



*Advanced PLC Program Development
and Documentation Software*

PLC-2 to SoftPLC Program Conversion

Application Note No. TD-AN-11.25

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1. CONVERSION PROGRAM OVERVIEW

1.1 INTRODUCTION

The PLC/PLC-2 to SoftPLC Program Conversion is an utility program that can be used to take an existing TOPDOC PLC-2 program with (or without) documentation and create a program that is equivalent in function to the original, but in TOPDOC SoftPLC format. Programs for the 1774 PLC and all PLC-2 processors are supported by this utility.

The Conversion translates the ladder logic, data table, address labels, and rung comments simultaneously. The result is a documented and operational program that can usually be loaded directly into a SoftPLC. A text file (named <filename>.TRX) containing user information pertaining to address associations, rung number correlations, and other information about the converted logic is also generated. Although every effort has been made to make the conversion as complete as possible, there may be some things that program may not convert.



NOTE: It is important that you read the <Filename> .TRX File before attempting to use the converted program, as it will contain information concerning the conversion, including messages and warnings about items that could not be converted.

1.2 INSTALLING THE CONVERSION UTILITY

Place the conversion disk in your floppy drive and copy the contents to the \TDZ directory (or the directory in which you installed TOPDOC for SoftPLC) on your hard drive using the DOS copy command.

For example: `A:>copy *.* c:\tdz\`

1.3 LOADING THE PROGRAM CONVERTER

The Conversion Utility (tr25.exe) is a DOS program. You should boot your computer with DOS, not try to run this utility from a DOS window under Windows. Follow the steps in Figure 1-1 to load the Conversion Utility.

DESCRIPTION	WHAT YOU TYPE
1. Log onto your hard drive.	c: [Enter]
2. Go into the directory.	cd TDZ [Enter]
3. Load the Conversion	tr25 [Enter]

Figure 1-1
Loading the Converter

After you perform the steps in Figure 1-1 you will see a window requesting entry of the current date. The current system date is displayed and you may simply hit [Enter] to continue. Otherwise enter the digits corresponding to the date.

2. PROGRAM CONVERSION

2.1 PREPARING FILES FOR CONVERSION



NOTE: It is important that files to be converted first be verified in TOPDOC PLC-2. Only after a file is verified, does it become a candidate for conversion.



NOTE: Prior to running the conversion utility, a current cross reference file must exist for the PLC-2 program. If the cross reference information is out of date, the conversion utility will ask you to run the cross reference first.

The program will prompt for the name of the PLC-2 program which is to be converted. Enter the appropriate <path> and <filename>.

After the PLC-2 filename is entered, another window will be displayed and you will be prompted to enter the output file <path> and <filename> for the resulting SoftPLC program.

2.2 I/O RACK RELOCATION

One of the inherent differences between the PLC-2 and SoftPLC is the system used to number the racks. The PLC-2 does not have a rack 0 and SoftPLC does. To properly relocate all of the pertinent data, the PLC-2 rack numbering system may have to be modified. When converting a PLC-2 program, three rack reassignment options will be given:

- 1) Map the highest numbered rack in the PLC-2 program into the SoftPLC's rack 0.
- 2) Shift all I/O racks down by one (i.e. Rack 1 = Rack 0, Rack 2 = Rack 1).
- 3) Leave all current addressing alone (i.e. Rack 0 is empty).

Figure 2-1 illustrates the two options that may be used to reconfigure the numbering system used on the PLC-2.

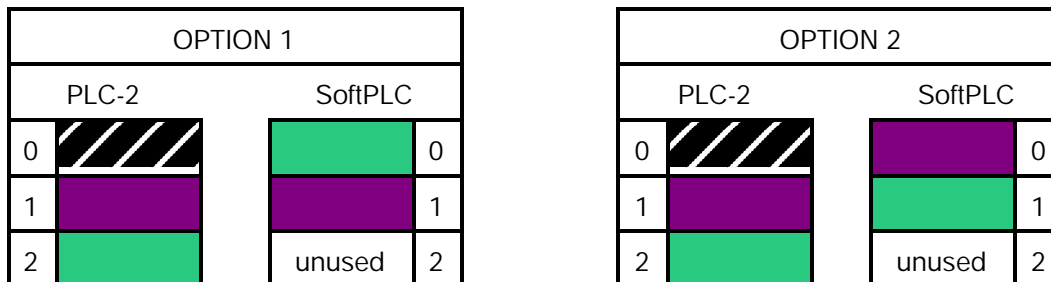


Figure 2-1
Rack Relocation

After you make your selection, the conversion process begins automatically.

