INSTALLATION DOCUMENT PACKAGE

Installation Instructions

S5-210

6ES5095-8MC03

S5-95U COMPACT CONTROLLER

Applicable product family: SIMATIC S5 automation systems

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SIMATIC S5

S5-90U/S5-95U
Programmable Controller

System Manual

EWA 4NEB 812 6115-02b

Edition 03

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How to Use This System Manual

The S5-90U and S5-95U are programmable controllers for lower and medium performance ranges. They meet all the requirements for a modern programmable controller. To use these controllers optimally, you need detailed information.

In this system manual we have attempted to present this information as completely and as well organized as possible.

This How to Use This System Manual section gives you information that will make it easier for you to find what you need. This section explains how the manual is organized.

Contents of This System Manual

- Hardware Description (Chapters 1, 2, and 3)
  These chapters describe the controllers: how they fit into the SIMATIC® S5 family of programmable controllers, how they function, and how you install them.

- Start-Up Information (Chapters 4, 5, and 6)
  These chapters summarize the information you need to start up your programmable controller.

- The Programming Language of the Programmable Controllers (Chapters 7, 8, and 9)
  These chapters describe the structure, operations, and structuring aids of the STEP® 5 programming language.

- Functions of the Programmable Controllers (Chapters 10, 11, 12, 13, and 14)
  Each of these chapters contains a complete description of a particular function, from wiring to programming. Subjects include analog value processing, counter and interrupt inputs, integral clock, and the programmable controller as a SINEC® L1 slave.

- Module Spectrum (Chapters 15 and 16)
  These chapters contain information about all the currently available S5-100U modules that you can use to expand your controller. Chapter 16, Function Modules, includes the modules that require an extensive description (i.e., more than just technical specifications).

- Overviews (Appendices)
  In these chapters you will find not only a complete list of operations but also the technical specifications of the PLCs, RAM address assignments, system data assignments, dimension drawings, a description of errors that may occur during operation of the programmable controller, maintenance and repair procedures, guidelines for handling electrostatic sensitive devices, a list of accessories, and reference literature about programmable controllers.

You will find correction pages at the end of the system manual. Use them to indicate any corrections, additions, or suggestions for improvement you might have. Send these suggestions to us. They will help us to improve the next edition of this system manual.

Safety-Related Guidelines for the User

This document provides the information required for the intended use of the particular product. The documentation is written for technically qualified personnel.
Qualified personnel as referred to in the safety guidelines in this document as well as on the product itself are defined as follows.

- System planning and design engineers who are familiar with the safety concepts of automation equipment.
- Operating personnel who have been trained to work with automation equipment and are conversant with the contents of the document in as far as it is connected with the actual operation of the plant.
- Commissioning and service personnel who are trained to repair such automation equipment and who are authorized to energize, de-energize, clear, ground, and tag circuits, equipment, and systems in accordance with established safety practice.

Danger Notices

The notices and guidelines that follow are intended to ensure personal safety, as well as protect the products and connected equipment against damage.

The safety notices and warnings for protection against loss of life (the users or service personnel) or for protection against damage to property are highlighted in this document by the terms and pictograms defined here. The terms used in this document and marked on the equipment itself have the following significance.

Danger

indicates that death, severe personal injury or substantial property damage will result if proper precautions are not taken.

Warning

indicates that death, severe personal injury or substantial property damage can result if proper precautions are not taken.

Caution

indicates that minor personal injury or property damage can result if proper precautions are not taken.

Note

contains important information about the product, its operation or a part of the document to which special attention is drawn.

Proper Usage

Warning

- The equipment/system or the system components may only be used for the applications described in the catalog or the technical description, and only in combination with the equipment, components, and devices of other manufacturers as far as this is recommended or permitted by Siemens.
- The product will function correctly and safely only if it is transported, stored, set up, and installed as intended, and operated and maintained with care.

