PLC Programming

from Beginner to

Paid Professional

Part 3

Learn How to Develop & Embed

Machine Vision System in PLC

with Demo Videos

By

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PLC Programming from Beginner to Paid Professional – Part 3

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About the Author

I am a Control Systems Engineer, Systems Integrator and a Content Creator. I have worked with over a thousand clients across business sectors, mostly the PLC automation industry. I have written numerous books, articles, and leadership classes for higher education institutions.

I have over 15 years of experience in Control Systems Engineering. I have had the opportunity to work within world class organizations such as Kraft Heinz, Procter & Gamble, and Post Holdings.

As a Control Systems Engineer, I have worked on several PLC-based systems such as the Allen-Bradley's RSLogix 5, 500, 5000, Studio 5000, PACs, PowerFlex variable frequency drives, and so much more. I have mastered other great technologies such as Cognex In-Sight Vision Systems & so much more.

Now I live and breathe PLCs (Programmable Logic Controllers). I've invested a lot of money and time into equipping myself with many of the latest PLC hardware in the world. This is because I truly believe that an investment in myself will pay dividends down the road and that the automation industry will only keep growing.

I believe in excellence and I'm highly driven by successful people. I am dedicated to seeing my clients succeed and achieve their goals. I love to create PLC programs and help manufacturing companies grow. I've successfully coached over a thousand business owners and leaders.

I'm proud to boast of extensive experience and a successful company which has been in business for over 15 years.

How this Book can Help You

This short book is part 3 of my 4-part series on PLC programming. This Part 3 is an exhaustive collection of my tutorials and demo videos on how you can develop and embed the Cognex In-Sight Machine Vision System in Programmable Logic Controller (PLC).

You will find this book very helpful if you are an electrician, an instrumentation technician, a manufacturing operator, an automation professional or engineer looking to looking to progress their career or level up their knowledge of Machine Vision for industrial development, and to acquire advanced PLC programming skills.

There are 6 chapters in this book. They are accompanied with **23 in-depth HD demo videos that you can download**. These videos simplify everything you need to understand, and help you **speed up your learning** of Cognex In-Sight Machine Vision for industrial development. There is also a link in this book for you to download my PLC programs (codes) for your revision.

I assume you have little knowledge of Machine Vision application to PLCs. So I prepared this book in such a way that when you read it and study the accompanying demo videos (23 episodes), you will not only have an in-depth knowledge of the different parameters which need to be configured in order to properly connect and communicate a Cognex camera to your PLC, you will also learn how to purchase, upgrade/downgrade the device firmware and trigger the camera. This will help gain a lot of job experience you need to build innovations and earn higher salaries.

I start with the basics, that is, an overview of the Cognex In-Sight 7000 Series Camera, and then move on to the detail of the In-Sight Software. Then I proceed to the Cognex pattern and part inspection tools, as well as how to trigger the Cognex In-Sight Camera. I went as far as dedicating a whole chapter to a 3-part in-depth tutorial on how to read bar codes with the camera.

So, after studying this book and the demo videos, you should develop a hands-on approach to the installation and integration of Cognex into Studio 5000 Rockwell Environment, and be able to use it in real world industrial applications.

The best way to master PLC programming is to use real world situations. The real-world scenarios and industrial applications developed in this book and its accompanying video demos will help you learn better and faster many of the functions and features of Studio 5000 platform.

The methods presented in the demo videos are those that are usually employed in the real world of industrial automation, and they may be all that you will ever need to learn. The information in this book and the demo videos is very valuable, not only to those who are just starting out, but also to any other skillful PLC programmer, no matter their skill level.

Merely having the user manual of Cognex In-Sight 7000 Series Camera, or referring to its help contents, is far from enough in learning machine vision development. Therefore, this book and

the accompanying demos are extremely useful for learning machine vision development and its applications.

One of the questions I get asked often by beginners is, where can I get a free download of RSLogix software to practice? I provide later in this book links to a **free version of the RSLogix Micro Starter Lite** (which is essentially the same programming environment as the RSLogix 500 Pro) and a **free version of the RSLogix Emulate 500**.

In Chapter 5, I also provide links to download the demo edition of **RSLogix 5000 / Studio 5000** Logix Designer to your system. Make sure you create an account at RockwellAutomation.com first. So, you don't even need to have a full-blown PLC to learn, run and test your ladder logic programs.

I do not only show you how to **get these important Rockwell** Automation **software for free and without hassle**, I also show with HD videos how to install, configure, navigate and use them to write ladder logic programs.

