, terms, control statements END VAR • PLC specifics are integrated, such as I/O access, timers, BEGIN // Division by ? IF TIME TO DINT(Ti) = 0 THEN counters...) OK := FALSE; Advantages: y := 0.0; **RETURN:** • Well structured, easy to understand END IF: program IF Init THEN y:= 0.0: • For those knowlegeable in high level ELSE langugages $y := y + TIME_TO_DINT(Ta)*x/TIME_TO_DINT(Ti);$ For complex algorithms IF y >olim THEN y :=olim; END_IF; IF y < ulim THEN y := ulim; END IF;END IF: END FUNCTION BLOCK



CFC - Tool for Graphic Interconnection of S7 Blocks



- Blocks are placed on function charts and interconnected
- Interconnection is possible:
 - between I/O fields
 - also to blocks in other charts
- Sources and destinations are managed in the margins
- Advantages
 - Program creation for technologists
 - quick creation, testing and commissioning times





Process Diagnosis with S7- PDIAG

- Process diagnosis: Detection of faults occurring <u>outside</u> the PLC
 - Sensor/actuator defective, movement faulty, ...
- S7- PDIAG: Tool for configuring the fault definition in STL, LAD, FBD
 - **o** Integrated in the development environment
 - Simple formulation of fault monitoring and message texts (during and after the program session)
 - Fault detection and criteria analysis are conducted automatically
 - Comprehensive information for the operator on:
 - type of fault
 - location of fault
 - cause of fault

□ Reduction of down-time







Testing User Programs with S7- PLCSIM

S7-PLCSIM: Simulation software for offline testing of PLC programs

• Functional program test

- on a simulated CPU
- with display/modify I/O
- $\sigma\,$ Testing of user blocks in
 - LAD, FBD, STL, S7-SCL,
 - S7-GRAPH, S7-HiGraph, CFC
 - S7-PDIAG, WinCC

Advantages

- Faults can be detected early and eliminated
- Many tests are already possible in the office without the final hardware











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Operator Control and Process Monitoring with SIMATIC[®] HMI

Process visualization system SIMATIC WinCC Process visualization system SIMATIC WinCC flexible

SIMATIC PG, PC

SIMATIC Panels, PGs, PCs





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Interfaces

PLC **Communication**

(Archiving)

Report Designer

(Report System)



Process Automation with SIMATIC[®] PCS 7





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DRIVES Technology

Consistent drives spectrum for all applications

- From standard drives with 100 W up to large drives with 50 MW
- □ Motion and vector control
- Technology-specific closed-loop controllers







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SINUMERIK[®] and SINAMICS Drives







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Training Units and Addressing



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Training Area Setup with S7 - 300













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Complete Symbol List (1)



Complete Symbol List (2)



Complete Symbol List (3)



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If You Want to Know More





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Training Area Setup with S7-400



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SIEMENS

The SIMATIC Manager





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Objectives

Upon completion of the chapter the participant will ...

- understand the project structure in the SIMATIC Manager
- understand the function "accessible nodes"
- be familiar with the offline / online view in the SIMATIC Manager
- be familiar with the STEP7 Standard Libraries
 - be familiar with the STEP7 help system
 - be able to create and manage a project with the SIMATIC Manager
 - be able to set the PG's interface
 - be able to erase an MMC
 - be able to perform an S7 CPU memory reset



From Process to Project Project Management SIMATIC Manager UPVENE SIMATIC PANEL SIMATOC TPUTER 50 Hardware 🗲 Communication **FB21** OB1 11.0 11.1 Q4.0 Software -T



SIMATIC Manager	· · ·	
ile PLC View Options Window Help		
New	Ctrl+N	
Open	Ctrl+0	
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Delete Reorganize Manage		User projects Libraries Sample projects Multiprojects
Archive Retrieve		Bite Bite
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1 T2k_LITE (Project) C:\\Step7\s7proj\Trans 2 My Project (Project) C:\\Siemens\Step7\s7 3 TIA _Pro1_Participant (Project) C:\\S7Proj 4 840D_Simulator (Project) C:\\Step7\S7Proj	L_2\T2k_LITE proj\My_Proje \TIAP1_ \840D_Sim	Ch05_Function_blocks C:\Program Files\Siemens\Step7\S7 Ch07_Micromaster_MM420 C:\Program Files\Siemens\Step7\S7 C:\Program Files\Siemens\Step7\s7 C:\Program Files\Siemens\Step7\s7
Exit	Alt+F4	Selected
		User Projects: Libraries: Sample Projects: Multiprojects: <u>B</u> rowse



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STEP 7 Project Structure





S7 Program Blocks

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		61 01 002	8- 01 CO4				
Press F1 to get Help.			CP5512(PROFIE	IUS)			



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Cyclic Program Processing





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Interesting Facts about Multiprojects





Creating an S7 Project

ew Jew Project' Wizard	Ctrl+N		ew Project		
pen	Ctrl+O		User projects Libraries	Multiprojects	
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alata			GD-Communication	D:\S7_Courses\PRO	3_Loe\GD-Kommu
			LueftungInitialsierung	D:\S7_Courses\Lueft	ungInitialisierungsTest
eorganize			My_Project	D:\S7_Kurse\SERV1	_L 2.1\C71
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SERV2_5 (Project) D:\S7_Courses\SERV2_5			Inity_1 tolect		Project
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	_				
es a new project or a new library.					///



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Inserting an S7 Program

ב	Station		_ 🗽 🔠 🗰 🐜 < No Filter >	- V 2 8 m 1	
	Subnet	► 1 S7 Brogram			
	GT. Celluran	2 M7 Program			
	57 Block	3 Program			
	M7 Software	4 Drive 5 SINAMICS			
	Symbol Table				
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	WinCC flexible RT	•			
	WinCC Object				
	Parameter External parameters	· ·			
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- B) M	y_Project	MPI(1)	😭 Global labeling field		



Standard Library

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ew Project' Wizard		Libraria Carr		
pen	Ctrl+O	Oser projects Libraries Sam	pie projects Multiprojects	1
Memory Card	•	Name	Storage path	<u> </u>
mory Card File	•	PDIAGLIB	C:\Program Files\Siemens'	\Step7\S7lit
lete		PROFINET System-Library	C:\Program Files\Siemens	\Step7\S7lit
organize		Redundant IU (V1)	C:\Program Files\Siemens'	Step7\S7lit
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ge Setup				
PRO1_SOL (Multiproject) D:\S7_Courses\PRO3_Loe\PRO3_Loe SERV2_B (Project) D:\S7_Courses\SERV2_B SERV2_S (Project) D:\S7_Courses\SERV2_L		Selected User Projects:		
cit	Alt+F4	Sample Projects: Multiprojects:		Browse
		ОК	Cancel	Help
Standard Library C:\Pr	rogram Files\Sie	mens\Step7\57libs\stdlib30	_	
a project to be selected or a li 💽 🔶 Standard Library	इन Commu इन Miscella इन PID Co इन System	nication Blocks aneous Blocks ntrol Blocks Function Blocks	河 IEC Function Blocks 기 Organization Blocks cks 게 TI-S7 Converting Blocks	



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STEP 7 Help System





Context Sensitive Help in STEP 7

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- 🔶 Standard Library	Object name	Symbolic name	e (Created in langu	age 🛛 Size in t	. Type Version (H	
IEC Function Blocks IEC For Organization Blocks IEC Forganization Blocks IEC	SFC1 SFC2 SFC3 SFC4 SFC5 SFC6 SFC7 SFC9 SFC10	READ_CLK SET_RTM CTRL_RTM CTRL_RTM File Edit B Contents Readin	itandard and ookmark Optic Index	STL STL STL System Funct ons Help Bar Me with	tions sFC 1 "R	System function System function System function System function 1.0	Press Hot-key F1
	SFC11 SFC12 SFC13 SFC13 SFC14 SFC15 SFC15 SFC17	Descript With SFC CPU.	ion 1 "READ_CL	.K" (read sys	tem clock), you	u read the current date or curren	t time of the system clock of the
ss F1 to get Help.		RET_VAL	Declaration OUTPUT	<u>Data Type</u> INT	<u>Memory Area</u> I, Q, M, D, L	Description If an error occurs during the exec function, the return value contain code.	ution of the s an error
		CDT	OUTPUT	DT	D,L	The current date and current time at the CDT output.	e are output



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Setting the PG/PC Interface





Offline / Online View in the SIMATIC Manager

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SERV1_S D:\S7_Courses\S	ERV1_L			SERV1_5 D:\S7_Courses\9	ERV1_L ONLINE		_ 🗆
⊡-🞒 SERV1_S	Object name	Symbolic name	Cre	⊡ 🎒 SERV1_S	Object name	Symbolic name	
🖹 🛄 S7_300_Station	🚔 Systemdaten			E S7_300_Station	🙆 Systemdaten		
🖻 🖳 🚺 CPU 315-2 DP	🕞 OB1	OB_Cycle	FBI	🖻 🖓 CPU 315-2 DP	🕶 OB1	OB_Cycle	
⊡ 📾 Ch13_MM420	🕞 FC14	FC_Signal	FBI	□ □ □ Ch13_MM420	🕞 FC14	FC_Signal	
Sources	🗗 FC15	FC_Mode	FBI		🗗 FC15	FC_Mode	
	🗗 FC16	FC_ConvMotor	FBI		🖬 FC16	FC_ConvMotor	
micromASTER_42	" 🕞 FC17	FC_Fault	FBI	E Choo Diasta	G FC17	FC_Fault	
	🗗 FC18	FC_Count	FBI		🗗 FC18	FC_Count	
⊞	G FC19	FC_Count_Add	FBI	E Kapos_binaly_op	G FC19	FC_Count_Add	
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					SFC2	-	
					G SFC3		
					SFC4		
					SFC5	GADR LGC	
					SFC6	RD SINFO	
					SFC7	-	
					SFC11		
					SFC12	D ACT DP	
				1	SFC13	DPNRM DG	
				1	SFC14		
				1	SFC15		
				1	G SFC17	ALARM SQ	
				1	SFC18		
				1	SFC19	ALARM SC	
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.1				1			



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Online Connection using "Accessible Nodes"

SIMATIC Manager - [Accessible	Nodes MPI]	- 🗆 🗙
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🗋 🗅 😅 🎛 🛲 X 🖻 🛍 🖆	🖬 🗢 🗣 🐘 🏥 🎬 🕋 < No Filter > 💽 🏹 😤 🕮 📆 🖷 🖃 🕻	🗖 N?
Image: Accessible Nodes Image: MPI = 3 Image: MPI = 4 (directly) Image: MPI = 4 (directly) Image: MPI = Blocks	MPI = 3 IMPI = 4 (directly)	
Press F1 to get Help.	CP5611(MPI)	



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Erasing Data Stored on the MMC





t PG/PC Interface		X	
Access Path			
Access Point of the Application:			
S70NLINE (STEP 7)> CP5611(MPI)	*		
(Standard for STEP 7)			
Interface Parameter Assignment Used:			
CP5611(MPI)	Properties		
CP5611(MPI)	Diagnostics		
CP5611(PPI)	Copy	Properties - CP5611(MPI)	>
CP5611(PROFIBUS) <active></active>	Delete	MPL)	
		- Station Parameters	
(Parameter assignment of your		PG/PC is the only master or	n the hus
MPI network)		Address:	
Interfaces		Address.	
Add/Remove:	Select	Timeout:	1 s 💌
		 Network Parameters 	
ОК С	ancel Help	Transmission Bate:	187.5 Kbps
		Highest Station Address:	31

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Exercise 2: Performing a CPU Memory Reset and a Warm Restart





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Exercise 3: Creating a Project

		=				
Blocks	My_Program	 	S7 MI	Pogram Pl	2920	
Press F1 to get Help.			CP5611(MP	I)		



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If You Want to Know More





SIMATIC Manager Customizing Options

File PLC View	Options Window H Customize Simulate Modules Set PG/PC Interfac	elp Ctrl+Alt+E e						
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Open new object Archive automatic Save window arra	automatically ally on opening proje ngement and conter	ect or library Its at end of session			- <u>N</u> ational Langua english deutsch english	ge	Minemonics Example German U E1.0 English A I1.0	e 1 Example 2 S A4.0 S Q4.0
eactivated system	messages:	w	A	ctivate				
					ОК			Cancel Help




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Objectives

Upon completion of this chapter the participant will ...

- ... be able to create a setpoint configuration and assign parameters to it
- ... be able to read out an actual configuration and assign parameters to it
- ... be familiar with the addressing of S7-300 input and output modules
- ... be able to adapt a given hardware configuration to an existing hardware
- ... as an option, be familiar with the Catalog CA01 hardware Import/Export function





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File Edit	Insert PLC View Op	tions Window Help				
	Station Subnet Program 57 Software	1 SIMATIC 400 Stat 2 SIMATIC 300 Stat 3 SIMATIC H Station 4 SIMATIC PC Stati 5 SIMATIC HMI Scale	ion 👔 🕅 🕅 🛛 K No F	ilter > 💽 🏹	8 🖗 📆 🖻 🗂 <u>१</u>	
	S7 Block M7 Software	6 Other station	.011			
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	WinCC flexible RT					
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	y My_Program	Ubject name ∰ MPI(1) ∰ Global labeling field ∭ My_Program	j Symbolic name	I type MPI Global labeling field S7 Program	<u> </u>	







Generating a Hardware Setpoint Configuration

	₩1 😂 🖽		\$ * ?								
1 PS 2 CP X2 DP	307 54 U 315-2 DP							<u>F</u> ind: <u>P</u> rofile:	Standa	ard	đ
4 1 DI3 5 6 7 7	IR						• •			SM 321 DI SM 321 DI	6xAC120 16xAC120 16xDC24V 16xDC24V 16xDC24V 16xDC24V 16xDC24V 16xDC24V 16xDC24V
Slot 🚺 Ma	JR	Order number	Firmware	MPI a	l add	Q	Com			SM 321 DI SM 321 DI SM 321 DI	I6xDC24V I6xDC24V
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<u>X2</u> DP 3					1023*					SM 321 DI SM 321 DI	6xDC48-1
4 DI32: 5	«DC24V	6ES7 321-1BL00-0AA0			03					SM 321 DI SM 321 DI	6xUC24/4 32xAC120
6 7										SM 321 DI: SM 321 DI:	32xDC24V 32xDC24V
8										SM 321 DI4 SM 321 DI9	xNAMUR
10										CM 021 DI	344C12072
11								6ES7 32 Digital in	I-1BL00-0 put module 32: also a	IAAO e DI32 24V, wailable as 9	







DI	/DO D	efault	Addre	essing	in Mu	ulti-Tie	er Con	figura	ations		
C Rack	PS	IM (Receive)	96.0 to 99.7	100.0 to 103.7	104.0 to 107.7	108.0 to 111.7	112.0 to 115.7	116.0 to 119.7	120.0 to 123.7	124.0 to 127.7	
C Rack C 2	PS	IM (Receive)	64.0 to 67.7	68.0 to 70.7	72.0 to 75.7	76.0 to 79.7	80.0 to 83.7	84.0 to 87.7	88.0 to 91.7	92.0 to 95.7	
C Rack C 1	PS	IM (Receive)	32.0 to 35.7	36.0 to 39.7	40.0 to 43.7	44.0 to 47.7	48.0 to 51.7	52.0 to 55.7	56.0 to 59.7	60.0 to 63.7	
Rack	CPU	IM (Send)	0.0 to 3.7	4.0 to 7.7	8.0 to 11.7	12.0 to 15.7	16.0 to 19.7	20.0 to 23.7	24.0 to 27.7	28.0 to 31.7	
Slot 1 2	3		4	5	6	7	8	9	10	11	

SIMATIC S7

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Station Lot Insert PLL View Uptons View Uptons Child Image: Chi	HW Config - [SIMATIC 300(1) (Configura	ation) My_Project]					
Image: Notice of the second secon) 같은 읍~ 및 및 클 Catalog						
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	Slot Module Order nu 1 PS 307 5A 6ES7 307 2 CPU 315-2 DP 6ES7 31 2/2 DP 3 3 - - 4 D132xDC24V 6ES7 321 5 D032xDC24V/0.5A 6ES7 323 6 D18/D08x24V/0.5A 6ES7 323 7 A12x12Bit 6ES7 331 8 - - 9 - -	Filter:	Outputs I Addre ddr. to Module 3 DI32xDC24√ 8 DI8/D08x24√/0.5A 307 AI2x12Bit 1023 DP 7 D032xDC24√/0.5A 8 DI8/D08x24√/0.5A 8 DI8/D08x24√/0.5A	ss gaps PIP DP 081 PI - 081 PI - 081 PI - 081 PI -	PN -	R S 0 4 0 6 0 7 0 2 0 5 0 6	IF - - 1 -



Var	riable Addressing Properties - D132xDC24V - (R0/54) General Addresses Inputs Start: 12 Process image: End: 15 BET PT System Default
	OK Cancel Help



Station Edit Insert PLC View Options Window Help	Сору	Ctrl+C	_ 8 ×
	Paste	Ctrl+∀	
	Replace Object		
	Add Master System		-
	Disconnect Master System		
	Insert PROFINET IO System		
	Disconnect PROFINET IO System		
	PROFINET IO Domain Management		
5 0032x0C24V/0.54 1x right	PROFINET IO Topology		
6 DI8/D08x24V/0.5A	Isochrone Mode		
7 Al2x12Bit	Specify Module		
9	Delete	Del	
	Go To		
	Eilter Assigned Modules		
l la min			
	Monitor/Modify		
Slot Module Order number	Edit Symbols		
1 PS 307 5A 6ES7 307-1EA00	Object Properties	Alt+Return	
2 CPU 315-2 DP 6ES7 315-2AF 0AB0	Open Object With	Chriettälten	
$\frac{X^2}{2}$ <i>DF</i>	open object wanth		
	Monitor/Modify - D032xDC24V/0.5	A - (R0/55)	
	Online via assigned CPU services		
Symbols - DO32xDC24V/0.5A			
Symbols - D032xDC24V/0.5A	Path: My Project\SIMATIC 300(1)\C	PU 315-2 DP	
Symbols - D032xDC24V/0.5A Address A Symbol Data type Comment Q 4.0 L_Weight_invalid BOOL Indicator light - weight invalid	Path: My_Project\SIMATIC 300(1)\C	PU 315-2 DP	
Symbols - D032xDC24V/0.5A Address A Symbol Data type Comment Q 4.0 L_Weight_invalid BOOL Indicator light - weight invalid Q 4.1 L_SYSTEM BOOL Indicator light System ON	Path: My_Project\SIMATIC 300(1)\C	PU 315-2 DP Displa Status value	Modify value
Symbols - D032xDC24V/0.5A Address A Symbol Data type Comment Q 4.0 L_Weight_invalid BOOL Indicator light - weight invalid Q 4.1 L_SYSTEM BOOL Indicator light System ON Q 4.2 L_MAN BOOL Indicator light MAN mode	Path: My_Project\SIMATIC 300(1)\C	PU 315-2 DP Displa Status value BOOL true	Modify value true
Symbols - D032xDC24V/0.5A Address A Symbol Data type Comment Q 4.0 L_Weight_invalid BOOL Indicator light - weight invalid Q 4.1 L_SYSTEM BOOL Indicator light System ON Q 4.2 L_MAN BOOL Indicator light MAN mode Q 4.3 L_AUTO BOOL Indicator light Automatic mode	Path: My_Project\SIMATIC 300(1)\C Address Symbol 1 47 Q 4.0 "L_Weight_invalid" 2 Q 4.1 "L_SYSTEM"	PU 315-2 DP Displa Status value BOOL true BOOL false	Modify value true
Symbols - D032xDC24V/0.5A Address A Symbol Data type Comment Q 4.0 L_Weight_invalid BOOL Indicator light - weight invalid Q 4.1 L_SYSTEM BOOL Indicator light System ON Q 4.2 L_MAN BOOL Indicator light MAN mode Q 4.3 L_AUTO BOOL Indicator light Automatic mode Q 4.4	Path: My_Project\SIMATIC 300(1)\C Address Symbol 1 40 2 4.0 3 40 4.0 "L_Weight_invalid" 2 4.1 3 4.2 4.1 "L_MAN" 4.2 "L_MAN"	PU 315-2 DP Displa Status value BOOL true BOOL false BOOL true	Modify value true true

