

White Paper

SIMATIC S5 to S7 Migration

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INTRODUCTION

This paper is written as a guide to assist SIMATIC S5 PLC users in migrating their current control systems to a SIMATIC STEP 7. It assumes that the reader has knowledge of both S5 and S7 hardware and software programs.

There could be many reasons why one would like to move from a S5 system to a S7 system. The end result might be a complete hardware change which would mean both a software and hardware conversion. It is also possible to reuse as much hardware as possible and then convert the software program. In most cases the hardware to be changed would start with the CPU. The CPU might be the only item changed, reusing the S5 I/O. A third but less popular possibility would be to change the I/O while keeping the S5 CPU. Since usually the I/O is the largest investment on a machine this strategy is less used.

For a small system (100U or 95U) the best approach would be to replace the entire system. The software program could probably be converted without too many errors using the conversion program included with the Step 7 programming package. For larger systems the amount of time and manual conversion will depend on the complexity of the original S5 system. Does it have several local racks? Does it have remote racks? Does it use ET 100 I/O? Does it use ET 200 I/O? Is it a redundant system? Is it a fail safe system? Is there new S5 hardware that is required for the migration, and is it still available? What IP's and CP's are used in the system? One can see from the above few questions that up front time is required for planning purposes before the migration is started.

This white paper will only touch on stand alone systems. Redundant and Failsafe systems will not be discussed since they would have to be completely redone to make them operate properly. This white paper will not cover the conversion of Protool or WinCC programs.

Section I of the paper covers three major conversion strategies to migrate from S5 to S7: migrate just the I/O, migrate the CPU, and the TIA migration. Section II of the paper covers special system options such as HMI's, Safety related equipment, and advanced networking where the S7 automation systems offer many more options than the S5 systems. Section III consists of several reference tables that clearly show comparisons and contrasts between S5 products and S7.products. References in Section III can help to plan which equivalent SIMATIC S7 products should be used to replace installed S5 equipment.

GLOSSARY

Becoming familiar with S7 requires learning new terminology. The following glossary lists several of the S7 terms used in this paper with a brief explanation.

Catalog – Use COM PROFIBUS or STEP 7 software for the initial selection of your hardware is selected from a 'catalog', or a tree-like structure that lists all possible HW product options. For instance all ET200M products are contained in the ET200M catalog folder from which individual models are selected as a part of your project configuration.

S7 Program- S7 program is a container for blocks, source files, and charts for S7 programmable modules which also contains the symbol table.

Step 7 Option Packages – STEP 7 Option packages are add-on software packages that are purchased separately, although they install and integrate into the basic STEP 7 programming environment and work together sharing symbols, adding enhanced features to the basic package, etc.. The STEP 7 "Professional" edition of the SW includes several of the option packages by default.

S7 Address – includes the address identifier and the physical memory location where the address is stored. Examples: Input I12.1; Memory Word MW25; Data Block DB3.

S7 Memory – includes RAM memory (M), inputs (I), outputs (Q), timers (T), counters (C), local memory (L), and elements of data blocks (DB), which can be accessed either absolutely or symbolically.

S7 Blocks – S7 Blocks are part of the user program and can be distinguished by their function, their structure, or their purpose. STEP 7 provides the following types of blocks:

- Logic blocks (FB, FC, OB, SFB, and SFC)
- Data blocks (DB, SDB)
- User-defined data types (UDT)

S7 Logic Blocks - In SIMATIC S7, a logic block is a block that contains part of the STEP 7 user program. The other type of block is a data block which contains only data. The following list shows the types of logic blocks:

- Organization block (OB)
- Function block (FB)
- Function call (FC)
- System function block (SFB)
- System function call (SFC)

TIA – Total Integrated Automation is the automation environment unique to Siemens products whereby each product suite (SW, CPU, I/O, HMI, drives, etc.) integrates seamlessly into an environment where symbols and tools work together to provide application benefits and advantages that would not otherwise be possible with stand alone products.

I. Migration Strategies

A. I/O Strategy

i. When to Use

When migrating the I/O from S5 to ET200 is a relatively low risk solution for upgrading portions of an automation system to the latest technologies, reducing field wiring, and reclaiming panel space for future expansion.

ii. Overview

Using ET200 I/O in combination with the S5 I/O requires you to:

- Make sure an IM 308C card is available for the main rack.
- Decide whether to convert all of the existing S5 I/O, or add new S7 I/O while retaining the existing S5 I/O. For new I/O requirements
- Select the ET200 I/O that corresponds to the application requirements.

After the above items are complete, the I/O configuration can be generated and downloaded to the IM 308C memory module. The necessary program logic code changes must then be generated. Many customers with large systems will replace the I/O in stages.

iii. Planning

Planning is a critical step towards the success of any project. The more complex a project is, the more planning is required to insure its overall success. Planning a conversion from S5 I/O to ET200 I/O requires: getting the right tools, choosing the ET200 hardware, making code changes, and documentation. Each of these planning requirements is briefly explained in the following sections 1 – 4.

1 Getting the right tools

Profibus I/O requires SIMATIC COM PROFIBUS software for the configuration of the I/O and its subsequent integration into the S5 programming software.

A IM 308C card with memory module will be required. A Siemens E Prom burner to download the Com Profibus program to the IM308C memory module is also needed. Be sure to check availability of the IM 308C.

2. Choosing the ET200 Hardware

In choosing the SIMATIC ET200 hardware, there are three possible implementation approaches. The first two approaches (explained in the following sections a and b) are chosen when S5 I/O and ET200 I/O are to be used together in a single system. The third approach (section c) is chosen when all the existing I/O in the system will be converted to ET200, along with additional ET200 I/O that may also be added.

a. Retaining the existing I/O

In regards to implementation effort, the easiest is to expand the I/O points simply by adding ET200 I/O to an existing S5 system. Using COM PROFIBUS software, the new ET200 I/O is selected from the ET200 catalog and the Profibus drops are populated.

