Software and System Products Division

APPLICATION NOTE

TITLE	**Profibus-DP Function Block for Siemens S7 PLC**		
PRODUCT:	UD70 with Profibus-DP Interface Mentor II with Profibus-DP interface Commander SE with Profibus-DP interface	**ISSUED:**	21 November 2001
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SUMMARY

A function block for the Siemens S7 PLC has been produced that will control cyclic and non-cyclic data communications between the PLC and Control Techniques Drive on the Profibus-DP network.

HARDWARE REQUIREMENTS

Siemens Simatic S7 PLC with 3xx CPU

Simatic S7 PC adaptor

SOFTWARE REQUIREMENTS

Simatic S7 Manager V3.0 or later

DETAILED INFORMATION

The FB73 block is designed to provide simple control of non-cyclic data. It also has the capability of controlling cyclic data as well if required.

It should also be used if the cyclic data format has consistency.

The terms "**IN data**" and "**OUT data**" refer to the data as seen by the PLC. Therefore, "**OUT data**" goes *OUT* of the S7 PLC to the network, while "**IN data**" comes *IN* from the network to the S7 PLC.

Note

This application note assumes that the user is familiar with the PLC ladder logic instruction set and PLC register structures.

STEP-BY-STEP GUIDE

Un-archiving the Function Block

The function block for the S7 is supplied as a compressed project file. This file must be expanded in the correct location for Simatic Manager to recognise the new project.

1. Launch the Simatic Manager software. Once loaded select **File** from the toolbar followed by **Retrieve…** from the drop down menu.
2. Select the file **CTSSPD_S7.ARJ** and click **Open**
3. Select the target directory / folder as **SIEMENS\STEP7\S7PROJ** and click **OK**
4. Any existing files with the same name will be overwritten. After the file has been retrieved, a message as seen in figure 1 will appear. Select as appropriate.

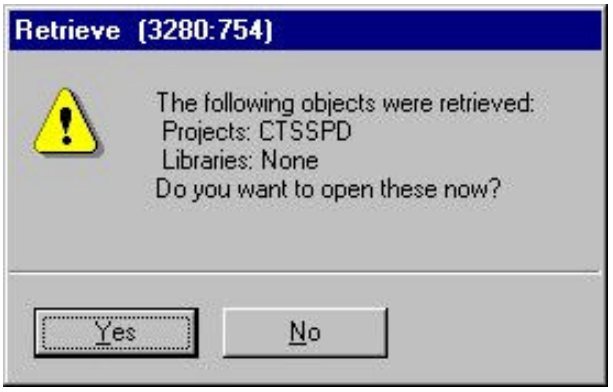

Fig 1

Inserting the FB73 block into a Project

The CTSSPD project should **NOT** be used as a base for new user projects. Always create a new project, and copy the CTSSPD function blocks into the new project.

1. Select **File** from the toolbar, followed by **Open** from the drop down menu and choose the **CTSSPD** file.
2. Expand all of the icons/folder in the project file list until the 3 function blocks are seen in the right hand section of the window. See figure 2.