S5-95U Programmable Controller

The S5-95U is a fast and compact PLC designed for complex applications with digital and analog inputs and outputs where space is a crucial factor.
It is suitable for small control tasks with high demands regarding response times and supplementary functions.

Salient features of the S5-95U:
- Onboard analog inputs/outputs with extremely short conversion times
- PID controller
- Networking capability as active or passive station in the SINEC L2 LAN

I/O Modules

The S5-90U and S5-95U programmable controllers can be expanded with I/O modules of the S5-100U range. Up to 32 modules can be connected directly to the S5-95U. For the S5-90U, however, the IM 90 interface module is required for connecting up to six modules.
These modules offer a variety of functions that supplement the onboard I/Os of the programmable controllers.
The following I/O modules are available:

- Digital input and output modules
- Analog input and output modules
- Ex modules for hazardous applications
- Function modules for external timer functions, fast counters and analog limit monitoring
- Intelligent I/O modules for closed-loop control and positioning tasks and for cam mechanisms
- Intelligent programmable modules for fast preprocessing functions
- Diagnostic modules for monitoring the I/O bus of the S5-100U
- Simulator modules for program testing.

Bus Units

Bus units provide the S5-90U/95U with extra-discrete configuration and expansion capabilities. The bus units incorporate the signal leads for communication between I/O modules and CPU. They are simply mounted on a 35 mm standard mounting rail and interconnected using the integral flat ribbon cable connectors.
Each bus unit has
- Two module slots
- Rotatable coding "locks" to avoid confusing of modules
- A terminal block for the signal leads.

Communications Capabilities

The SINEC L1 and SINEC L2 (S5-95U only) LANs offer extensive communications functions for data interchange with various devices and stations. The internal 20 mA (TTY) interfaces and the CP modules additionally permit point-to-point connections, for instance, to
- Printers
- Terminals
- Personal computers
- Other programmable controllers.

Dimensions

The S5-90U and S5-95U programmable controllers are distinguished by their low space requirement. They can be used even in places too small for accommodating a conventional control consisting of contactors and relays. They are thus the ideal solution if a controller for a small control task must additionally be fitted in a control cabinet already containing a complete configuration.
The two PLCs can also be operated without any I/O modules. They constitute, of course, the most economical solution with regard to space requirements if the onboard I/Os are sufficient for implementing the control task.
The number of bus units used for external I/Os determines the space requirement.

Table 1-1. Dimensions

Programmable Controller		Width	Height	Depth
S5-90U programmable controller		145 mm	135 mm	97 mm
S5-95U programmable controller		145 mm	135 mm	146 mm
Bus unit with two I/O modules, with terminal block for	screw-type connection	91.5 mm	162 mm	137.8 mm
	crimp snap-in connection	91.5 mm	135 mm	137.8 mm

Mounting

The S5-90U can be mounted directly on walls or mounting plates. For this purpose, you need four **wall brackets** that can be pushed into the four openings on the rear of the casing and then mounted on the wall using screws.
The S5-95U snaps onto a 35 mm **standard mounting rail** which also accommodates the bus units for the external I/O modules. Optionally, the S5-90U can also be fitted on a 35 mm standard mounting rail.

Power Supply

When configuring a system or plant, you have to make sure the PLC is provided with the supply voltage required.
The S5-90U can be connected directly to the 115/230 V AC mains supply.
The S5-95U can be connected directly to a 24 V DC voltage supply. Power supply modules providing 1 A to 10 A (at 24 V) are available for connection to 115/230 V AC.

PID Controller

Many applications require PID control functions in addition to the usual control tasks. For this purpose, the operating system of the S5-95U has a PID controller which can be called up from the program. The PID controller forms an integral part of the PLC's operating system and therefore takes up no space in the user memory.

Standard Function Blocks

Besides the performance capabilities of a program, programming overheads are of great importance. Standard function blocks including standardized program structures for recurrent, usually complex functions can be loaded in the S5-95U. These software blocks can easily be linked into the program and facilitate the task of programming considerably.

