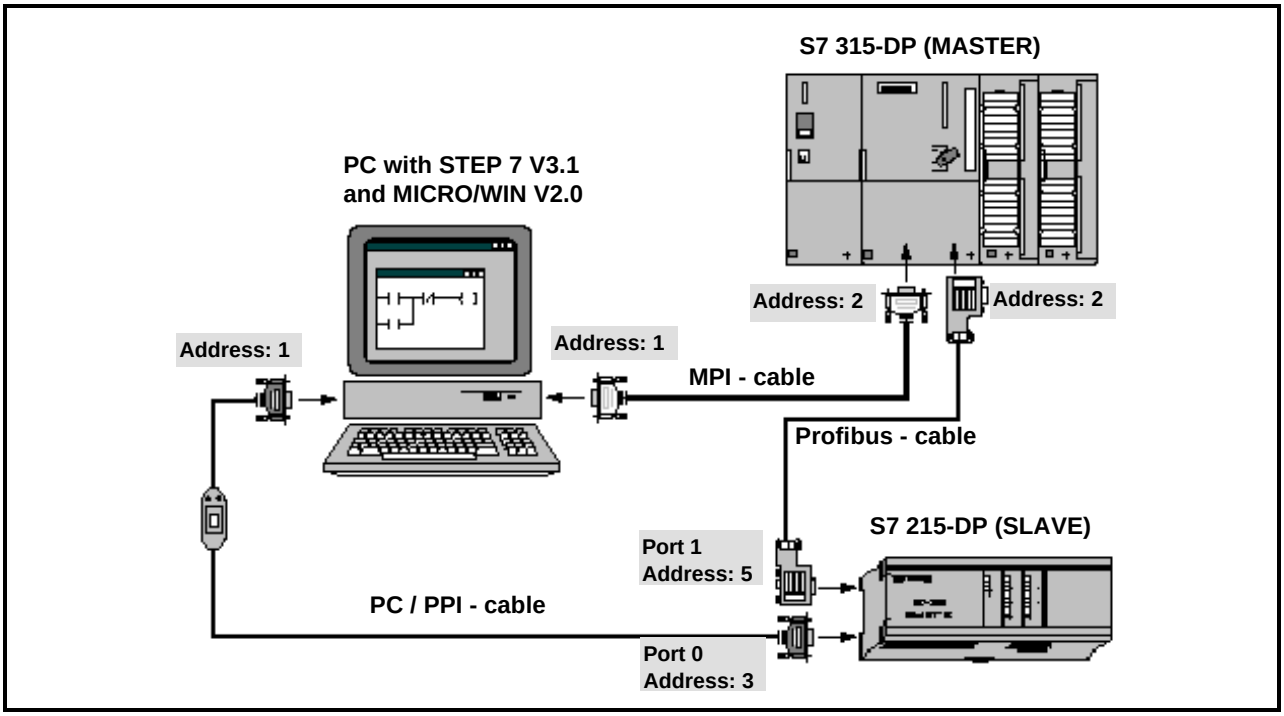
# SIMATIC S7-200 Tips

| Group | Topic |
|---|---|
| 3 | Interfacing a S7-300 (Master) with a S7-200 (Slave) by Profibus |

| CPUs required for this tip | | | | | |
|---|---|---|---|---|---|
| CPU 210 ☐ | CPU 212 ☐ | CPU 214 ☐ | CPU 215 ☑ | CPU 216 ☐ | OTHER ☐ |

## Overview

In this example, the S7-215 DP is interfaced with the S7-315 DP by means of the Profibus.
The S7-315 DP is the master, and the S7-215 DP is used exclusively as a slave device.
To ensure faultless communication between the DP master and the CPU215 DP, certain settings have to be made on the participating devices. The settings / initialization of the master with the program software STEP7 (starting with Version 3.1) will be explained in detail below.
The sample program for the S7-200 demonstrates how you can apply the S7-300 inputs to the outputs of the S7-200. In addition, it makes it possible to represent the S7-200 inputs on the output module of the S7-300.