Edit Symbols, Monitor/Modify Variables



CPU Properties: Cycle/Clock Memory

۔ میں اور اور														
」 🗁 ≅∿ 🚥	911			Proper	rties - C	PU 315-2	2 DP - (F	10/52)						
🚍 (0) UR				Tim	(D	l	1 out	- 11		Dia ana dia	. JClassic	1 Protect	e	C
1 PS	307 5A	-			e-or-Day energi	Interrupts	U Lyci	ic interru Cucle	ipts VClock I	Viagnostic Vernoru		Protec	tion [t	Lommunication
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3					ycle —									
4 🚺 DI3	32xDC24V				🛛 Updat	te OB1 pro	cess ima	ge cyclia	cally					
5 DO	132xDC24V/	0.5A									_			
5 DI8	37DU8x24V7 ≫128⊮	U.5A		S	ican cycl	le monitorir	ng time (n	ns]:	-	150				
8				M	linimum :	scan cycle	time [ms]:	Γ	D				
9			-	S	can cycl	le load fron	n commu	nication	[%]:	20	_			
1 1				_							7			
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				S	ize of the	e process i	mage		l	<u></u>	<u> </u>			
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(0) L Slot 🚺 Md	JR odule	Order numb	er	- - 0	iize of the 1885 - ca	e process i all up at I/O	mage) access	error:	[No OB85	21 call up			-
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(0) L Slot Mo 1 PS 30 2 CPU	JR odule 07 5A I 315-2 D F	Order numb 6ES7 307-1E 6ES7 315-2	er A00-0AA0 2AF03-0AB0		ize of the 1885 - ca lock Mer	e process i all up at 1/0 mory	mage) access	error:	 	No 0885	call up			-
(0) U Slot (1) Ma 2 (1) PS 30 2 (1) CPU X2 (1) DP 3	JR odule 07 5A I 315-2 DF	Order numbe 6ES7 307-1E 6ES7 315-2	er A00-0AA0 2AF03-0AB0		ize of the IB85 - ca lock Mer Z Clock	e process i all up at 1/0 mory memory	mage) access	error:]	L No OB85	all up			-
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(0) U Slot (1) PS 30 2 (1) CPU X2 (1) CPU X2 (1) CPU 3 4 (1) D1320 5 (1) D032	JR odule 07 5A 1 315-2 DF xDC24V 2xDC24V/0.	Order numb 6ES7 307-1E 6ES7 315-2 6ES7 321-1B 54 6ES7 322-18	er A00-0AA0 2AF03-0AB0 L00-0AA0 L00-0AA0		ize of the IB85 - ca lock Mer Z Clock	e process i all up at 1/0 mory	mage) access	error:	 	No OB85	call up			
(0) U Slot (0) U Slot (1) PS 30 2 CPU X2 (1) DF 3 4 D1325 5 D032 6 D1327 6 D1327 5 D032 6 D1327	JR 07 5A 1 315-2 DF xDC24V 2xDC24V/0. D08x24V/0.	Order numb 6ES7 307-1E 6ES7 315-2 6ES7 321-1B 54 6ES7 322-1B 54 6ES7 323-1B	er A00-0AA0 2AF03-0AB0 L00-0AA0 L00-0AA0 H00-0AA0		ilze of the IB85 - ca lock Mer Clock	e process i all up at 1/0 mory memory wte:	mage) access	error:	 	No OB85	call up			•
(0) U Slot (0) U Slot PS 30 2 DP 3 4 DI320 5 DO32 6 DI870 7 Al2x1 8	JR 07 5A 1 315-2 DF xDC24V 2xDC24V/0 D08x24V/0 12Bit	Order numbe 6ES7 307-1E 6ES7 315-3 6ES7 321-1B 6ES7 321-1B 5A 6ES7 322-1B 5A 6ES7 323-1B 6ES7 331-7K	er A00-0AA0 2AF03-0AB0 L00-0AA0 L00-0AA0 H00-0AA0 B01-0AB0		IB85 - ca IB85 - ca Iock Mer Z Clock	e process i all up at I/O mory memory ute:	mage) access	error:	ו ר ר	No OB85	2 call up			
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(0) U Slot (0) U Slot PS 30 2 CPU X2 DF 3 4 D1325 5 D032 6 D18/0 7 A12x1 8 9 10	JR 07 5A 1 315-2 DF xDC24V 2xDC24V/0. D08x24V/0 12Bit	Order numb 6ES7 307-1E 6ES7 315-2 6ES7 321-1B 5A 6ES7 322-1B 5A 6ES7 323-1B 6ES7 323-1B 6ES7 323-17K Clock Memory	er A00-0AA0 2AF03-0AB0 L00-0AA0 L00-0AA0 H00-0AA0 B01-0AB0 Bit 7		IB85 - ca Iock Mer Clock	e process i all up at 1/0 mory memory ute: 4	mage) access 3	error: 2	 	No OB85	call up	C.	ancel	Help
(0) U Slot (0) U Slot PS 30 2 DP 3 4 D1320 5 D032 6 D18/0 7 A12x1 8 9 10 11	JR 07 5A 1 315-2 DF xDC24V 2xDC24V/0 12Bit	Order numbe 6ES7 307-1E 6ES7 315-2 6ES7 321-1B 5A 6ES7 322-1B 5A 6ES7 323-1B 6ES7 331-7K Clock Memory Frequency (H	er A00-0AA0 2AF03-0AB0 L00-0AA0 L00-0AA0 H00-0AA0 B01-0AB0 B01-0AB0 B01-0AB0 B11 7 Z) 0.5	6 0.62	IB85 - ca Iock Mer Clock	e process i all up at I/O mory memory ute: 4 1.25	mage) access 3 2	error: 2 2.5	 	No OB85	2 call up		ancel	Help



provide CDU 215 2	DD _ (D0/52)	×I	
operties - CPU 315-2 Time-of-Day Interrupts General Startu Short Description:	DP - (R0/S2) Cyclic Interrupts Diagnostics/Cloc up Cycle/Clock Memory F CPU 315-2 DP 64 KB work memory; 0.3 ms/1000 instr	k Protection Communication Retentive Memory Interrupts	
Order No. / firmware Name: Interface Type: MPI Address: 2 Networked: Yes Comment:	Receive capability for lateral communic routing, firmware V1.1 6ES7 315-2AF03-0AB0 / V1.1 CPU 315-2 DP	Properties - MPT interface CPU 315-2 DP (R0/52) General Parameters Address: 2 Highest address: 31 Transmission rate: 187.5 Kbps Subnet: not networked MPI(1) 187.5 Kbps	New Properties Delete
		ОК	Cancel Help

1/24/2012 PRO1_04E.13 Date: File:



Saving Station Names in the CPU





Saving the Setpoint Configuration and Downloading it in Modules

	<mark>∎ų</mark> н ∎ŋ	W Config - [SIMATIC 300(1) (Station Edit Insert PLC View	(Configuration) My_ w Options Window H	Proje Ielp	ct]							
		New Open Open ONLINE Close	Ctrl+N Ctrl+O		₩?						<u> </u>	
Allower The second		Save Save and Compile Properties	Ctrl+5									
		Import Export Consistency Check	Ctrl+Alt+K								F	
		Check CiR. Compatibility Print Print Preview	Ctrl+Alt+F Ctrl+P								' _ /	
	[.	Page Setup 1 My_Project\SIMATIC 300(1) 2 LueftungInitialsierung\S7_300	D_Station	0	Firmware V1.1	MPI a 2	1 add	Q C	omment	_	Download	ŵ
		3 My_Project\57_300_Station 4 SERV2_S\57_300_Station Exit	Alt+F4				03	47	_		only when C in STOP mod	CPU is de)
	7 8 0	Al2x12Bit	6ES7 331-7KB01-0AB0				8 304307	8				
	l Save	s and creates all system data in th	e current station.									



Uploading the Actual Configuration to the PG









Exercise 2: Adapting the Actual Configuration

HW Config - [Upload (Configuration) My M Station Edit Insert PLC View Options	/_Project] Window Help] 1
	Specify Module Selection of the Module (In Short Description D116xDC48-125V D116xDC24V D116xDC24V D116xDC24V D116xDC24V D116xDC24V D116xDC24V D116xDC24V D132xDC24V D16xAC120V D116xAC120V D116xAC120V D116xAC120V	Order No.): Fin 6ES7 321-1CH80-0AA0 Fin 6ES7 321-1BH01-0AA0 6ES7 321-1BH02-0AA0 6ES7 321-1BH02-0AA0 6ES7 321-1BH82-0AA0 6ES7 321-1BH81-0AA0 6ES7 321-1BH81-0AA0 6ES7 321-1BH80-0AA0 6ES7 321-1BH80-0AA0 6ES7 321-1BH80-0AA0 6ES7 321-1BL80-0AA0 6ES7 321-1BL80-0AA0 6ES7 321-1EH01-0AA0 6ES7 321-1EH01-0AA0 6ES7 321-1EH01-0AA0	
Slot Module Order number	Fi DI8xAC120/230V DI8xAC120/230V	6ES7 321-1FF01-0AA0 6ES7 321-1FF81-0AA0 6ES7 321-1EL00-0AA0	-
2 CPU 314 6ES7 314-1AE04-04 3 4 7 DI-300	xB0 V1 Digital input module DI32	24 V, grouping 32	 ▼
5 ? D0-300 6 ? DI0-300 7 ? AI-300 8		Cancel	Help
Press F1 to get Help.			



Exercise 3: Assigning Parameters to the CPU Clock Memory and Testing It

HW Config - [SIMATIC 300(1) (Configuration) My_Project] Image: Station Edit Insert PLC View Options Window Help	×
🕒 😅 🖫 🖷 🖏 🎒 🗈 💼 💼 🎰 🌆 🚯 📼 号	roperties - CPU 315-2 DP - (R0/52)
Image: 1 PS 307 5A Image: 2 Image: 1 Image: 2 Image: 2 Image: 2 <thi< th=""><th>Time-of-Day Interrupts Cyclic Interrupts Diagnostics/Clock Protection Communication General Startup Cycle/Clock Memory Retentive Memory Interrupts Cycle Image: Cycle of the process image cyclically Image: Cycle of the process image cyclically Image: Cycle of the process image cyclically Scan cycle monitoring time [ms]: 150 Image: Cycle of the process image Image: Cycle of the process image</th></thi<>	Time-of-Day Interrupts Cyclic Interrupts Diagnostics/Clock Protection Communication General Startup Cycle/Clock Memory Retentive Memory Interrupts Cycle Image: Cycle of the process image cyclically Image: Cycle of the process image cyclically Image: Cycle of the process image cyclically Scan cycle monitoring time [ms]: 150 Image: Cycle of the process image Image: Cycle of the process image
(0) UR Slot Module Order number 1 PS 307 5A 6ES7 307-1EA00-0AA0 2 CPU 315-2 DP 6ES7 315-2AF03-0AB0 X2 DP 3 4 DI32x0C24V 6ES7 321-181 00-0640	OB85 - call up at 1/0 access error: No OB85 call up Clock Memory Clock memory Memory Byte: 10
5 DO	
6 D18, 7 A12, 8	Deptions Window Help Cancel Help Value Modify value Window Help Cancel Help Cancel Help Value Modify value Window Help Cancel Help Cancel Help Value Help Cancel Help Value Value
My_Project\SIMATIC 300(1)	AL //







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CPU Properties

🙀 HW Config - [SIMATIC 300(1) (Configuration) My_Pro	iect]
1 Station Edit Insert PLC View Options Window Help	Properties - CPU 315-2 DP - (R0/52)
Image: Constraint of the second se	Time-of-Day Interrupts Cyclic Interrupts Diagnostics/Clock Protection Communication General Startup Cycle/Clock Memory Retentive Memory Interrupts Short Description: CPU 315-2 DP 64 KB work memory; 0.3 ms/1000 instructions; MPI+ DP connection (DP restructions) 64 KB work capability for lateral communication, constant bus cycle time, routing, firmware V1.1 Image: Order No./ firmware 6ES7 315-2AF03-0AB0 / V1.1
(0) UR Slot Module Order number 1 PS 307 5A 6ES7 307-1EA00-0AA0 2 CPU 315-2 DP 6ES7 315-2AF03-0AB0 X2 ZP 3 4 DI32vDC24V 6ES7 321-181 00-0AA0	Interface Type: MPI Address: 2 Networked: Yes Properties Comment:
4 6 5 1 D032xDC24V 6ES7 3211BL00-00A0 6 5 1 D032xDC24V/0.5A 6ES7 3221BL00-00A0 6 6 1 D18/D08x24V/0.5A 6ES7 3231BH00-00A0 6 7 1 Al2x12Bit 6ES7 331-7KB01-00A0 8 9 10	OK Cancel Help
Press F1 to get Help.	



CPU Properties: Startup

General	Startup Cycle/Clock Me	agnostics/Clock Protection Comm emory Retentive Memory In	iunication terrupts
Startup if pre:	set configuration does not match	actual configuration	
Reset output	s at hot restart		
Disable hot re	estart by operator (for example, fro	om PG)	
or communica	ation (ob (ror example, from MP) s	lations).	
-Startup after Po	ower On		
C Hot restart	Warm restart	C Cold restart	
- Monitoring Time	e for		
"Finished" mes	sage from modules [100 ms]:	650	
	ameters to modules [100 ms]:	100	
Transfer of para		0	
Transfer of para Hot restart [100	(ms]:	J	
Transfer of para Hot restart [100	i ms]:		

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	Pro	operties - CPU 315-2 DP	- (R0/52)		· · · ·	×
		Time-of-Day Interrupts General Startup	Cyclic Interrupts	Diagnostics/Clock Memory Rete	Protection Communicat entive Memory Interrup	tion ts
		Retentivity Number of memory bytes Number of S7 timers star Number of S7 counters s	starting with MB0: ting with T0: starting with C0:	16 0 8		
	٢	Areas Retentive Area 1:	DB No.	Byte Address	Number of Bytes	
Relevant only for CPUs		Retentive Area 2: Retentive Area 3:	1	0	0	
have no backup battery	Í	Retentive Area 4: Retentive Area 5: Retentive Area 6:	1			
		Retentive Area 7: Retentive Area 8:	1	0	0	
		OK			Cancel Help	



CPU Properties: Protection

General Startup Cycle/Cloc Time-of-Day Interrupts Cyclic Interrupts	k Memory Retentive Memory Interrupts Diagnostics/Clock Protection Communication
 Protection level 1: Keyswitch setting Removable with password 2: Write-protection 3: Write-/read protection Password: Enter again: 	Mode Permissible cycle increase via test functions: 5 ms Test mode
ок	Cancel Help



CPU Properties: Diagnostics/Clock

Extended functions		
Report cause of STOP		
Acknowledgment-triggered reporting of	SFB33-35	
-Clock		
Synchronization Synchroniz	ation Type Time Interv	al
In the PLC: None	 None 	~
On MPI: None	▼ None	v
On MFI: None	▼ None	
Correction factor:	,	
	mə	



CPU Properties: Communication

General Startup Time-of-Day Interrupts	Cycle/Cloc Cyclic Interrupts	k Memory Diagnostics	Retentive Memory Clock Protection	Interrupts Communication
Connection Resources Re	served for			
PG Communic	ation:	1		
OP Communic	ation:	1		
S7 Basic Com	munication:	8		
S7 Communic	ation:	0	(already configured)
Maximum number of conne	etion resources:	12		
OK			Cancel	Help

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Exporting a Hardware Station

	Station Edit Insert PLC View Optic New	ns Window He		<u>B</u> ×
	Open Open ONLINE Close	Ctrl+O		-
2 <u>X</u> 3	Save Save and Compile	Ctrl+S	PROFIBUS(1): DP master system (1)	
<u> 4</u> 5	Properties			
$\frac{\overline{6}}{7}$	Import Export			
8911	Consistency Check Check CiR. Compatibility	Ctrl+Alt+K Ctrl+Alt+F		
	Print Print Preview Page Setup	Ctrl+P	Export File: D:\S7_Courses\S7_300_Station.cfg Browse	_
	2 My_Project\SIMATIC 300(1) 3 LueftungInitialsierung\S7_300_Station 4 My_Project\S7_300_Station		Options Format Export default values Readable	
	Exit 0	Alt+F4	Image: Export symbols Image: Compact Image: Export subnets Image: Compact	
	2			
i Expo	rts an existing station.		Save Cancel Help	



CA01: Selection Assistant for SIMATIC

Siemens Catalog CA 01 10/2003 INT ENG



Date: 1/24/2012 PRO1_04E.31 File:



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test station	Properties	Parts list Des	cription	ĭ	System
	Order number	Designation	Quantity	List price	Total price
	6ES7307-1EA00-0AA0	Load power supply PS 307; AC 120/230V, DC	1	upon request	upon request
	6ES7321-1BL00-0AA0	Digital input SM 321, isolated, 32 DI, DC 24V	1	upon request	upon request
	6ES7322-1BL00-0AA0	Digital output 32D0, DC 24V, 0.5A; isolated	1	upon request	upon request
	6ES7390-1AE80-0AA0	480 mm rail (single mod. width 40 mm)	1	upon request	upon request
	6ES7392-1AM00-0AA0	Front connector, 40-pole, with screw contact	2	upon request	upon request
		l otal price:			upon request







Objectives

Upon completion of this chapter the participant will ...

- ... know the different types of S7 blocks
- ... understand the principle of "structured programming"
- ... know the meaning of the process images (PII, PIQ)
- ... be able to explain the principle of cyclic program execution
- ... know and be able to select the LAD, FBD and STL programming languages
- ... be able to edit, save and download a block with the LAD/STL/FBD Editor
- ... be able to carry out a simple program debugging with the "Monitor Block" test function
- ... as an option, be able to make customizations to the LAD/FBD/STL Editor





Date: 2/3/2012 File: PRO1_06E.3



Program Structuring Possibilities
















Inserting an S7 Block

	Station Subpet		ь- ь- ь-	Properties - Function		
-	Program	•		General - Part 1 Genera	al - Part 2 Calls Attributes	
L:	57 Software <mark>57 Block</mark> M7 Software	1 Organization 8 2 Function Block	Block	Name:	FCI	
	Symbol Table Text Library External Source	3 Function 4 Data Block 5 Data Type		Symbolic Name: Symbol Comment:		
	WinCC flexible RT WinCC Object	b variable Table		Created in Language: Project path:	STL	
My Proje	Parameter External parameters. ect D:\57 Course	s\My Proje		Storage location of project:	i D:\S7_Courses\My_Proje	
₽ My_P ⊡ ∭ S	Project IMATIC 300(1)	System data 🗗 FC16	🖸 08	Date created:	Code 10/12/2006 02:25:42 PM	Interface
<u> </u>	CPU 315-2 DP 57 Program(5) 50 Sources 6 Blocks	■ FC42	¥ 1 70	Last modified: Comment:	10/12/2006 02:25:42 PM	10/12/2006 02:25:42 PM
				ОК		Cancel Help
ts Function	at the cursor position)				







The STEP 7 Programming Languages

Function Block Diagram





Selecting the Programming Language





Programming in LAD and FBD





Programming in STL

The File Edit Insert PIC	- My_Project(SIMATIC 300(1)\CPU 315-2 DP]	_ 린 시
	* 🖻 🖻 🎦 애 🚾 🖂 📰 ! (>>! 🔲 📖 !! -!	
FC1 : System	ON/OFF	
A I S Q AN I R Q NOP O	0.0 8.0 0.1 8.0	€≤
× ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	$\mathbf{r} \mathbf{\lambda} 2: \ln \mathbf{fo} \mathbf{\lambda} 3: \operatorname{Cross-references} \mathbf{\lambda} 4: \operatorname{Address} \inf \mathbf{fo}. \mathbf{\lambda} 5: \operatorname{Modify} \mathbf{\lambda} 6: \operatorname{Diagnostics} \mathbf{\lambda} 7: \operatorname{Comparison} \mathbf{\lambda}$	
Irect E1 to get Help	🖸 efficient Abrie - 5.2 Novit Le C. Terrert Cha	



	Saving a Block
	Current project directory with block name
ELAD/STL/ - [FC1	My_Project\SIMATIC 300(1)\CPU 315-2 DP]
FC1 : System	Contents Of: 'Brwironment\Interface'
	Program elements
	or λ 2: Info \wedge 3: Cross-references λ 4: Address info. λ 5: Modify λ 6: Diagnostics λ 7: Comparison /
Press F1 to get Help.	😨 offline Abs < 5.2 Nw 1 Ln 6 Insert Chg 🥢







Downloading Blocks into the PLC

e Edit Insert PLC View	Options Window Helj	p		_ & ×
ê 🔡 🛲 X 🖻 🖻	📩 😨 💁 🏨	📴 🟥 🏢 🔁 < No Fil	ter > 💽 🏹	' 🔡 📾 📆 🖷
My_Project	Object name	Symbolic name	Created in language	Size in the work me
SIMATIC 300(1)	🙆 System data			
🖻 – 📓 CPU 315-2 DP	🕀 0B1	OB_Cycle	LAD	68
⊡ 🚮 S7 Program(5)	🕀 FC1		LAD	48
	🕀 FC14	FC_Signal	FBD	124
BIOCKS	🕀 FC15	FC_Mode	FBD	104
	🖬 FC16	FC_ConvMotor	FBD	1 <mark>00</mark>
	🕀 FC17	FC_Fault	FBD	
	🖬 FC18	FC_Count	FBD	64
	🖬 FC19	FC_Count_Add	FBD	112
	🖬 FC42	FC_MM420	FBD	102
	1/0 Conveyor	VAT_I/O_conveyor		
		J		
) get Help.			CP5611(MPI)	





