# General MODBUS TCP Master Driver

Introduction

This manual describes how to connect the Display and the External Device (target PLC).

In this manual, the connection procedure will be described in the sections identified below.

| 1 | System Configuration<br>This section lists the types of External Devices and SIO that you can connect. | ☞ "2 System Configuration" (page 4) |

| 2 | External Device Selection<br>Select the model (series) of the External Device and its connection method. | ☞ "3 External Device Selection" (page 5) |

| 3 | Communication Settings<br>This section shows setting examples for communicating between the Display and the External Device. | ☞ "4 Communication Setting" (page 6) |

| 4 | Setup Items<br>This section describes communication setup items on the Display.<br>Set the communication settings of the Display with GP-Pro EX or in off-line mode. | ☞ "5 Setup Items" (page 8) |

Operation

# 1 General MODBUS TCP Master Driver

The general MODBUS TCP Master Driver is used to connect the Display to a MODBUS-compatible External Device for general purpose.

The function code and boundary required for communication can be changed according to the External Device.

# 2 System Configuration

The following table lists system configurations for connecting MODBUS-compatible External Device and the Display.
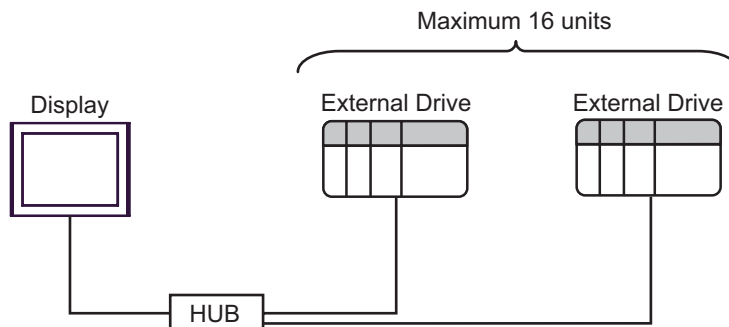
| Series | CPU | Link I/F | SIO Type | Setting Example |
|---|---|---|---|---|
| MODBUS Slave Device | | | Ethernet (TCP) | Setting Example 1 (page 6) |

## ■ Connection Configuration

### ◆ 1:1 Connection



### ◆ 1: n Connection

Maximum 16 units
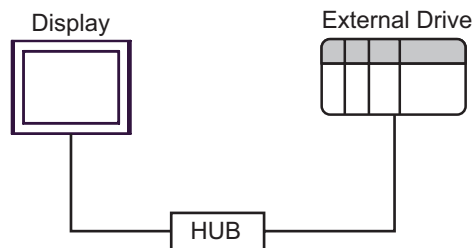


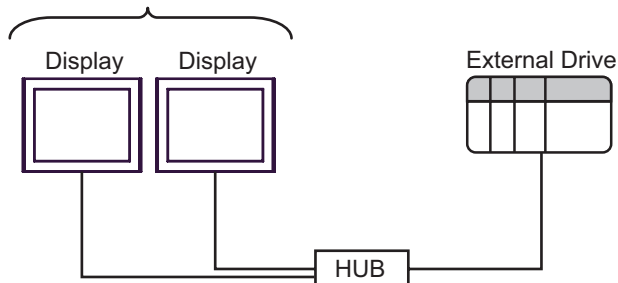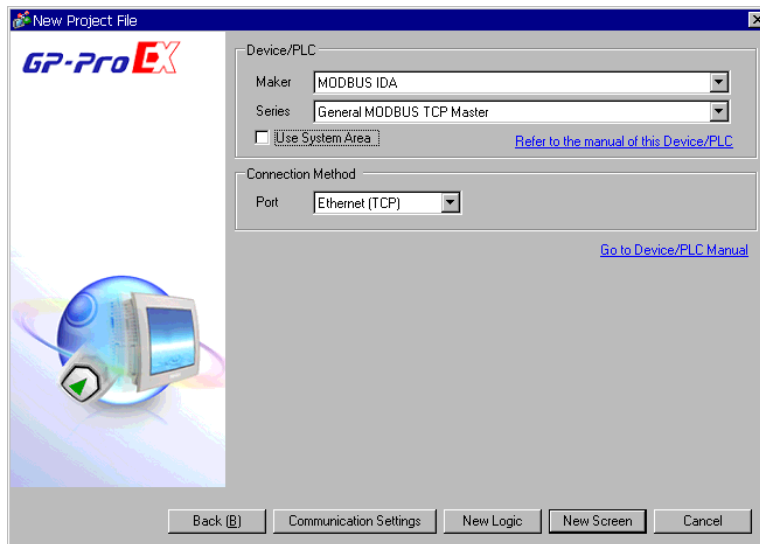### ◆ n: 1 Connection

The number of connectable Displays depends on the External Device.