SIMATIC S7-200 customers have free use of the application tips. These tips are only a general approach to using the S7-200 with various applications. Your specific application may be different. It is your responsibility to use the SIMATIC S7-200 properly in your applications.

## Hardware Requirements

1 S7-215-DP
1 S7-315-DP (consisting of a power supply unit PS307-2A, the CPU S7-315-2 DP and a digital input/output module SM374 respectively for simulation)
1 Siemens PC/PPI cable for programming the S7-200
1 Profibus cable (should be terminated on the two ends of the cable through the matching resistor integrated in the connector = switch on ON!)
1 MP cable for programming the S7-300
1 PC with MPI card ( and the programming software STEP 7 Version 3.1 as well as MICRO/WIN Version 2.0)

## Setting the DP Slave-Address (S7-215-215)

**A.) With STEP7-Micro/DOS V1.3**

1.) Go online (F4) and change to the menu 'Utilities' (spacer bar => F6). The operating mode switch has to be onTERM.

2.) In the menu 'Communication Parameters', set the DP address of the CPU215 (AS Utility Number 10) .

3.) Store the address in the CPU with the key F3 Write. Then, exit menu 'Communication Parameters' and 'Utilities' with ESC. Activate spacer bar and key 'ASSSPEI' (F8) to store the changes in the CPU.

**B.) With STEP7-Micro/WIN V2.0**

1.) Open a new project and select the CPU type CPU215.

2.) In the menu item 'CPU', select the submenu 'Configure' and click on 'DP-Port'. Set the desired CPU address in the area from 0 to 126 in the corresponding field. Note: The field 'Baudrate' is irrelevant to the DP interface, since the master always sets the baudrate.

3.) In the menu 'Project', submenu 'Load from PG', load the CPU configuration into the CPU. This will set the DP address in the CPU.



SIMATIC S7-200 customers have free use of the application tips. These tips are only a general approach to using the S7-200 with various applications. Your specific application may be different. It is your responsibility to use the SIMATIC S7-200 properly in your applications.

## Configuring the DP Master (S7-315 DP)

**With STEP7 (Version 3.1):**

The S7-CPU315 DP is configured as DP Master with STEP7. The follwing steps refer to Version V3.1 of STEP7. There may be deviations with respect to previous or later versions.

### Steps for Initializing the S7-315 DP:

Starting Step 7 S7/M7 (Version used is 3.1)

**1. Setting Up a New Project:**

Enter project name : for example, 'DP_Connect'
Acknowledge entry by pressing the 'OK' key

**2. Selecting the Components:**

a) Inserting the Station

Menu: 'Insert - Station - Simatic S7-300 Station'

⇨ The symbol for the Simatic S7-300 station is inserted into the current directory and displayed.

b) Inserting the connection between S7-300 and S7-200

Menu: 'Insert - Subnet - Profibus'

⇨ The symbol for the Pofibus Subnet is inserted into the current directory and displayed.

**3. Configuring the S7-300 Hardware:**

A) Starting the Program for the Hardware Configuration

- Double click (with the left mousekey) on the symbol named 'SIMATIC 300 Station(1)'
  - ⇨ The directory of the SIMATIC 300 station will be opened! A mailbox with the name 'Hardware' will be displayed.
- Double click (left mousekey) on the symbol for 'Hardware'
  - ⇨ The program for the hardware configuration named 'HWKONFIG' will be startet. In addition, a window with a hardware catalog will be opened.

B) Configuring the S7-300 Hardware with 'HWKONFIG'

The S7-300 hardware (hardware used: CPU , input and output modules) is specified using 'HWKONFIG' of the software.