Simple Program Debugging









Exercise 1: Jogging the Conveyor Motor (FC 16)



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Exercise 2: Calling FC 16 in OB 1









Editor Customization: "General" Tab

File Edit Insert PLC Debug View Options Window Help Customize Customize Customize Compare On-/Offline Partners Compare On-/Offline Partners RG1 Customize Reference Data	General View STL LAD/FBD Block Sources Source Text
FC1 : System Symbol Table Ctri	Font: Font Size: Courier New 8 Select Further options Report cross-accesses as error Save window arrangement on exit Set network title automatically Program status Program status
Symbol information: T_System_ON IO.O Momentar T_System_OFF IO.1 Momentar	Control at Contact Automatic Program Status Change on Blocks Terminate ONLINE connection after program status Time Lag: 5 (0 - 60) seconds Mnemonics (Change: SIMATIC Manager Options>Customize): English
anges various individual settings of this application.	OK Abbrechen Hilfe



Editor Customization: "View " Tab

General View STL LAD/FBD Block Sources Source Text FG1: System Compare On-/Offline Partners Reference Data Symbol Table Curl View after Block Open **T_System Q8:0 ON* Symbol Table Curl Symbol information **T_System_OFF Q8:0 ON* Symbol information Symbol selection (for LAD/FBD) System_OFF N:0.0 Moment ar: Address identification T_System_OFF IO.0 Moment ar: Moment ar: T_System_OFF IO.1 Moment ar: T_System_OFF IO.1 Moment ar: * Yiew for Block Types Data Blocks: Lap Declaration View Program element overview * Libraries: Type and number Type and number	File Edit Insert PLC Debug View Options Window Help	ustomize
Project Libraries: Type and number Type and number	Customize Compare On-/Offline Partners Reference Data Symbol Table Ctrl- Symbol information: T_System_OFF ID.0 Momentary T_System_OFF	General View STL LAD/FBD Block Sources Source Text View after Block Open Symbolic representation Symbolic representation Symbol information With text color: Select Automatic symbol selection (for LAD/FBD) Select Sorting of selection list by: Symbol Block/network comments Address identification Permanently forced addresses (FORCE) Process diagnostic addresses (PDIAG) With background color: Select View for Block Types Data Blocks: Logic Blocks: Data Blocks: LAD Declaration View
	anges various individual settings of this application.	Project Libraries: Type and number Type and number



Editor Customization: "STL" Tab

neral I View – STL – LLAD / FBD I Block I Sources I Source Tevt I –	
Display of the Status Fields	
Status bit De negister 1	
Result of Logic operation Do negister 2	
🗖 Address Register 1 👘 Status Word	
🗖 Address Register 2	
Accumulator 2	



Editor Customization: "LAD/FBD" Tab

DIN A4 Portrait	Address Field Width
Element Representation:	3-dimensional
- Line/Color	
Reference:	Status fulfilled
Line Weight	◯ Narrow ● Medium ◯ Wide
Color:	Select
Type Check of A	ddresses
Display symbol in	rormation at address



Editor Customization: "Block" Tab

General View STL LAD/FBD Block Sources Source Text		Should the re	ference data be	
With the Creation of a Block	- 🖊			
Create reference data			ad2	
Create Logic Blocks		 Tegeneral 	eur	
Language: O STL 💿 LAD O FBD				
Function blocks with multiple instance capability		Yes	Cancel	Help
		100		
	_,			
Default				
OK Abbrechen Hilfe	e			



Editor Customization: "Sources/Source Text" Tab

With Compiling a Source	Format
✓ Display warnings	Tab width: 🚺 🗧 Character
Errors before warnings	Display line number
✓ Overwrite existing blocks	Indent automatically
Create blocks only for error-free compilation	Key words in capital letters
With Saving a Block	Color and Style
🔲 Generate source automatically	Source text display with the following color and style assignment
Derive name from:	Text type: Normal text
 Absolute identifier of the block Symbolic identifier of the block 	Font Style: 🗖 Bold 🗖 Italic
Addresses:	Color: Select
Symbolic	Preview test
Generate sources for blocks that already exist Execute	
(with the settings indicated above):	
	Black and white
	Standard font
Default	
OK Abbrechen Hilfe	OK Abbrechen Hilf



Symbolic Addressing

🙀 Symbol Editor - [S7 Program(2) (Symbols) My_Project\SIMATIC 300(1)\CPU 315-2 DP]								×	
👌 Symbo	I Table	Edit Insert View Op	tions	Windov	v Help			_ 8	×
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	Status	Symbol 🛆	Addr	ess	Data ty	pe	Comment		
1		L_Weight_invalid	Q	4.0	BOOL		Indicator light - weight invalid		
2		L_SYSTEM	Q 4.1		BOOL		Indicator light System ON		
3		L_MAN	Q	4.2	BOOL		Indicator light MAN mode		
4		L_AUTO	Q	4.3	BOOL		Indicator light Automatic mode		
5		L_Restart_man	Q	4.5	BOOL		Indicator light for manual warm restart		
6		L_Restart_aut	Q	4.6	BOOL		Indicator light for automatic warm restart		
7		L_Conv_Fault	Q	5.0	BOOL		Indicator light Conveyor fault		
8		L_Fault1	Q	5.1	BOOL		Indicator light Fault 1		
9		L_Fault2	Q	5.2	BOOL		Indicator light Fault 2		
10		L_Fault3	Q	5.3	BOOL		Indicator light Fault 3		
11		L_S4_Mill	Q	5.4	BOOL		Indicator light Milling at Bay 3		
12		L_S5_3->LB	Q	5.5	BOOL		Indicator light Transport Bay 3 -> Light barrier bay		
13		L_S6_Final_Check	Q	5.6	BOOL		Indicator light Final check at LB bay		
14		L_Bay1	Q	8.1	BOOL		Indicator light Bay 1		
15		L_Bay2	Q	8.2	BOOL		Indicator light Bay 2		
16		L_Bay3	Q	8.3	BOOL		Indicator light Bay 3		
17		L_Bay-LB	Q	8.4	BOOL		Indicator light Light barrier bay		
18		K_Conv_RIGHT	Q	8.5	BOOL		Run conveyor RIGHT		
19		K_Conv_LEFT	Q	8.6	BOOL		Run conveyor LEFT		
20		Horn	Q	8.7	BOOL		Horn		
21		QB_Simulator-LED	QB	5	BYTE		lower Simulator LEDs		
22		QW_DigDisp	QW	6	WORD		BCD digital display		
23		QVV_Control_MM420	QW	42	WORD		Control word for MM420		
24		QW_Setp_MM420	QW	44	WORD		Setpoint speed for MM420		
25		DB_Instance_FB20_F	DB	2	FB 20	0	Instance DB for FB20, Evaluation of Fault 2		
26		DB_Instance_FB20_F	DB	3	FB 20	0	Instance DB for FB20, Evaluation of Fault 3		
27		DB_FB11_RunningLight	DB	11	FB 11	1	Instance DB for FB11_RunningLight		
28		DB_FB17_Fault	DB	17	FB 17	7	Instance DB for FB17 Fault evaluation		-
Press F1 to	get Help								1



Objectives

Upon completion of the chapter the participant will ...

- ... know the difference between absolute and symbolic addressing
 - know the difference between local and global symbols
- ... be able to edit a global symbol table
 - be able to use the Block Editor to edit global symbols



...

...



Absolute and Symbolic Addressing

Absolute Representation						
Α	10.0					
=	Q8.0					
A	10.4					
=	Q20.5					
Call	FC18					

Symbolic	Representation
А	"SYSTEM_ON"
=	"SYSTEM_ON"
А	"M_FORW"
=	"MOTOR_FOR"
Call	"COUNT"

Symbol	Address	Data Type	Comment
MOTOR_FOR	Q20.5	BOOL	Motor moves forward
COUNT	FC18	FC18	Count bottles
SYSTEM_ON_SW	10.0	BOOL	Switch system on
SYSTEM_ON_LT	Q8.0	BOOL	Indicator: System is "On"
M_FORW	10.4	BOOL	Pushbutton: Motor forward
(max. 24 characters)			۲ (max. 80 characters)



Symbolic Addressing

Where are symbols used?	Where are they stored?	With what are they created?
Global Data: - Inputs - Outputs - Bit mem., timers, counters - Peripheral I/O	Symbol Table	Symbol Editor
Local Block Data: - Block parameters - local / temporary data	Declaration part of the block	Program Editor
Jump Labels	Code section of the block	Program Editor
Block Names: - OB - FB - FC - DB - VAT - UDT	Symbol Table	Symbol Editor
DB Components	Declaration part of the DB	Program Editor



		Т	he	Symbol	Tab	le	
SIMATIC Manager - [My_Proje	ct D:\S7_0	Courses\	My_Pi	ʻoje]			
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- 🛅 Sources		🚭 Symbo	l Editor	- [57 Program(2) (5y	mbols) M	y_Project\S	IMATIC 300(1)\CPU 315-2 DP]
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É IP170B_Color		🖻 🔒	3	🔏 🖺 💼 🖉	× All Symbo	ols	▼ 1/2 N?
			Status	Symbol	Address A	Data type	Comment
		41		T_System_ON	1 0.0	BOOL	Momentary contact System ON
		42		T_System_OFF	I 0.1	BOOL	Momentary contact System OFF (NC contact)
		43		T_Jog_RIGHT	1 0.2	BOOL	Jog conveyor RIGHT, momentary contact
		44		T_Jog_LEFT	1 0.3	BOOL	Jog conveyor LEFT, momentary contact
		45		S_M/A_ModeSelect	1 0.4	BOOL	Switch - Operating Mode Preselect: '0'=MANUAL, '1'=AUTO
		46		T_M/A_Accept	1 0.5	BOOL	Momentary contact, confirm operating mode
		47		S_Weight/Quantity	1 0.6	BOOL	0 = Display quantity, 1 = Display weight
		48		T_Ackn_WarmRestart	1 0.7	BOOL	Momentary contact to acknowledge warm restart display
		49 🏲		T_Ackn_Fault	I 1.0	BOOL	Momentary contact Fault acknowledgement
		50		S_Fault1	I 1.1	BOOL	Simulate Fault 1, 0=OFF/1=ON
		51		S_Fault2	I 1.2	BOOL	Simulate Fault 2, 0=OFF/1=ON
		52		S_Fault3	I 1.3	BOOL	Simulate Fault 3, 0=OFF/1=ON
Press E1 to get Help		53		LB	1 8.0	BOOL	Light barrier
		54		T_Bay1	I 8.1	BOOL	Momentary contact Bay 1
		55		T_Bay2	1 8.2	BOOL	Momentary contact Bay 2
		56		T_Bay3	1 8.3	BOOL	Momentary contact Bay 3
		57		T_Bay-LB	I 8.4	BOOL	Momentary contact Light barrier bay
		58		BAY1	1 8.5	BOOL	Proximity sensor Bay 1
		59		BAY2	I 8.6	BOOL	Proximity sensor Bay 2
		60		BAY3	1 8.7	BOOL	Proximity sensor Bay 3
		61		INV_Thumbw	IW 2	WORD	BCD thumbwheel
		62		NV_State_MM420	IW 42	WORD	State word of MM420
		Press F1 to	get Help	4			



Edit:	Find	and	Rep	lace
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Symbo	ol Table	Edit Insert View C	ontions Windo	w Help	
	/=	Lindo	Chrl+7		
		Redo	Christ		
	Status	- NGUU	Curren	ata type	Comment
41		Cut	Ctrl+X	OOL	Momentary contact System ON
42		Сору	Ctrl+C	OOL	Momentary contact System OFF (NC contact)
43		Paste	Ctrl+∀	OOL	Jog conveyor RIGHT, momentary contact
44				00L	Find and Replace
45		Delete	Del	OOL	
46		Select			Find what: Replace with:
47		Upde Selection			Q8.1 Q4.1 (Less
48					
49 🏲		Find and Replace	Ctrl+F		Search Range
50		Continue	Ctrl+₩		From cursor O From cursor O All O Selection
51		Go To Row	Ctrl+E	OOL	
52				00L	Options
53		Add Default Symbol:	s	OOL	Find whole words only Search with Wildcards
54		Generate SDB		OOL	
55		Special Object Prope	erties	▶ OOL	
56		т_вауз	1 0.3	BOOL	
57		T_Bay-LB	1 8.4	BOOL	Card March Declare Declare All Clare Unit
58		BAY1	1 8.5	BOOL	Find Next Heplace Heplace All Liose Help
59		BAY2	I 8.6	BOOL	
60		BAY3	1 8.7	BOOL	Proximity sensor Bay 3
61		IVV_Thumbw	NV 2	WORD	BCD thumbwheel
62		IVV_State_MM420	IVV 42	WORD	State word of MM420



Symbo	ol Editor	- [57 Prog	ram(2) (5	mbols) M	/_Project	\SIMATI	C 300(1)\CF	PU 315-2 DP]							
🔄 Symbo	ol Table	Edit Inser	t View O	otions	Windo	w Help	F					6				
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	Status	Symbol	Zoom	Out		Ctrl+N	lum-	ment	Filter)
119		OB_Cycle	Zoom	Hactor	•			or cyclic prog								-
120		OB_Cyclic	Filter.						Filter List —							
121		OB_I/O_FLT1 Sort					raun No : Eilter name:									
22		OB_SlaveFai				OB for slave		All C			I (Sele	ction in the Sy	mbol Tab	ole		
123		OB_WarmF		ns R, O,	м, с,	CC Ctrl+k		n restart OB		All Syr	NDOIS		with A	Alt+0,, Alt+9)		
124		PIVV_AD	🗸 Toolba	r			-	ator Poti for								
125		FIVV_AIZ	🗸 🗸 Status	Bar				ator light	New filt	-r	S	ave			Diel	ete
120		L_SYSTEM						ator light Svel				070			Del	010
128		L MAN	Updat	e		F5		ator light MAN								
129		L AUTO		Q	4.3	BOOL	Indica	ator light Auto	⊢ Display Symb	ol with Pro	perty					
130		L_Restart	man	Q	4.5	BOOL	Indica	ator light for r	Propidy Symb		P	-				
131		L_Restart	aut	Q	4.6	BOOL	Indica	ator light for a	Name:	×		*	Monitor	ina:		×
132		L_Conv_Fa	ult	Q	5.0	BOOL	Indica	ator light Con	A	lio x					i i	
133		L_Fault1		Q	5.1	BOOL	Indica	ator light Faul	Address:	18.^		*	Up. Utri	l. + Monitoring:		× 🗾
134		L_Fault2		Q	5.2	BOOL	Indica	ator light Faul	Data Tupe:	×		*	Messar	1e.		×
135		L_Fault3		Q	5.3	BOOL	Indica	ator light Faul	Data Type.				mooodg	j 0.		<u> </u>
136		L_S4_Mill		Q	5.4	BOOL	Indica	ator light Millir	Comment:	×		*	Commu	inication:		× 🔻
137		L_S5_3->L	B	Q	5.5	BOOL	Indica	ator light Trar		· ·		_	Control	-1 1 1	i i	
138		L_S6_Fina	_Check	Q	5.6	BOOL	Indica	ator light Fina					Lontrol	at contact:		× 🗾
139		L_Bay1		Q	8.1	BOOL	Indica	ator light Bay								
40	😽 Symi	bol Editor ·	[S7 Progra	am(<u>2) (</u>	Symb	ols) My	_Project\	SIMATIC 3	🚽 🗖 Display Symb	ol with Sta	itus					
142	🔄 Syml	bol Table B	dit Insert	View	Option	s Window	Help				P 1					
143			X 🖻 🖻	l M	Ca	< Filtered	view>	-		I ⊻ (nvalid non-unique,	incomple	te)			
44		Status	Symbol		Ac	ldress 🛆	Data type	Commen								
46	1		LB		1	8.0	BOOL	Light bar								
140 114 - 114 -	2		T_Bay1		<u> </u>	8.1	BOOL		Filter					Cancel		Halp
licers the	3		I_Bay2			8.2	BOOL	Momonte						Cancer		neib
	4		і_⊡ауз Т.Вау I.В			0.3 8.4	BOOL	Momenta		1917						
	6		BAY1			8.5	BOOL	Proximity	sensor Bay 1							
	7		BAY2			8.6	BOOL	Proximity	sensor Bay 2							
	8		BAY3		1	8.7	BOOL	Proximity	sensor Bay 3							
	9									•						

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View: Sort

Symbo	ol Editor	· - [S7 Progra	m(2) (5y	mbo	ls) My	_Project\SI		C 300(1)\CPU	J 315-2	DP]				
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37		FC_MM420	Zoom F	acto	r			ontrol MM420						
38		FC_Sequenc	Filter	·				equencer for p	roductio	n line				
39		FC_Command	Sort							<u> </u>				
40		FC_Scale						r analog value	SCam					
41		T_System_O	Column	is R,	о, м, с, (CC Ctrl+K	6	entary contact	Syste	4				
42		T_System_O	🖌 Toolba	r			6	entary contact	Syste	FF (NC cont	act)			
43		T_Jog_RIGH1	A Status	Bar			þ	onveyor RIGH	T, m	Zy contact				
44		T_Jog_LEFT		Dai			P	onveyor LEFT	mome	ry contact				
45		S_M/A_Mode	Update	;		F5	9	ch - Operating	Sort					X
46		T_M/A_Acce	л.	•	0.0	DOOL	monte	entary contact			_			
47		S_Weight/Qua	antity	1	0.6	BOOL	0 = 0	Display quantit	Colu	mn:	Address Ascendir	הם	-	
48		T_Ackn_Warr	nRestart	1	0.7	BOOL	Mome	entary contact			Address Ascendin	-9 Va		
49 🏲		T_Ackn_Fault		1	1.0	BOOL	Mome	entary contact			Address Ascendi	lina	<u> </u>	
50		S_Fault1		1	1.1	BOOL	Simul	late Fault 1, 0=			Data Type Ascen	dina		
51		S_Fault2		1	1.2	BOOL	Simul	late Fault 2, 0=			Data Type Desce	nding		
52		S_Fault3		I	1.3	BOOL	Simul	late Fault 3, 0=			Comment Ascend	ing –	-	
53		LB		1	8.0	BOOL	Light	barrier						
54		T_Bay1		1	8.1	BOOL	Mome	entary contact		OK	Canool		Help	
55		T_Bay2		1	8.2	BOOL	Mome	entary contact		UN	Lancel		пер	
56		T_Bay3		I	8.3	BOOL	Mome	entary contact						
57		T_Bay-LB		1	8.4	BOOL	Mome	entary contact	Light ba	rrier bay				
58		BAY1		1	8.5	BOOL	Proxi	mity sensor Ba	iy 1					
59		BAY2		1	8.6	BOOL	Proxi	mity sensor Ba	iy 2					
160		IBAY3			8.7	BOOL	Proxi	mitv sensor Ba	IV 3					
Sorts the d	isplay ac	cording to speci	ific criteria	•										



Editing Symbols in the LAD/STL/FBD Editor



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Date: 2/4/2012 File: PRO1 04E.9







