

NOTE

This manual describes how to connect NS and Siemens S7-300 PLC via Renu HMI-MPI adapter. If you want to know how to connect NS and S7-300 via SIMATIC HMI adapter, please see Chapter 4 of “Host Connection Manual (Multivendor Connection).”

Chapter 4. Connecting to Siemens S7-300 PLC

Applicable CX-Designer Version	V2.00 or later
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Applicable NS System Version	V6.60 or later
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4-1 Compatible PLC

4-1-1 Supported PLC models

The complete Siemens S7-300 series CPU supported.

4-1-2 Protocol

The 3964(R) + serial protocol is supported. In order to connect, Siemens SIMATIC S7 HMI Adapter (order number: 6ES7 972-0CA11-0XA0) is required. Beside the Siemens adapter you can also use the Renu HMI-MPI adapter. The Renu adapter supports a higher speed serial connection to the HMI.

If you use SIMATIC S7 HMI Adapter, please see Chapter 4 of “Host Connection Manual (Multivendor Connection).”

For detailed information about Renu HMI-MPI adapter, refer to “4-2 Connection configuration” of this manual.

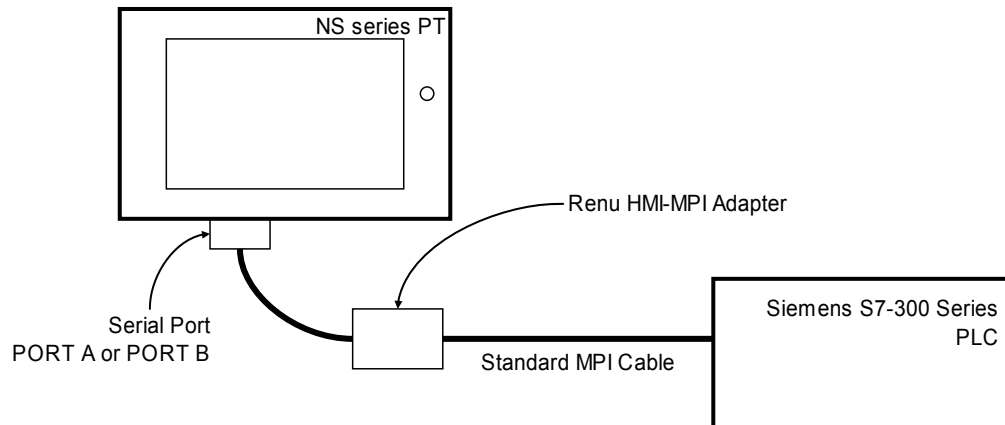
4-1-3 Topology

Current version of NS only supports 1:1 connection.

4-2 Connection configuration

4-2-1 Overview of connection method

Connect a PT to Siemens S7-300 series in the following methods. Please make sure that Renu HMI-MPI Adapter and MPI cable is required.



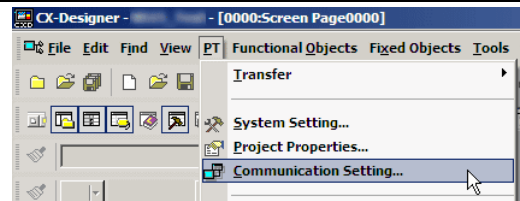
4-2-2 Communication setting for PLC

Make the following communication settings to connect to the PLC. For more information on how to setup the communication of the S7 PLC, refer to your programming tool's or your PLC's manual.