**B1.0 Inserting the RACK:**

- Open the SIMATIC 300 catalog be selecting the PLUS sign in front of the entry 'SIMATIC300' with the left mousekey
  - ⇨ The entry 'SIMATIC300' opens; different sub-items are displayed
- Under the item 'RACK 300', select the entry 'RAIL' by double-clicking on it with the left mousekey
  - ⇨ In the form of a table, the selected S7-300 RACK is inserted in the window for the hardware configuration.



SIMATIC S7-200 customers have free use of the application tips. These tips are only a general approach to using the S7-200 with various applications. Your specific application may be different. It is your responsibility to use the SIMATIC S7-200 properly in your applications.

**B2.0 Inserting the RACK Components**

- With the mouse, select the window 'Hardware Configuration' (where the table for the RACK is located). If the window or the table is too small, you can make it larger/smaller by sizing it with the mouse and adjust it as desired.
- To insert a component in the rack, click on the first line of the RACK table.
  - ⇨ The table line has a blue background, if you have selected it.
- Now, one after the other, the hardware components are inserted into the slots (lines) of the rack.

**B2.1 Inserting the Power Supply** (not absolutely necessary for configuration!)

- In the 'hardware catalog', select the item 'PS-300', and below it the power supply that you are using.
  - ⇨ In this example, the hardware is equipped with the power supply module 'PS-307-2A'. You have to select it with the left mousekey.
    The module 'PS-307' is placed in the first position in the rack (the name of the power supply is indicated in the first line of the table).

**B2.2 Inserting the CPU-315 DP** (needs two slots!)

- Select Slot Two by clicking on it with the mouse.
- In the 'hardware catalog', open the directory 'CPU-300'
- With the mouse, select the correct CPU 315 DP. Since there are two different ones, the order number of the hardware and the software setting have to agree.
  - ⇨ Here: select the CPU-315 DP with the order number:
    6ES7 315-2AF00-OAB0 (**important**: this number has to be the same as on the CPU!)
- With the left mousekey, double click on the correct CPU-315 DP; a dialog appears where you have to specify the Profibus parameters. Set the desired Profibus address (for example, 2) and the other Profibus parameters (or use the default values). After you now have selected a Profibus subnet, and all parameters for the Profibus have been set, press the 'OK' key.
  - ⇨ The CPU including the Profibus net is inserted into the table under the power supply.

**B2.3 Inserting the Input/Output Modules**

Selection of the input/output modules under the entry 'SM-300'

⇨ In this case, two digital input/output modules have to be inserted.
The first module is configured as digital input module (16 bits) and the second as digital output module (16 bits).



SIMATIC S7-200 customers have free use of the application tips. These tips are only a general approach to using the S7-200 with various applications. Your specific application may be different. It is your responsibility to use the SIMATIC S7-200 properly in your applications.

*B2.3.1 Selecting the Digital Input Module*

Double click with the left mousekey on the module designated:
'SM321 DI16xDC24V (Input 16DI 24V, grouping 16)' and the order number 6ES7-321-1BH01-0AA0

⇨ The module will be inserted in the fourth slot. The start address of the input module is specified as 0 by the system.

*B2.3.2 Selecting the Digital Output Module*

Double click with the left mousekey on the module designated:
'SM322 D016xDC24 (Output 16D0 24V/0,5A, grouping 8)' and the order number 6ES7 322-1BH01-0AA0

⇨ The module will be inserted in the fifth slot. The start address of the output module is specfied as 4 by the system.

The hardware configuration for the S7-300 is about complete; only the different addresses still have to be set correctly.

**4. Setting the Different Addresses**

*a. Setting the MPI Address for Communication between PC and S7-300*:

In the window 'Hardware Configuration', the S7-315 DP was inserted in the second table line. Click on this second line with the right mousekey. A pop-up dialog will appear. After selecting the item 'Object Properties ALT+RET', a dialog window with the name 'Properties CPU 315-2-DP' follows. The MPI address has to be set under this dialog.

⇨ In this case, the MPI address is set to 2.

The settings and the dialog are closed with the 'OK' key.