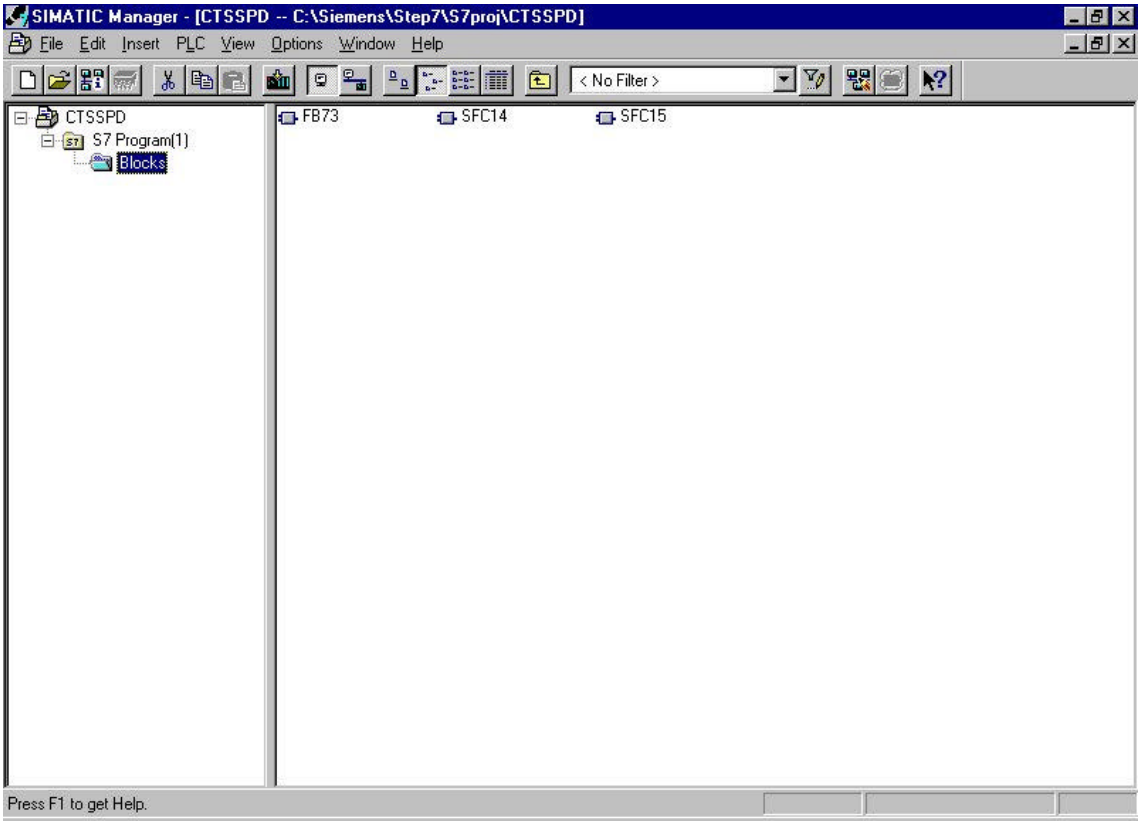

Fig 2 CTSSPD Function blocks

3. Select / highlight the **FB73** icon then select **Edit** from the toolbar followed by **Copy**.
4. Close the CTSSPD project and paste (select **Edit** from the toolbar followed by **Paste**) in to a new or existing project.

Profibus Data Transfer Type

Operation of the Profibus-DP network is controlled automatically by the system in the PLC. The transfer of data values over the network must be initiated form the PLC program itself. There are two ways of transferring data between the PLC and the remote nodes, the choice of which depends up on the nature of the application.

1. **Consistent Data** transfer ensures that all data bytes are written to the data bus at the same time. This can be particularly relevant if a 32-bit reference is to be written, as it prevents data skew. This occurs when the data high and data low words of a reference are not transferred to the bus at the same instant. Consequently, special function calls within the PLC must be used to ensure consistency of data is maintained. If this data transfer format is to be used then the special function call within the PLC must be used. These are **SFC14** to perform a write and **SFC15** to perform a read.
2. **Non-consistent Data** transfer can be used if there is no need to ensure new references are transferred to the bus together. This format allows data values to be transferred directly to and from the peripheral I/O registers.
3. Also refer to the **Siemens S7 PLC with Profibus-DP** applications note for basic setting up.

Using the FB73 block in a Program

1. To insert the FB73 in to a program add a new network / ladder rung.
2. Open the catalogue window by selecting **View** from the toolbar followed by **Catalogue**.
3. Expand the function block icon, then drag and drop the **FB73** block to the new network / ladder rung. See figure 3.