It is suggested that ET200M be used as the I/O type although if desired the ET200S or ET200L could be used. In planning bear in mind that each Profibus drop can contain only 8 modules. It may require several drops at a physical location to obtain the required I/O points.

b. Converting the S5 Remote I/O to Profibus

The original remote I/O might be ET100U or remote racks interfaced using cables. In both cases to replace the I/O with S7 I/O the ET200 type must be used. Again the ET200M is the suggested choice. The Com Profibus software must be used to develop the file for the IM308C memory module.

The original I/O in the remote racks may be sizable, care must be taken to insure that only 8 new ET200M modules are used at each logical Profibus drop. It will probably be necessary to have several Profibus drops at each physical drop. It is suggested to start the remote drop addresses at 4. Step 7 usually reserves drop 1 for a OP, drop 0 for a programmer, drop 2 for a CPU, and drop 3 for a drive.

c. Converting the S5 I/O to ET200 I/O

This option has a more complex implementation, although it results in a more uniform and easier-to-maintain system since all the I/O will be of one type, the ET200. Any digital or analog I/O in the main rack will have to be replaced with ET200 I/O. The type ET200M is the suggested type. A remote drop address would be required for these modules. One might consider leaving the main rack I/O as S5 type unless failures have occurred and replacements are not available. Converting to ET200M doesn't seem to add anything except for standardization.

For the remote racks follow the information as documented in b. above.

Other options for ET200 I/O include ET200S and ET200L. These families of I/O include many specialty modules such as motor starters, VFD drives, and PLC Controllers that are already built into the unit. These compact I/O families make it easy to expand a machine where panel space is limited.

3 Making Code Changes

PLC code must be written to read the inputs and write the outputs of the newly added I/O. This is done through S5 in the same manner as with S5 I/O. As with any system that has newly added HW and SW, testing of the modified system should be planned as part of the implementation.

There probably are address changes of the old I/O when converted to S7 because of additional drops etc. The S5 software includes a software feature that allows "Rewire" of the address. Make use of this feature either on a single step or the entire revised I/O map. For ease of locating the I/O physically the I/O may be mapped using a different group for each

location. I.e. byte address's 10 through 19 for drop 4, 20 through 29 for drop 5, etc.

4 Documentation

The integrated program documentation capabilities of S5 can be used to incorporate the new I/O and code. Each rung of ladder logic can be described in detail. New I/O can be given descriptors (also called symbols or tags). Drawing for panel wiring must be updated to show both the new I/O and any changes to the existing I/O. Documentation is essential to maintaining the system.

iv. Execution

Good planning and documentation prior to the start of the effort is essential to a successful execution phase of the implementation. As explained in previous sections, the basic steps will include choosing the implementation method, and creating the Profibus configuration with the COM PROFIBUS software. Enter the new control code into the PLC program using S5. While programming, be sure to document the code. Test the I/O and the new control code. When testing and documentation have been completed, online production can be restarted.