2.3 PROGRAM CONVERSION

The conversion is accomplished in three passes. The first pass handles block transfers, the second pass relocate data table information, and the third pass performs the actual rung translations. While the conversion is in process, a window will be displayed which contains information about the status of the translation. The current stage (1, 2, or 3) and the percent completed will be indicated. When the conversion is completed, the display window will indicate the number of rung comments which were converted, along with a message indicating that the conversion was completed successfully. At this point, striking any key will take you back to DOS.

If an error is detected in the PLC-2 program during conversion, a message will appear in the window indicating that the process was stopped, where the problem was encountered, and where to look for help. Interruption of the conversion process due to program error will not harm the PLC-2 program file. Output files will be covered in detail in Chapter 3.

3.0 CONVERSION OUTPUT

3.1 OUTPUT FILES

During the first phase of the PLC program conversion, two output files are generated in the TDZ\SPLC directory:

- 1) <FILENAME>.LOB
- 2) <FILENAME>.TRX

3.2 <FILENAME> .LOB FILE

This is the ladder and data table file that can be loaded into TOPDOC for SoftPLC. However, it may not be ready to run. There are many differences between the two types of PLC's and there may be items that will require your attention.

CAUTION: You should never download and try to run a converted file before examining it and understanding the new logic completely.

3.3 <FILENAME> .TRX FILE

This file contains various messages giving information about how the conversion was carried out, such as address associations and the rung number correlations. The .TRX file is located in the same directory as the .LOB file that was produced and has the same filename.

You may use any text editor or word processor that can read ASCII files to read/print the .TRX file.

3.4 .TRX FILE MESSAGES

The first section of the .TRX file contains messages concerning the conversion of certain PLC-2 instructions. These are usually PLC-2 instructions that are handled differently in the SoftPLC or don't have a comparable SoftPLC instruction. It also contains messages relating to any problems encountered during the actual translation of the instructions. The messages are generally self-explanatory and will contain enough information so that you can modify the SoftPLC program as needed and clear up any problems. Figure 3-1 is an example of the type of message that may be found in the .TRX file:

Changing the PLC-2 program to SoftPLC
Number of racks is 7
This is only for your information and is not an error.

Figure 3-1
.TRX Message

3.5 .TRX FILE ADDRESS ASSOCIATIONS

The second section of the .TRX file contains a listing of the address associations that have been made between the PLC-2 and the SoftPLC programs. The PLC-2 address will appear on the left margin with the corresponding SoftPLC address to the right.

PLC-2 counters may be assigned 3 different SoftPLC destinations.

- 1) Counters used in Block Transfer instructions will be relocated as SoftPLC Block Transfer Control blocks in a special integer file set aside for those control blocks.
- 2) PLC-2 counters used in file operations will be relocated as SoftPLC control elements (R6:XXX).
- 3) PLC-2 counters used as counter instructions will be relocated as counters (C5:XXX).

Messages concerning counters used in Block Transfers and files may be placed in the .TRX file, as mentioned in Section 3.4. Figure 3-2 is an example message issued when a counter is used in a file operation:

PLC-2 counter found in a file:
PLC-2 file #220, SoftPLC #N010:000
Warning: Bit references to this counter will be mapped
into the SoftPLC data file, not into the SoftPLC counter.

Figure 3-2
.TRX Message

Counters and timers in files are discussed in Section 5.4.

The following is a partial list of Address Associations as might appear in the .TRX file:

ADDRESS ASSOCIATIONS	
PLC-2 Address	SoftPLC Address
010/01	O:000/01
010/05	O:000/05
020/12	T004:003.ACC/10
033/03	N010:009/03
040/15	N010:014/13
050/10	N010:022/08
120/06	N009:000/13
123/12	B003/00
177/01	N011:018/01
320/12	N027:000/10
402/00	R006:001.POS/00
520/12	N013:080/10
602/00	R006:003.POS/00
2300/00	R006:002.LEN/00
2300/01	R006:002.LEN/01
6000/12	N023:000/10

3.6 .TRX FILE DEFAULT DATAFILE ASSIGNMENTS

The next section of the .TRX file is listed as Default Datafile Assignments. If there are block transfers in the PLC-2 program, then this section will indicate which SoftPLC datafile was assigned to the control block file.

If there are words found in the PLC-2 which are part of a larger structure, like a file or a counter, then this section will show which SoftPLC datafile was assigned to hold these "loose" words. The same information is given for "loose" bits if applicable. Figure 3-3 is an example of the Default Datafile Assignments section in the .TRX file:

Default datafile assignments in the SoftPLC
 SoftPLC datafile #9 used as default Block Transfer Control block file.
 SoftPLC datafile #7 used as default file for words.
 SoftPLC datafile #3 used as default file for bits.