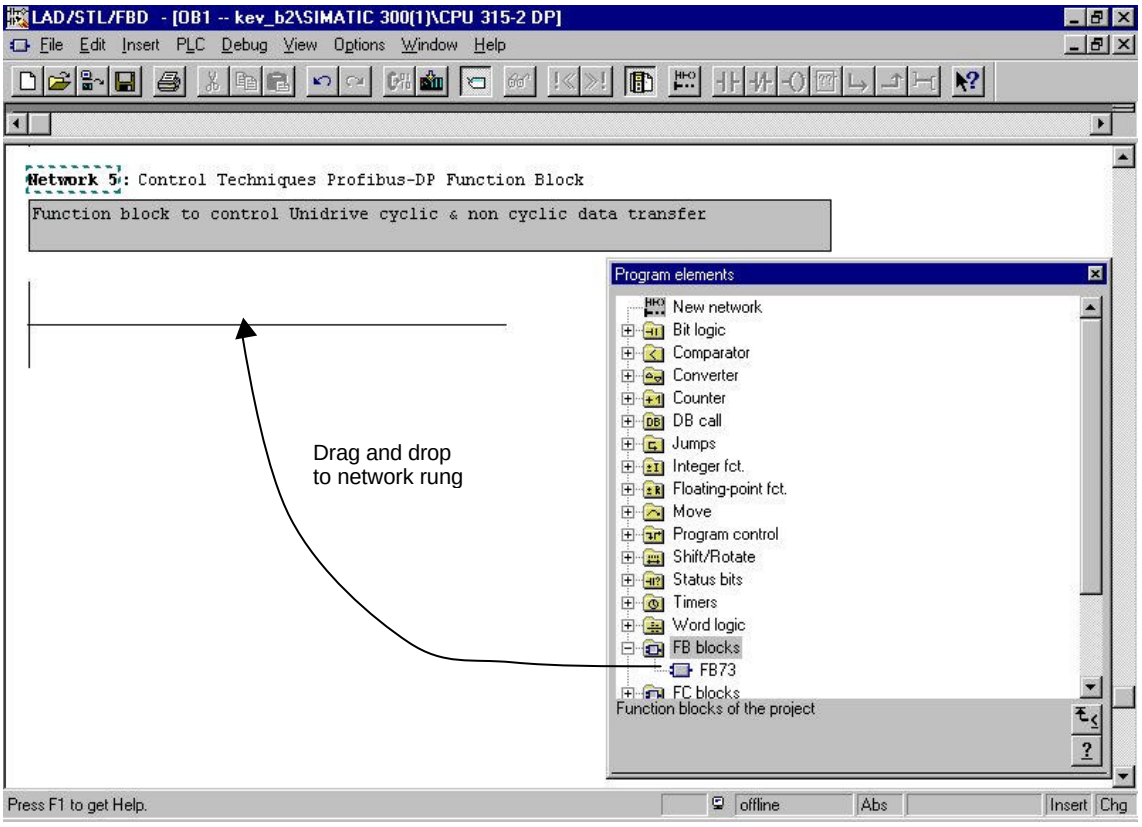

Fig 3 Inserting the FB73

4. The function block (see figure 4) has several variables, their names and functions are shown in the following two tables:-

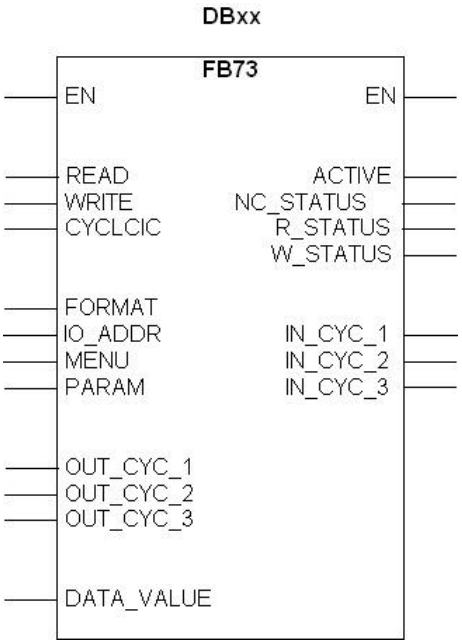

Fig 4 **F**unction **B**lock 73

Variable	Type	Data	Description
EN	IN	BIT	Enables the function block execution when the input is set
READ	IN	BIT	Set to execute a non-cyclic READ operation
WRITE	IN	BIT	Set to execute a non-cyclic WRITE operation
FORMAT	IN	WORD	Determines the data transfer type from PLC to the drive 1 = 8 bytes, full consistency (U,M) 2 = 4 words, full consistency (U,M,C) 3 = 4 words, no consistency (U,M,C) 4 = 3 words, full consistency, no non-cyclic data (C) 5 = 3 words, no consistency, no non-cyclic data (C) 6 = 2 words, full consistency, no non-cyclic data (C) 7 = 2 words, no consistency, no non-cyclic data (C)
IO_ADDR	IN	WORD	Specifies the first address within the peripheral I/O memory that is allocated to the target node. To determine the I/O address for a node, go to the **Hardware Configuration** and click on the required node on the Profibus network. In the table at the bottom of the screen, the **I** and **Q** address will be given, e.g. if the address range displayed is "256….263", the value required for **IO_ADDR** would be 256. **NOTE** The **I** and **Q** addresses must show the same range as each other for FB73 to operate correctly.
MENU	IN	WORD	Menu number of the target parameter for non-cyclic READ or WRITE operation
PARAM	IN	WORD	Parameter number of the target parameter for non-cyclic READ or WRITE operation
DATA_VALUE	IN	INT	READ Outputs the value read from the drive WRITE Inputs the value to be written to the drive
ENO	OUT	BIT	Set to true when the function block operation for 1 cycle has completed.
ACTIVE	OUT	BIT	Set to true when a non-cyclic access is in progress. When output goes false, non-cyclic access has been completed. DATA_VALUE will contain the value returned from a READ operation when the ACTIVE flag is reset.
NC_STATUS	OUT	WORD	0 The READ or WRITE operation was successful 1 An error occurred. Possible causes are writing to a read-only parameter, reading a write-only parameter, or addressing an invalid parameter. 2 Time-out. The non-cyclic message could not be completed. The message was cancelled and the slave node reset.
R_STATUS	OUT	WORD	0 Cyclic READ operation was successful. 32912 No module configured for the specified address. 37011 No module present to communicate consistent data with at the specified address. **NOTE** When using mode 3, data is written directly to the peripheral I/O registers. If a peripheral I/O register is specified that does not exist, the program will stop.
W_STATUS	OUT	WORD	