Symbol Selection in LAD/FBD

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FC14 : Title:								
Network 1: Indicator ligh	t Bay 1							
"K_Conv_		"M_Conv_						
"L_AUTO" RIGHT"	"BAY1" "BAY2"	Fault"	"L_B:	ay-LB"	"L_Bayl"			
	—//—_//	V	l		_()	1		
	"M_Flash_	"M_Conv_						
"L_AUTO" "BAY1"	"BAY2" 1Hz"	Fault"	"L_B	ay-LB"				
	—//——/ —	//⊨						
"K_Conv								
"L_AUTO" RIGHT"	m.							
	"M Flash 2Hz"							
	AM Aux Left	BOOL	м	14.0	Aux. me			
-	M Aux Man ON	BOOL	м	15.2	Edge at			
Network 2 : Indicator ligh	M Aux System ON	BOOL	м	15.1	Edge at			
	M Bayl occup	BOOL	м	14.1	Memory			
"K_Conv_	M_Bay2_occup	BOOL	м	14.2	Memory			
"L_AUTO" RIGHT"	M_Bay3_occup	BOOL	м	14.3	Memory			
j/	M_Bays_occup_HMI	BOOL	м	33.0	all Bay			
	🔄 M_Conv_Fault	BOOL	м	17.0	Memory			
"L_AUTO" "BAY1"	M_Conv_Fault_HMI	BOOL	м	33.1	Memory			
	M_Conv_Jog_LE	BOOL	м	30.3	Memory			
	M_Conv_Jog_RI	BOOL	м	30.2	Memory			
"K Conv		DOOT	W.	101 0	Auxilis			
"L_AUTO" RIGHT"	🔄 M_Edge_Aux	BOOL	rı	101.0				
"L_AUTO" RIGHT"	M_Edge_Aux	BOOL	M	17.1	Memory			
"L_AUTO" RIGHT"	M_Edge_Aux M_Fault1 M_Fault2	BOOL BOOL BOOL	M M M	17.1	Memory Memory			
"L_AUTO" RIGHT"	M_Edge_Aux M_Fault1 M_Fault2 M_Flash_1Hz	BOOL BOOL BOOL	M M M M	17.1 17.3 10.5	Memory Memory Memory			
"L_AUTO" RIGHT" Network 3: Title:	H Edge_Aux H Fault1 H Fault2 H Fault2 H Flash_1Hz H Flash_2Hz	BOOL BOOL BOOL BOOL	M M M M M	17.1 17.3 10.5 10.3	Memory Memory Memory Memory			
"L_AUTO" RIGHT" Network 3: Title:	M_Edge_Aux M_Fault1 M_Fault2 M_Flash_1Hz M_Flash_2Hz M_InitialState	B00L B00L B00L B00L B00L B00L	M M M M M M	101.0 17.1 17.3 10.5 10.3 101.1	Memory Memory Memory Memory Memory			
Network 3: Title:	M_Edge_Aux M_Fault1 M_Fault2 M_Flash_1Hz M_Flash_2Hz M_InitialState M_Jog_LEFT	B00L B00L B00L B00L B00L B00L	M M M M M M M	101.0 17.1 17.3 10.5 10.3 101.1 16.3	Memory Memory Memory Memory Memory Memory			
Network 3: Title:	M_Edge_Aux M_Fault1 M_Fault2 M_Flash_1Hz M_Flash_2Hz M_InitialState M_Jog_LEFT M_Jog_RICHT	B00L B00L B00L B00L B00L B00L B00L	M M M M M M M M	101.0 17.1 17.3 10.5 10.3 101.1 16.3 16.2	Memory Memory Memory Memory Memory Memory Memory			



Symbol Table: Export

	Open Close	Insert view Op	cions winac	w Heip Ctrl+O Ctrl+F4		∑⁄/ \ ?						
0	Save			Ctrl+S	Contro	_ nment A						
2	Properties				Count	parts	Where do you want to store the table?					
3 4	Import				Count to ev	parts using ad(212					
5	Print			Ctrl+P	Store	Speichern 🚺	🔁 S7_Courses 🗸 🗸 🔁 🕂 🖽 -					
Ē	Print Preview				Contro							
3	Page Setup				Seque							
<u>,</u> –	1 My Project\SI	MATIC 300(1)\CPU 31	15-2 DP\\S	/mbols	for an	PRO3_Loe						
-	2 My_Project\S7	_300_Station\CPU 31	.5-2 DP\\S	/mbols	nentar	nentar 🗁 SERV1_A						
2	3 SERV2_5\57_3	00_Station\CPU 315-	2 DP\\Sym	bole	nentar	SERV1_L						
3	4 SERV1_S\S7_3	00_Station\CPU 315-	2 DP\\Sym	bole	CONV	SERV2_B						
4 - 5	Exit			Alt+F4	itch - (
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r	S_\	/Veight/Quantity	I 0.6	BOOL	0 = Displ	Datemane.	Symbol_Table Speichein					
}	T_/	Ackn_WarmRestart	1 0.7	BOOL	Momentar	Dateityp:	System Data Format (*.SDF)					
		Ackn_Fault	I 1.0	BOOL	Momentar							
pies	; the selected syml	bol table or parts of it	to a file (of a	a different forma	at).							
						l t	n which format do you want to store the table?					



Symbol Table: Import

ם Syr	mbol Table Edit Insert View	Options \	Window Help	
á '	Open		Ctrl-	
	Close		Ctrl-	1+F4 mment
0	Save		Ctrl-	I+5 Control of conveyor motor
1	Properties			Fault evaluation
$\frac{2}{3}$	roperaesin			Count parts
4	Import			for evaluating faults
5	Export			Control BCD digital display
5	Print		mort	2 1
7	Print Preview		mport	
5	Page Setup	V	Suchen in:	🗁 S7_Courses 🛛 💌 🖛 🖻 📸 📰 🗸 🛶 👘
<u> </u>	1 My Project\SIMATIC 300(1)\C	PU 315-2 D		
<u>-</u> 1	2 My Project\S7 300 Station\C	PU 315-2 DI	LuettungIn	nitialisierungsTest SERV2_L
2 :	3 SERV2_S\S7_300_Station\CPU	315-2 DP\.	My_Proje	Symbol_Table.sdf < _ Select directory path
3	4 SERV1_S\S7_300_Station\CPU	315-2 DP\.	PRO3_Loe	
4	Evit		SERV1_A	
5 <u> </u>	T M/A Accort		SERV1_L	
7	S Weight/Quantity		SERV2_B	
8	T Ackn WarmRest	tart I (
9	T_Ackn_Fault	I - 1	<u> </u>	
- serts 2	a copy of a saved file (of a differ	rent format	Dateiname:	Sumbol Table off
			e atomarno:	
			Dateityp:	System Data Format (*.SDF)
		_		
				Solact file format
				Select file format


Exercise 1: Importing a Symbol Table

🚭 Symbo	🙀 Symbol Editor - [My_program (Symbols) My_project_ch3_ch8\test station\CPU 315-2 DP]									
👌 Symbo	Symbol Table Edit Insert View Options Window Help									
😂 🖬 🎒 👗 🖻 💼 🗠 🖂 🛛 All Symbols 💽 🏹 💦										
	Symbol	Address 🔺	Data type	Comment	▲					
1	Counter_faults	C 17	COUNTER	Counts conveyor belt faults in Auto mode						
2	Counter_Parts	C 18	COUNTER	S5 counter function for parts in AUTO mode						
3	Instance_FB20_Call_2	DB 2	FB 20	Instance DB for FB20						
4	Instance_FB20_Call_3	DB 3	FB 20	Instance DB for FB20						
5	Instance_FB20_Call_4	DB 4	FB 20	Instance DB for FB20						
6	DB_Parts	DB 18	DB 18	Data block stores actual quantity and both auxiliary edge memory bits						
7	HMI_Interface	DB 99	DB 99	Transfer interface for HMI System in general						
8	FB_Fault	FB 20	FB 20	Evaluation of process faults						
9	FC_Signalizing	FC 14	FC 14	Signalizing during conveyor movement						
10	FC_Modes	FC 15	FC 15	System ON and OFF, Mode_Man; Mode_Auto						
11	FC_Conveyor	FC 16	FC 16	Control logic for conveyor belt						
12	FC_Faults	FC 17	FC 17	Evaluation of process faults						
13	FC_Count	FC 18	FC 18	Count parts						
14	FC_Statistic	FC 19	FC 19	Function for counting parts with Arithmetic						
15	FC_Evaluate_Fault	FC 20	FC 20	Evaluation of Fault 1 (2)						
16	FC_Edge_Detection	FC 28	FC 28	Example for using digital word instructions						
17	FC_MM420	FC 42	FC 42	Test for MM420						
18	FC_MM420_synchron	FC 44	FC 44	Like FC42 + additional synchronism Conveyor / MM420						
19	FC_Scaling	FC 105	FC 105	Scaling block for analog value						
20	T_System_ON	1 0.0	BOOL	System ON						
21	T_System_OFF	I 0.1	BOOL	System OFF (NC contact)	-					
Press F1 to get Help.										









Objectives

Upon completion of the chapter the participant will ...

- ... understand the difference between 'real' connected NC contacts and NO contacts, and programmed symbols
 - be able to explain the terms Result of Logic Operation (RLO), Status (STAT) and First Check
 - be able to program basic binary logic operations



. . .

...













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- 1Hz flashing light at the bay where the part is placed and the conveyor has not yet been started
- 2Hz flashing light at both bays during conveyor movement





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REAL (Floating-point Number, 32 Bit) Data Type



Operations: such as + R, * R, <R, ==R sin, acos, In, exp, SQR

<u>General format of a Real number</u> = (Sign) \cdot (1 + f) \cdot (2^{e-127})

Example: 0.75



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상 <mark>(</mark> 상	Va i Tal	r - [VAT_ ble Edit	×				
-)¤I		0 🚘	- <u>-</u>	· · · × = =	N?	iller	
		Address	Symbol	Display format	Status value	Modify value	▲
1		NV 0		DEC	2055		
2		NV 0		BIN	2#0000_1000_0000_0111		
3					\uparrow \uparrow \uparrow		
1		1 0.7	"T_Ackn_WarmRestart"	BOOL	false		
5		I 0.0	"T_System_ON"	BOOL	false		
3		I 1.0	"T_Ackn_Fault"	BOOL	true		
7							
3		W 2	"MV_Thumbw"	HEX	VV#16#0132		
3		W 2	"W_Thumbw"	BIN	2#0000_0001_0011_0010		
10		W 2	"W_Thumbw"	DEC	306		
1							
12		QVV 6	"QW_DigDisp"	HEX	VV#16#000A		
13		QVV 6	"QW_DigDisp"	BIN	2#0000_0000_0000_1010		
14		QVV 6	"QW_DigDisp"	DEC	10	10	
15							
16		MW 20	"M/V_ACT"	DEC	132	132	
17		MVV 20	"MAV_ACT"	HEX	VV#16#0084		
18		MW 20	"MAV_ACT"	BIN	2#0000_0000_1000_0100		
19					↓ Ť		
20		MB 20		BIN	2#0000_0000		
21		MB 21		BIN	2#1000_0100		
22					1 11 00	1.000	
23		MD 80	<u>i</u>	DEC	L#132	L#132	
24		MD 80	1	HEX	DYV#16#0000084		
20		100/ CO	A Accessed in Last	DEA	24677 Invelidingly a		
20	•	19199 03	Accessed in Det	Mee U	-sion invalid value !	<u>.</u>	
27		MD 94			132.0	132.0	
		MD 94			132.0	132.0	
-9		MD 04			L#1124333010		

Number Formats









Data Storage in Accumulator 1










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Application Example: Digital Edge Detection



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Introduction to PROFIBUS DP and the HMI Operator Panel (1)



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Objectives

Upon completion of the chapter the participant will ...

- ... be familiar with the use of PROFIBUS DP
- ... be familiar with the WinCC flexible software
- ... be able to set the interface of the HMI operator panel
- ... be able to download a project to the HMI operator panel
- ... be familiar with the principle of interfacing the HMI operator panel via tags









Configuring a PROFIBUS DP Master System	
HW Config - 57_300_Station Station Edit Insert PLC View Options Window Help Insert Object Replace Object Master System PROFINET IO System 1 2 CPU 315-2 DP X2 0 3 4 DI32xDC24V/ 5 D032xDC24V/0.5A 6 D18/D08x24V/0.5A 7 Al2x12Bit	Properties - PROFIBUS interface DP (R0/52.1) General Parameters Address: 2 Highest address: 12 Highest address: 12 Highest address: 12 New Properties Delete
Image: Solution (0) UR Slot Module 0 Fi M I Q Comment 1 Image: Constraint of the station Station Edit Insert PLC View Options Window Help Image: Constraint of the station Station Edit Insert PLC View Options Window Help Image: Constraint of the station Station Edit Insert PLC View Options Window Help Image: Constraint of the station Image: Constraint of the station Image: Constraint of the station Image: Constraint of the station Image: Constraint of the station Image: Constraint of the station Image: Constraint of the station Image: Constraint of the station Imag	Properties - PROFIBUS General Network Settings Name: PROFIBUS_TIA_SERV1 S7 subnet ID: 0089 Project path: My_Project\PROFIBUS_TIA_SERV1 Storage location D:\S7_Courses\My_Proje Author: Date created: 10/12/2006 03:20:46 PM Last modified: 10/12/2006 03:20:46 PM Comment: Simple DP-Mastersystem with DP-Slaves ET2005 and Micromaster MM420 MM420







Exercise 1: Configuring the DP System (ET 200S) - U X HW Config - [S7_300_Station (Configuration) -- SERV1_L] _ 8 × III Station Edit Insert PLC View Options Window Help 🏜 🌓 🗖 👯 💦 े 🚘 🔓 🖼 D Replace Object... 😑 (0) UR 미지 Master System Find: mt mi CPU 2 Х2 DP Profile: Standard PROFIBUS(1): [Ŧ З IM151-1 FO Standard ÷ ٠ DI32xDC24V 4 ÷ 🚡 IM151-1 HF 5 D032xDC24V/0.5A 🚠 (4) IM151-1 🚡 IM151-1 HF ÷ 6 DI8/D08x24V/0.5A IM151-1 Standard Al2x12Bit 🖻 📷 IM151-1 Standard < 8 🗄 💼 Al 9 🗄 💼 AO 10 🗄 - 🧰 CP l • 🗄 -- 🧰 🛛 DI 🗄 💼 DO IM151-1 Standard Pack Addresses (4) 1 F-RO 24V..230V/5A ł 2D0 AC24..230V/1A Module Order Number I Address Q Address Slot ment ł 2D0 DC24V/0.5A HF PM-E DC24V 6ES7 138-4CA00-0AA0 2D0 DC24V/0.5A HF 4DI DC24V ST 6ES7 131-4BD00-0AA0 2 8.0...8.3 2D0 DC24V/0.5A ST 3 4DI DC24V ST 6ES7 131-4BD00-0AA0 8.4...8.7 2D0 DC24V/0,5A ST 8.0...8.3 4D0 DC24V/0,5A ST 6ES7 132-4BD00-0AA0 4 200 DC24V/24 HE 4D0 DC24V/0,5A ST 6ES7 132-48D00-04A0 8.4...8.7 5 6 6ES7 151-1AA02-0AB0 7 Interface module IM151-1 for ET 200S 8 electronic modules, send capability for direct data exchange $\overline{\mathbf{n}}$ Press F1 to get Help.



Control and Monitoring with SIMATIC HMI



WinCC simatic hmi

SIEMENS

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SIMATIC Panels



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	Definin	g the Connec	tion to the Controll	er
WinCC flexible 2005 Advanc	ed - My_Project - TP17	0B_Color		
<u>Project Edit View Insert Forn</u>	nat F <u>a</u> ceplates <u>O</u> ptions	<u>W</u> indow <u>H</u> elp		
📲 🖓 • 🖙 🔚 🖍 • 😋		🤣 🖥 🖨 🐐 . 🗦 . 🖬	🖕 🛗 🍜 🖏 Connection_1 🔄 🗸 🧇	?∎ ?⊾ .
English (United States)				
Project Project	Start 🗖 MM420	Connections		
PRO			C	NNECTIONS
E TP170B_Color(TP 170B				JUNECITON2
Add Screen	Name	Active Communication d	river Station Partner Noo	le Online Comment
Template	Connection_1	On v SIMATIC 57 300/400	▼ \My_Project\S ▼ CPU 315-2 DP ▼ DP	▼ On ▼
		• •		
Start				
Connections 2	x Carameters Area p	ointer		
Alarm Management	V			
	TP 170B	color Interface		Station
⊕ 🧒 Settings				
⊕				
🕀 🚝 Runtime User Admini				
🕀 ⁄ Device Settings		HMI device	Network	PLC device
Project Languages	Туре	Baud rate	Profile DP	Address 2
Graphics	O TTY	1500000	Highest station address (HSA)	Expansion slot
Indect Texts Indect Texts	0 RS232	Address 1		
	R5485	Access point S7ONLINE	126	Rack 0
	 Simatic 	Only master on the bus	Number of masters	✓ Cyclic operation
📑 🤽 Objects				

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ţψ	/inCC flexible 2005 Adv	anced -	My_Project	- TP170	B_Color			
Proje	ect <u>E</u> dit <u>Vi</u> ew <u>I</u> nsert	<u>F</u> ormat	F <u>a</u> ceplates (options	<u>Wi</u> ndow <u>H</u> elp			
D	<u>N</u> ew	C Selec	t devices for t	ransfer				<u> </u>
	Ne <u>w</u> Project with Projec	TP1	70B_Color (TP 1	70B c	Settings for TP1	70B_Color (TF	P 170B color)	() (n
-	Open							Transfer to
	<u>⊂l</u> ose						2	
	<u>S</u> ave				Mode	[MPI/DF	•	Delta transfer
	Save <u>A</u> s	1			Chatian address	. 1		
	Save As <u>V</u> ersion				Station addless	»]'		Enable back transfer
	Change <u>D</u> evice Type							Overwrite password list The second
	Import Tags							Overwrite recipe data records
	Integrate in STEP 7							
	Copy from STEP 7							
	Print Project Documenta							Transfer Apply Cancel
	Print Selection		Ctrl+W			2		SIEMENS
			•	Р 170В со	blor			SIMATIC PANEL
	Geneiler		r		Interr			
			•					
	<u>T</u> ranster		•	🜷 Tr	ansfer <u>S</u> ettings.			Jog Station / Station 2 Station 2 Station Jog John
	Recent Projects		•	Ba	a <u>c</u> ktransfer	t de	evice	Parts
ł	<u>E</u> xit			Ba	ackup			System Man 000000 000000
	Project Languages Graphics			Re	estore			
	Project Texts		O R5232	Lio	ense keys			Byrtian Enter ackn off. Mode fault
_	🗄 🧑 Dictionaries		R5422	Q	ptions			Rystem On Man Auto Consultant Start Screen
+)/ +)/	🧧 Structures 🧑 Version Management		C R5485	05	5 <u>U</u> pdate	.INE		
			Simatic		🗸 Only master (on the bus		

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Exercise 2: Copying the Touchpanel Project

- By PROI_B	Object name	Symbolic name	Туре	Size At
TP270B_Color	TP270B_Colo)r 1(SIMATIC HMI S	tation
Hand Chapter	🔄 🛐 Chap07_bina	ry_Op	S7 Program	
	🔄 🛐 Chap08_digita	al_Op	S7 Program	
Elucation Charles	🔄 🛐 Chap10_MM4	420	S7 Program	
	Ginap14_Fault	ts	S7 Program	
	MPI(1)		MPI	2984
	PROFIBUS(1))	PROFIBUS	7684
Project	: C:\Program I	Files\Siemens\Step7	\s7proj\My_Proje	
🖃 🛃 My_Proje	ot	Object name	Symbolic name	Туре
E SIMA	TIC 300(1)	🔝 SIMATIC 300(1)		SIMATIC 300 Station
	PU 315-2 DP	TP270B_Color		SIMATIC HMI Station
	My_Program	뿜 MPI(1)		MPI
		PROFIBUS(1)		PROFIBUS
	DB Color			
	-			
		<	III	





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Options		51	IMATIC NET diagnostics - CP5611(PROFIBUS)
Set PG/PC Interface			PROFIBUS/MPI Network Diagnostics Hardware
			Status/Network Diagnostics
Set PG/PC Interrace			Test OK
Access Path Access Point of the Application:			Station address: 0
S70NLINE (STEP 7)> CP5611(PROFIE (Standard for STEP 7)	3US) 🔽		Baudrate: 1500.00 Kbps ▲ Highest station address (HSA): 126 Minimum station delay Time (Min Tsdr): 11 tBit Maximum station delay Time (Min Tsdr): 11 tBit
Interface Parameter Assignment Used: CP5611(PROFIBUS) <active></active>	Properties		Setup time (tset): 1 tBit
(CP5611(MPI)	Diagnostics		Bus Nodes 0 1 2 3 4 5 6 7 8 9 1011 121314151617181
CP5611(PPI) CP5611(PROFIBUS - DP Slave)	Copy Delete		
(User parameter assignment of your communications processor CP5611 for SOFTNET DP Master)			80 FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF
Add/Remove:	Select		Read Station active Station active ready

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WinCC flexible 2005 Advance	ed - My_Project - TP2	70B_Color						
oject <u>E</u> dit <u>V</u> iew <u>I</u> nsert <u>F</u> ormat	F <u>a</u> ceplates <u>O</u> ptions <u>Wi</u> nd	dow <u>H</u> elp						
🔜 New 🔻 📂 📕 🗠 - 😋 -)	× X 🖬 🖬 - I 🗸	b ⇔ % -	🕴 - 👫 - 🧶 ?	1 A -				
English (United Kingdo 💟 🗸		_				_	_	
roject 🔶 💙	Start Start	ections						
Project TP270B Color(TP 270 6")						CONN	ECTI	ONS
			1					
	Name	Active	Communication driver	Station	Partner	Node	Online	Comme
Conveyor	Connection_1	On	SIMATIC 57 300/400	▼ \My_Project\S	CPU 315-2 DP	▼ DP	On	_
Start								
😑 🦙 Communication	[
Connections 2xL								
Cycles	/							
Alarm Management								
Discrete Alarms	_							
🕀 🨾 Settings			<					
u - Zanger Historical Data	Parameters Area	pointer						
🗄 🏧 Scripts								
⊞~⁄77 Heports ⊞-∕77 Text and Graphics Lists	TD 2	70 ¢"					Station	
🗄 🕌 Runtime User Administration	IF 2	Interfac	e .					
Device Settings		HMT ME	 PT/D 🔽					
🦉 🔍 Bildginositos 🏹 Language Settings								
Project Languages								
Project Texts			HMI device		Network		PLC d	evice
🗄 与 Dictionaries	Туре	Baud rate		Profile DP		Address	2	
Structures		1500000 🗸				E and i		
	🔾 R5232	Address	1	Hignest station add	ress (H5A)	Expansion	2	
					100	Dead		
	O R5422	Access point	STONE THE		126	Rack	0	

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Rewiring using Absolute Addresses

	ect D:\S7_Co <u>urses\My_Proj</u> e	e]				
🞒 File Edit Insert PLC View	Options Window Help				_ 8 ×	
🗅 🛩 🔡 🛲 👗 🖻 🖻	Customize	Ctrl+Alt+E	Filter > 🔻 🏹	7 🔡 🏛 📆	₽ ₽ 1 №	
R Project	Access Protection	+	Created in language	Size in the work		
	Change Log	· · ·			SDB	
🖻 – 🚺 CPU 315-2 DP	Text Libraries	+	FBD		134 Organization	
⊡ 🗊 Ch13_MM420	Language for Display Devices		FBD		124 Function	
	Manage Multilingual Texts	+	FBD		104 Function	
	Rewire		FBD		100 Function	
	Run-Time Properties				76 Function	
	Compare Blacks				64 Function	
	Compare blocks		L ARD		112 Function	
10.0 M	/30.0		N/0	MV30	non address	
10.1 N	//30.1		2			
10.2 M	//30.2		3			
10.3 M	130.3					
10.4 N	//30.4 //30.5					
	/31.0					
I1.0 N			3 4			
11.0 N		<u> </u>	· •			
11.0 h						
			ote			
			ote			
ert Row	Delete Row	N	ote		Delet	e Ro
ert Row	Delete Row for peripherals)		ote Insert Row All accesses within the specified	addresses (not for per	Delet	e Ro

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Segment Length Depending on the Baud Rate

Baud	Rate	Segment Length
9.6 to 187.5	kBaud	1,000 meters
500	kBaud	400 meters
1.5	kBaud	200 meters
3 to 12	MBaud	100 meters







Standard connector with screw terminal

Plug for Fast Connect





Preparing a Fast Connect Cable

1. Measure



2. Strip



3. Remove









Objectives

Upon completion of this chapter the participant will ...