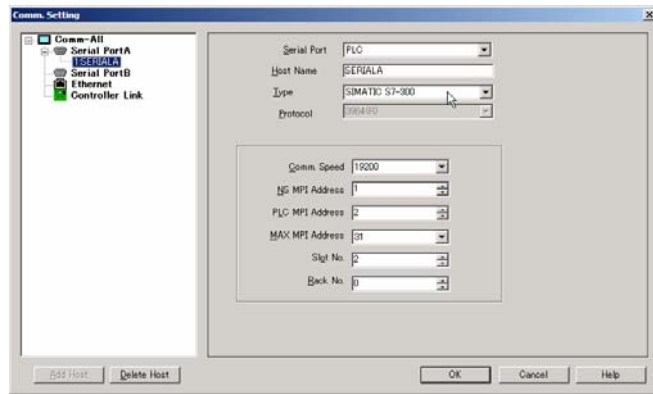
MPI Transmission speed: Set to 187.5 kbps

4-2-3 Communication setting for NS project (screen data)

- 1) Click [PT] — [Communication Setting...].



- 2) "Comm. Setting" dialog will be displayed. Click "Serial Port A" or "Serial Port B" depending on the port you want to connect S7-300 series PLC, and configure it on right-side pane. Set [Serial Port] to [PLC], [Type] to [SIMATIC S7-300], and [Protocol] to [3964(R)].



Configure other settings according to your environment.

- 3) Click [OK] to apply configuration.

Note: The Renu HMI-MPI adapter supports a maximum communication speed of 115.2 kbps between NS and the adapter (SIMATIC HMI adapter supports only up to 38.4 kbps).

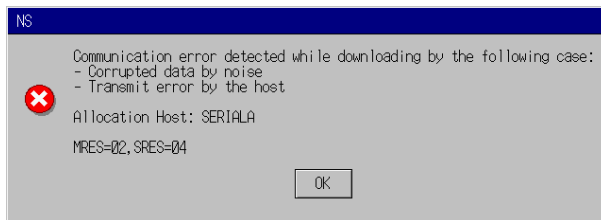
4-3 Accessible address range

When using Siemens S7-300 series as a host, accessible addresses in screen data are as follows. Devices with Yes in the following table can be used. Also read carefully the instructions below the table.

Address area name 1) (E, A, Z are German notation)	Double word access 3)		Word access		Bit access	
	Read	Write	Read	Write	Read	Write
I (E) 2)	YES	No 5)	YES 3)	No 3)5)	YES	No 5)
Q (A) 2)	YES	No 5)	YES 3)	No 3)5)	YES	No 5)
M	YES	YES	YES 3)	YES 3)	YES	YES
DB 8)	YES	YES	YES 3)	YES 3)	YES	YES
T 6)	No	No	YES	YES 6)	No	No
C (Z) 2)7)	No	No	YES	YES 7)	No	No

Instructions

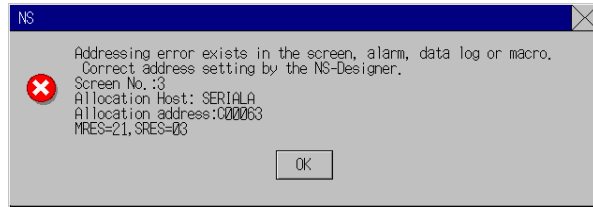
- Do not use addresses that your PLC does not support. If you operate screen data that contains unsupported addresses, the error dialog box like right (error code may be different) will be displayed, and it may also cause disturbances such as accessing unexpected memory area.



- When using objects that occupy a large memory area such as the “string display & input” objects, make sure that the end address is within the range.
- Only English notation is supported. Germany notation will be supported in future version.
 - Siemens PLC supports byte access, but PT does not. But accessing 1 word from odd address is supported (address specification like “MW1” is accepted).
 - Even when accessing double word, specify W (word width) as an alphabet of access unit to add the end of the address range. For example, when accessing double word that starts with M0 in the Numeral Display & Input, specify 2 words width such as MW0 for the Address and UDINT and DINT for the Storage Type. Do not use D that stands for double word access.
 - I(E) and Q(A) are read-only. Do not place functional objects which write to these areas. When attempting to write to these areas, an error dialog box will be displayed.
 - When using T, make sure that invalid values as SIMATIC_TIME are not written.

When writing an invalid value, an error dialog box (error code may be different) will be displayed.