*b. Setting the Profibus Address for Communication between S7-300 and S7-200*:

In the window 'Hardware Configuration', the S7-315 DP was inserted in the second and third table line. With the right mousekey, click on the third line (DP master).
A pop-up dialog appears. After selecting the item 'Object Properties ALT+RET', a dialog window named 'Properties DP Master' follows. The Profibus address has to be set under this dialog. In this case, the Profibus address is set to '2'.
The settings and the dialog are closed with the 'OK' key.

**5. Checking the addresses of the Digital Input/Output Modules**

- In the window 'Hardware Configuration', select the line with the I/O- module.
- Click on this line with the right mousekey.

⇨ A pop-up dialog appears.
After selecting the item 'Object Properties ALT+RET', a dialog window appears named: 'Properties DI16xDC24V or DO16xDC24V'.

- Under Address, the preset address of the input- and output module can be read.

⇨ In this example, the address of the input module is set to 0, the address of the output module is set to 4.

- The settings and the dialog are closed with the 'OK' key.



SIMATIC S7-200 customers have free use of the application tips. These tips are only a general approach to using the S7-200 with various applications. Your specific application may be different. It is your responsibility to use the SIMATIC S7-200 properly in your applications.

**6. Inserting the S7-215 DP in the Subnet**

- In the window 'Hardware Configuration', select the symbol (dashed line) for the Profibus by clicking on it with the left mousekey.
- Open the Profibus catalog by selecting the PLUS sign in front of the entry 'PROFIBUS'.
  - ⇨ The entry 'PROFIBUS' opens; different sub-items are displayed
- Under the item 'SIMATIC', select the entry 'S7-200 CPU 215 DP' by double-clicking onit (left mousekey)
  - ⇨ The selected S7-215 DP is inserted in the window for the hardware configuration (as new table added to the Profibus).

**7. Specifying the Communication Parameters for the S7-215 DP**

- After the table of the S7-215 DP was added to the Profibus, select the first line of the table (slave).
- In the hardware catalog, under S7-200 CPU-215 DP, select the type of communication (Byte, Word or buffer). In our case, a word by word transmission is wanted.
  - ⇨ The '1 Word Out/ 1 Word In' transmission is selected.

With that, communication of the S7-215 DP with the S7-315 DP via Profibus is specified. The I/O input- and output area is specified for Address 256.

**8. Downloading the Hardware Configuration in the S7 315-DP**

After all settings mentioned above have been made, the hardware configuration can be loaded into the CPU via a 'download'. Make sure that the PLC is in the 'STOP'- mode; that is, the mode switch has to be on 'STOP'.
Downloading the hardware configuration can be activated in the menu under 'PLC/Download' or via the 'Download' button.

## Communication Addresses (Profibus, MPI, PPI)

For this example, the following addresses have to be set:

| | | |
|---|---|---|
| **Profibus:** | **Master** | **Address (S7-315 DP) = 2** |
| | **Slave** | **Address (S7-215 DP, Port1) = 5** |
| **MPI:** | **PC** | **Address (MPI-Card) = 1** |
| | **Master** | **Address (S7-215 DP,Port0) = 2** |
| **PPI** | **PC** | **Address (PC) = 1** |
| | **Slave** | **Address (S7-215 DP) = 3** |



SIMATIC S7-200 customers have free use of the application tips. These tips are only a general approach to using the S7-200 with various applications. Your specific application may be different. It is your responsibility to use the SIMATIC S7-200 properly in your applications.

