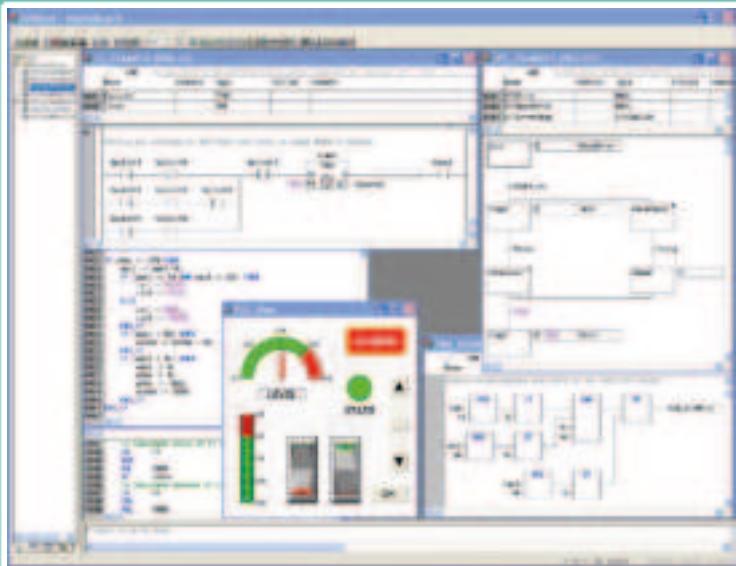


Object-Oriented PLC Programming in CODESYS

Modular and Scalable Control Systems
Using Structured Text



Academy Pro Title by
Majid Pakdel

Object-Oriented PLC Programming with CODESYS



Majid Pakdel



- This is an Elektor Publication. Elektor is the media brand of Elektor International Media B.V.
PO Box 11, NL-6114-ZG Susteren, The Netherlands
Phone: +31 46 4389444
- All rights reserved. No part of this book may be reproduced in any material form, including photocopying, or storing in any medium by electronic means and whether or not transiently or incidentally to some other use of this publication, without the written permission of the copyright holder except in accordance with the provisions of the Copyright Designs and Patents Act 1988 or under the terms of a licence issued by the Copyright Licensing Agency Ltd., 90 Tottenham Court Road, London, England W1P 9HE. Applications for the copyright holder's permission to reproduce any part of the publication should be addressed to the publishers.

● Declaration

The authors and publisher have used their best efforts in ensuring the correctness of the information contained in this book. They do not assume, or hereby disclaim, any liability to any party for any loss or damage caused by errors or omissions in this book, whether such errors or omissions result from negligence, accident or any other cause.

- British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library
- **ISBN 978-3-89576-696-1** Print
ISBN 978-3-89576-697-8 eBook
- © Copyright 2024 Elektor International Media
www.elektor.com
Editor: Glauçileine Vieira
Prepress Production: Elektor
Printers: Ipkamp, Enschede, The Netherlands

Elektor is the world's leading source of essential technical information and electronics products for pro engineers, electronics designers, and the companies seeking to engage them. Each day, our international team develops and delivers high-quality content - via a variety of media channels (including magazines, video, digital media, and social media) in several languages - relating to electronics design and DIY electronics. www.electormagazine.com

Contents

Contents	5
Preface	8
Chapter 1 • Introduction	9
1.1 The Object-Oriented Programming for PLC	9
1.2 The CODESYS Software	10
Chapter 2 • The Structured Text (ST) Programming Language	12
2.1 Conditional Statements	12
2.2 Calling the Standard Functions	18
2.3 The Finite State Machine	30
2.4 The Arrays	35
2.5 The Loops	38
2.6 The Non-Instantiated Function Principle	40
2.7 The Non-Instantiated Function Demo	42
2.8 Writing an Expandable PLC Program	49
Chapter 3 • The Class	56
3.1 Introduction	56
3.2 The Class Demo	58
3.3 The Structured Variables	63
3.4 The Structured Variables Demo	66
3.5 Passing Structures to the Class	68
3.6 The Structure Pass Demo	69
3.7 The Array of Structures and Objects	73
3.8 The Array of Objects Demo	74
3.9 Calling Multiple Objects	76
3.10 The Sequence Activation Project	77
Chapter 4 • The Method	87
4.1 Introduction	87
4.2 The Methods Demo	92
4.3 The Methods Parameters Pass	102

4.4 The THIS Keyword	108
4.5 The THIS Keyword Demo	109
4.6 The Wrappers	113
4.7 The Wrappers and Method to Method Passing Demo	117
4.8 Two Production Lines for the Sequence Activation Project.	127
Chapter 5 • The Properties	152
5.1 Introduction	152
5.2 The Property Software Demo	154
5.3 The Properties as IO	159
5.4 The Properties as IO Demo.	160
Chapter 6 • The Inheritance and Polymorphism	165
6.1 The Inheritance.	165
6.2 Inheritance Demo	167
6.3 The Deep Inheritance.	180
6.4 The Method Override	183
6.5 The Override and Super Keyword	185
6.6 The Polymorphism.	189
6.7 The Polymorphism Software Demo	191
Chapter 7 • The Access Specifiers	195
7.1 The Public.	195
7.2 The Private	196
7.3 The Protected	198
7.4 The Application	199
7.5 The Application Demo	201
Chapter 8 • Interfaces and Abstractions	218
8.1 The Interface	218
8.2 The Interface Software Demo	220
8.3 The Interfaces Vs Inheritance	223
8.4 The Multiple Interfaces Demo	228
8.5 The Interfaces and Polymorphism	235
8.6 The Interfaces and Polymorphism Demo.	237
8.7 The Object Composition	243

Chapter 9 • The Delegation and Advanced FSM.....	248
9.1 The Delegation	248
9.2 The Object Pointers and References.....	251
9.3 The Object Pointers and References Demo	254
9.4 Advanced FSM Pointers	258
9.5 The FB_INIT Constructor	260
9.6 Advanced FSM Demo Part 1	262
9.7 The Transitions	269
9.8 Advanced FSM Demo Part 2	271
9.9 The State Initializer.....	282