- 7) When using C, make sure that invalid values as COUNTER type cannot be written. When writing an invalid value, an error dialog like right (error code may be different) will be displayed.



- 8) Do not use nonexistent datablock numbers.

4-4 Data format

4-4-1 Numerics

I, Q, M, DB area

NS treats the numeric data stored in S7-300 PLC as big-endianed.

For example, when 16bit integer value 0x1234 is written into MW0 from NS, PLC's memory becomes like right.

Address	M0								M1							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Value	0	0	0	1	0	0	1	0	0	0	1	1	0	1	0	0
Value(hex)	0x12								0x34							

Another example, 32bit integer value 0x12345678 is written, PLC's memory becomes like below.

Address	M0								M1								M2								M3							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Value	0	0	0	1	0	0	1	0	0	0	1	1	0	1	0	0	0	1	0	1	0	1	1	0	0	1	1	1	1	0	0	0
Value(hex)	0x12								0x34								0x56								0x78							

T area

Data format of T is pursuant to SIMATIC_TIME type format.

C area

Data format of C is pursuant to COUNTER type format.

4-4-2 Strings

ASCII String

For example, when an ASCII string "ABCDEF" is written from NS into MW0, PLC's memory becomes like right.

Address	M0	M1	M2	M3	M4	M5	M6	M7
Value(char)	A	B	C	D	E	F	NULL	NULL
Value(hex)	0x41	0x42	0x43	0x44	0x45	0x46	0x00	0x00

Please make sure that NS handles string data by 1 word. So when the length of the string is even, two byte of null characters will be appended.

Unicode String

For example, when a Unicode string "ABCDEF" is written from NS into MW0, PLC's memory becomes like below. One Unicode character consists of 2 bytes. Higher byte will be stored into prior address, and lower into posterior.

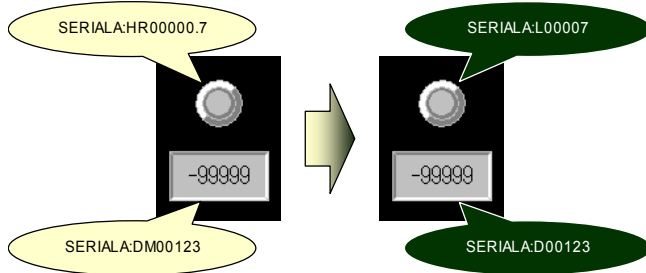
Address	M0	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13
Value(char)	A		B		C		D		E		F		NULL	
Value(hex)	0x00	0x41	0x00	0x42	0x00	0x43	0x00	0x44	0x00	0x45	0x00	0x46	0x00	0x00

4-5 Address conversion when converting host type

In case host type is converted between OMRON PLC

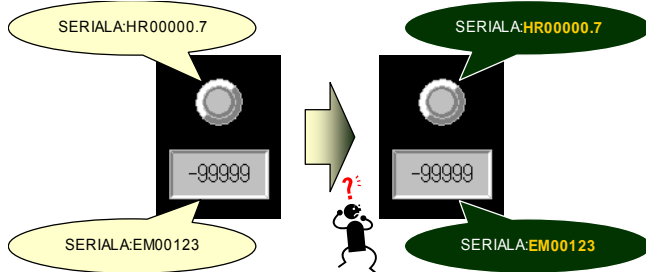
When host type is converted between OMRON PLC and S7-300 series PLC, address types (areas / devices) are automatically converted according to the table shown right (see also the figure below).

In case changing host type of SERIAL A from SYSMAC PLC to MELSEC-A



“—” in the right table means those addresses

cannot be mapped to new PLC's address, and they are not converted. This may cause invalid addresses (see the figure below), so you have to modify such invalid addresses by yourself. See “1-3-1 Notes and Restrictions When Changing a Host Type” of “Host Connection Manual (Multivendor Connection)” to know how to find and modify them.