Table 1-4. Software Overview

Software Overview	S5-90U	S5-95U
User memory (1 statement ≙ 2 bytes)	4 KB	16 KB
Execution time for 1024 binary statements	2 ms	2 ms
Flags (512 retentive)	1024	2048
Counters (8 retentive)	32	128
Timers	32	128
Program organization:		
• Structured programming	Yes	Yes
• Interrupt-driven program execution	Yes	Yes
• Time-controlled program execution	No	Yes
• PID controller	No	Yes
• Standard function blocks	No	Yes

In addition to process control, production processes often require supplementary functions, such as closed-loop control or communication with I/Os. Special function modules are available for these tasks.

Intelligent I/O Modules (IPs)

Intelligent I/O modules process open-loop and closed-loop control functions and positioning tasks mainly autonomously. They can thus offload the CPU of the PLC.

Communications Processors (CPs)

Communications processors enable point-to-point connections between the PLC and printers, peripherals or other computers via integral serial interfaces. They also permit interfacing with the SINEC L1 LAN.

Operator Control and Process Monitoring Equipment (TDs, OPs)

Processes and functions in your plant can be visualized with the help of operator control and process monitoring equipment especially tuned to SIMATIC S5 programmable controllers. Text displays (TDs) can be used for process monitoring; operator panels (OPs) enable spontaneous intervention in the process if necessary.

Communications

Complex applications sometimes make it necessary for the programmable controller to communicate with other PLCs or peripherals. SIMATIC S5 PLCs offer two possibilities:
- Point-to-point connections or
- Networking via SINEC L1 and SINEC L2 LANs.

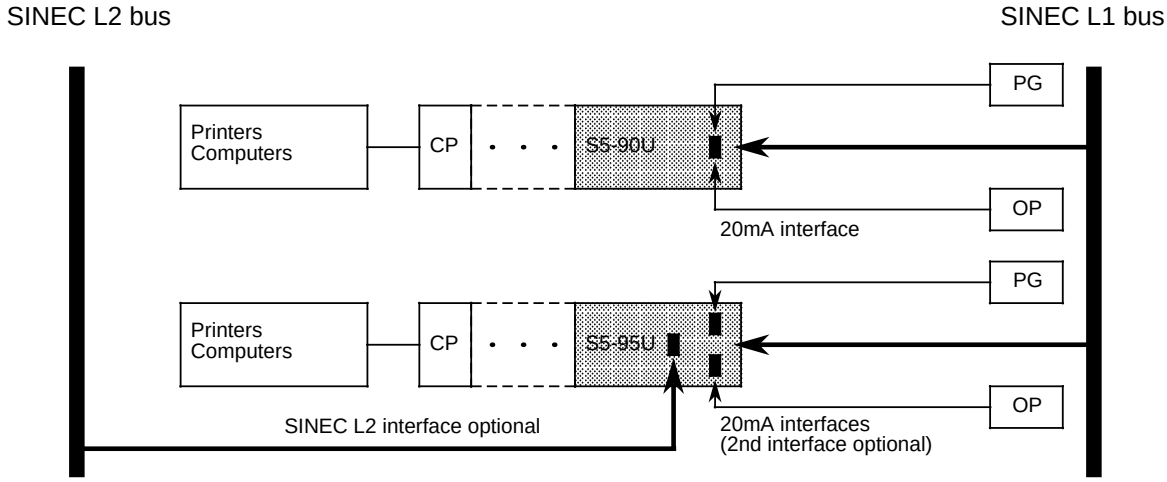

Figure 1-2. Communications Capabilities

Point-to-point connections are the ideal solution for connecting up only two devices. They are both economical and very efficient. The integral 20 mA (TTY) interface (programmer interface) can be used to connect a programmer (PG) or operator panel (OP).