However, if you are a complete novice to PLCs or PLC programming, here's the link to my book that you will find very helpful to get started: PLC Programming Using RSLogix 500 & Real World Applications: Learn Ladder Logic Concepts Step by Step with Real Industrial Applications.

Then you can move on to the first part of this series, PLC Programming from Beginner to Paid Professional - Part 1: Learn RSLogix Software & Hardware with Demo Videos.

Finally, if you have questions or need further help, use the support link I provided in Chapter 5. I will get back to you very quickly.

How to Use the Demo Videos & PLC Programs

You will find the link to download all the 23 demo videos and program codes in Chapter 5 of this book. The serial 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 projects in this book on your own. Build your own program after you have watched me build mine in each video. Then later you can cross check your programs with mine. Also feel free to use or modify any of the PLC programs you downloaded as you wish.

1. Hardware Overview: Getting Started with Cognex In-Sight Camera

In this chapter we're going to look closely at the Cognex In-Sight 7000 Series Camera shown in Fig. 1.1.

Fig. 1.1: Cognex In-Sight 7000 Series Camera. *Cognex.com*

We will talk about the pin outs on the camera, as well as its capabilities. But before we jump into the hardware, I believe it's very important to answer this question:

What are the purposes of a vision system, especially within an industrial or manufacturing environment where they are most commonly deployed?

To answer that question, it's very important to look at the manufacturers themselves and see what they recommend or say about their systems. If you take a look at the Cognex website, you will see different products, in particular the In-Sight product line. There are quite a few different systems available for your selection.

1.1. First Look at the Cognex In-Sight Camera Series

On the Cognex site, a description of the features of the In-Sight 7000 Series says it's a powerful, modular vision system that is highly field-customizable to your application requirements. But that doesn't really answer the question as to what the system does. However, from industry experience, I can tell you that there are 3 main things that your system is going to be capable of doing.

The first one is to **detect** what's called a reject or quality defect. That is, a product that does not correspond to the specifications to which it was meant to be built. Here are some examples.

Imagine a bottle which gets filled to a certain level where the manufacturer has a certain specification. Take a bottle of one liter of Coke as an example. It is normally filled at one liter but is allowed to be slightly below or slightly above that level. You don't necessarily always hit

the target, but you do have a certain limit range of the bottle. So, a vision system can be placed to look at the bottle which is moving on a conveyor. If the system detects that the bottle is either below or above a certain threshold, then it is rejected due to a quality defect.

Of course, that is just a very basic example. I've seen some parts, such as precisely manufactured bolts for example, being inspected to a certain tolerance. So, if we have a bolt that needs to be down to, let's say, 0.001mm dimensions for aerospace purposes, then a camera will be placed to inspect if those tolerances are met. That's a quality or a defect examination.

The second thing that you can do with cameras is **measurements**. For example, you can measure things like the diameter or length of a certain part. Once again, that is commonly used for rejects, but it can also send information back to your system to help you analyze a statistical data.

For example, if you're making plastic spoons and you start deviating from the form factor of that spoon, you can predict the kind of an adjustment you need to make on your plastic forming machine in order to correct that particular deficiency and get that system back into check. This is not per se a quality check but a *measurement* check that you can do on different kinds of your parts.

The third application is going to be **machine specific**. For example, I had an application where I had a certain rapper going around a particular piece. That wrapper needed to be positioned in a certain place. So, I needed to take a measurement of where that deviation is, and essentially correct the web in order to wrap that piece in the right position. This is essentially used for control, not rejecting the product, because we are essentially controlling a piece of equipment.

Another example of such an application would be in **robotics**. Picture a conveyor with a robot at the end. On this conveyor, you have parts that are scattered in different orientations. Your vision system can look down and examine where the pieces are relative to the speed of course of the conveyor. It can tell the robotic arm to, for example, pick up a piece and place it in a particular orientation, and so on and so forth. It's essentially providing feedback for the control system to work efficiently.

Those are the three main applications that I've seen in most vision systems. But I do encourage you to explore the Cognex website. There're different data sheets you can download. There're different specifications of this camera that you can look at.

Of course, Cognex does describe the full capabilities, which I sometimes look at when I do need to pick a new system. The camera that I own is a monochrome (black and white), but you can of course get vision systems with color. You can get, depending on your needs, a whole, a wide

array. Of course, there's always trade-offs, depending for example on how fast you want to process your part, and how complex your application is.

So, I highly encourage you to explore this particular line, as well as the other lines from Cognex, in order to see which one fits your needs the most.