Figure 3-3
 Default Datafile Assignments

3.7 .TRX FILE NEW RUNG INFORMATION

This section contains information about rungs added to the SoftPLC program that do not correspond directly to rungs that were in the PLC-2 program.

These new rungs are used in subroutines that help support some PLC-2 operations.

EXAMPLE: If a MUL instruction is used in the PLC-2 program, a subroutine will be added to the SoftPLC program to yield a two-word result similar to the PLC-2's output.

The following is a listing of rungs added to the SoftPLC program to support various PLC-2 instructions.

SoftPLC	P6/0 corresponds to the Multiply subroutine's 0 rung
SoftPLC	P6/1 corresponds to the Multiply subroutine's 1 rung
SoftPLC	P6/2 corresponds to the Multiply subroutine's 2 rung

Figure 3-4
.TRX File Subroutine Rungs Information

P6/0, 1, and 2 are the rung numbers of the subroutine rungs added by the conversion.

3.8 .TRX FILE NEW RUNG DATA TABLE LOCATIONS

This section lists locations in the SoftPLC program's data table which are used as work locations for the add-on subroutines. Also listed are data items that were added to the SoftPLC program that do not correspond to a PLC-2 program data item. Figure 3-5 is an example of a .TRX message pertaining to new rung data table work locations:

The following is a listing of the work locations in the SoftPLC program.

B003:536
N007:123
N007:124
F008:000
F008:001
N007:125
N007:126

Figure 3-5
.TRX File Work Locations

3.9 .TRX FILE LABEL ASSIGNMENTS

This section lists the assignments given to labels in the PLC-2 program. In the usage column, PF (program file) shows that the PLC-2 label was used as the target for a JSR instruction and that the label has been assigned to a program file in the SoftPLC.

If LBL appears in the usage column, then the label is used as the target of a JMP instruction, and the columns that follow will indicate the program file in which the label appears and the label number in that program file. The following table is an example of the File Label Assignments section in the .TRX file.

PLC-2 LABEL	PROGRAM FILE USAGE	SoftPLC LABEL	SoftPLC PROGRAM FILE
1	PF	3	0
2	PF	4	0
3	PF	5	0
4	PF	6	0
5	PF	7	0
6	PF	8	0
7	PF	9	0
8	PF	10	0
9	PF	11	0
10	PF	12	0
11	PF	13	0
12	PF	14	0
13	PF	15	0
14	PF	16	0
15	PF	17	0
16	LBL	10	10
18	PF	18	0
19	PF	19	0

3.10 .TRX FILE CORRESPONDING RUNG NUMBERS

The last listing in the .TRX file documents the PLC-2 rung numbers and the corresponding SoftPLC program file rung numbers. The following is an example of part of a .TRX file rung correlation section.:

PLC-2 Rung #	SoftPLC Program file / Rung #
0	2/0
1	2/1
...	...
11	2/11
12	2/12
13	2/13
14	2/14
15	2/15
16	2/16
17	2/17
18	2/18
19	2/19
20	2/20
21	2/21
22	2/22
23	2/23
24	2/24
25	2/25
26	2/26
27	2/27
28	2/28
29	2/29
30	2/30
31	2/31
32	2/32
33	2/34
34	2/35
35	2/36
36	2/37
37	2/38
38	2/39
39	2/40

4. ADDRESS DESCRIPTIONS AND RUNG COMMENTS

4.1 ADDRESS DESCRIPTIONS

The second phase of the conversion takes care of converting the address description database. The output of this phase is a SoftPLC address description database. If there are any problems during conversion, a text file named DBFERROR.LST will be created in the current directory.

The most common problem encountered in database conversion is active records for addresses that were not used in the PLC-2 program. Since there is no record for the reassignment of the PLC-2 address, these records are simply discarded.

These records are still in the Database however, and the Database utility (DBF5.exe) can be used to extract and merge these records with your new SoftPLC Database.

4.2 RUNG COMMENTS

The final phase of conversion will create a rung comment file for the SoftPLC program. The only problem that may be encountered here is if rung comments were unsynchronized in the PLC-2 program. Should this be suspected, the PLC-2 program needs to be brought into the TOPDOC PLC-2 Editor and saved again. A cross reference would also have to be done before beginning the conversion.