SYSMAC PLC CS, CJ, etc...	SIMATIC S7-300
CIO	M
HR	—
AR	—
LR	—
TIM	T
CNT	C (Z)
DM	—
WR	—
EM	—
EM0~EMC	—
TU	—
CU	—
—	I (E)
—	Q (A)
—	DBxxxx

Note: Address numbers will be converted to make their bit offsets equal. For example, CIO00003.12 is the 60th bit ($60=16 \times 3 + 12$) of CIO, so will be converted to M00007.4 ($60=7 \times 8 + 4$).

It is same in reverse case. MW00004 of S7-300 will be converted to CIO00002 of SYSMAC, and M00005.7 to CIO00002.15.

Note: When host type being converted from S7-300 to SYSMAC PLC, word access from odd address (MW1, MW303, etc.) will not be converted automatically. This is because they cannot be mapped to addresses of new PLC.

4-6 Precautions

See also instructions shown in “4-3 Accessible address range”.

4-6-1 Macro Functions

Precaution of Macro function (READCMEM/WRITECMEM)

Data length that can be read at once with READCMEM is limited to 110, and writable length at once with WRITECMEM is limited to 80.

If too large data length is specified, a macro error will occur.

Precaution when handling 32 bit length numeric data with macro function

Because of the difference of numeric format between NS and S7-300 series PLC, word-order must be changed after reading 32 bit length data with READCMEM, and also must be changed before writing with WRITECMEM. Otherwise, strange data will be seen on NS or S7-300 PLC.

When reading 32 bit integer value from S7-300's MW0 to NS's \$W1000, program as follows (adapt `s7_300_hostname` to your environment).

```
READCMEM($W1000,[s7_300_hostname:MW00000],2);  
SWAPL($W1000,1);
```

When writing 32 bit integer value from NS's \$W1000 to S7-300's MW0, program as follows. The program below first changes the word-order to S7-300-format, then writes it to PLC, and finally re-changes to NS-format.

```
SWAPL($W1000,1);  
WRITECMEM([s7_300_hostname:MW00000],$W1000,2);  
SWAPL($W1000,1);
```

4-6-2 Limitation of communication restoration

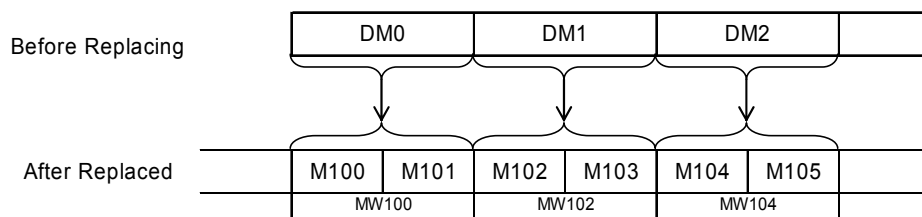
When the communication cable is disconnected or the PLC is reset / shut down, it may take about 1 minute even if you restore them right soon.

4-6-3 Address replacement

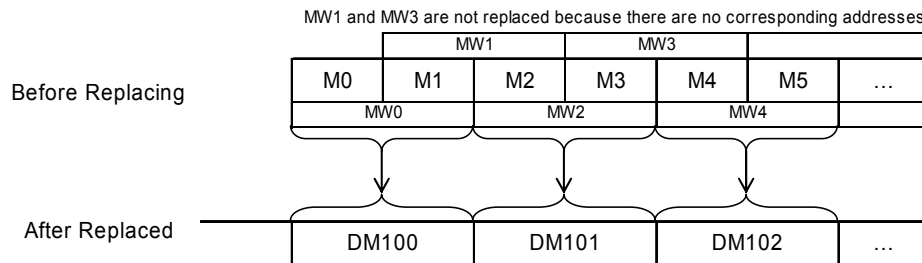
When addresses are replaced between hosts for which SIMATIC S7-300 is set and hosts for which other host types are set, the address numbers will be replaced in principle considering bit absolute positions.