## Sample Program in DP Master (S7-315 DP)

**With STEP7 (Version 3.1):**

The sample program of the DP master is located in OB1. It is very simple; the code itself consists of the following lines (only one network):

```
Network 1:
// Transfer inputs of master (S7-315 DP) to slave (S7-215 DP)
L     PIW   0     // Fetch the I/O input word of the input module
T     PQW   256   // Transfer it to Address Area 256
                  // (master's send mailbox or I/O output area)
// Transfer inputs of slave (S7-215 DP) to master (S7-315 DP)
L     PIW   256   // Fetch the I/O input word 256 (slave's inputs)
T     PQW   4     // Transfer it to the outputs of the output module
BE                // End of block
```

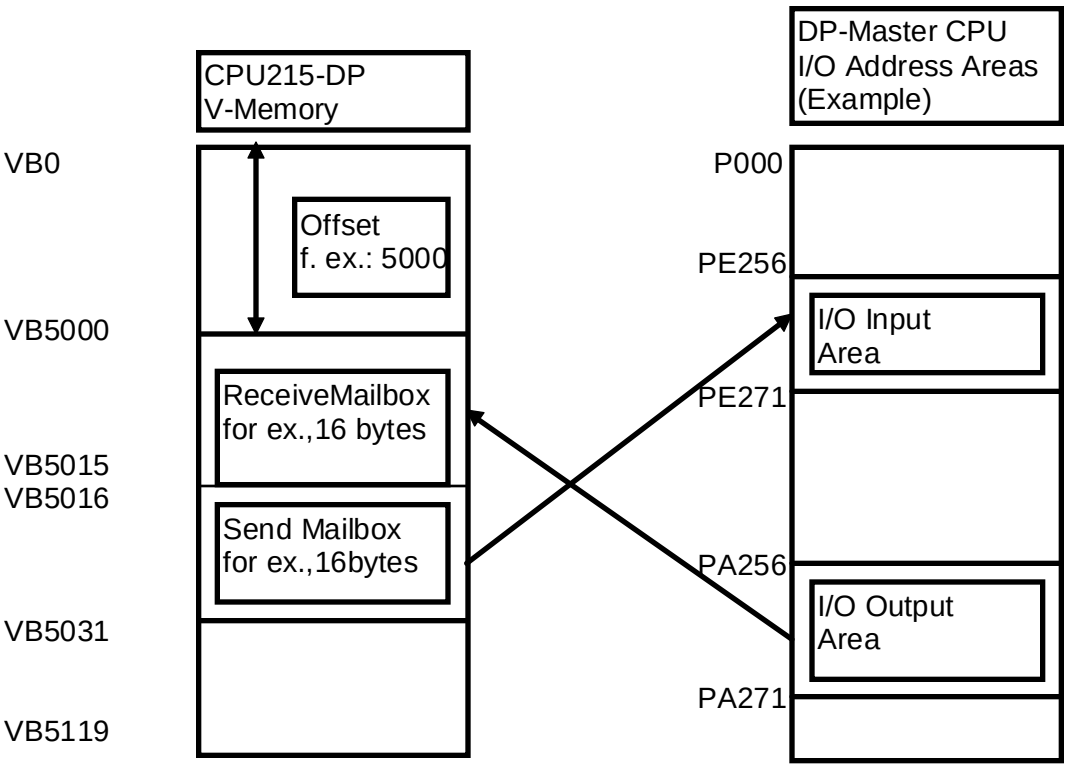
The master initiates the data transfer by reading the I/O input word of the input module and storing it in the slave's I/O output area (starting with Address PQ256).
In addition, the master reads the I/O input area (starting with Address PI256) where the slave's inputs are imaged, and stores the word in the physical outputs of the output module.
If, for example, an input of the S7-215 DP is activated, it will be indicated on the S7-315 DP on the output module. Conversely, the input of the S7-315 DP is indicated on the S7-215 DP.

## Memory Model DP-Master & DP-Slave

The purpose of a Profibus connection is the exchange of data. Data from a PLC is transferred to another PLC. The initiator of this data transfer is designated as the 'Master', and the other communication station is the socalled 'Slave'. The principle is simple: The master reads the data from the slave's send mailbox and stores it in an I/O input area. In addition, the master transfers data to the slave's receive mailbox. Since the CPU215 can only be a slave, the send- and receive mailboxes are in the CPU's variable memory (V-Memory). The figure below shows the memory model.