Table 1 Non cyclic variables

U = supported by Unidrive
M = supported by Mentor II
C = supported by Commander SE

Variable	Type	Data	Description
CYCLIC	IN	BIT	Set to enable cyclic data transfer. All OUT cyclic data sent and IN cyclic data returned by the block is set to 0 if cyclic data is disabled
OUT_CYC_1	IN	WORD	Data value for OUT cyclic word 1
OUT_CYC_2	IN	WORD	Data value for OUT cyclic word 2
OUT_CYC_3	IN	WORD	Data value for OUT cyclic word 3
IN_CYC_1	OUT	WORD	Returns the data value of IN cyclic word 1
IN_CYC_2	OUT	WORD	Returns the data value of IN cyclic word 2
IN_CYC_3	OUT	WORD	Returns the data value of IN cyclic word 3

Table 2 Cyclic variables

5. To control data transfer from the PLC to the Profibus, FB73 must be called from one of the run-time blocks (OBxx) within the PLC program. FB73 can be used more than once in any program block, but each instance **MUST** have a unique data block associated with it. To set the data block edit the **???** at the top of the FB73 and change it to **DBxx** where the xx is a decimal number, which when set will allocate PLC RAM to the function block. See figure 4.

Known Pitfalls and Tips

- Ideally, there should be one function block call for each network node, allowing things such as FORMAT and address to be configured as constants. This should assist with system commissioning by preventing accidental data corruption by the rest of the user program.
- The user program is responsible for ensuring that the correct data is supplied to the FB73 each time it is called. OUT cyclic data values will only be transferred to the Profibus-DP network if the cyclic data has been enabled. IN cyclic data values will always be returned as 0 unless cyclic data is enabled.
- Once the ACTIVE bit is high, FORMAT and IO_ADDR can be changed without corrupting the current non-cyclic message in progress. The READ bit can also be reset and FB73 will complete the current non-cyclic message. If the READ bit is not reset, FB73 will immediately start a new non-cyclic message access. See figure 5.

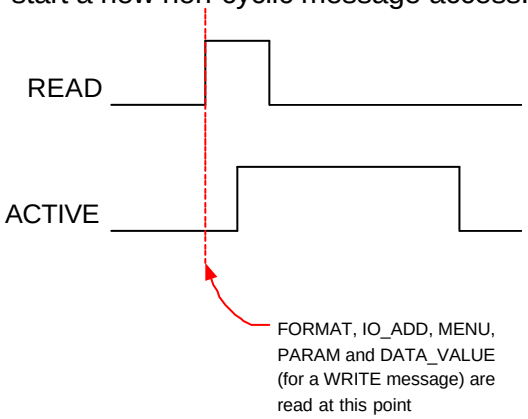

Fig 5 Parameter variable timings

- The target parameter for a non-cyclic message must be specified when the block is executed. MENU, PARAM (and DATA_VALUE for a WRITE message) are only read on the first execution of a new message. Once the ACTIVE bit has been set for a message, these values can be changed without corrupting the parameter access.
- The OUT bit variables (see table 2) can be used to give signals to the user program about the status of each block. The ACTIVE signal indicates that a non-cyclic parameter access is in progress, and is not reset until this access has been completed. This bit can be interlocked with the EN, READ or WRITE signals to ensure that a non-cyclic read is disabled only when it has been completed.

Upgrading FB73 from V1.x.x to V2.0.x

FB73 was upgraded to V2.0.0 to prevent possible corruption of the FORMAT and IO_ADDR values during a non-cyclic message. The changes required 2 new static variables in the data block associated with each FB73 call, so each data block must be upgraded.

1. Replace the existing **FB73** in the user project as described above.
2. Open an **OBxx** block that uses the **FB73** block, and find a network that calls **FB73**.
3. Click on the **DBxx** reference for **FB73** and re-enter the data block number.
4. Simatic Manager will now re-generate the data block.
5. Repeat steps 2 to 5 for all networks in all blocks that call **FB73**.

Ancillary Files

Profigsd.zip

GSD file name	Supported drive
ctu_3345.GSD	Unidrive
ctm_3345.GSD	Mentor II
ctse04FA.GSD	Commander SE

ctsspd_s7.arj

Various associated project files	Archived CT SSPD Simatic Manager project file.