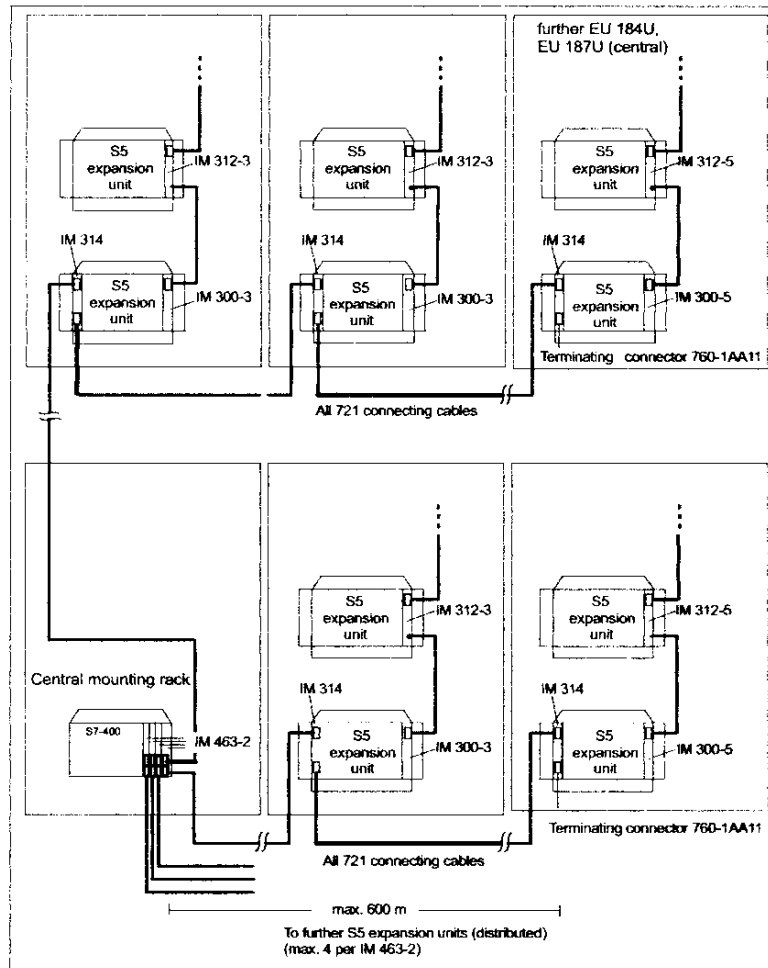
B. CPU Strategy

- i. When to use
There are obvious reasons for migrating from the S5 controller to an S7 controller. A primary reason may be due to insufficient memory in the S5 CPU. Other reasons include taking advantage of one or more of the many new technologies available in S7, moving to a Structured programming environment, or taking advantage of additional programming languages and/or S7 option packages.
- ii. Migration Steps
 1. Training, the first step
The first step is to attend a “*STEP 7 Programming I*” training course. These courses are scheduled periodically at Siemens training locations throughout the US. The schedule, syllabus, and locations can be found at <http://www.sea.siemens.com/sitrain>. Training will significantly reduce the learning curve on S7. There are also other courses such as the S7 PID Loop class covering the STEP 7 PID blocks, the optional Standard PID blocks and the optional Modular PID blocks. Taking this class will help in the deciding which S7 PID option package is the best fit for the application. With adequate training, it is easier to plan the conversion and successfully execute the conversion and migration plans.
 2. How to replace S5 CPU
The SIMATIC S7 PLC's are separated into 3 families, S7-200, S7-300, and S7-400. SIMATIC S7-200 is a compact micro programmable logic controller (PLC) designed for lowered end applications. With a system that has a very small program, it would be cost effective to use an S7-200 PLC rather than a S7-300 PLC. However, there is no software converter to use for a migration to a S7-200. SIMATIC S7-300 is a modular mini controller designed for mid range applications. SIMATIC S7-400 is designed for high end/ high performance applications. The critical factor is to choose the correct S7 CPU. There are two parameters to focus on. The first is CPU memory size. Choose an S7-300 or S7-400 CPU with a memory size equivalent to the memory size of your S5 Controller plus any additional memory to cover expansion or 20% excess capacity. The excess will vary depending on how much of the S5 CPU memory the program actually uses. The second important parameter is CPU I/O addressing capacity. Refer to Appendix A for a CPU reference chart that shows the amount of memory in the S5 CPU and the comparative S7 CPU.
 - a. Retaining the Existing I/O
To reuse the existing (non Profibus) I/O, ET200U could be used. S5-100U I/O is converted to ET200U by adding a IM318 interface card to the I/O rack. Unfortunately, these cards are mature and only available as spare part (not available for sale).
 - b. Interface Modules on the Main Rack

Since replacing the PLC CPU also requires changing the PLC entire back plane, any modules that were previously used in the S5 rack must also be replaced. This includes all I/O modules, function modules, and communication modules.

c. Interface Modules in Local Expansion Racks

In legacy S5 applications, there may have been more than one tier of modules (local expansion racks) connected to the main rack. In these cases, all the modules will have to be replaced with S7 modules. If using the S7-300 family, a similar architecture can be achieved using the IM360, IM361, and IM365 modules to expand the main rack. If using the S7-400 family, the IM460 and IM461 are used. Another possible thing to consider is to move the modules to a remote rack and use the IM463 interface as shown below. This might be cost effective since you could reuse the S5 I/O modules. The following sketch shows remote racks of S5 type connected to a S7 main rack through the IM463. Note this could be a possible setup for both intermediate performance and high performance systems. The IM463 interface is very easy to program. Very similar to a DP coupler in that it has S5 addresses assigned on one side and S7 addresses assigned on the other side. Experience has proven that the correct length of the 721 cable is important. There is a switch on the front of the IM463 module which must be set to the length of the 721 cable. There are 4 choices for length. Again, the other way to migrate the system would be to convert the remote racks and all of the modules to ET200M. It may be wise to make several estimates of hardware conversions, and choose the most cost effective approach.



Connection Variant for CCs and EUs via the IM 463-2 and IM 314

d. Function Modules and Communication Modules

In both S5 and S7 systems, the Function Modules (FM's) and Communication Processors (CP's) reside in the main rack. It is possible to reuse some of the FM's used in the intermediate and high end PLC's when using the S7-400 system. To accomplish this, new COM software and an adapter case is required. However, in researching this fact for this paper, it was discovered that the adaptor cases are no longer available and cannot be ordered anymore. Therefore, if you do not already own the adaptor cases, you will have to migrate your FM's. As for CP's, there is no possibility of reusing the S5 modules. The migration of these modules should be checked with the hotline personnel for the latest availability and usage.

e. Digital and Analog I/O

Appendix B and C provide a cross reference of S5 to S7 I/O. These cross reference tables are set up with the best

replacement items for most of the features of the original S5 module. Some of the features may not be in the choices therefore use the tables as a starting point but check the latest ST50 and ST70 catalogs once your list has been established. The tables were set up for ET200M remote racks. If replacement for the main racks or local expansion racks of an S7-400 system is desired, use the ST50 and ST70 catalogs directly.

- f. Robot Control SIROTEC RCM 1P
If a robot control system was used for 3 axis handling applications, one migration opportunity is the S7-300 CPU 317T (6ES7317-6TJ10-0AB0) with the option software package S7 Technology (6ES7864-1CC30-0YX0). The downloadable template "Simple 3D-Interpolation with cam disks"
<http://support.automation.siemens.com/US/view/en/21364022> covers exactly such applications for servo drives connected to the Profibus DP (mainly Siemens: SINAMICS S120, SIMODRIVE 611U, Master drives MC) or analog with the SIMATIC IM174 module (6ES7174-0AA00-0AA0, 4 channels incremental or SSI encoder inputs and 4 channels analog outputs or stepper outputs with pulse/direction interface).
- g. Closed Loop Control System SIMADYN D
Most of the SIMADYN D 16/32 bit applications could be migrated to the S7-400 application module FM 458-1DP (6DD16070AA2) with their expansion modules for communication and I/O. Programs written in the UNIX based STRUC L or STRUC G normally can be converted to a STEP 7/CFC/D7-SYS program with about 20% manual coding left. Depending of the former complexity of the closed loop control demands a second migration solution can be a SIMATIC TDC system.

After determining the correct CPU, it is necessary to obtain STEP 7 and the S7 optional programming packages that may be required. Again, the S7 training course is the quickest way to obtain a clear understanding of the S7 programming concepts.

All S7 projects require STEP 7. STEP 7 includes the S5 conversion tool. STEP 7 includes 3 basic programming languages, Ladder Logic, Function Block Diagram, and Instruction List. In addition to these languages, there are several option packages available to extend the capabilities of the basic software.

S7 SCL (Structured Control Language) is an S7 option package that looks similar to a high level “Pascal” like language. It is very useful for complex subroutines or advance math calculations.

S7 Graph is also a S7 option package. S7 Graph allows programming of sequential control systems graphically.