SIMATIC S7-200 customers have free use of the application tips. These tips are only a general approach to using the S7-200 with various applications. Your specific application may be different. It is your responsibility to use the SIMATIC S7-200 properly in your applications.




You can configure in the master where the start of the receive mailbox is by setting an offset. If the offset is 0, it means that the receive mailbox starts at the variable byte VB0. If the offset is 5000, the receive mailbox starts at VB5000. In addition, the size of the receive mailbox can be specified in bytes when the master is configured. If the size is 16 bytes and the offset is 5000, the receive mailbox starts at VB5000 and ends at VB5015. The size of the send mailbox -it is directly adjacent to the receive mailbox- can also be configured; that is, if the size is 16 bytes,for example, the send mailbox extends from VB5016 to VB5031.

**Data Exchange**

Once the CPU 215 has been connected to the master and the configuration information has been successfully downloaded, the CPU 215 will enter the data exchange mode. In this mode, the master will send output data to the CPU 215 and the CPU 215 will respond with input data. The V memory address that is supplied as part of the configuration information specifies the starting location of the output data that is sent by the master. Immediately following the last byte of output data is the starting location of the input data. In order to know the starting address of the input data, you must know how many words of output data the master was configured to send.

The starting address of the data buffers and their lengths must be known at the time the user program for the CPU 215 is created. The output data sent by the master must be moved by the program in the CPU 215 from the output buffer to the various locations for use. Likewise, the input data must be moved from various locations to the input buffer for transfer to the master.



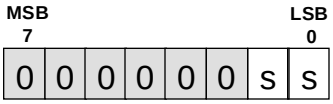
SIMATIC S7-200 customers have free use of the application tips. These tips are only a general approach to using the S7-200 with various applications. Your specific application may be different. It is your responsibility to use the SIMATIC S7-200 properly in your applications.

**Data Consistency**
In a system where data values larger than a single byte must be accessed one byte at a time, care must be taken to make sure that all multi-byte values are accessed as a unit, thus preserving data consistency. The CPU 215 operating system guarantees word consistency as long as the data is aligned on word boundaries. The user program can guarantee both double word and buffer consistency by simply performing all data transfers to or from the input and output buffers in the main program or in a subroutine called from the main program. If data is transferred to or from the input and output buffers from an interrupt routine, then double word and buffer inconsistencies must be expected.

## Program Description

A brief explanation of the sample program for DP communication between the S7-215 DP and S7-315 DP is provided below. The program is located in the CPU-215 DP which represents the DP slave. In this example, the slave CPU (CPU-215 DP) reads data that the master CPU (CPU315 DP) reads out and writes the values to the phyical outputs of the slave CPU. The program writes the values of the physical inputs of the slave CPU to the master CPU.

**Monitoring the DP Standard Protocol**
Using the special memory bytes SMB110 to SMB115 (status of the DP standard protocols), the status of the DP standard protocol can be monitored.




**Port 1:** DP standard protocol status byte

**ss:** DP standard status byte
**00** = Configuration/parameterization error detected
**01** = Currently in data exchange mode
**10** = Currently in data exchange mode
**11** = Dropped out of data exchange mode

SM111 to SM115 are updated each time the CPU accepts configuration-parameterization information. These locations are updated even if a configuration-parameterization error is detected. These locations are cleared every time the CPU is powered up.

| | |
|---|---|
| **SMB111** | This byte defines the address of the slave's master (0 to 126). |
| **SMB112/ SMB113** | These bytes define the V memory address of the output buffer (offset from VB0). SM112 is the most significant byte, and SM113 is the least significant byte. |
| **SMB114** | This byte defines the number of bytes for the output data. |
| **SMB115** | Dieses Byte definiert die Anzahl der Eingabebytes. |