5. ADDITIONAL CONVERSION PROGRAM INFORMATION

5.1 BCD VALUES VERSUS BINARY

In general, the SoftPLC performs operations on binary values, as opposed to BCD, like the PLC-2. This conversion utility, where possible, recognizes that values in the PLC-2 program are being manipulated as arithmetic quantities, and will convert those values from BCD to binary. For example, counter and timer presets are converted to binary.

Messages will be issued to the .TRX file when bit references are made to a PLC-2 BCD word, because the operation may be different in the SoftPLC. Figure 5-1 is an example of a .TRX file message when a bit reference to a BCD word is encountered during the conversion:

Bit reference into a PLC-2 BCD value, do not expect the same behavior.
PLC Bit: 654/01, PLC-5 Bit R006:015 .Pos/01

*Figure 5-1
.TRX Bit References Message*

5.2 SUBROUTINE CONVERSION

Two facts need to be considered when addressing subroutine conversion:

- 1) The conversion utility recognizes the end of a subroutine in the PLC-2 program by the presence of an unconditional RET instruction.

- 2) It is legal in the PLC-2 to have more than one "point of entry" into a subroutine. In other words, the PLC-2 will permit a starting rung with a LBL and a few rungs down another LBL, both of which are followed by a terminating RET instruction.

In the PLC-2, either LBL is a valid target for a JSR instruction. TheSoftPLC program file which will be generated will include the first rung with the LBL up to the terminating RET instruction. The first LBL will be mapped as a SoftPLC SBR, and the second LBL will also be mapped as an SBR instruction, however, the SoftPLC does not support this configuration.

The SoftPLC subroutine will have to be broken into two smaller subroutines. Messages regarding this will be issued to the .TRX file. Figure 5-2 is an example of such a message:

JSR target LBL found in the "middle" of a subroutine.
 SoftPLC does not support jumping into the middle of a program file.
 The SoftPLC program generated will have to be edited to break the subroutine into smaller ones.
 The PLC-2 label is 072.
 The SoftPLC program file number is 21.

*Figure 5-2
Subroutine Message*

5.3 FILES IN REAL I/O SPACE

This conversion utility will stop with an error if any files are found that start in a real I/O image table and extend out of it. If the converter encounters this situation, the window will issue a message indicating that the process has stopped, what is causing the problem, and where to look for help.

5.4 FILES WITH TIMERS OR COUNTERS

SoftPLC counter and timer elements are composed of three words, and are separated into special file types. Thus, a PLC-2 file which contains counter or timer presets or accumulators will be broken up as the counters and timers are placed in their respective files.

Messages will be issued to the .TRX file when counters or timers are encountered in files, other than the counter which controls the block instruction, so that the SoftPLC program may be edited. Section 3.5 contains an example of a .TRX message when a counter is discovered in a file. Figure 5-3 is an example of a .TRX message if a timer is encountered in a file:

PLC-2 Timer found in a file.
 PLC-2 file C400, SoftPLC file R006:000
 PLC-2 timer: T400, SoftPLC timer: T004:000
 Warning: bit references to this timer will be mapped
 into the SoftPLC datafile, not into the SoftPLC timer.

*Figure 5-3
.TRX Timer Message*

5.5 BLOCK TRANSFER INSTRUCTIONS

The formats for Block Transfers in the PLC-2 and the SoftPLC are completely different. In the SoftPLC no I/O is involved in the transfer, thus bit references to the I/O bytes may behave differently. Also, the enable and done bits, which were in I/O space, are mapped into the control block for the Block Transfer instruction. If there is more than one Block Transfer read or write instruction for the same

Rack/Group/Module, then the enable and done bits will be mapped only to the first instruction's control block. A message will be issued to the .TRX file if a situation is detected in the program in which bit references may behave differently than expected. Figure 5-4 is an example of a message for this type of occurrence:

PLC-2 bit reference to an I/O byte controlled by a block transfer instruction. PLC-2 bit: 010/00.
Warning: behavior may not be similar.

*Figure 5-4
.TRX Block Transfer*

5.6 GET BYTE INSTRUCTION (GTB)

GET BYTE instructions are not supported.

5.7 IMMEDIATE INPUT (IIN)

The Immediate Input Instruction is an input instruction in the PLC-2 and an output instruction in the SoftPLC. Since the IIN instruction can be placed anywhere on the PLC-2 rung, the conversion "lifts" it out with the rung and places it on its own rung below the original rung. This configuration will need your attention.

5.8 DATA HIGHWAY PROGRAMMING

The PLC-2 Get, Get style of Data Highway Programming does not convert to MSG instructions. You will need to modify these rungs manually.