Another S7 option package to consider is S7 PLC Sim. PLC Sim is a simulator program that runs on the same PC where STEP 7 is running. The STEP 7 program output is transferred to PLC Sim and executes the code as though it were running and being monitored in the actual PLC. PLC Sim allows the program’s memory and I/O to be manipulated and tested prior to its real world installation. With PLC Sim, there is also an option for Visual Basic programs to be written to provide a custom user interface that can simulate the actual PLC operation visually.

STEP 7 and the S7 optional packages can be purchased and added as they are needed. If you plan on buying multiple options specified above, you may want to consider the STEP 7 Professional package which includes the options STEP 7, SCL, Graph and PLC Sim. Your Siemens representative can help you get the tools and training you need.

3. How to convert a program

There are two approaches to converting the S5 program logic to STEP 7 program logic. Both approaches require that the programmer performing the conversion attend at least one STEP 7 training course. The first approach is to use the S5 to S7 conversion tool that’s included with STEP 7. The other option is to manually convert the program. In the first section the S7 conversion tool is discussed.

a. Automatic Conversion

Preparing for a Program Conversion

Before starting to convert a S5 505 program, it is highly recommended that you attend “S7 Programming I” training classes offered by Siemens Energy & Automation.

The S5 to S7 Conversion tool is designed to convert S5 source programs into S7 Statement List text files suitable to be edited and/or compiled by the STEP 7 Program Editor. Any program converted must be carefully analyzed and tested after conversion to ensure proper operation. The primary requirement for conversion is a complete understanding of the application. All functionality required by the application must be verified. This must be done with caution as a prime safety consideration.

Any S5 programs to be converted must be accessible on the personal computer (PC) where the S5 to S7 Conversion tool is installed. S5

programs may be copied using standard DOS or Windows file copy techniques.

Overview of a Program Conversion

The S5 to S7 Converter reads information from the associated S5 files and creates text files containing the equivalent STEP 7 commands. Complete conversion is not possible because operand and architectural differences prohibit this. As a result, any program converting must be carefully analyzed and tested after conversion to ensure proper operation.

Similar to the S5 programming software, the STEP 7 programming package has several editors that allow several different programming languages to be used. The LAD (Ladder Editor), the STL/AWC (Statement List Editor), the FBD (Function Block Diagram), and the SCL (Sequential Control Language) are examples of different program/language editors available with the STEP 7 software. STEP 7 has the ability to toggle between editors such that the program logic can be displayed in either language simply by selecting to toggle from one language to another. The output text files created by the S5 to S7 conversion tool are used as input to STEP 7. The resulting output generated by the conversion tool, for the S5 Ladder logic is statement list (STL). When possible, the conversion tool constructs STL so that the rungs may be displayed graphically as ladders. When difficulties are encountered converting a S5 construct, the converter generates Warning Messages and enters them in the AWL / SCL and LIS files.

Steps In a Program Conversion

The S5 to S7 Converter program allows you to choose the S5 source file you want to convert, the destination directory, and several other options.

The conversion process creates text files and STEP 7 imports text source files. You might want to create a directory to hold both the S5 program and the conversion output. Each output directory only holds one conversion file set, since names used for output files are standardized.

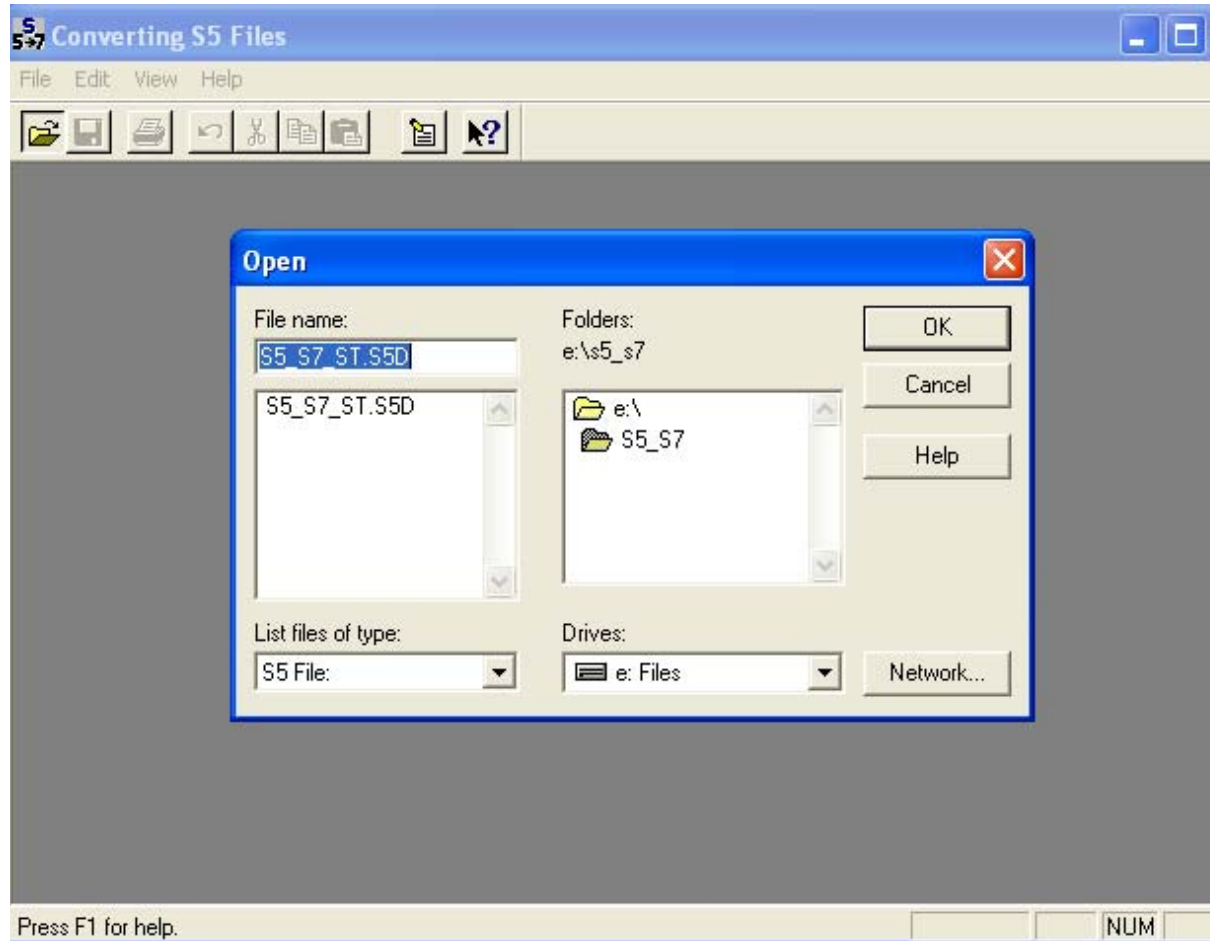
Once the S5 program is converted, you need to create a STEP 7 project to hold it. Use the SIMATIC Manager to import the conversion files from the destination directory into the source object of your STEP 7 project.