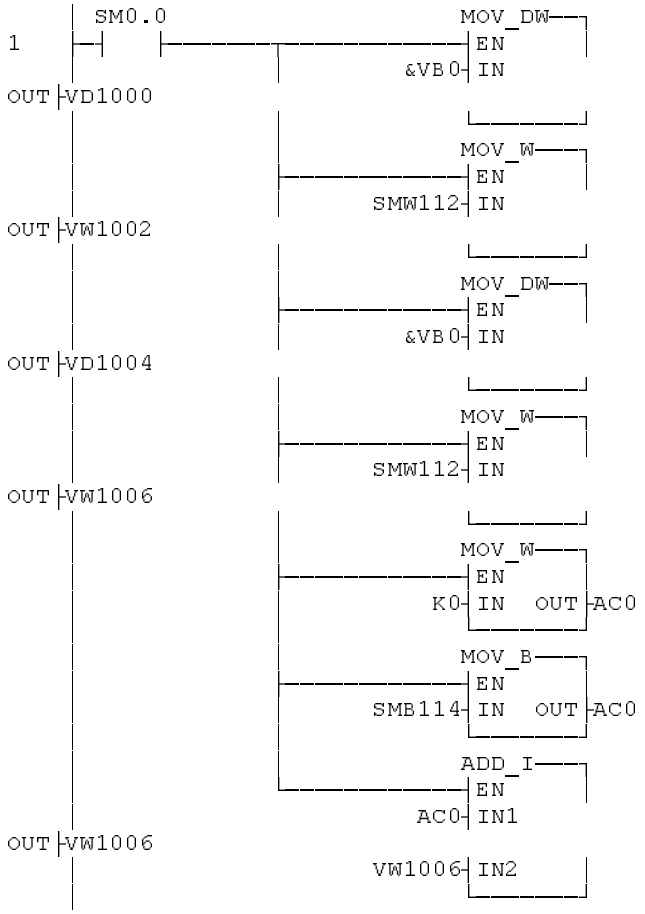


SIMATIC S7-200 customers have free use of the application tips. These tips are only a general approach to using the S7-200 with various applications. Your specific application may be different. It is your responsibility to use the SIMATIC S7-200 properly in your applications.

| Ladder (S7-MicroDOS) | STL (IEC) |
|---|---|

## main- program

```
//
// This program is a generic DP slave program. It will take the outputs from the master and write them
// to the physical outputs of the PLC. The physical inputs from the PLC are copied to the master.
//
// The DP configuration data in SM memory is used to configure the DP slave.
// The data is :
//        SM 110  DP status
//        SM 111  master address
//        SM 112  V-memory offset of outputs (word value)
//        SM 114  number of output bytes
//        SM 115  number of input bytes
// My data is :
//        VD1000 output data pointer
//        VD1004 input data pointer
```

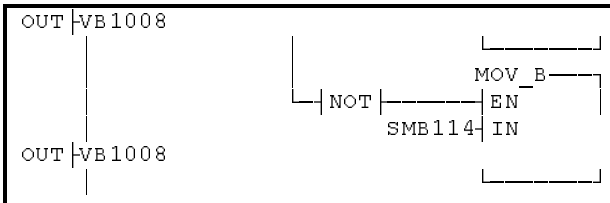



```
LD SM0.0                // on every scan
MOVD &VB0, VD1000       // create output
pointer

MOVW SMW112, VW1002
                        // add in output offset

MOVD &VB0, VD1004
                        // create input pointer

MOVW SMW112, VW1006
                        // add in output offset

MOVW 0, AC0     // clear accumulator

MOVB SMB114, AC0
                        // get number of output bytes

+I AC0, VW1006          // offset pointer
```

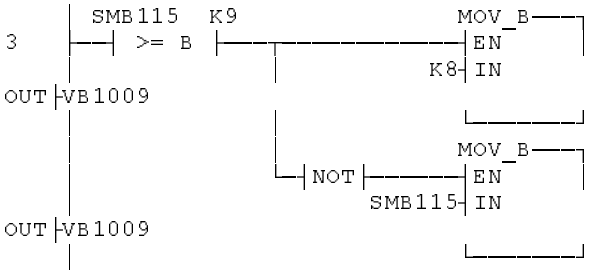
```
LDB>= SMB114, 9
        // if number of output bytes > 8
```