Addresses will not be replaced when there is no corresponding address in the destination.

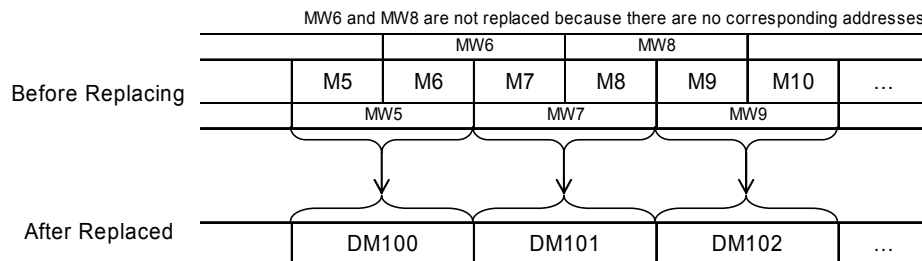
For example, when SERIALA is set to SYSMAC PLC, SERIALB is SIMATIC S7-300, and when replacing SERIALA:DM0 to 99 with SERIALB:MW100, each DM0, DM1, DM2, ... will be replaced with MW100, MW102, MW104,



For another example, when SERIALB:MW0 to MW5 are replaced with SERIALA:D100, each MW0, MW2 and MW4 will be replaced with DM100, D101 and D102. However MW1, MW3 and MW5 will not be replaced since they do not have corresponding addresses.



For another example, when SERIALB:MW5 to MW9 are replaced with SERIALA:D100, each MW5, MW7 and MW9 will be replaced with DM100, D101 and D102. However MW6 and MW8 will not be replaced.

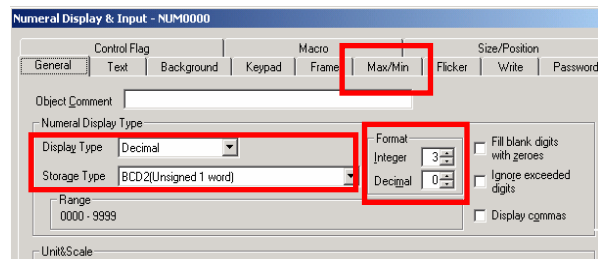


4-7 Tips on creating screen data

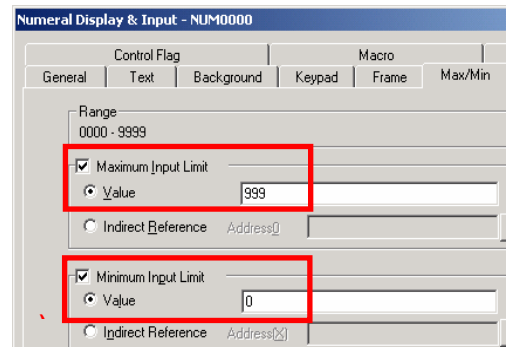
4-7-1 How to avoid inputting invalid values as COUNTER in the Numerical Display & Input functional object

For the S7-300 series, BCD values of 999 or less are valid as a counter. When writing invalid values from a PT, an error dialog box will be displayed. However, making some settings can avoid inputting invalid values. The procedure is described below.

- 1) Place numeral display & input object and double-click it.
- 2) A dialog box as shown right will be displayed. Set the Display Type to Decimal and the Storage Type to BCD2 (unsigned 1 word).
- 3) Set [Integer] in [Format] group box to 3.



- 4) Click the Max/Min tab.
- 5) Check [Maximum Input Limit] checkbox and set the [Value] to 999.
- 6) Check [Minimum Input Limit] checkbox and set the Value to 0.
- 7) Press OK button to exit this dialog box.



* This setting is required for each object that you want to limit input value.

* Registering this object to the library makes it easier to reuse this object. For details of how to register objects to library, see CX-Designer's help or programming manual.