You may want to create the S7 project before the conversion. Once the project is created, insert the appropriate object, a SIMATIC 300 Station or a SIMATIC 400 Station. Open the S7 Hardware Station Configuration and configure the CPU and I/O. This will help you complete the I/O Mapping portion of the Converter.

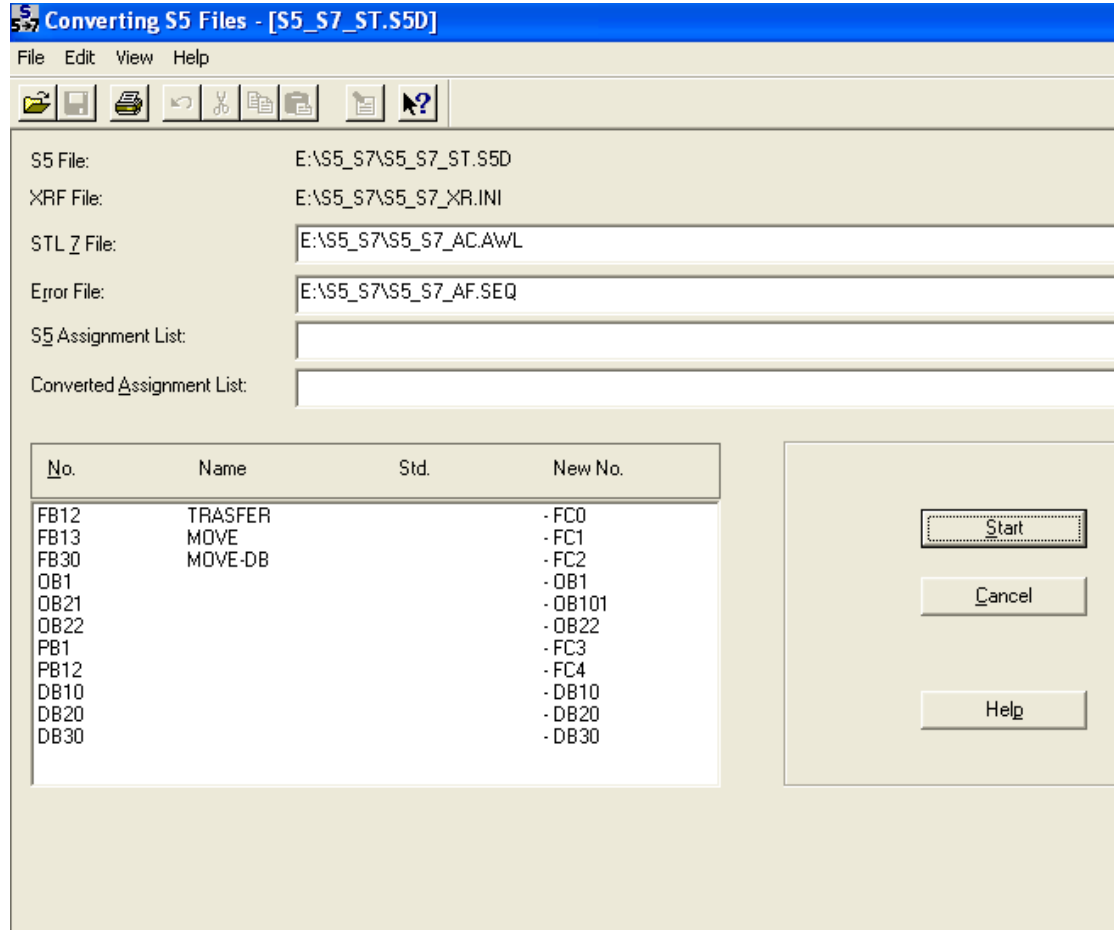
Before running the conversion software program, it is suggested that you print out the parameter blocks DB 1 and DX0 from the S5 program. The information (parameters) for the S7 program are loaded into the property

settings of the CPU out of the Hardware subdirectory. These blocks can then be deleted out of the S5 program. Below you will see several screen shots of the conversion using the convert program.

Open the SIMATIC > STEP 7 > Converting S5Files to begin the conversion. See *Figure 1*. The S5 file is chosen, after which the OK button is pressed.



After the OK button is pressed the program will list all the S5 blocks and provide the block number of the S7 converted block. The block number can be changed by you if desired. The location for the resulted converted blocks can also be changed. All the blocks will be converted into AWL files which can be reviewed using WordPad or some other ASCII program,.