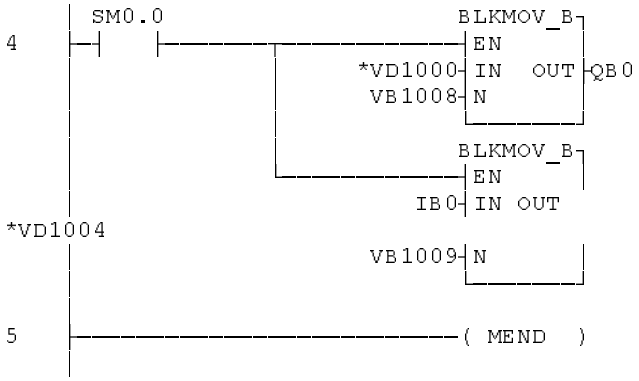
SIMATIC S7-200 customers have free use of the application tips. These tips are only a general approach to using the S7-200 with various applications. Your specific application may be different. It is your responsibility to use the SIMATIC S7-200 properly in your applications.




```
MOVB 8, VB1008          // output count = 8

NOT                     // else
MOVB SMB114, VB1008
        // output count = number of output
bytes
```




```
LDB>= SMB115, 9
        // if number of input bytes > 8
MOVB 8, VB1009          // input count = 8
NOT                     // else
MOVB   SMB115, VB1009
        // input count = number of input bytes
```




```
LD SM0.0                // on every scan
BMB *VD1000, QB0, VB1008
        // copy DP outputs to outputs


BMB IB0, *VD1004, VB1009
        // copy inputs to DP inputs


MEND
```

## Conversion Notes

To Convert from IEC STL to S7-Micro/DOS STL:

- Add a 'K' before all non-Hex numerical constants (i.e. 4 ⇒ K4)
- Replace '16#' with 'KH' for all Hex constants (i.e. 16#FF ⇒ KHFF)
- Commas denote field divisions. Use arrow or TAB keys to toggle between fields.
- To convert an S7-Micro/DOS STL program to LAD form, every network must begin with the word 'NETWORK' and a number. Each network in this Application Tip program is designated by a number on the ladder diagram. Use the INSNW command under the EDIT menu to enter a new network. The MEND, RET, RETI, LBL, SBR, and INT commands each receive their own networks.
- Line-Comments denoted by '//' are not possible with S7-Micro/DOS, but Network-Comments are possible.



SIMATIC S7-200 customers have free use of the application tips. These tips are only a general approach to using the S7-200 with various applications. Your specific application may be different. It is your responsibility to use the SIMATIC S7-200 properly in your applications.

## General Notes

The SIMATIC S7-200 Application Tips are provided to give users of the S7-200 some indication as to how, from the view of programming technique, certain tasks can be solved with this controller. These instructions do not purport to cover all details or variations in equipment, nor do they provide for every possible contingency. Use of the S7-200 Application Tips is free.

Siemens reserves the right to make changes in specifications shown herein or make improvements at any time without notice or obligation. It does not relieve the user of responsibility to use sound practices in application, installation, operation, and maintenance of the equipment purchased. Should a conflict arise between the general information contained in this publication, the contents of drawings or supplementary material, or both, the latter shall take precedence.

Siemens is not liable, for whatever legal reason, for damages or personal injury resulting from the use of the application tips.

All rights reserved. Any form of duplication or distribution, including excerpts, is only permitted with express authorization by SIEMENS.



SIMATIC S7-200 customers have free use of the application tips. These tips are only a general approach to using the S7-200 with various applications. Your specific application may be different. It is your responsibility to use the SIMATIC S7-200 properly in your applications.