

Preface	7
Introduction	8
Chapter 1 • Installing the Raspberry Pi 4	11
1.1 Hardware description	11
1.2 Installing the operating system	12
1.3 Installing the VNC Viewer	15
1.4 Installing the File Transfer Software WinSCP	18
1.5 Installing the openplcproject runtime	22
Chapter 2 • OpenPLC Editor Installation	32
2.1 Download and Installation	32
2.2 Raspberry Pi pin descriptions	37
2.3 Additional Hardware I/O Test Board	40
2.4 Additional 24 V PLC Board hardware	41
Chapter 3 • The OpenPLC Editor	44
3.1 Description of the OpenPLC Editor	44
3.2 Ladder Logic Example (LD)	55
3.3 Function Block example (FBD)	67
3.4 Instruction List example (IL)	76
3.5 Structured Text examples (ST, SCL)	81
3.5.1 Variable	82
3.5.2 Control structures	83
3.5.3 Conversion operators	88
3.5.4 Standard function blocks according to IEC 61131-3	88
3.5.5 First ST program example	90
3.5.6 ST example for controlling a conveyor belt	93
3.5.7 Defining arrays with the OpenPLC Editor	96
3.5.8 Defining structures with the OpenPLC Editor	100
3.5.9 Combining structures with arrays using the OpenPLC Editor	103
3.5.10 Definition of ENUMs	106
3.6 Sequential Function Chart example (SFC)	109
Chapter 4 • OpenPLC and the Modbus	120
4.1 Testing PLC programs with Modbus TCP	120

4.2 Visualization of PLC programs with AdvancedHMI	130
4.3 Visualization of PLC programs via the Internet	140
Chapter 5 • Modbus I/O modules	147
5.1 Modbus RTU module with the Arduino UNO.	147
5.2 Modbus TCP module with the ESP8266 and WLAN	158
5.3 Web server application with the ESP8266 I/O module	168
Chapter 6.1 • Bibliography, circuit diagrams and layouts	175
6.2 Web links	176
6.3 Modbus commands for the ESP8266 I/O module	178
6.4 Circuit diagrams and layouts.	181
6.4.1 Circuit diagram for the test board with buttons and LEDs:	181
6.4.2 Circuit diagram for the test board with 24V input outputs:	183
6.4.3 Circuit diagram for the ESP8266 board with 24V input outputs:	185
Index	187