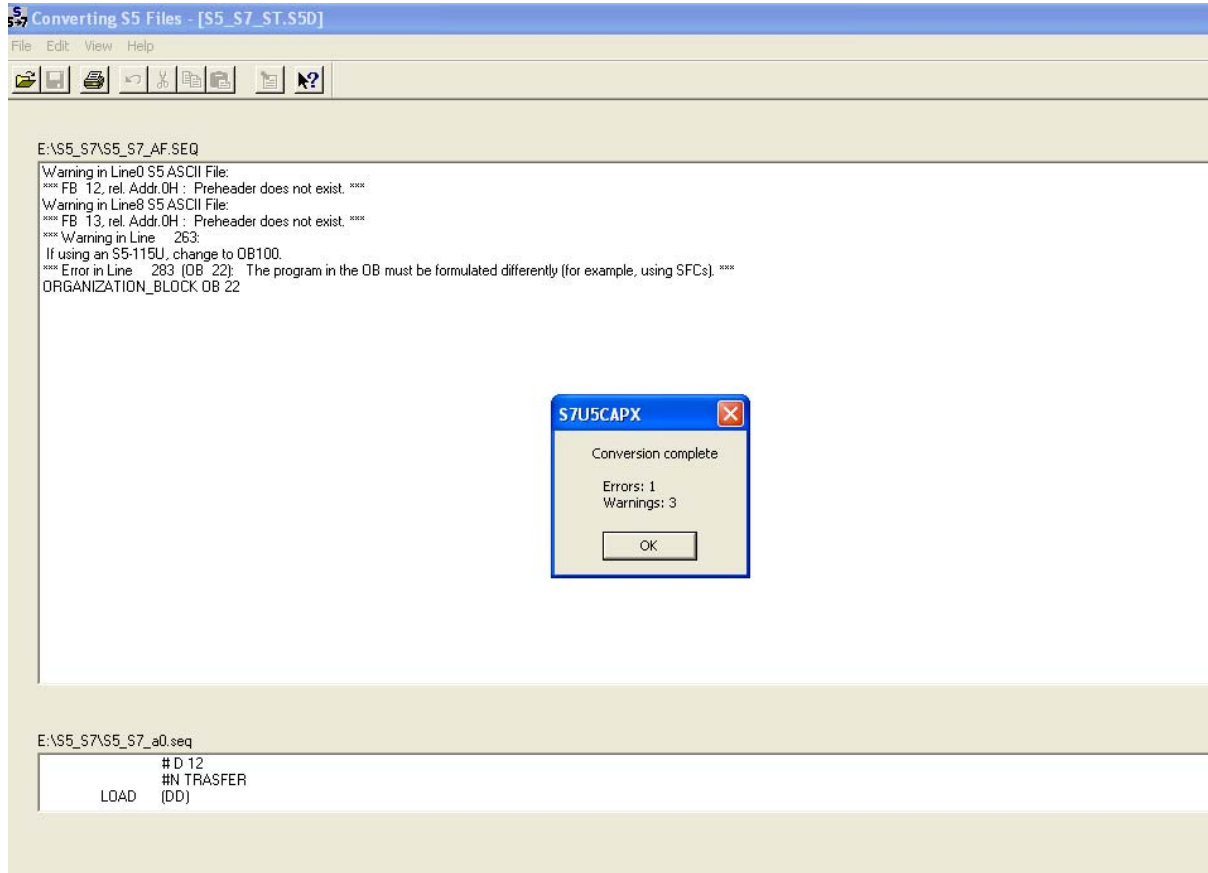


After the Start push button is pressed the conversion will take place. Errors and warnings are displayed in the end result screen. Depending on the actual the errors should be corrected. This might be done by revising the Step 5 blocks, but usually the easiest thing to do is manually create the S7 block to functionally do what the original S5 block was doing. The corrected AWL files can be placed in the SOURCE folder of the new S7 project, compiled and the result blocks will be made as Statement List blocks in the Blocks Folder of the Step 7 project.

S5 File: E:\S5_S7\S5_S7_ST.S5D
 XRF File: E:\S5_S7\S5_S7_XR.INI
 STL File: E:\S5_S7\S5_S7_AC.AWL
 Error File: E:\S5_S7\S5_S7_AF.SEQ
 S5 Assignment List:
 Converted Assignment List:

No.	Name	Std.	New No.
FB12	TRASFER		- FC0
FB13	MOVE		- FC1
FB30	MOVE-DB		- FC2
OB1			- OB1
OB21			- OB101
OB22			- OB22
PB1			- FC3
PB12			- FC4
DB10			- DB10
DB20			- DB20
DB30			- DB30

S7U5CAPX
 E:\S5_S7\S5_S7_AC.AWL
 File already exists. Overwrite?
 Yes No



The I/O addresses might have to be adjusted if a change of I/O had been made. The Rewire Feature of the Step 7 software can be used to accomplish this function.

b. Manual Conversion

As indicated in the Automatic section above one would probably use the automatic conversion and then manually convert blocks that had many errors in them. There is a library section of canned blocks that give many of the S5 functions and should be looked at as possible starting point for needed blocks.

C. TIA Strategy

- i. When to use
A TIA or **Totally Integrated Automation** Strategy is used on new installations similar to previous SIMATIC S5 installations. With TIA, SIMATIC STEP 7 is the programming environment, SIMATIC S7 is the controller and ET200 is the I/O used. This is applicable for new installations and OEM equipment. It combines the application knowledge from the SIMATIC S5 with the new technologies of SIMATIC S7

- ii. Migration Steps
The Migration steps are similar to the steps outlined in this document. Refer to Appendix A to select the CPU. Refer to appendix B and C to cross reference the SIMATIC S5 I/O to ET200 I/O.

Program conversion can be accomplished with the S5 to S7 Converter or reprogramming in STEP 7.

II. Special Situations

A. HMI

If the S5 system had Siemens Operator Panels connected to the S5 CPU, there will be several Data Blocks no longer required and these can be deleted. Their also will be a FB that can be deleted. The FB number will depend on how the connection was made i.e. AS511, Ethernet, Profibus etc. a review of the Profibus manual would be a way to check on this. The Operator Panel connection to the S7 CPU is done behind the scenes using S7 functions and no code is required. There are drivers for the S7 that allow for connections through MPI, Profibus and Ethernet. Once the S7 symbols have been converted they can very easily used by the new ProTool program if the Operator Panel is integrated into the Step 7 project. It is possible to copy some of the pictures, but you may find out that it is easier to start from scratch taken advantage of new features of ProTool or WinCC Flex.