The optional second serial interface (20 mA) of the S5-95U permits the simultaneous connection of programmers and operator panels. Additionally, the following devices can be linked:
- Other SIMATIC PLCs (SINEC L1 protocol, S5-95U as point-to-point master)
- Siemens devices (3964(R) protocol) or
- Third-party devices (ASCII protocol).

Communications processors (CPs) offer additional communications possibilities.
If more than two devices are to be interconnected, the use of a LAN is recommendable. The low-cost **SINEC L1 LAN** for applications that are not critical with regard to time can connect devices over distances of up to 50 km via a four-wire cable. It can easily be expanded for a maximum of 31 stations.
S5-90U and S5-95U programmable controllers can be connected as slaves to this LAN via the integral 20 mA (TTY) interface (programmer interface) or the CP 521 SI communications processor.

The S5-95U is optionally available with SINEC L2 interface. **SINEC L2** is the LAN type required for the lower and medium-range cell and field levels in industrial environments and conforms to the PROFIBUS standard (DIN 19245).
The open LAN architecture permits the connection of non-Siemens field devices. However, it is also possible to link S5-95U PLCs only.
The S5-95U with SINEC L2 interface can communicate both as active and passive station on the bus.

Conventional controls using relays or contactors are hardwired. Their functions are implemented by wiring the switching elements. If the control task changes, time-consuming modifications of the wiring have to be made.
In a programmable controller, however, rewiring is taken over by the program. Modifications of functions, testing and start-up are thus considerably facilitated.

STEP 5 programming language

It enables the first-time user to become quickly familiar with PLC technology. The SIMATIC PLCs can be programmed using the STEP 5 language. STEP 5 is easy to comprehend and makes developing of programs user-friendly, flexible and economical.

Methods of representation

STEP 5 features four methods of representation:
- Statement list (STL)
- Control system flowchart (CSF)
- Ladder diagram (LAD)
- GRAPH 5, GRAPH Mini.

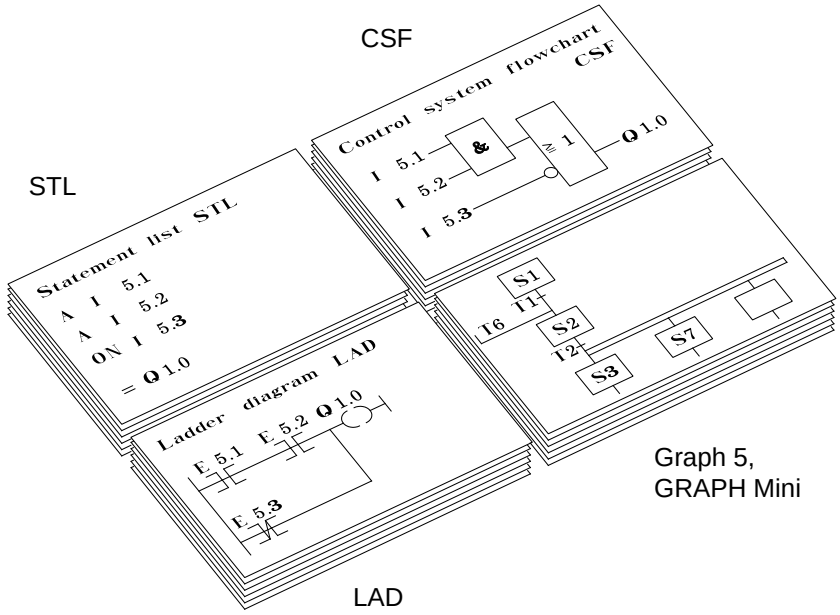

Figure 1-3. STEP 5 Programming Language

The **statement list** uses mnemonics for statements.
The **control system flowchart** is ideal for those who prefer the logic representation of machine functions and processes.
If you are accustomed to working with circuit diagrams, the use of the **ladder diagram** is recommendable.

The following packages are additionally available for programming sequential controls:
- **GRAPH Mini** and
- **GRAPH 5** (limited use only; for S5-95U only)