- ... understand the purpose of global data blocks
 - be familiar with elementary and complex data types
- ... be able to monitor a data block
 - be familiar with the possibilities for addressing data block variables



...

...





Date: 2/8/2012 File: PRO1_10E.3





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Date: 2/8/2012 File: PRO1 10E.4



Elementary Data Types in STEP 7



SI

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		Complex Da	ta Types				
	Keyword	Length (in bits)	Examp	ole]		
	DATE_AND_TIME	64	DT#01-08-24-12:14:55:234-1				
	STRING (character string with max. 254 characters)	8 * (number of characters +2)	This is a string SIEMENS				
	ARRAY (Group of elements of the same data type)	user- defined	Measured values: AR INT	RAY[120]			
	STRUCT (Group of elements of different data types)	user- defined	Motor: STRUCT Speed : INT Current : REAL END_STRUCT				
	UDT		UDT as block	UDT as array			
	(User Defined Data Type =	user-	STRUCT				
	"Template" consisting of	defined	Speed : INT	Drive: ARRAY[14]			
	elementary or complex		Current : REAL				
MA	A TOC 2006 All rights reserved	Date: 2/8/20 File: PRO1	END_STRUCT	SITRAIN Training for Automation and Industrial S	Soluti		



Date: 2/8/2012 File: PRO1 10E.7



Entering, Saving, Downloading and Monitoring a Data Block

Kadystl/FBD - [D I File Edit Insert	9 <mark>81 My_project\test stat</mark> PLC Debug View Options	ion\CP Winda	PU 31: Iow H	5-2 DP] Ielp						×	
		G ⁿ	1	D 66' !«	»!						
Address	Name		Тур	e	Init	ial value	Comment			1	
0.0			STR	UCT			·				
+0.0	Motor_data		STR	UCT		Declarat	ion view				
+0.0	speed		INT		0		motor spee	d			
+2.0	rated_current	KLAD) /STL/F		oject\t	est station\CPU 3	15-2 DP]				
+6.0	started_current	🖬 File	e Edit	Insert PLC Debug	View	Options Window	Help				_ 8 ×
+10.0	 direction) 🚘 🛙	- 🖬 🎒 👗 🛙		ରେ ଜ୍ଞା 🏜	🗖 🔐 🔜	>! 🗖 🗖	N?		
=12.0		Addr	ress 1	lame			Туре	Initi	al value	Actual value	
+12.0	measuring point		0.01	Motor_data.spe	≥d		INT	0		D	
*2.0			2.0 Motor_data.rated_current			REAL	0.000	1000e+000	0.000000e+000		
=32.0			6.01	Motor_data.sta	rted_	current	REAL	0.000	000e+000	0.000000e+000	
-32.0			10.01	Motor_data.dire	ectio	n	BOOL	FALSE		FALSE	
•			12.0 r	measuring_point	t[1]		INT	0		0	
File/Block saved.			14.0 r	measuring_point	t[2]		INT	0		0	
			16.0 r	measuring_point	t[3]		INT	0		0	
			18.0r	measuring_point	t[4]		INT			0	
			20.0r	measuring_point	t[5]		INT	U		U	
			22.Ur 24.0-	measuring_poin	с[6] - (7)		INT	0	Data	View	
			24.0r	measuring_point	⊑[/] ⊨rol			U		0	
			20.01 28 0	measuring point	-[0]			0		0	
			30.0*	measuring_point	t[10]		TNT	0		0	
		F	00.0	"caparand_boru	0[10]		INI			15	
		•									Þ
		Press F1	1 to get	Help.					9 offline	Sym as of 5. Ins	ert ///





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Date: 2/8/2012 File: PRO1 10E.9





Date: 2/8/2012 File: PRO1_10E.10



Accessing Data Elements

	DB 18 "Parts	11
Addr.	Name	Туре
0.0	Act_Quantity	INT
2.0	FL_Aux	BOOL
4.0	Number	INT
6.0	Weight[1]	REAL
10.0	Weight[2]	REAL



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Date: 2/8/2012 File: PRO1 10E.12





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Date: 2/8/2012 File: PRO1 10E.13





Date: 2/8/2012 File: PRO1_10E.14



Example of an ARRAY

Measuring_point

1. Measuring_point, data type Real

2. Measuring_point, data type Real

3. Measuring_point, data type Real

Array with the name "Measuring_point" (several elements of the same data type)

10. Measuring_point, data type Real

Display in the Program Editor (Data Block DB 2):

•	DB2 My_Project\My_Station\CPU 314											
A	ddress	Name	Туре	Initial value	Comment							
	*0.0		STRUCT									
IE	+0.0	Measuring_point	ARRAY[110]									
	*4.0		REAL									
IE	=40.0		END_STRUCT									
•					Þ							



Example of a STRUCTURE

Motor_data

Speed, data type Integer

Rated_current, data type Real

Starting_current, data type Real

Direction, data type Bool

Structure with the name "Motor_data" (several elements with different data types)

Display in the Program Editor (Data block DB 1):

Kad/STL/FBD - [I	DB1 My_project\test station\CP	U 315-2 DP]								
🖬 File Edit Insert	🖬 File Edit Insert PLC Debug View Options Window Help									
Address	Name	Туре	Initial value	Comment						
0.0		STRUCT								
+0.0	Motor_data	STRUCT								
+0.0	speed	INT	0							
+2.0	rated_current	REAL	0.000000e+000							
+6.0	started_current	REAL	0.000000e+000							
+10.0	direction	BOOL	FALSE							
=12.0		END_STRUCT			•					
I				*	•					
Press F1 to get Help.			🛛 🗐 offline	Abs < 5.2 Inse	rt / //.					



Defining the Address Priority (Symbolic/Absolute)

General Block:	s Checksums Address priority:		
	Behavior as in STEP7 < V5.2	Recommended for symbolic programming	
Absolute value has priority	Symbols are applied from the symbol table and the DB for all accesses (I,Q,M,T,C and DB)	Exception: symbol accesses remain on the DB as they were programmed in the code block	
Symbol has priority	Exception: for accesses in structurally unchanged data types, the current symbols will be applied	 For all accesses (I,Q,M,T,C and DB) 	
ОК		Cancel	Help





Date: 2/8/2012 File: PRO1_11E.1


Objectives

Upon completion of this chapter the participant will ...

. .

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. . .

...

- be familiar with the purpose of temporary variables
 - be able to program parameter-assignable functions and their calls
 - know the difference between functions (FCs) and function blocks (FBs)

be familiar with the purpose of static variables

- be able to declare static variables and apply them in the program
- be able to program parameter-assignable function blocks and call them



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Variables Overview

Global Variables / Data (valid in the entire program)	Local Variables / Data (only valid in one block)	
 PII / PIQ I / O Peripherals M / T / C DB areas 	 Temporary Variables are overwritten with <u>undefined</u> values after the associated block is executed temporary storage in L stack usable in OBs / FCs / FBs 	Static Variables • are retained even after the block is executed • permanent storage in DBs • can be used in FBs <u>only</u>



Temporary Variables

	-							
	Conter	rs Of: 'Enviro	Data Two	e\TEMP'	Comment			
		ux_result	Int	0.0	commente			
	OUT							
	TIRN 🔽		Declaration					
			Deviaration					
FC100 : H	xample for how to	o use a tempora	ary variable					
Network 1	Calculation							
		SUB_I					ADD_I	
	EN	ENO				EN	EN	0 C
	MW100 — IN1	OUT	-#aux_result		#aux_resu	lt – IN1	OU	T_MW106
	MU102 TW2				ъл.11	D4 TN2		
	MW102 - 112				1400 T	04- <u>1N2</u>		
								I
	1: Error À 2: Info	A 3: Cross-referen	nces λ 4: Addr	essinfo λ	5: Modifu À 6: D	iagnostics λ	7: Comparison	1
- 14 4 6 6	I LENO A SUMO			566 milo. 7(o. modily y(o. c	idgnostics /	r. companson	





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Parameter-assignable Blocks Solution with Solution with parameter-assignable block non-parameterassignable block Program in FC 20 Call of FC 20 (e.g. in OB 1) **FC 20** 1.1 **#Fault Signal** Α Α 11.1 Fault Signal FP 17.2 Μ #Edge_Memory FP Acknowledge Display 11.0 Q 5.1 S M 17.1 S **#Stored Fault** M 10.3 1.0 Flash_Freq. Α Α #Acknowledge M 17.1 **#Stored Fault** R R M 17.1 Stored Fault 17.1 **#Stored Fault** Μ Α Α Edge_ M 17.2 -M 10.3 **#Flash_Freq.** Α Α Memory 0 0 AN M 17.1 **AN #Stored_Fault #Fault_Signal** 1.1 Α Α **Formal parameters** Q 5.1 **#Display** = = **Actual parameters**

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Declaring Formal Parameters

Type of Parameter	Declaration	Use	Graphic Display
Input parameter	in	Read only	To the left of the block box
Output parameter	out	Write only	To the right of the block box
In/Out parameter	In_out	Read / Write	To the left of the block box





Editing a Parameter-assignable Block

Nale plant at the least		
	Do Re 2 200 KN TE BUHHOMPth K	
	Contents Of: 'Environment\Interface'	
Dinterface	Name	
E Reult Innut		
Acknowledge	IN OUT	
E Clock_Memory	TEMP	
i⊐ - I OUT	- RETURN	
Indicator		
IN_OUT		
M_Bit_fault_ev		
- Aux_Dic_edge_detect		
#Aux bit #P	1_Bit_	
#Fault_ edge_ fa Input detect [P S	sR Memory #Indicator	
#Fault_ edge_ fa Input detect (P)S #Acknowled ge_R	Nult_ev #Clock_ SR Memory #Indicator	
#Fault_ edge_ fa Input detect (P) S #Acknowled ge - R #M_Bit_ #Fault_ fault_ev Input	SR Q Henory #Indicator	
#Fault_ edge_ fa Input detect (P)S #Acknowled ge - R #M_Bit_ #Fault_ fault_ev Input	SR Memory #Indicator	
<pre>#Fault_ edge_ fa Input detect</pre>	SR Memory #Indicator	
#Fault_ edge_ fa Input detect (P) s #Acknowled ge - R #H_Bit_ #Fault_ fault_ev Input	SR Memory #Indicator	
<pre>#Fault_ edge_ fa Input detect</pre>	Memory #Indicator	
#Fault_ edge_ fa Input detect {P} s #Acknowled ge - R #M_Bit_ #Fault_ fault_ev Input /	MLt_ev #Clock_ SR Hemory Image: SR Image: SR Image: SR Iman	





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	antivaliation - my_rojectismmile soc(r)tero sis-z braa czej	
File Edit Insert PLC Debug View	Options Window Help	S ×
) 🖆 🖬 🧧 🔏 🖬 🖪 🔤	오 여행 ㅋ 홈페 !<>! 그로 밤 귀구이입으구도 ??	
	Contents Of: 'Environment\Interface'	_
🕀 Interface	Name	
in In		
Fault_Input		
E Acknowledge		
OUT		
Indicator		
TU_OUT		
🖾 M_Bit_fault_ev		
<pre> Aux_bit_edge_dete Aux_bit_edge_dete </pre>	ct 📃	
+		
FC20 · Title·		Ê
Network 1: Fault Evaluation	on	
#Fault Innut	ux_bit_edge_ #M_Bit_fault_ev 	
#radic_inpac		
11		
	#Acknowledge — R	
#M Bit fault av 4	frault Innut	
#M_DIC_TAULC_EV #		





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Function Blocks (FB)

Function Block for Fault Display

	Concencs of: 1	sucrionmenc(1)	iceriace/	TIM					
E Interface	Name	Data Type	Address	Initial Val	lue Exclu	usion add	ress Term	ination addre	ess Comment
Ē. -∎- IN	🔚 Fault_Input	Bool	0.0	FALSE					
🗁 🖼 Fault_Input	🔚 Acknowledge	Bool	0.1	FALSE					
🗠 🖼 Acknowledge	🔚 Clock_Memory	7 Bool	0.2	FALSE					
🔤 Clock_Memory	12								
Ė⊶ ⊒- out									
🔤 Indicator		- + +	\						
TU_OUT	Declarati	on lable							
⊨	of the								
— 🖾 M_Bit_fault_ev	Function	Disali							
aux_bit_edge_detect		RIOCK	J						
			,						
1									
Data Block									
						(_		
By default, instance data blocks are	opened with "Paramete	er assignment				ſ			
By default, instance data blocks are for data blocks" as of STEP 7 V5.2	opened with "Paramete (see Help).	er assignment				ſ	In	stance	
By default, instance data blocks are for data blocks" as of STEP 7 V5.2 There is no functional difference for	opened with "Paramete (see Help). this DB to the editor in	er assignment					- In: Dat	stance a Block	
By default, instance data blocks are for data blocks" as of STEP 7 V5.2 There is no functional difference for LAD/STL/FBD.	opened with "Paramete (see Help). this DB to the editor in	r assignment	SFRV2 S	\ Ch04 FC-FB]			In: Dat	stance a Block	
By default, instance data blocks are for data blocks" as of STEP 7 V5.2 There is no functional difference for LAD/STL/FBD.	opened with "Paramete (see Help). this DB to the editor in	r assignment	2 5ER¥2_5 PLC Debug	\ Ch04_FC-FB]	_		In: Dat	stance a Block	
 By default, instance data blocks are for data blocks" as of STEP 7 V5.2 There is no functional difference for LAD/STL/FBD. The DB could be opened with the D V5.1 	opened with "Paramete (see Help). this DB to the editor in)B editor in LAD/STL/F	er assignment	2 SERV2_S PLC Debug	\ Ch04_FC-FB]	.		In: Dat	stance a Block	
 By default, instance data blocks are for data blocks'' as of STEP 7 V5.2 There is no functional difference for LAD/STL/FBD. The DB could be opened with the D V5.1). 	opened with "Paramete (see Help). this DB to the editor in)B editor in LAD/STL/F	er assignment INDB Param - [DB2 IND Data block Edit IND Tata block Edit	2 SER¥2_S PLC Debug ගෙ දා ද්	\ Ch04_FC-F8] View Window Help 🗈 💼 !<< >! 🎽	ắ n 6° N	?	In: Dat	stance a Block	
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 By default, instance data blocks are for data blocks" as of STEP 7 V5.2 There is no functional difference for LAD/STL/FBD. The DB could be opened with the D V5.1). Do you want to open the DB with "F blocks"? 	opened with "Paramete (see Help). this DB to the editor in)B editor in LAD/STL/F Parameter assignment fo	er assignment	2 SER¥2_5 PLC Debug ⊮⊃ ా ∦ Declaration in	\Ch04_FC-F8] View Window Help B C !< >! in Name Fault_Input	ණී 60° € Type BOOL	P Initial value	In: Dat	stance a Block	
 By default, instance data blocks are for data blocks" as of STEP 7 V5.2 There is no functional difference for LAD/STL/FBD. The DB could be opened with the D V5.1). Do you want to open the DB with "F blocks"? 	opened with "Paramete (see Help). this DB to the editor in)B editor in LAD/STL/F Parameter assignment fo	er assignment	2 SER¥2_5 PLC Debug ⊯⊃ ⊂≃ ∦ Declaration in in	\Ch04_FC-F8] View Window Help Pare (1 ≪ ≫! ▲ 1 Name Fault_Input Acknowledge	m 6d° ♥ Type BOOL BOOL	P Initial value	Actual value	stance a Block	
 By default, instance data blocks are for data blocks'' as of STEP 7 V5.2 There is no functional difference for LAD/STL/FBD. The DB could be opened with the D V5.1). Do you want to open the DB with ''F blocks''? Always display this message for Open Instance 	eopened with "Paramete (see Help). this DB to the editor in 08 editor in LAD/STL/F Parameter assignment fi tance DB	er assignment	2 SER¥2_5 PLC Debug In Declaration In In I	\Ch04_FC-F8] View Window Help Particle I (≤ ≫) Name Fault_Input Acknowledge Clock_Memory Indicator	60° № Type BOOL BOOL BOOL	P Initial value FALSE FALSE FALSE FALSE	Actual value FALSE FALSE FALSE	stance a Block	
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 By default, instance data blocks are for data blocks" as of STEP 7 V5.2 There is no functional difference for LAD/STL/FBD. The DB could be opened with the D V5.1). Do you want to open the DB with "F blocks"? Always display this message for Open Instance 	eopened with "Paramete (see Help). this DB to the editor in 08 editor in LAD/STL/F Parameter assignment fi tance DB	er assignment	2 SER¥2_5 PLC Debug IDeclaration in in out stat	\Ch04_FC-F8] View Window Help Particle I ≤ ≫! ▲ Name Fault_Input Acknowledge Clock_Memory Indicator M_Bit_fault_ev Aux bit edge detect		Initial value FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE	Actual value FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE	Stance a Block	evaluation
By default, instance data blocks are for data blocks" as of STEP 7 V5.2 There is no functional difference for LAD/STL/FBD. The DB could be opened with the D V5.1). Do you want to open the DB with "F blocks"? Always display this message for Open Inst	eopened with "Paramete (see Help). this DB to the editor in 08 editor in LAD/STL/F Parameter assignment fi tance DB	BB Param - [DB2 DB Param - [DB2 Data block Edit E Param - [DB2 Address 1 Address 1 2 0.1 3 0.2 4 2.0 5 4.0 5	2 SER¥2_5 PLC Debug ▷ ে ⅔ Declaration in in in out stat	View Window Help Ware Image: Second Sec	60° ► Type BOOL BOOL BOOL BOOL BOOL BOOL	Initial value FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE	Actual value FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE	Stance a Block	evaluation
 By default, instance data blocks are for data blocks" as of STEP 7 V5.2 There is no functional difference for LAD/STL/FBD. The DB could be opened with the D V5.1). Do you want to open the DB with "F blocks"? Always display this message for Open Instance 	e opened with "Paramete (see Help). this DB to the editor in 0B editor in LAD/STL/F Parameter assignment fo etance DB	er assignment	2 SER¥2_5 PLC Debug Declaration in in in out stat stat	View Window Help Ware Image: Second Sec		Initial value FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE	Actual value FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE	Stance a Block	evaluation riable for edge dete
By default, instance data blocks are for data blocks" as of STEP 7 V5.2 There is no functional difference for LAD/STL/FBD. The DB could be opened with the D V5.1). Do you want to open the DB with "F blocks"? Always display this message for Open Ins	e opened with "Paramete (see Help). this DB to the editor in 08 editor in LAD/STL/F Parameter assignment fi etance DB	er assignment	2 SER¥2_5 PLC Debug ▷ C 및 및 Declaration in in in in out stat stat	View Window Help Ware Image: Second Sec		Initial value FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE	Actual value FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE	Stance a Block	evaluation riable for edge dete
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 By default, instance data blocks are for data blocks" as of STEP 7 V5.2 There is no functional difference for LAD/STL/FBD. The DB could be opened with the D V5.1). Do you want to open the DB with "F blocks"? Always display this message for Open Instance 	eopened with "Paramete (see Help). this DB to the editor in 0B editor in LAD/STL/F Parameter assignment fr stance DB	er assignment	2 SER¥2_S PLC Debug ID Collection In In In In Stat Stat	View Window Help View Window Help Image: State of the		P Initial value FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE	Actual value FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE	Stance a Block	evaluation