Again with WinCC (SCADA) (**Supervisory Control And Data Acquisition**) there are drivers for all the possible connections you might want to use. If the WinCC is integrated then the Symbols can be used as tags making it easier to convert the SCADA over to S7 PLC

B. Safety

Safety means protecting personnel, equipment and environment from potential safety hazards. Hazards arising from functional faults must be prevented before they occur. Safety Integrated is Siemens safety module in the world of Totally Integrated Automation and stands for greater cost effectiveness, flexibility and safety. The complete Safety Integrated safety concept can be seamlessly integrated in standard automation and offers a one-stop range of Siemens products to cover all requirements. Consult your Siemens representative for assistance.

C. PROFINET - The open industrial Ethernet standard (PTO) (**Profibus Trade Organization**)

Profinet brings together all aspects of automation including; distributed IO, motion control, distributed automation and connectivity to management systems. Consult your Siemens representative to see what Profinet offers.

III. Appendix

A. CPU cross-reference Charts

S5 CPU	S5 Max Memory	Initial S7 CPU to consider	Working Memory of S7 CPU
Low End PLCs			
6ES5 090-8MA01	4KB	6ES7 312-5BE03-0AB0	32KB
6ES5 095-8MA03	16KB	6ES7 313 5BF03-0AB0	64KB
6ES5 095-8MB02	16KB	6ES7 313-6CF03-0AB0	64KB
6ES5 095-8MC01	16KB	6ES7 313-6BF03-0AB0	64KB
6ES5 095-8MD01	16KB	6ES7 313-6CF03-0AB0	64KB
6ES5 095-8ME01	16KB	6ES7 313-6CF03-0AB0	64KB
6ES5 095-8FB01	16KB	6ES7 315-6FF01-0AB0 (*safety PLC, not redundant)	128KB
6ES5 100-8MA02	2KB	6ES7 312-1AE13-0AB0	32KB
6ES5 102-8MA02	4KB	6ES7 312-1AE13-0AB0	32KB
6ES5 103-8MA03	20KB	6ES7 314-6CG03-0AB0	96KB
Intermediate PLCs			
6ES5 941-7UA11		6ES7 315-2AG10-0AB0	128KB
6ES5 941-7UB11	18KB	6ES7 315-2AG10-0AB0	128KB
6ES5 942-7UA11		6ES7 315-2AG10-0AB0	128KB
6ES5 942-7UB11	42KB	6ES7 315-2AG10-0AB0	128KB
6ES5 942-7UF15	32KB	6ES7 315-6FF01-0AB0	128KB
6ES5 942-7UH11	32KB	6ES7 414-4HJ04-0AB0	768KB
6ES5 943-7UA11		6ES7 315-2AG10-0AB0	128KB
6ES5 943-7UB11	48KB	6ES7 315-2AG10-0AB0	128KB
6ES5 943-7UA21		6ES7 315-2AG10-0AB0	128KB
6ES5 943-7UB21	48KB	6ES7 315-2AG10-0AB0	128KB
6ES5 944-7UA11		6ES7 315-2AG10-0AB0	128KB
6ES5 944-7UB11	96KB	6ES7 315-2AG10-0AB0	128KB
6ES5 944-7UA21		6ES7 315-2AG10-0AB0	128KB
6ES5 944-7UB21	96KB	6ES7 315-2AG10-0AB0	128KB
6ES5 945-7UA13	256KB	6ES7 317-2AJ10-0AB0	512KB
6ES5 945-7UA23	384KB	6ES7 317-2AJ10-0AB0	512KB
High End PLCs			
6ES5 921-3UA11		6ES7 412-2XJ05-0AB0	512KB
6ES5 922-3UA11	86KB	6ES7 412-2XJ05-0AB0	512KB
6ES5 928-3UA21	110KB	6ES7 414-2XJ05-0AB0	1MB

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6ES5 928-3UB21	110KB	6ES7 414-2XJ05-0AB0	1MB
6ES5 946-*****		6ES7 416-2XN05-0AB0	5.6MB
6ES5 947-*****		INCLUDED IN CPU 416 ABOVE	
6ES5 948-3UA11	640KB	6ES7 416-2XN05-0AB0	5.6MB
6ES5 948-3UA21	1664KB	6ES7 417-4XT05-0AB0	30MB
6ES5 948-3UR12	640KB	6ES7 414-4HJ04-0AB0	1.4MB
6ES5 948-3UR22	1664KB	6ES7 417-4HL04-0AB0	20MB

