PLC Practical Training

with Demo Videos

A Solid Foundation for

SIEMENS SIMATIC S7

Hardware and Software

By

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About the Authors

We are control systems engineers, a systems Integrators and also content creators. We have worked with many clients across business sectors, most of which are in the Siemens PLC automation industry. We have more than a decade of experience on designing control systems for industries like refineries, steel, oil, and gas from natural gas compressor stations to cold rolling steel plants.

How This Book Can Help You

This book and its supplemental demo videos make up an excellent practical training program that provides the foundation for installation, configuration, activation, troubleshooting and maintenance of Siemens SIMATIC S7 PLCs (programmable Logic Controllers) in an industrial environment.

The 5 chapters of this book and its videos serve as an exhaustive collection of my step-by-step tutorials on PLCs for beginners and advanced learners alike. If you fall in the following categories of people, you will find this book very helpful:

- Engineers
- Electricians
- Instrumentation technicians
- Automation professionals
- Graduates and students
- People with no background in PLC programming but looking to build PLC programming skills

This book is accompanied with **33 in-depth HD demo videos**. In these videos, I use a practical approach to simplify everything you need to understand to help you speed up your learning of PLCs in general, and of Siemens S7 PLCs specifically.

Because I assume you have little or no knowledge of PLCs, I strongly urge you to digest all the contents of this book and its supplemental demo videos (33 episodes). This will not only help you build an in-depth knowledge of PLCs in general; it will also help you gain a lot of job skills and experience you need to be able to install and configure Siemens PLCs.

In this book I teach the fundamentals of SIMATIC S7 PLCs. I also touch advanced topics, such as PLC networks, virtual CPU, CPU models and what their codes mean, digital input and output configurations, and so much more. The knowledge you gain from this training will put you on the path to becoming a paid professional in the field of PLCs.

The quickest way to build skills in PLC hardware and software is to use real-world scenarios and industrial applications. **The real-world scenarios and industrial applications I treat in this book and the demo videos will help you learn better and faster** many of the functions and features of both the S7 PLC family and the Step 7 software platform.

If all you use is just a PLC user manual or S7 help contents, you cannot become a skillful PLC programmer. That is why I have designed this training program to help you develop skills by teaching you PLC hardware configuration and programming step by step. This will give you a big head start if you have never installed or configured a PLC before.

One of the questions I get asked often by beginners is, where can I get a free download of Siemens PLC software to practice? I provide later in this book **links to a free version of the**

SIMATIC S7 PLC Software which is essentially the programming environment you need to practice.

In Chapter 3, I also provide two hassle-free download links for the free edition of SIMATIC STEP 7. This will help you get hands-on practice because you can use it to run and test your PLC programs on a PC or Mac. I do not only show you **how to get this important Siemens automation software for free and without hassle**, I also show **how to install, configure, navigate and use them to program Siemens PLCs**.

Finally, if you have questions or need further help, you can use the support link I provide in Chapter 4. I will get back to you very quickly.

How to Use the Demo Videos

You will find the link to download all the 33 demo videos in Chapter 3 of this book. The serial/section number and title of the video you should watch is mentioned in the appropriate section of each chapter. For effective learning and to get good practice, I strongly advise you attempt the challenges and exercises in this book and its demo videos on your own.

1. Getting Started: PLC Hardware Foundation

It is easy to install, configure, troubleshoot and maintain STEP 7 PLCs. In this chapter, you will see how I will get you started very quickly.

1.1. Introduction: Control System Skills

I would first like to explain the idea behind creating this book and the supplemental videos on S7 PLC, and what sets this training program apart from similar ones out there. - *Video 1.1: Introduction*

My company has more than a decade of experience on designing control systems for industries like refineries, steel, oil, and gas from natural gas compressor stations to cold rolling steel plants. We have designed various control systems for many different industries. During this time. One of the biggest challenges that we faced was finding skilled automation engineers to hire when we needed additional resources.

Simply put, the newly graduated electrical engineers that were applying for the jobs were not trained with the skills that were needed to be able to handle a real task. Like the majority of engineering companies in this field, we did not have time to hire new engineers and commit to a long-term training period, hoping that it would pay off in a year or so.

So, we decided to do something different, which was to design a high-end compressed in-house training program that would train the engineers we hired with the exact skills that were needed to design various aspects of control systems and programming PLCs. We trained the first group of new engineers with this method, and the result was beyond all of our expectations. It went so well that other companies working in our field were continually asking us to instruct their new engineers with this training system.

The reason for the success of this program is simple. After several years of working on real life projects, we know exactly what techniques and skills an automation engineer needs to help us with designing and programming.

We demonstrated these skills and techniques in a very easy to follow format. Delivering complicated engineering concepts that are simple to understand required putting more time and energy in the content creation phase, but that single feature had a great impact for the efficiency of the program.

After a while, we decided to launch this system online to give other controls and electrical engineers, technicians and students all around the world, the chance to arm themselves with the exact skills needed to land a job in this field. The result is the training program in this book and the accompanying demo videos.

We have spent a lot of time and energy on this training book and its demo videos. The contents have been reviewed over and over again to ensure that we are delivering practical points in the easiest format to understand. This can help you to learn the skills you need without having any background in PLC programming.

Again, the most important factor that sets this book apart from similar books is **what you will learn is what we have gained from working on real life projects over the past decade**.

So, if you are going to learn the design and programming skills needed to get a job in engineering companies or take your career to the next level, you have made a great choice. You will not find a better opportunity to obtain those skills than you will find in this book and its accompanying videos. So, let's get started and take the first step.

1.2. Control System Components: Introduction to PLCs and the Hardware They Use

Fig. 1.2.1 shows the **modules** that usually reside in a PLC. – *Video 1.2: What Components Makeup a PLC*

Fig. 1.2.1: PLC Modules

The first component needed is a **rack** which holds all of the modules and areas called **slots**. The first slot is typically the power supply module, which provides the necessary power to the PLC modules.

The **output voltage** of the power supply that we use is usually 24 volts DC. But the output current varies depending on the number of the modules needed in a PLC. For instance, this output current could be **2A**, **5A** or **10A** (amperes). Depending on which, and how many modules are used, the output current of the power supply may need to be higher.

The second slot usually holds the **CPU**. The CPU is the brains of the system, and its job is to evaluate inputs, process the logic and the program we supply, and energize the outputs based

on that logic.

After the CPU, we may have any number of different input and output modules, depending on the signals and components that we want to monitor and control within the process. If we have both digital and analog signals in the process, we would install a digital input module (DI) and then an analog input module (AI) in the two slots on the right side of the CPU (see Fig. 1.2.1).

As for outputs within the system, we can install a digital output module (DO) for devices that receive digital signals, like contactors, and an analog output module (AO) for items that receive analog signals, such as proportional valves.

Depending on which module models are selected, between 8 and 32 separate signals may be connected to these IO modules. Some applications require that particular signals are processed with higher accuracy. Those signals may not be connected to the standard IO modules, but instead requires specialized modules called **Function Modules** or **FM**s. FMs process signals independent of the CPU, therefore providing for higher accuracy.

Another module that may be installed in this rack is a **Communication Processor** or **CP**. The CPU usually contains network ports for use in industrial networks, such as **NPI** (New Product Introduction), **PROFIBUS** (Process Field Bus), or **PROFINET** (Process Field Net).

However, if additional communications ports are needed, we can use a CP module. These are the modules typically used in a PLC. Module selection depends entirely on the process the PLC will control. Some applications may require the use of the CP or FM modules while others may not. Other plant processes may need many IO modules, and even require expansion racks to accommodate them.