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🌃LAD/STL/FBD - [FB20 "FB_Fa	ultEvaluation" SERV2_S\C	.h04_FC-FB\\FB20]			
□ File Edit Insert PLC Debug	View Options Window Help				
	ы м сч (н 🏜 🔁)	📲 🚳 🛛 🔜 🗖	-++-+- 🚟 🗖	이랍니 카니 🕅	1
	Contents Of: 'E	nvironment\Interfac	e'		
🖃 🕀 Interface	Name		-		
Ģ. -⊡- IN	IN				
🖓 🖾 Fault_Input	= от				
🔁 Acknowledge	IN_OUT				
E Clock_Memory	= STAT				
	- TEMP				
Indicator					
IN_OUT					
STAT					
Aux hit. edge det	ect				
TEMP					
FB20 : Title:					
Notrouk 1. Roult Freinstein	n				
THEOROTA I. FAULT EVALUATIO					
	AN DAL				
#Aux_bit_	#M_Bit_ feult en #Clock				
Input detect	SR Memory	#Indicator			
(P)		()			
#Acknowled					
ae –	R				
#M_Bit_ #Fault					
fault_ev Input					
		1			
'					
					Þ
× ▲ ► ► 1: Error 2:	nfo 🖌 3: Cross-references	A Address info.	λ 5: Modify λ	6: Diagnostics λ 7	: Comparison /











Checking the Block Consistency

My_project (Component view)) D:\S7-Courses\N	1y_proje			
🖃 🎒 My_project	Object name	Symbolic name	Created in la		
🖹 🛄 test station	🖬 0B1	OB_Cycle	FBD		
🖻 - 📓 CPU 315-2 DP	🖬 OB100	OB_Startup	FBD		
⊡ 🖅 My_program	🖬 0B121		FBD		
	🖬 FB20	FB_Faults	LAD		_
Blocks	🗗 FC15	FC_Operating_Modes	FBD	Block incon	sistency
	🗗 FC16	EC Conveyor	FBD		
Blocks	🕞 FC17	Check block consistency	[Chapter12 My_p	roject]	
	Color	Program Edit View Help			
Cut	Ctrl+X	🕹 🗗 🗶 🚦 📲 🖬	• • • ¥ *	!«»!	
Copy	Ctri+C		Cucle		
Pasce	CUITY		-,		
Delete	Del	Ubject Hierarchy:			
Tocert New Of	piect	S7 program Call Tree (F	References)		
PIC	5,600		'CIE" [HBD] 2 Operation: Medee		
			Conveyor" [FBD]	[FBD]	
Rewiring		FC17 "FC	C Op/Elt Mess" [FB	נסנ	
Compare Block	ks 5	DB2 Instanc	e DB - FB20	"DB_Instance_Fault2" [DB Editor]	
Reference Da	ta 🖉	DB3 Instanc	:e DB - FB20	"DB_Instance_Fault3" [DB Editor]	
Check Block C	onsistency	FC20	"FC_Fault" [LAD]		
Print	\checkmark	📔 🚺 🕞 🕞 🕞 БВ2О	"FB_Faults" [LAD]		
			C_Count" [LAD]		
Rename	F2	DB18 Globa	IDB "DB_Pa	arts" [DB Editor]	
Object Proper	ties Alt+Re				
Special Object	: Properties 📃 💊	•			
		I:Compile 2:Info			
		Press F1 for help.			





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		Summary: Blo	ock Calls	
	F	C		FB
Language	without parameters	with parameters	w/o parm., w/o stat var.	with parm., and/or stat var
STL	CALL FC1UC FC1CC FC1	• CALL FC2 Par1: Par2: Par3:	• UC FB1 • CC FB1	• CALL FB2, DB3 Par1: Par2: Par3:
LAD	FC1 (CALL)	FC2 EN ENO Par1 Par2 Par3	not available	DB3 FB2 EN ENO Par1 Par2 Par3
FBD	FC1 CALL FC1 EN ENO	FC2 — EN Par3 — Par1 — Par2 ENO	not available	DB3 FB2 EN Par3 Par1 ENO Par2

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Exercise 5: Recognizing Operand Types



Statement	0	e e	r 🔁	nc	TY	
Statement	Global	Local	Absolute	Symbolic	Static	Parameter
L #Number_1						
L #Number_2						
T #Maximum_value						
L "Number_1"						
T MW 40						
T #Number_2						







Comparison of Functions and Function Blocks Program execution CALL FB5, DB5 Start :=I 0.0 Stop :=I 0.1 Motor_on CALL FC 10 :=Q8.0 **DB 5** On 1 := 10.1 :=QW12 Speed 10.2 On 2 := 0.0 Start BOOL Off := Q 8.0 Drive 0.1 Stop BOOL 2.0 Motor on BOOL **FC10 FB** 5 4.0 Speed INT On 1 BOOL in BOOL in Start BOOL in On 2 in Stop BOOL out Off BOOL out Motor on BOOL out Speed INT ... stat ... Temp... Α #On_1 #On 2 Α #Off ... = **#Start** Α ... AN #Stop #Motor_on = ...

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Objectives

Upon completion of the chapter the participant will ...

... know the purpose of temporary variables

know the organization blocks that are available

understand the difference between "Warm Restart", "Hot Restart" and "Cold Restart"

be able to explain the principle of interrupt processing

know the "Time-of-day Interrupt", "Cyclic Interrupt", "Hardware Interrupt" and "Diagnostic Interrupt"



...

. . .

...

. . .

know and be able to use the error OBs

be able to interpret the OB start information









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Time-of-Day Interrupt (OB 10)

		10,		biogi		1100000001	
	Priority	Active	e Execution		Start date	Time of day	Process images partition
OB10:	2		Every day	-	27.04.04	12400	OB1-PA
OB11:	2	Г	None	~	01.01.94	00:00	OB1-PA
OB12:	2	Γ	None	~	01.01.94	00:00	OB1-PA
OB13;	2		None	~	01.01.94	00:00	OB1-PA
OB14:	2		None	~	01.01.94	00:00	OB1-PA
OB15;	2	Γ	None	~	01.01.94	00:00	OB1-PA
OB16:	2	Г	None	~	01.01.94	00:00	OB1-PA
OB17:	2	Г	None	~	01.01.94	00:00	OB1-PA
OB16: OB17:	2		None	Y	01.01.94	00:00	OB1-PA
OK						Cancel	н

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Cyclic Interrupt (OB 35)

Time-of-	al Startup DayInterrupts	Cycle/Clock M Cyclic Interrupt	lemory Retentive Men liagnostics/Clock Protect	nory Interrupts i ion Communication	
	Priority	Execution (ms)	Phase offset (ms)	Process image partition	
OB30:	7	5000	0	OB1-PA 💌	
OB31:	8	2000	0	OB1-PA	
OB32:	9	1000	0	OB1-PA	
OB33:	10	500	0	OB1-PA	
OB34:	11	200	0	OB1-PA 💌	
OB35:	12	1000		OB1-PA	
0836;	13	20			
0838	15	10			
nR38:	15	10	lu	UB1-PA	
	<u>OB3</u> 5		O <u>B3</u> 5	O <u>B3</u> 5	
Interval	▶ <mark>●</mark> Ir	nterval —	Interval		Pric
					/ Dria

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OB Start Information using OB100 as an Example

Address			
0 / 1	Start event Start-up request		
2/3	Priority	OB No.	
4 / 5	Reserved		
6/7	Number of the event that caused the CPU to go into STOP		
8/9	Additional information on the current startup???		
10 / 11			
12 / 13	Year	Month	
14 / 15	Day	Hours	
16/17	Minutes	Seconds	
18/19	1/10 seconds, 1/100 seconds	1 /1000 seconds, weekday	

Inhalt von: 'Umgebung\Schnittstelle\TEMP' Schnittstelle Name Datentyp Adresse Kommentar TEMP 0B100_EV_CLASS Byte 0.0 16#13, Event class 1, Entering event state, Event logg OB100_STRTUP Byte 1.0 16#81/82/83/84 Method of startup 0B100_STRTUP Byte 2.0 Priority of OB Execution OB100_PRIORITY Byte 3.0 100 (Organization block 100, OB100)	
Schnittstelle Name Datentyp Adresse Kommentar TEMP 0B100_EV_CLASS Byte 0.0 16#13, Event class 1, Entering event state, Event logg 0B100_STRTUP 0B100_STRTUP Byte 1.0 16#81/82/83/84 Method of startup 0B100_STRTUP 0B100_PRIORITY Byte 2.0 Priority of OB Execution 0B100_PRIORITY 0B100_OB NUMBR Byte 3.0 100 (Organization block 100, OB100)	
Image: TEMP Image: OB100_EV_CLASS Byte 0.0 16#13, Event class 1, Entering event state, Event logg. Image: OB100_EV_CLASS Image: OB100_EV_CLASS Image: OB100_EV_CLASS Image: OB100_EV_CLASS	
Image: DB100_EV_CLASS Image: DB100_STRTUP Byte 1.0 16#81/82/83/84 Method of startup Image: DB100_STRTUP Image: DB100_STRTUP Byte 2.0 Priority of OB Execution Image: DB100_PRIORITY Image: DB100_OB NUMBR Byte 3.0 100 (Organization block 100, OB100)	
Image: Strup in the image: Strup in	
BOB100 PRIORITY IN OB100 OB NUMBER Byte 3.0 100 (Organization block 100, OB100)	` /
BOB100_OB_NUMBR BOB100_RESERVED_1 Byte 4.0 Reserved for system	
OB100_RESERVED_1 🕲 OB100_RESERVED_2 Byte 5.0 Reserved for system	
Description of the stop of the	
B OB100_STOP B OB100_STRT_INFO DWord 8.0 Information on how system started	
B OB100_STRT_INFO	







Asynchronous Errors

Type of error	Example	ОВ	Priority
Time error	Maximum scan cycle time exceeded	OB80	25
Power supply fault	Backup battery failure	OB81	
Diagnostic interrupt	Wirebreak at input of diagnostics-capable module	OB82	
Insert / remove interrupt	Removal of a signal module during operation of an S7-400™	OB83	
CPU hardware fault	Incorrect signal level at the MPI interface	OB84	
Program execution error	Error in updating the process image (module defective)	OB85	
Rack fault	Failure of an expansion device or a DP slave	OB86	
Communication error	Error in reading message frame	OB87	25 / 28




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Date: 2/8/2012 File: PRO1 12E.13



Synchronous Errors

Type of Error	Example	ОВ	Priority
Programming error	A block that is not present in the CPU is called in the program	OB121	Same as that
Access error	A module that is either defective or not present is addressed in the program (such as direct access to a non-existent I/O module)	OB122	of the OB interrupted as a result of the error











Objectives

Upon completion of the module the participant will ...

- ... know the principle of analog value processing
- ... be able to assign parameters to an analog module
- ... be able to address an analog module
- ... be able to evaluate the diagnostic interrupt of an analog module





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		11		
(0) UR 1 1 PS 307 5A A CPU 315-2 1 X2 DP 3 4 DI32xDC24V 5 D032xDC24V	PROFIBUS_C10: DP ma	aster system (1)	Properties - AI2x12Bit - (R0/57)
6 DI8/D08x24V 7 Al2x12Bit 8	☐ (4) IM151-1	CRON		General Addresses Inputs Enable Diagnostic Interrupt Hardware Interrupt When Limit Exceeded
				Input 0-1
D (0) UR				Diagnostics Group Diagnostics:
Slot 🚺 Module	Order number	Firmware	MPI ad	
1 1 DC 207 EA	6ES7 307-1EA00-0AA0	U1 0	-	Measuring Type: E
	6ES7 315-ZAF03-0AB0	V1.2	2	Measuring Range: +/-10 V
2 CPU 315-2 DP				Position of Monouring
2 S 307 34 2 CPU 315-2 DP X2 DP 3				Postori or Measuring
2 CPU 315-2 DP X2 DP 3 4 DI32xDC24V	6ES7 321-1BL00-0AA0		$\left \right $	Range Selection Module: [B]
Image: Proceeding of the state of	6ES7 321-18L00-0AA0 6ES7 322-18L00-0AA0			Range Selection Module: [B] interference frequency 50 Hz
Image: Proceeding of the state of	6ES7 321-18L00-0AA0 6ES7 322-18L00-0AA0 6ES7 322-18L00-0AA0 6ES7 323-18H00-0AA0			Position of Measuring [B] Range Selection Module: [B] interference frequency 50 Hz Trigger for Hardware Interrupt Channel 0
Image: Proceeding of the state of	6ES7 321-18L00-0AA0 6ES7 322-18L00-0AA0 6ES7 322-18L00-0AA0 6ES7 323-18H00-0AA0 6ES7 331-7KB01-0AB0			Position of Measuring [B] Range Selection Module: [B] interference frequency 50 Hz Trigger for Hardware Interrupt Channel 0 High Limit: 8.000
Proj Sur 34 2 Image: CPU 315-2 DP X/2 D/P 3 DI32xDC24V 5 Image: Dis2xDC24V/0.5A 6 Image: Dis2xDC24V/0.5A 7 Al2x12Bit 8	6ES7 321-18L00-0AA0 6ES7 322-18L00-0AA0 6ES7 323-18H00-0AA0 6ES7 331-7KB01-0AB0			Fostion of Measuring [B] Range Selection Module: [B] interference frequency 50 Hz Trigger for Hardware Interrupt Channel 0 High Limit: 8.000 Low Limit: 2.000

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Analog Input Modules

□ Diagnostic Interrupt □ Herdware interrupt et end of scen cycle □ Sgan Cycle Time for A/D Conversion: 0.5 ms □ Input 0 1 2 □ Diagnostics □ □ 0 □ Group Diagnostics □ □ □ □ With Check for Wire Break: □ □ □ ■ Measuring Type: E E 4DMU 4DMU ■ Measuring Type: E E 4DMU 4DMU ■ Measuring Range: +/-10V +/-10V mA +/-10 mA ■ Cl [C] [C] [C] [C] Trigger for Hardware Interrupt ■ With Check for Wire Break: □ □ □ □ ■ Measuring Range: +/-10V +/-10V +/-10 mA Hout ■ Position of Measuring Range [C] [C] [C] [C] [C] [C] ■ OK □ □ □ □ □ □ □ ■ V/-10V ● □ □ □ □ □ □ 0.10V ● ● □ □ □ <	Enable		
Sgan Cycle Time for A/D Conversion: 0.5 ms Input 0 1 2 3 Diagnostics Group Diagnostic: with Check for Wire Break: Imput Diagnostics: With Check for Wire Break: Imput Imput Imput Diagnostics: Measuring Measuring Type: Imput Imput Measuring Type: Measuring Range: Imput Imput Imput Measuring Type: Position of Measuring Range Imput Imput Imput Measuring Range Selection Module: Imput Imput Imput Imput Imput OK Cancel Help OK Imput Imput OK Imput Imput Imput Imput Imput OK Imput Imput Imput Imput Imput Imput OK Imput	Diagnostic Interrupt	\square <u>H</u> ardware interrupt at end of scan cycle	Diagnostic Interrupt
Input 0 1 2 3 Diagnostics Group Diagnosis: I I Imput Imput <th>Scan Cycle Time for A/D Conversion:</th> <th>0.5 💌 ms</th> <th>Input</th>	Scan Cycle Time for A/D Conversion:	0.5 💌 ms	Input
Diagnostics Group Diagnosis: Image: Position of Measuring Type: Measuring Type: E E 4DMU 4DMU 4DMU Measuring Type: E E Image: Position of Measuring Range: Position of Measuring Range: Image: Position of Measuring Range Image: Position of Measuring Rang	Input	0 1 2 3	Diagnostics Group Diagnostics: with Check for Wire Br
Measuring Measuring Type: E E 4DMU 4DMU Measuring Range: +/-10V +/-10V +/-10 mA +/-10 mA Position of Measuring Range: [C] [C] [C] [C] [C] OK Cancel Help OK OK OK +/-1V deactivated E voltage e 0.10V -/-10V 0.2V Image: Image: Image:	Utagnostics Group Diagnosis: with Check for Wire Break:		Measuring Measuring Type:
Position of Measuring Range Selection Module: OK OK Cancel Help +/- 1V +/- 2.5V 0.10V +/- 10V 0.2V	Measuring Measuring Type: E Measuring Range: +/-	E 4DMU 4DMU 10 V +/-10 V +/-10 mA +/-10 mA	Measuring Range: Position of Measuring Range Selection Mode interference frequency
OK Cancel Help OK +/- 1 V +/- 25 V deactivated +/- 10V	Selection Module:		Trigger for Hardware Inte High Limit: Low Limit:
+/- 1 V +/- 2.5 V 0.10 V +/- 10 V 0.2 V	ОК	Cancel Help	
0.2V	+/-1V +/-25V 0.10V	↓ deactivated E voltage	+++++++++++++++++++++++++++++++++++++++
	0.2V		

t 🔽 Hardwar	e Inte	errupt Whe	en Limit Exceede	ed		
0.	1					
Break:	7					
E +/- 10 ' dule: [E cy [50 Hz terrupt Channe [8.000 [2.000]	× 3] 40 ×			Cancel	He	elp
+						
+/- 80 mV +/- 250 mV +/- 500 mV +/- 1 V +/- 2.5 V +/- 5 V 15 V +/- 10 V		E 4DMU 2DMU R-4L RT TC-I TC-I TC-E TC-IL TC-EL	deactivated voltage current (4-wire current (2-wire resistor (4-con resistor (therm thermocouple thermocouple thermocouple	e transmitter) e transmitter) nductor terminal al,lin.) (int. comp.) (ext. comp. line (ext. comp. line) ar.) sar.)	

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Date: 2/23/2012 File: PRO1_13E.6



×

Analo	og Value	Repre	sentatio	n of D	if [.]	ferent N	leasu	ri	ng Range	es
	Voltage such as:		Current such as:			Resistanc such as:	e		Temperature e.g. Pt100 () Standard)
Range	Meas.range ± 10V	Units	Meas.range 4 to 20mA	Units		Meas.range 0300Ohm	Units		Meas.range -200+850°C	Units
Overflow	>= 11.759	32767	>= 22.815	32767] [>=352.778	32767		>= 1000.1	32767
Overrange	11.7589	32511	22.810	32511		352.767	32511		1000.0	10000
	10.0004	27649	20.0005	27649		300.011	27649		850.1	8501
Rated range	10.00 7.50	27648 20736	20.000 16.000	27648 20736		300.000 225.000	27648 20736		850.0 :	8500 :
Ŭ	-7.5 -10.00	-20736 -27648	4.000	: 0		: 0.000			-200.0	-2000
Underrange	- 10.0004	- 27649	3.9995	- 1		Negative	- 1		- 200.1	- 2001
	- 11.759	- 32512	1.1852	- 4864		values not	- 4864		- 243.0	- 2430
Underflow	<= - 11.76	- 32768	<= 1.1845	- 32768		possible	- 32768		<= - 243.1	- 32768









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operties - AI2x12Bit - (R0/	(57)	
General Addresses Inputs		
Enable-		
Diagnostic Interrupt	Hardware Interrupt When Limit Excee	eded
Input	0.1	
Diagnostics		
Group Diagnostics:		
with Check for Wire Break:		
Measuring Measuring Tupe:	F	
Measuring Range:	+/- 10 V	
Position of Measuring	(0)	
Range Selection Module:	[8]	
interference frequency	50 Hz	
Trigger for Hardware Interrup	t Channel 0	
Low Limit:		
ок		Cancel



Exerc	ise 2:	Hard	ware Diagnosis with Diagnostic Interrupt
rdware Diagnostics	- Quick View		
ath: PR02_S\Ch	ap06_FC-FB		
PU/Faulty Modules			
Module	Addr.	DP	PN R S Module Information
🔏 СРИ	-	-	- 0 2 J J
Djsplay Quick View	during hardware o	diagnostics	Status: Error General Diagnostic Interrupt Standard Diagnosis of the Module: External error Faulty module There is a channel error.
			Channel-Specific Diagnosis (Channel No. 0 to Maximum): Channel no. Error Channel 0: Analog Input measuring range / High limit exceeded
			Help on selected diagnostic row: Display





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Objectives

Upon completion of the chapter the participant will ...