B. S5 115U to ET200M I/O Cross-reference Chart

S5 Product	Description	S7 - 300 / ET200M Product	Comment
6ES5 420-7LA11	32 DI 24V DC non-float	6ES7 321-1BL00-0AA0	
6ES5 430-7LA12	32 DI 24V DC Group of 8	6ES7 321-1BH02-0AA0	
6ES5 431-7LA11	16 DI 24/48 V DC Group of 4	6ES7 321-1CH00-0AA0	
6ES5 432-7LA11	16 DI 48/60 V Group of 4	6AG1 321-1CH20-2AA0	
6ES5 435-7LA11	16 DI 115 V AC Group of 1	6ES7 321-1FF10-0AA0	8 Point module
6ES5 435-7LB11	16 DI 115 V AC Group of 2	6ES7 321-1FF01-0AA0	8 Point module
6ES5 435-7LC11	8 DI 115 V AC Group of 1	6ES7 321-1FF10-0AA0	
6ES5 436-7LA11	16 DI 230 V AC Group of 4	6ES7 321-1FH00-0AA0	
6ES5 436-7LB11	16 DI 230V AC Group of 2	6ES7 321-1FF01-0AA0	8 Point module
6ES5 436-7LC11	8 DI 230V AC Group of 1	6ES7 321-1FF10-0AA0	
6ES5 441-7LA12	32 DQ 24V DC 0.5 a non-float	6ES7 322-1BL00-0AA0	
6ES5 451-7LA11	32 DQ 24V DC 0.5 amp	6ES7 322-1BL00-0AA0	
6ES5 451-7LA21	32 DQ 24V DC 0.5 amp	6ES7 322-1BL00-0AA0	
6ES5 453-7LA11	16 DQ 24/60V DC 2 amp		
6ES5 454-7LA12	16 DQ 24V DC 2 amp	6ES7 322-1BF01-0AA0	8 Point module
6ES5 454-7LB11	8 DQ 24V DC 2 amp	6ES7 322-1BF01-0AA0	
6ES5 455-7LA11	16 DQ 48/115V DC	6AG1 322-1CF00-2AA0	8 Point module
6ES5 456-7LA11	16 DQ 115/230V AC	6ES7 322-1FF01-0AA0	8 Point module
6ES5 456-7LB11	8 DQ 115/230V AC	6ES7 322-1FF01-0AA0	
6ES5 457-7LA11	32 DQ 24V DC 100ma	6ES7 322-1BL00-0AA0	
6ES5 458-7LA11	16 DQ Relay 30V DC	6ES7 322-1HH01-0AA0	
6ES5 458-7LB11	8 DQ Relay 250V AC	6ES7 322-1HF01-0AA0	
6ES5 458-7LC11	16 DQ Relay 230V AC	6ES7 322-1HH01-0AA0	
6ES5 482-7LA11	16 DI Source, 16 DQ Source	6ES7 321-1BH50-0AA0	Source In no Out
6ES5 482-7LF11	16 DI Sink, 16 DQ Source		
6ES5 482-7LF21	16 DI Source, 16 DQ Sink		
6ES5 482-7LF31	8DI, 8 DQ Source or Sink	6ES7 321-1BH50-0AA0	Source In no Out
6ES5 485-7LA11	24 DI, 16 DQ 24V DC	6ES7 323-1BL00-0AA0	16 Point In 16 Point Out
6ES5 460-7LA13	8 Channel AI Float	6ES7 331-7KF02-0AB0	
6ES5 465-7LA13	16 Channel AI Non Float	6ES7 331-1KF01-0AB0	8 Channel
6ES5 470-7LA13	8 Channel AQ +-10V 0-20ma	6ES7 332-5HF00-0AB0	
6ES5 470-7LB13	8 Channel AQ +-10V	6ES7 332-5HF00-0AB0	
6ES5 470-7LA13	8 Channel AQ 1-5V 4-20ma	6ES7 332-5HF00-0AB0	

C. S5 135U & 155U to ET200 M I/O Cross-reference Chart

S5 Product	Description	S7 - 300 / ET200M Product	Comment
6ES5 420-7LA11	32 DI 24V DC non-float	6ES7 321-1BL00-0AA0	
6ES5 430-7LA12	32 DI 24V DC Group of 8	6ES7 321-1BH02-0AA0	
6ES5 431-7LA11	16 DI 24/48 V DC Group of 4	6ES7 321-1CH00-0AA0	
6ES5 432-7LA11	16 DI 48/60 V Group of 4	6AG1 321-1CH20-2AA0	
6ES5 435-7LA11	16 DI 115 V AC Group of 1	6ES7 321-1FF10-0AA0	8 Point module
6ES5 435-7LB11	16 DI 115 V AC Group of 2	6ES7 321-1FF01-0AA0	8 Point module
6ES5 435-7LC11	8 DI 115 V AC Group of 1	6ES7 321-1FF10-0AA0	
6ES5 436-7LA11	16 DI 230 V AC Group of 4	6ES7 321-1FH00-0AA0	
6ES5 436-7LB11	16 DI 230V AC Group of 2	6ES7 321-1FF01-0AA0	8 Point module
6ES5 436-7LC11	8 DI 230V AC Group of 1	6ES7 321-1FF10-0AA0	
6ES5 441-7LA12	32 DQ 24V DC 0.5 a non-float	6ES7 322-1BL00-0AA0	
6ES5 451-7LA11	32 DQ 24V DC 0.5 amp	6ES7 322-1BL00-0AA0	
6ES5 451-7LA21	32 DQ 24V DC 0.5 amp	6ES7 322-1BL00-0AA0	
6ES5 453-7LA11	16 DQ 24/60V DC 2 amp		
6ES5 454-7LA12	16 DQ 24V DC 2 amp	6ES7 322-1BF01-0AA0	8 Point module
6ES5 454-7LB11	8 DQ 24V DC 2 amp	6ES7 322-1BF01-0AA0	
6ES5 455-7LA11	16 DQ 48/115V DC	6AG1 322-1CF00-2AA0	8 Point module
6ES5 456-7LA11	16 DQ 115/230V AC	6ES7 322-1FF01-0AA0	8 Point module
6ES5 456-7LB11	8 DQ 115/230V AC	6ES7 322-1FF01-0AA0	
6ES5 457-7LA11	32 DQ 24V DC 100ma	6ES7 322-1BL00-0AA0	
6ES5 458-7LA11	16 DQ Relay 30V DC	6ES7 322-1HH01-0AA0	
6ES5 458-7LB11	8 DQ Relay 250V AC	6ES7 322-1HF01-0AA0	
6ES5 458-7LC11	16 DQ Relay 230V AC	6ES7 322-1HH01-0AA0	
6ES5 482-7LA11	16 DI Source, 16 DQ Source	6ES7 321-1BH50-0AA0	Source In no Out
6ES5 482-7LF11	16 DI Sink, 16 DQ Source		
6ES5 482-7LF21	16 DI Source, 16 DQ Sink		
6ES5 482-7LF31	8DI, 8 DQ Source or Sink	6ES7 321-1BH50-0AA0	Source In no Out
6ES5 485-7LA11	24 DI, 16 DQ 24V DC	6ES7 323-1BL00-0AA0	16 Point In 16 Point Out
6ES5 460-7LA13	8 Channel AI Float	6ES7 331-7KF02-0AB0	
6ES5 465-7LA13	16 Channel AI Non Float	6ES7 331-1KF01-0AB0	8 Channel
6ES5 470-7LA13	8 Channel AQ +-10V 0-20ma	6ES7 332-5HF00-0AB0	
6ES5 470-7LB13	8 Channel AQ +-10V	6ES7 332-5HF00-0AB0	
6ES5 470-7LA13	8 Channel AQ 1-5V 4-20ma	6ES7 332-5HF00-0AB0	