4-7-2 How to display a value of SIMATIC_TIME type by its original mean

A SIMATIC_TIME value consists of 16 bits. A set of higher four bits represents timer unit (0000=10ms, 0001=100ms, 0010=1s, 0011=10s), and a set of lower 12 bits represents significant (BCD). For example, SIMATIC_TIME value "0x3124" means $10 \times 124 = 1240$ seconds.

To display SIMATIC_TIME value by its original mean, do as followings.

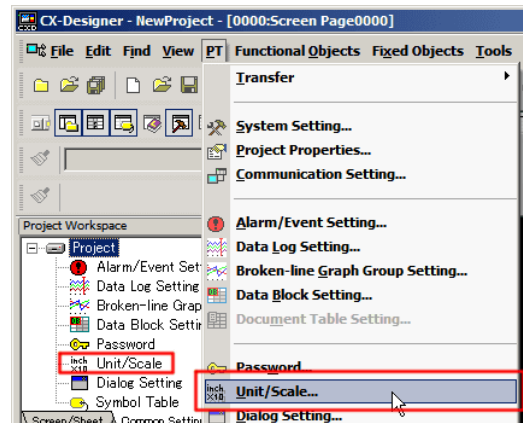
The procedure consists of three parts — "Unit setting", "Screen macro programming", and "Numerical Display & Input functional objects setting". Unit setting is required for each project only once on which you want to place "SIMATIC_TIME display & input objects". Screen macro programming is required for each screen or sheet, and

Numerical Display & Input functional objects setting for each object you want to display SIMATIC_TIME value by its mean.

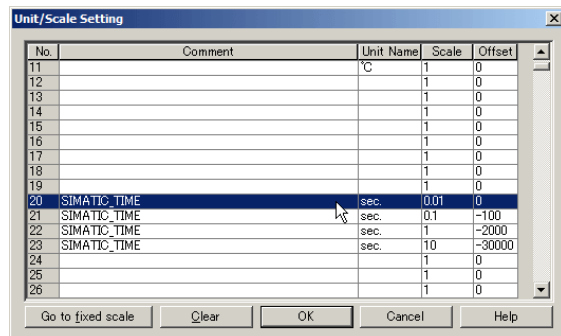
This example describes how to monitor a SIMATIC_TIME value of SERIALA:T23. Please make sure that following procedure requires a word temporary memory (\$W1023 is used in this example), and four continuous unit/scale numbers (20 ~ 23 are used in this example).

Unit Setting

1) Click [PT] – [Unit/Scale] from menu, or double-click [Unit/Scale] on Common Setting tab of project workspace.



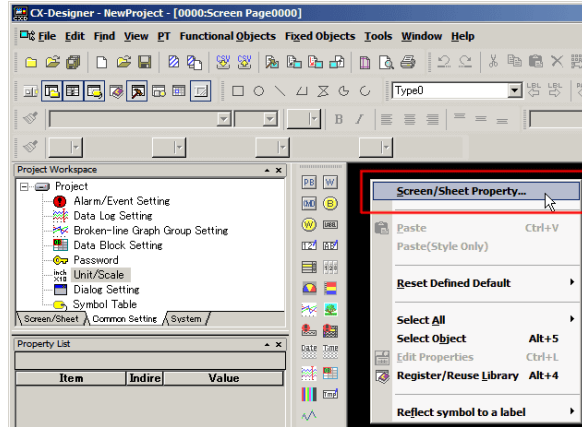
2) Specify unit setting like the right figure using continuous four numbers. In this example, No. 20~23 are used.