- ... be able to classify occurring errors as "Errors detected by the system" and "Functional errors"
- ... be familiar with the "Displaying CPU Messages" function
- ... be able to read out the diagnostic buffer, interpret it and use it for troubleshooting
- ... be able to read out the I STACK, B STACK and L STACK and interpret them
- ... be able to read out the hardware diagnosis
- ... be able to apply the "Monitor/Modify Variables" test function
- ... be able to interpret the displays of the "Monitor" test function in the LAD/STL/FBD Editor and use them for troubleshooting
- .. be able to read out the reference data, interpret them and use them for troubleshooting
- . understand the "Force" function



Categories of Errors

Errors Detected by the System

- Recording, evaluating and indicating errors <u>within</u> a PLC (as a rule: CPU STOP)
 - Module failure
 - Short-circuit in signal cables
 - Scan time overrun
 - Programming error (accessing a non-existent block)

Functional Errors

- Desired function is either not executed at all or is not correctly executed
 - Process fault (sensor/actuator, cable defective)
 - Logical programming error (not detected during creation and startup)











System Diagnostics - Overview





	Di	splaying	J CPU N	lessages		
SIMATIC Manager	- [My_Project D:\S7_Projekte\My_Proje]					
🎒 File Edit Insert	PLC View Options Window Help			_ 8 ×		
D 🚄 🔡 🛲	Access Rights	No Filter >	- V 9			
Bu Broject	Download Ctrl+L	- 0B35				
⊡ <u>∭</u> My_Station	Compile And Download Objects	FC1	- FC4			
🖻 🚺 CPU 31	Upload	🗗 FC17	🕞 FC18			
⊡ <u>s7</u> My_	Copy RAM to ROM	🚰 CPU Messag	jes			
	Download user program to memory card	File Edit PLC	View Options Help			
	Save to Memory Card	🧠 🖽 🍞	🗗 📲 🍯 🕅 🕅			
	Retrieve from Memory Card	W A Mod	jule	-		
	Manage M7 System		Project\My_Station\CPU 31	4		
		D te/time	ID	Message text		St 🔺
	Display Accessible Nodes	0.29.03 04:15:	:49:343 pm	Message for 'W' (diagnostic events):	Activated	
	CPU Messages			Messages for 'A' (process and system error): My Project/My Station)CPU 314	Activated	
	Display Force Values	Sturce:		PG/PC		
	Monitor/Modify Variables	0.29.03 05:09:	:12:957 pm 16#	STOP caused by stop switch being activated		1
	Diagnostic/Setting	•		Previous operating mode: RUN Requested operating mode: STOP (internal)		
	PROFIBUS	Midule:		My_Project\My_Station\CPU 314		
	Assign Ethernet Address	0 ,29.03 04:15:	:55:302 pm	Current Operating Mode:	STOP	
	Assign PG/PC	the tute:		My_Project\My_Station\CPU 314		
Customize - CPU	J Messages	•	×	PG/PC		
L Arabius			i3 pm	Current Operating Mode:	vvarm restart	
Col Alchive		· · · · · · · · · · · · · · · · · · ·		PG/PC		
Size:	300 🛨	Empty Archive	3 pm	Current Operating Mode:	RUN	
				My_Project/My_Station/CPU 314		T
- Modules			_	Poinc		
Save List o	of the modules logged on an evit				Message 45 of 49 preselected	NUM //
	of the modules logged on on exit					
Restore co	nnection status when starting					
			-			
ОК	Cane	el Helo	1			
		P	- 1			

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Calling the "Module Information" Tool

SIMATIC[®] Manager

LAD/STL/FBD Editor

		版 I AD /STL /SPD _ D	@EC1 My Droject	Mu Chation/CDU 2	
SIMATIC Manager - [My_Project D:\57_Projekte\My_Proje]			erei - riy_rioject	(ing_station(cros	
By File Edit Insert PLC View Options Window Help		💶 File Edit Insert	PLC Debug View	Options Window H	
Access Rights Access Rights Access Rights Access Rights Access Rights Download Ctrl+L Compile And Download Objects Upload Up	No Filter > ✓ ⊕ 0835 ⊕ 08100 ⊕ FC1 ⊕ FC4 ⊕ FC17 ⊕ FC18		Download Select Online CPU,, CPU Messages	Ctrl+L	<u>N?</u>
Copy RAM to ROM Download user program to memory card	I/O Conveyor 앞 VAT1	FC1 : Operating	Monitor/Modify Vari	iables	
Save to Memory Card Retrieve from Memory Card		Network 1(: 5yst	Module Information Operating Mode	Ctrl+D Ctrl+I	
Manage M7 System Display Accessible Nodes		Path: My_Project\My Status: OK	Station\CPU 314\My_F	Module In	formation
CPU Messages Display Force Values Monitor/Modify Variables		Time System General	Performance Da Diagnostic Buffer	ata Commun Memory	ication Stacks Scan Cycle Time
Diagnostic/Setting	Hardware Diagnostics Module Information Ctrl+D	Description:	CPU 314	System	SIMATIC 300
Assign Ethernet Address Assign PG/PC Cancel PG/PC assignment	Operating Mode Ctrl+I Clear/Reset Set Time of Day	Version:	Order No./ Description 6ES7 314-1AE04-0AB0	Component Hardware Firmware	Version 1 V 1.2.1
Update Operating System Displays the status of the selected module (diagnostic buffer, memory, scan cycle	e times, stacks).	Dis Back:	0	Address.	
		Slot	2		
		Status:	Module available and o.	k.	<u>^</u>
					Y
		Close	Update Print		Help



Module Information Tab: "Diagnostic Buffer"

Path: Status:	SERV2_	32S\C	hapter10'	\Blocks		Operal Not a l	ing mode o force job	of the CPU:	灾 S	TOP	
	Time Syst General	em) D	Performan iagnostic Bu	ce Data íffer		Commu Memory	Inication) Scan C	Stack: ycle Time	s ;
Eve	nts:		Filter	settings acti	ve	🔲 Tim	e including	CPU/local	time diffe	erence	
No	. Time	of day		Date	Event						
1	05:32	:04:32	7 pm	01/29/03	STOP c	aused by	programmi	ing error (OB) not loa	ded or n	-
2	05:32	:04:32	7 pm	01/29/03	BCD co	nversion	error				
3	05:31	:41:21	6pm	01/29/03	Mode tra	ansition fr	om START	UP to RUN			
4	05:31	:41:21	5pm	01/29/03	Reques	t for manu	ial warm re	start	_		
5	05:31	:41:17	9 pm	01/29/03	Mode tra	ansition fr	omSIUP	toSTARTU	Р		
6	05:31	:40:58	4 pm	01/29/03	All modu	iles are re	ady for op	eration			
6	05:31	:40:36 .27.00	5 pm 7	01729703	Module	monitorin	g time start	ed			
0	05:31	:37:08	7 pm	01723703	Memory	reset exe	cuted				-
Deta	ails on Eve	nt:	1 of 100					Event ID:	16#4	4562	
STC Brea Prio FC I Moo Pre)P caused akpoint in r rity class: number: dule addre: vious oper	by pro user pro 1 18 ss: 2 atina m	gramming ogram: C 2 ode: RUI	g error (OB ni yclic progran N	ot loaded (n (OB1)	or not pos	sible, or no	oFRB)			•
	Save As		Se	ettings	Op	en Block			He	lp on Eve	ent
C	lose	L	Jpdate	Prir	nt					He	elp



0 Mo	dule Informati	ion - CPU 314								
Path:	SERV2_32S\C	hapter10\Blocks	0	Iperat	ting mode of the CPL	J: 💎 S	STOP			
Status:	🛃 Error		N	lot a f	force job					
	Time System	Perform	ance Data		Communication		Stacks			
	General	Diagnostic	Buffer	ł	Memory	Scan C	lycle Time			
Ever	nts:	Filter settings a	ctive 🗖	6	Module Informa	tion - CP	U 314			_ 🗆
No	Time of dau	Date	Event	Pa	ath: SERV2_32SM	Chapter10)\Blocks		Operating mode of the CPU:	🐨 STOP
	05:32:04:32	7 pm 01/29/0	3 STOP cause	Sta	atus: 🔀 Error				Not a force job	
2	05:32:04:32	7 pm 01/29/0	3 BCD conver		Time System	1	Performan	ce Data	Communication	Stacks
3	05:31:41:21	6 pm 01/29/03	3 Mode transit 2 Request for		General	[Diagnostic Bu	iffer	Memory	Scan Cycle Time
5	05:31:41:21	9 pm 01/29/0	3 Nequest for 3 Mode transit						_	
6	05:31:40:58	4 pm 01/29/0	3 All modules	a	Events:	Filte	r settings acti	ve	Time including CPU/local ti	ime difference
7	05:31:40:36	5 pm 01/29/0	3 Module mon	ii 👘	No. Time of day	,	Date	Event		▲
8	05:31:37:08	7 pm 01/29/0	3 Memory rese	3	1 05:32:04:3	27 pm	01/29/03	STOP	caused by programming error (OB	not loaded or n 💻
Deta	ails on Event:	1 of 100			2 05:32:04:3	27 pm	01/29/03	BCD co	onversion error	
OTC		: (00			4 05:31:41:2	15 pm 15 pm	01729703	Beques	ransition from STARTUP to RUN	
Brea	JP caused by pro ak point in user pr	igramming error (UB ogram: Cuelie prog	not loaded in not ram (OB1)		5 05:31:41:1	79 pm	01/29/03	Mode tr	ransition from STOP to STARTUP)
Prior	rity class: 1	ogram. Cyclic prog			6 05:31:40:5	B4 pm	01/29/03	All mod	ules are ready for operation	
FC r	number: 18	_			7 05:31:40:3	65 pm	01/29/03	Module	monitoring time started	
Pres	dule address:	2 vode: BUN			8 05:31:37:0	87 pm	01/29/03	Memory	v reset executed	<u> </u>
ji tev	nous obcradina n				Details on Event:	2 of 100)		Event ID:	16# 2521
	Save As	Settings	Op <mark>e</mark> n f	ВГ	BCD conversion err	or.				
					Affected register: ac	cumulato:	v 1			
C	lose 🛛 l	Jpdate F	Print		Requested OB: Pro	gramming	error OB (OB	121)		
					Internal error, Incom	abled, or ind event	cannot be sta	arted in th	e current operating mode	
					J					
					Saue Ae		ottings	1 0	pop Rlook	Halp on Event
					Jave As		eanys		heurnock	
					Claus 1		1			11.61-



Opening a B	lock Containing an Error
Module Information - CPU 314	
Path: SERV2_32S\Chapter10\Blocks Operating mode Status: Kerror Not a force job Time System Performance Data Common General Diagnostic Buffer Memory	e of the CPU: 🐨 STOP munication Stacks Scan Cycle Time
Events: 🔽 Filter settings active 🗖 Time includ	[I] [I] [I] [I] [I] [I] [I]
No. Time of day Date Event 1 05:32:04:327 pm 01/29/03 STOP caused by program 2 05:32:04:327 pm 01/29/03 BCD conversion error 3 05:31:41:216 pm 01/29/03 Mode transition from STA 4 05:31:41:215 pm 01/29/03 Bequest for manual warp	Image: Section of the section of
5 05:31:41:179 pm 01/29/03 Mode transition from STC 6 05:31:40:584 pm 01/29/03 All modules are ready for 7 05:31:40:365 pm 01/29/03 Module monitoring time s 8 05:31:37:087 pm 01/29/03 Memory reset executed Details on Event: 1 of 100	Contents Of: 'Environment\Interface\TEMP' Interface Name Data Type Address Comment IN IN Interface Int 0.0 IN Int 0.0 Int 0.0 IN_OUT IN_OUT Int 0.0 Int
STOP caused by programming error (OB not loaded or not possible, o Breakpoint in user program: Cyclic program (OB1) Priority class: 1 FC number: 18 Module address: 2 Previous persiting mode: BUN	EMP Setpoint_Value RETURN
Save As Settings Open Block	Network 5: Read in and convert Setpoint Value BCD_1 EN EN EN UV2-IN OUT-#Setpoint_Value
	Image: Second secon
	Press F1 to get Help.







Contents of the B Stack

Status	General	Diagnostic Buffer	Memory	Scan Cy	cle Tim
	Time System	Performance Data	Communic	ation	Stac
В <u>S</u>	jtack:				
В	lock Symbol		1st DB	2nd DB	
F	IB1 Main_pi C18 FC Mat	rogram the	DB18		
	<u>I</u> Stack	L Stack	ing Stack	en <u>B</u> lock	



Contents of the I Stack

Point of Interrup	ption —		Register Va	lues at the Point of Ir	nterruption
Priority Class:		1, OB1	Register ACCU 1:	Value 0000 11C7	Display Format
nterrupted Bloc	:k:	FC 18	ACCU 2:	0000 0000	Hex
		Open Block			
Continuation in I	Block:	FC 18			
DBs Selected-					
	1st DB	2nd DB	Addr. Reg.1	: 0.0	Address 💌
Number:	DB 18		Addr. Reg.2	: 0.0	Address 💌
Size in Bytes:	4		Status Word:	BR CC1 CC0 OV 0 0 0 0	0S 0R STA RL0 /FC 0 0 0 1 0





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Image: Metric Config - [My Station (Diagnostic)] Image: Metric Config - [My Station (Diagnostic)] Image: Station Edit Insert PLC View Options Patr: SERV2_32S:My Station/CPU 314 Operating mode of the CPU: Image: Status: Image:	Displaying the Hardware Diagnostics								
Slot Module Order nur 1 PS 307 5A 6ES7 307- 2 CPU 314 6ES7 314- 3	Image: Market of the second state o	rmation - AI2×12Bit Image: Constraint of the constraint							
Help on selected diagnostic row: Display Close Update Print	Slot Module Order nur 1 PS 307 5A 6E S7 307. 2 CPU 314 6E S7 314. 3 - - 4 DI32xDC24V 6E S7 321. 5 D032xDC24V/0.5A 6E S7 322. 6 DI8/D08x24V/0.5A 6E S7 323. 7 Al2x12Bit 6E S7 331.	Channel-Specific Diagnosis (Channel No. 0 to Maximum): Channel no. Error Help on selected diagnostic row: Display Close Update Print Help							



Ex 1: Copying a Faulty Program and Preparing for Troubleshooting





Exercise 2: STOP Troubleshooting

Please Note: That after every STOP error correction, you must carry out a CPU warm restart. If, after the warm restart, the CPU once again goes into the STOP state, there still exists a further STOP error.













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Displaying the Program Structure

Ref - [My Program (Program structure) My Project	t\Mv_Sta	tion(
E Reference Data Edit View Window Help			
Call structure - no filter		∇_{0}	
		<u> </u>	
Startobjekt: OB1 (OB_Cycle)			
Block(symbol), Instance DB(symbol)	Local dat	La	Filter reference data
■- 🗋 S7 Program			
□-□ OB1 (OB_Cycle) [maximum: 28]	[22]		Cross-references Assignment Program Structure Unused Symbols
FC15 (FC_Operating_Modes)	[22]	LA	
FC16 (FC_Conveyor)	[22]	LA	✓ Display absolutely and symbolically
E- FC17 (FC_Op/Flt_Mess)	[28]	LA	
FC20 (FC_Fault)	[28]	LA	Show
FB20 (FB_Faults), DB2 (DB_Instance_Fault2)	[28]	LA	Call structure C Dependency structure
FB20 (FB_Faults), DB3 (DB_Instance_Fault3)	[28]	LA	Multiple Calls
E- FC18 (FC_Count)	[24]	LA	
DB18 (DB_Parts)	[24]	LA	I♥ Block language
□-□ OB35 (OB_Cyclic_Interrupt)	[42]		✓ Locations of use
FC105 (FC_SCALE)	[62]	LA	Memory required for local data
OB100 (OB_Startup)	[0]		in bytes
OB121 (OB_Prog_ERR)	[0]		
FC1	[0]		
•			M in path
Drocs Et to get Help			✓ for blocks
Press F1 to get help.		_	
			Load Default Setting
			UK Cancel Help



Displaying Cross References

🔀 Ref - [My_Program (Cros	s-references) My_Project	\My_	Station(1)\CPl	J 314]					J	
🖳 Reference Data Edit View	w Window Help									, D	- 8 ×
2 4 4 1 1 1	Filtered		Y/	*	\?						
Address (symbol)	Block (symbol)	Тур	Languag	Locat	ion		Locati	on			
I 0.0 (T_System_ON)	FC15 (FC_Operating_Modes)	R	LAD	NW	1	/A					
I 0.1 (T_System_OFF)	FC15 (FC_Operating_Modes)	R	LAD	NW	1	/AN					
I 0.2 (T_Jog_RT)	FC16 (FC_Conveyor)	R	LAD	NW	1	/A	NW	2	/AN		
I 0.3 (T_Jog_LT)	FC16 (FC_Conveyor)	R	LAD	NW	1	/AN	NW	2	/A		
□ I 0.4 (S_M/A_ModeSelect)	FC15 (FC_Operating_Modes)	R	LAD	NW	2	/AN	NW	2	/0		
				NW	3	/A	NW	3	/ON		
I 0.5 (T_M/A_Accept)	FC15 (FC_Operating_Modes)	R	LAD	NW	2	/A	NW	3	/A		
I 0.6 (S_Weight/Number)	FC18 (FC_Count)	R	LAD	NW	5	/AN					
	OB35 (OB_Cyclic_Interrupt)	R	LAD	NW	4	/A					
I 0.7 (T_Conv_Rst)	FC15 (FC_Operating_Modes)	R	LAD	NW	4	/A					
I 1.0 (T_Fault_Rst)	FC17 (FC_Op/Flt_Mess)	R	LAD	NW	4	/A	NW	5	/A		
I 1.1 (S_Fault1)	FC17 (FC_Op/Flt_Mess)	R	LAD	NW	4	/A					
I 1.2 (S_Fault2)	FC17 (FC_Op/Flt_Mess)	R	LAD	NW	5	/A					
I 1.3 (5_Fault3)	FC17 (FC_Op/Flt_Mess)	R	LAD	NW	6	/A					
1 8.0 (LB)	FC16 (FC_Conveyor)	R	LAD	NW	3	/A	NW	4	/A		
I 8.3 (T_PB3)	FC17 (FC_Op/Flt_Mess)	R	LAD	NW	3	/A					
I 8.4 (T_PB4)	FC18 (FC_Count)	R	LAD	NW	1	/A					
	FC16 (FC_Conveyor)	R	LAD	NW	4	/A	NW	4	/AN		
1 8.6 (BAY2)	FC16 (FC_Conveyor)	R	LAD	NW	4	/A	NW	4	/AN		
1 8.7 (BAY3)	FC16 (FC_Conveyor)	R	LAD	NW	3	/0					
IW 2 (IW_BCD)	FC18 (FC_Count)	R	LAD	NW	3	/L					
H 10.3 (2_Hz)	FC17 (FC_Op/Flt_Mess)	R	LAD	NW	1	/A	NW	2	/A		
M 10.5 (1_Hz)	FC17 (FC_Op/Flt_Mess)	R	LAD	NW	1	/A	NW	2	/A		
M 16.0 (M_LB_Edge(FC16a))	FC16 (FC_Conveyor)	W	LAD	NW	4	/FP					
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,						NW	3	/A /A	DOM	2	/^
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Save as default setting	₹	5 (L. Man Rest)	FC15 (FC Operating Modes)	W	LAD	NW	4	/R			
Save as default setting		6 (L Aut Rest)	FC15 (FC Operating Modes)	W	LAD	NW	4	/R			
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Assignment of I, Q, M, T, C

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Unused Symbols / Addresses without Symbols

🔀 Ref - [My_Prog	gram (Unus <u>ed s</u>	ymbols) My_Pro	ject\My_Station(1)\CPU 314]		
(📼) Reference Data	a Edit View W	/indow Help		_ <u>_</u> _	
🖻 🎒 🌬 🛙	10 MLO	No filter	M 🔁 💦		
Symbol 🛆	Address	Data type	Comment		
C_Parts	⊂ 18	COUNTER	Transported Parts Counter		
T_PB1	I 8.1	BOOL	Push Button at Bay 1, Momentary Contact		
T_PB2	I 8.2		Puch Button at Ray 2 Momentary Contact	seiset Mr. Chebine (13) CDU 01 (1	
M_Fault2 M_Fault2_Edge	M 17.3	MI0 - CMy_Pro	gram (Addresses without symbol) My_Pi	roject\My_Station(1)\LPU 314]	
M LB Edge(EC18)	M 18.0	Reference Data	Edit View Window Help		
MW Parts	MW 20	🗃 🔿 🖓	No filter	🏹 🔭 💦	
MW_Setpoint	MW 22				
K_Horn	Q 8.7	Address A	lumber		
Press F1 to get Help.		I 16.2 1			
		09.2 1			
		0 9.4	Edit Symbols.		
		-		1	F
		Droce E1 to get Help			
		Press F1 to get help.	· L		
	Edit Symbols -	Reference data	*	×	
	Address	Symbol Data T	уре	Comment	
	Q 9.2				
	A 44 C	at I para	Contrat		
	Add Symp		e symbol		
	The symbol tabl	le is updated with 'OK' (or 'Apply'		
	<u>0</u> K	Apply		<u>Cancel</u> Help	