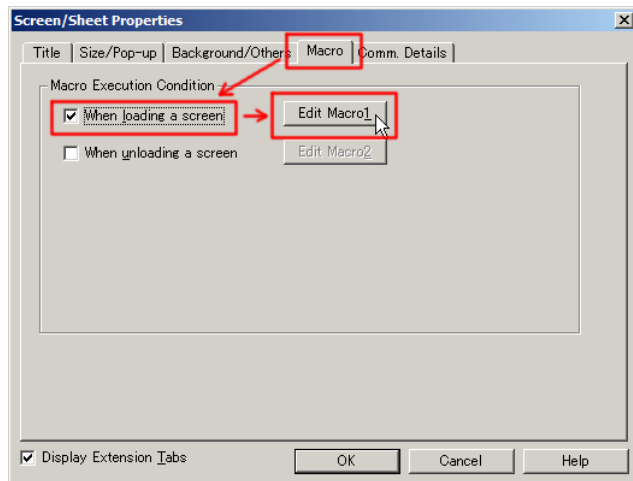
3) Click [OK] to close the window.

Screen macro programming

- 1) Open the screen or sheet on which you want to place the numerical display & input object that displays SIMATIC_TIME data by its original mean.
- 2) Right-click the blank area of the screen, then click [Screen/Sheet Property].



- 3) The dialog will open. Click [Macro] tab, [When loading a screen] checkbox, and [Edit Macro] button in this order.



- 4) “Edit Macro” dialog will be displayed. Type the following program into the edit box. Please adapt bolded and underlined **\$W1023**, **SERIALA:T23**, **20** to your environment (20 is the head number which we set the unit/scales for SIMATIC_TIME).

```
READCMEM($W1023, [SERIALA:T23], 1);  
$W1023 = ($W1023 >> 12) + 20;
```

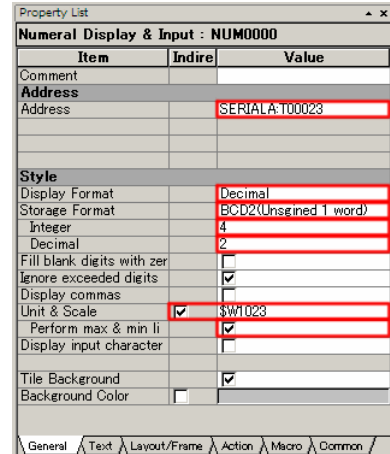
- 5) Click [OK] button to close “Edit Macro” dialog.
- 6) Click [OK] button to close “Screen/Sheet Properties” dialog.

Numerical Display & Input functional objects setting

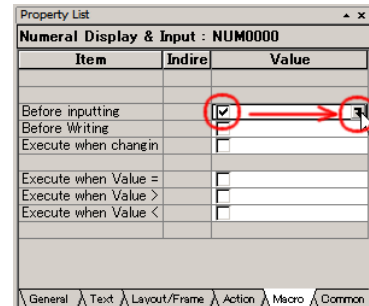
1) Place a Numerical Display & Input object on the screen.

2) Set parameters as the right figure in property list.

If property list window is hidden, it can be show by pressing [Alt]+[3].



3) Click “Macro” tab in the property list, then check on [Before Writing] and click



4) “Edit Macro” dialog will be displayed. Type the following program into the edit box. Please adapt bolded and underlined **\$W1023**, **SERIALA:T23**, and **20** to your environment (20 is the head number which we set the unit/scales for SIMATIC_TIME).

```
$W1023 = ( $W1023 >> 12 ) + 20 ;
```

5) Click [OK] button to close “Edit Macro” dialog.

6) Check on [Before Writing] and click

7) “Edit Macro” dialog will be displayed. Type the following program into the edit box. Please adapt bolded and underlined **\$W1023**, **SERIALA:T23**, **20** to your environment (20 is the head number which we set the unit/scales for SIMATIC_TIME).

```
READCMEM( $W1023 , [ SERIALA:T23 ] , 1 ) ;  
$W1023 = ( $W1023 >> 12 ) + 20 ;
```

8) Click [OK] button to close “Edit Macro” dialog.

9) Click “Action” tab in the property list, check “Maximum Limit”, and set “Maximum Value” to “3999”.

10) Check “Minimum Limit”, and set “Minimum Value” to “0”.

That's all. Following pictures show examples of objects which are applied vs. which are NOT applied this settings.