Com	paring Blocks (1)	
	Compare Blocks - Results	×
Compare Blocks Type of comparison: Including Comparison Including SDBs Execute code comparison Including blocks created in different programming languages	The block comparison resulted in the following differences: Path 1: My_Project\My_Station(1)\CPU 314\My_Program\Blocks Storage Location: D:\S7_Projekte\My_Proje Path 2: ONLINE Mu_Project\Mu_Station(1)\CPU 314\Mu_Program\Blocks	
Selected Path 1: My_Project\My_Station(1)\CPU 314\My_Program Blocks	Storage Location: Block List:	
	Block Result of comparison	
OK starts the ONLINE/offline corparison.	Hide instance data blocks of the same length	
Properties Path 1 Path 2 ONLINE Iast code change 30/01/2003 03:59:09 PM. 30/01/2003 04:00:31 PM. Last interface change 11/07/2000 05:30:58 PM. 11/07/2000 05:30:58 PM. Block checksum 0xF320 0x5753 Created in language LAD LAD Total length of block 462 bytes 462 bytes Length of local data 6 bytes 360 bytes Block version 2 2 Name (Header) 0.1 0.1	e block codes are different.	elp
Close	next	see page

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"Force" Variables

	Access Diabts	- E		1. 1911			Triager		Ctrl+R		
	Access Rights		< 1	No Fill	er>	<u> </u>	Monitor		Ctd+E7		
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⊡ 💼 ChC	Upload to PG					FBD	Update Monitor	r Values	F7		
	Upload Station to PG	и	otor			FBD	Activate Modify	v Values	F9		
	Copy RAM to ROM					FBD					
	Download User Program to Memory Card					FBD	Modify Address	s to 1	Ctrl+1		
🗄 💼 Backup_Pro	Save to Memory Card		Add)			FBD	Modify Address	s to O	Ctrl+0		
-	Retrieve from Memory Card		,			100	Enable Periphe	ral Outputs	Shift+F9		
	Manage M7 System Drive	•									
-	Dive	_					Display Force V	/alues	Alt+F2		
_	Display Accessible Nodes						Force				
	Change Module Identification						Stop Forcing				
	CPU Messages						Earran University	Comment	F0		
	Monitor/Modify Variables	Force value as comment in For									
-	Disapastic/Solting	Var - [Force Values : My_Project\SIMATIC 300(1)\CPU 315-2 DP\Ch07_Error ONLINE									
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	Cancel PG/PC Assignment	ŝ	Sy 66′ ¥		- 60	T Ker					
	Update Firmware		<u>^</u>	A	dress	Symbol	Symbol comment	Display format	t Force value		
_	Update the Operating System	_ 1	F	I QV	V 6	"QVV_DigDisp"	BCD digital display	HEX	W#16#ABCD		
	Save Service Data	2	F	1 Q	8.5	"K_Conv_RIGHT"	Run conveyor RIGHT	BOOL	true		
lays the force variable	es active in the module with current values.	3	F	•	8.0	"LB"	Light barrier	BOOL	false		
		4									
		Tiro	e of L	ast L	Jodate	:14:52:55			FRCE 🐼 RUN	Abs <	

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Exercise 4: Testing the Quantity Display



Date: 2/23/2012 File: PRO1_14E.37





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Trigger	Conditior	ns for Block	Monitoring (1)	
Call Environment of the Block	×	Call Environment of the Block		×
Trigger Conditions ────────────────────────────────────	With Address	Trigger Conditions	□ With ∆ddress	
	WithMuticas		- With Address	
FC99 FC60 FC70 FC70 FC60 OB1 OB1 OB1 OB1 OB1 FC60 OB1	Project]			
B Reference Data Edit View Window Help	-8×	🔽 Open Data Blocks		Project
Statebiekt OR1		Shared DB Number		filter
Block(symbol), Instance DB(symbol) Local da Language	Location Local da	Instance DB Number	7	
⊟- 🗋 57 Program				ge Location Local da
□ □ 0B1 [maximum: 28] [22] □ □ FC50 [28] LAD	[22] NW 1 [6]	ОК	Cancel Help	[22] NW 1 [6]
■ FB12, DB6 [28] LAD	NW 1 [0]		FB12, DB6 [28] LAD	NW 1 [0]
□ FB12, DB8 [28] LAD	NW 3 [0]		FB12, DB7 [28] LAD	NW 2 [0]
□-□ FC60 [24] LAD	NW 2 [2]		□ F612, 066 [26] LAD □-□ FC60 [24] LAD	NW 2 [2]
☐ FC99 [24] LAD	NW 1 [0]		G FC99 [24] LAD	NW 1 [0]
□-□ FC70 [26] LAD	NW 2 [2]		□-□ FC70 [26] LAD	NW 2 [2]
FC99 [26] LAD	NW 1 [0]		□ FC99 [26] LAD	NW 1 [0] NW 3 [2]
	NW 3 [2] NW 1 [0]		F C99 [24] LAD	NW 1 [0]
				Þ
			Press F1 to get Help.	
Press F1 to get Help.				, ,

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Exercise 5:	Testing the Evaluation of Fault 4
Call Environment of the Block	×
Call-Up Path	
From Cross References Manual	
□··· ♥ □ FB20 □··· □ □ FC17 □··· □ □ OB1	
☐ With Address	
Global DB Number:	Instance DB Number: 3
ОК	(@FB20 "FB_FaultEvaluation" PR01_B\Chap14
	FB20 : Title:
	#Stored_ #Fault
	#Stored_ #Fault_ Fault Signal



File Edit Insert PLC Deb	un View Ontions Win	dow Help				
	Overviews ✓ Details PLC Register	Ctrl+C	!«»! 🗖 📰	<u>1 - - </u>	№	
FC1 : Exercise for Brea	• LAD STL FBD	Ctrl+1 Ctrl+2 Ctrl+3				
L O T MB beg: L "MW_Pa	20 Data View • Declaration View rts Display with					
T U 1 JP a al L M INC 1	00 Zoom In Zoom Out Zoom Factor	Ctrl+Num+ Ctrl+Num-				
T MB L 16 >=I JC not	20 V Toolbar V Breakpoint Bar Status Bar					
JU beg eval: L MB T MB	20 Display Columns 40 Update View	. F11 F5				
not: S M BE	4.0					



	Testing the Program Execution using Breakpoints (Part 2)	
	IAD/STL/FBD - [FC1 My_Project\My_Station\CPU 314 ONLINE] Image: File Edit Insert PLC Debug View Options Window Help Image: File Edit Insert PLC Debug View Options Window Help Image: File Edit Insert PLC Debug View Options Window Help Image: File Edit Insert PLC Debug View Options Window Help Image: File Edit Insert PLC Debug View Options Window Help Image: File Edit Insert PLC Debug View Options Window Help Image: File Edit Insert PLC Debug View Options Window Help Image: File Edit Insert PLC Debug View Options Window Help Image: File Edit Insert PLC Debug View Options Window Help Image: File Edit Insert PLC Debug View Options Window Help Image: File Edit Insert PLC Debug View Options Window Help Image: File Edit Insert PLC Debug View Options Window Help Image: File Edit Insert PLC Debug View Options Window Help Image: File Edit Insert PLC Debug View Options Window Help Image: File Edit Insert PLC Debug View Options Window Help Image: File Edit Insert PLC Debug View Options Window Help Image: File Edit Insert PLC Debug View Options View Options Window Help Image: File Edit Insert PLC Debug View Options Vie	
Break- point Next state- ment	FC1 : Exercise for Breakpoints Image: transformation of the second sec	
	Image: Second state state A Address info. A 5: Modify A 6: Diagnostics A 7: Comparison Press F1 to get Help. Image: Second state Image: Second state Image: Second state A Address info. A 5: Modify A 6: Diagnostics A 7: Comparison	1







Objectives

Upon completion of the chapter the participant will ...

- be familiar with the documentation possibilities of blocks
- ... understand the "Managing multilingual project" function
- ... be able to print out programs
- ... understand the memory concept of the SIMATIC S7-300/400
- ... be able to make a "PLC Copy" (online data storage)
- ... be able to load/read a program to/from a Memory Card
- ... be able to achrive/retrieve a project onto/from a diskette or other storage media







Block Documentation

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FC4 : Block Title up to 64 characters		
Block comment: To enter a comment, select menu Comment". You have up to 64 kBytes per Block :	u options "View -> Display with -> for block and network comments.	
Network 1: Network Title up to 64 characters		
Network comment: To enter a comment, select me -> Comment". You have up to 64 kBytes per Blo	enu options "View -> Display with ck for block and network comments.	
A "T_System_ON" //	/ Statement comment up to 160 characters	
// Comment can also be inserted between th	he lines / IED for Swatem ON	
AN "T_System_OFF" //	/ System OFF	
R "L_System" /,	/ LED for System ON	

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Page Setup

Page Setup 🔀
Layouts:
A4 Margin
A3 A3 Margin A4
A4 Margin
A5 A5 Margin Legal 8,5" x 12" Legal 8,5" x 12" Margin Letter 8,5" x 11" Letter 8,5" x 11" Margin
OK Cancel Help

Li	abeling Fi	elds
[-Header-	
	Left	SIMATIC
	Centered	{Object}
	Right:	{Date} {Time}
[- Footer-	
	Left	
	Centered	
	Right:	Page (Page) of (Total)
[OK	Default Cancel Help



<u>,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,</u>		My Project	\My Station	\CPU 314\.	\FC20 -	<offline></offline>	> 01/:	22/2003 9:2	20:24
FC20 - <offl:< td=""><td>ine></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></offl:<>	ine>								
"FC_Fault" Eva	luation_o	f Faults no	memory						
Name: Author:	Fa	maly: rsion: 0.1							
	Bl	ock version:	2						
Time stamp Code: Interfa	10 	.01.2002 09:	17:22						
Lengths (block/log	ic/data):	00152 0004	18 00000						
Name	Data Tvp	e Address	Initial Value	Comment					
IN		0.0							
Disturbance_Input	Bool	0.0	FALSE						
Acknowledge	Bool	0.1	FALSE						
Flash_frequency	Bool	0.2	FALSE						
OUT		2.0							
Display	Bool	2.0	FALSE						
IN_OUT		4.0							
Report_Memory	Bool	4.0	FALSE						
Edge_Memory_Bit	Bool	4.1	FALSE						
TEMP		0.0							
		0.0							
	1	111111							
RET_VAL		10.0							
RET_VAL		0.0							
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RET_VAL		10.0							
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RET_VAL Block: FC20 Network: 1 D:	isturbance	e evaluation							
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RET_VAL Block: FC20 Network: 1 D: #Disturbance I #	isturbance	e evaluation	rt Memory #F	lash freque					
RET_VAL Block: FC20 Network: 1 D: #Disturbance_I #	isturbance #Edge_Memo	e evaluation	rt_Memory #F SR _ cy	lash_frequer	h #Dişp	lay			
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Managing Multilingual Project Documentation

SIMATIC Manager - [TIA-PRO	1-Solution_en D:\S7-Kurse\TIA-PRO1	TIA-PRO1]
🛐 File Edit Insert PLC View	Options Window Help	_ 문 ×
D 📂 🎛 🛲 🔏 🖻 🖻	Customize Ctrl+Alt+E	No Filter > 💽 🎦 🔡 📾 🖷
⊡® TIA-PR01-Solution_en ⊕₽ My project C9 HMI	Text libraries Display language	Symbolic name Created in langua
B B My_project_C10_MM420 B B mm test station	Manage Multilingual Texts	Export Import
⊡் இ CPU 315-2 DP ⊡்னு C10_My_Pro	Run-Time Properties	Change Language Delete Language
Sources Blocks	Compare Blocks Reference Data	Reorganize Settings for Comment Management
MICRUMASTER	Define Global Data Configure Network	FC_Faults FBD FC Count FBD
E IIII Cl2_FC_FB_E1	Simulate Modules	FC_Edge_Detection STL
⊕-	SIMATIC PDM	► FC_MM420 LAD FC_Scaling STL
⊡ 💼 C12_FC_FB_E4	Configure Process Monitoring	Control_Micromaster
Sources	Charts	•
	Import WinCC objects PLC-OS Connection Data	
Manages user texts	Set PG/PC Interface	

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	Overview: Saving User Data
Uploading program from the CPU to PG	 Create a new S7 program in the SIMATIC Manager Switch to the online view Open the new S7 program and select Blocks folder SIMATIC Manager → PLC → Upload
Upload station in PG	 SIMATIC Manager → PLC → Upload Station
Load program from PG to Memory Card inserted in PG/PC or Inserted in CPU	 Open two windows in the SIMATIC Manager: "Blocks folder of the S7 program" and "S7 Memory Card" Use drag & drop to copy blocks to the "S7 Memory Card" SIMATIC Manager → PLC → Download user program to Memory Card
Copy program from CPU to Memory Card (only S7-300)	• SIMATIC Manager \rightarrow PLC \rightarrow Copy RAM to ROM
Project archiving on Memory Card/MMC (S7-400, S7-300 after 10.0	 Select the CPU on whose Memory Card the project data are to be saved SIMATIC Manager → PLC → Save Project on Memory Card
Project archiving on diskette	 SIMATIC Manager → File → Archive Select project to be archived Specify name and storage path of the archive file and start function In the Windows Explorer, copy archive file onto diskette



Uploading a Program from the CPU to the PG







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Copying a Program onto a Memory Card

□ □ □	ISE\TIA-PRO1\TIA-PRO1	No Filter >									
TIA-PR01-Solution_en D:\S7-Ku	irse\TIA-PRO1\TIA-PRO1		_ []] ;								
			😼 TIA-PR01-Solution_en D:\S7-Kurse\TIA-PR01\TIA-PR01								
CPU 315-2 DP CPU 315-2 DP CPU 315-2 DP Sources MicroMASTER_420 My_project_C11_C14 My_project_C3_C8		Object name System data OB1 OB86 OB100 FC14 FC15 FC16 FC17 FC18 FC28 FC42 FC105 Yet 2005	Symbolic name OB_Cycle OB_RACK_FLT OB_Restart FC_Signalizing FC_Modes FC_Conveyor FC_Faults FC_Count FC_Edge_Detection FC_MM420 FC_Scaling Control_Micromaster								
🖬 57 memory card			>								
S7 memory card	System data 🖶 0B1 FC14 🖶 FC15 FC18 🕞 FC28	 OB86 FC16 FC42 	 OB100 FC17 FC105 								
, Press F1 to get Help.											





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Determining the Size of a Project

Datei Bearbeiten Ansicht Favoriten 🏾 🎽		Servz_52 Properties	
↓ ↓ Zurück ↓ → ↓ 1 @ Suchen »		General	
Adresse D:\S7-Courses\V 🔹 🔗 Wechseln zu		Serv2_32	
Ordner			
Desktop Arbeitsplatz JANTZON_W2K (C:) Daten_GFA_W2K (D:) Dotumente und Einstellungen Outlook Programme S7-Courses TIA_PRO1	k	Tupe:File FolderLocation:C:\S7_CoursesSize:1.54MB (1,620,458 bytes)Contains:345 Files, 52 FoldersMS-DOS name:SERV2_32Created:Tuesday, December 04, 2001 11:18:58 AM	
PRO1_Tei PRO1_Tei PRO1_Tei TIA_PR_1 S7-Kurse Simatic Software 09.2002 Prop ONUNT Prop OD (R:) OD (R:) Province Construction 2.1.09 KB Province Construction		Attributes: Read-only Hidden Archive System OK Cancel	ply

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		Project Arc	hiving	
Archiving User projects Librar D_Communication Mein_Project SERV1_32S SERV2_32S	ies Sample projects Multiprojects Storage path C:\S7_Kurse\GD_Kommu C:\S7_Kurse\Mein_Pro C:\S7_Courses\My_Proje C:\S7_Courses\Serv1_32 C:\S7_Courses\Serv2_32			
User Projects:	Archiving - Select an archive Save in: S7_Courses My_Proje Serv132s Serv2 Serv2_32	ip)	?×	Archive - Options Archive That Goes across Diskettes: No Incremental Archiving Reset Archive Bit Check Consistency OK Cancel Help



Exercise 1: Documenting a Block and Printing It Out



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Ex.2: Saving the Program and Hardware Configuration (PLC Copy) SIMATIC Manager - [PLC Copy -- C:\Program Files\Siemens\Step7\s7proj\PLC_Copy] File Edit Insert PLC View Options Window Help - 8 × 💽 🏏 🞇 🎯 📆 📑 🗖 🗂 🗅 🚅 🚼 🛲 Access Rights ۲ < No Filter > 🖶 PLC Copy Download Ctrl+L X Select Node Address Ctrl+K Configure... Compile and Download Objects... Which module do you want to reach? Upload to PG Copy RAM to ROM ... 0 🕂 Rack: Download User Program to Memory Card <u>S</u>lot: 0 🕂 Save to Memory Card... Retrieve from Memory Card... Elocal Target Station: Manage M7 System... C Can be reached by means of gateway Drive Enter connection to target station: Display Accessible Nodes PROFIBUS address Module type Station name Module name Plant designation Change Module Identification... 2 CPU 315-... CPU Messages... Display Force Values Accessible Nodes Monitor/Modify Variables Uploads the current stat d program). Diagnostic/Setting 6 IM151-1 PROFIBUS ۲ View / Update Edit Ethernet Node... Assign PG/PC **Button** Cancel PG/PC Assignment Update Firmware Update the Operating System... Update Save Service Data... 0K Help Cancel



Exercise 3: Archiving a Project

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Exercise 4: Deleting a Project and Retrieving It SIMATIC Manager - 🗆 🗵 File PLC View Options Window Help New.... Ctrl+N 'New Project' Wizard... Open... Ctrl+O Open Version 1 Project... ? × Retrieving - Select an archive S7 Memory Card ۲ 💌 🖶 🖻 🖛 🔄 S7_Courses Look in: Memory Card File Þ 🗋 My_Proje Delete... Serv132s Reorganize... Serv2 Select destination directory X Manage... Serv2 32 Archive... My_proje.zip 🗄 😑 SYSTEM (C:) * 🚊 👝 Data (D:) Retrieve... 🗄 🧰 DRIVERS Page Setup,... 🗄 🧰 Encarta98 🗄 🧰 Markus Print Setup... 🗄 🧰 PecDos My_proje.zip File name: 🗄 🙆 Programme 1 My_Project (Project) -- C:\S7_Courses\My_Proje Files of type: PKZip 4.0-Archive (*.z 🗄 🧰 RECYCLER 2 Accessible Nodes -- MPI 🗄 🧰 Reinhold 3 SERV2_325 (Project) -- C:\S7_Courses\Serv2_32 🗄 🙆 S7-Projekte 4 SERV1_32S (Project) -- C:\S7_Courses\Serv1_32 🗄 🙆 S7_Courses 🗄 🛄 SIMATIC-Kurse Alt+F4 Exit 🗄 🛅 System Volume Information **•** Gets object from the archive. OK. Cancel Help

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MMC - as Additional Data Memory on the CPU







Save to Memory Card in the PLC X **Corresponds to** STEP 7 Data "Load user program Current user program (incl. HW configuration) Caution! on MC" The memory card will be completely deleted if 'Current user program' is selected. **Currently open project** Current project is compressed and Libraries in current multiproject copied Other files All individual files except archives (e.g. *.zip) and - 🖻 📸 🔳 Search in: 칠 MM420_Manuals_englisch directories MM4 FROFIBUS En odf D:\#TIA_PR0123_V55\Entwi D:\#TIA_PR0123_V55\Entwi 🔀 MM420_Operating Instruction.pdf D:\#TIA_PR0123_V55\Entwi 🕅 MM420 Parameter List.pdf --> **Current Selection List !!** No current MMC content × Dateien laden in EPROM Memory Card auf CPU Dateien übertragen ins Zielsystem Quelle: D:\S7_SERV1\Übungen\MM420_Parameterliste.pdf Storage location on PLC Ziel: CPU Memory Card Datenübertragung ins Zielsystem läuft ... C Load memory (RAM). Geschätzte Dauer: 4 min 23 sec Gesamtes Datenvolumen: 1.396 MB Bereits übertragen: 1.396 MB OK. Help Starts transmission Abbrechen

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PLC: Getting Data from the Memory Card



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Hardware Configuration









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