# 3        External Device Selection

Select the External Device to be connected to the Display.



| Setup Items | Setup Description |
|---|---|
| Maker | Select the maker of the External Device to be connected. Select "MODBUS IDA". |
| Series | Select the model (series) of the External Device to be connected and connection method. Select "General MODBUS TCP Master".<br>In the System Configuration, check to make sure the External Device you are connecting is supported in "General MODBUS TCP Master".<br>☞ "2 System Configuration" (page 4) |
| Use System Area | Select this option to synchronize the system data area of the Display and the device (memory) of the External Device. When they are synchronized, you can use the ladder program of the External Device to switch the display or to display a window on the Display.<br><br>Cf.    GP-Pro EX Reference Manual "Appendix 1.4 LS Area (Direct Access Method)"<br><br>This can also be set with GP-Pro EX or in the Display's off-line mode.<br><br>Cf.    GP-Pro EX Reference Manual "5.17.6 Setting Guide of [System Setting Window], Setting Guide of [Main Unit Settings], System Area Setting"<br><br>Cf.    Maintenance/Troubleshooting Manual "2.15.1 Common to the Display", Setting Guide of [Main Unit Settings], System Area Setting" |
| Port | Select the port of the Display to be connected to the External Device. |

# 4        Communication Setting

This section provides examples of communication settings for the Display and the External Device, which are recommended by Pro-face.

## 4.1        Setting Example 1

### ■ GP-Pro EX Settings

#### ◆ Communication Settings

To display the setup screen, from the [System Settings] workspace, select [Device/PLC].

◆ Device Setting

To display the [Individual Device Settings] dialog box, select the external device and click [Settings] from [Device-Specific Settings] in the [Device/PLC] window. To connect multiple External Devices, click from [Device-Specific Settings] in the [Device/PLC] window to add another External Device.
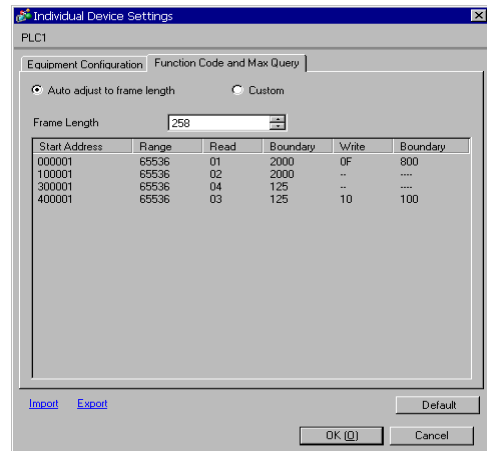
[Equipment Configuration] Tab

[Function Code and Max Query] Tab



◆ Notes

• Check with your network administrator about the IP address you want to use.

• Do not duplicate IP addresses on the same network.

• In [Individual Device Settings], set the IP address of the External Device.

• Set the Display's IP address in off-line mode.

■ External Device Settings

External Device settings vary depending on the device. Refer to your External Device manual for details.

◆ Notes

• Check with your network administrator about the IP address you want to use.

• Do not duplicate IP addresses on the same network.

# 5 Setup Items

Set up the Display's communication settings in GP-Pro EX or in the Display's off-line mode.

The setting of each parameter must match that of the External Device.

☞ "4 Communication Setting" (page 6)

| NOTE | • Set the Display's IP address in off-line mode. |
| --- | --- |
| | Cf. Maintenance/Troubleshooting Manual "2.5 Ethernet Settings" |

## 5.1 Setup Items in GP-Pro EX

### ■ Communication Settings

To display the setup screen, from the [System Settings] workspace, select [Device/PLC].



| Setup Items | Setup Description |
| --- | --- |
| Port No. | Use an integer from "1024 to 65535" to enter the port number of the Display. If you check [Auto], the port number will be automatically set. |
| Timeout | Use an integer from 1 to 127 to enter the time(s) for which the Display waits for the response from the External Device. |
| Retry | In case of no response from the External Device, enter how many times the Display retransmits the command, from "0 to 255". |
| Wait To Send | Enter the standby time (ms) from when the Display receives packets until it transmits the next command, from "0 to 5000". |

■ Device Setting

To display the [Individual Device Settings] dialog box, select the external device and click [Settings] from [Device-Specific Settings] in the [Device/PLC] window. To connect multiple External Devices, click from [Device-Specific Settings] in the [Device/PLC] window to add another External Device.

• [Equipment Configuration] Tab



| Setup Items | Setup Description |
|---|---|
| IP Address | Set the IP address of the External Device.<br><br>**NOTE**<br>• Check with your network administrator about the IP address you want to use.<br>• Do not duplicate IP addresses on the same network. |
| Port No. | Use an integer from "1 to 65535" to enter the port number of the External Device. |
| Unit ID | Use an integer from 1 to 247 (or 255) to enter the unit ID of the External Device. |
| Bit manipulation (set/reset) to Holding Register | Select how other bits in the same word are handled when you manipulate bits in the holding register, from "Clear" or "Do not clear". |
| Rest of the bits in this word | |
| IEC61131 Syntax | Select this item to use the IEC61131 syntax for variables.<br>If you check this item, select the address mode from "0-based" or "1-based". |
| Double Word word order | Select the order of storing double word data from "Low word first" or "High word first". |
| Import | Import the device settings described in the xml file.<br>☞ " ◆ Import Procedure in the Device Setting" (page 14) |

Continued to next page.

| Setup Items | Setup Description |
|---|---|
| Export | Export the device settings into the xml file.<br>☞ " ◆ Export Procedure in the Device Setting" (page 14) |

• [Function Code and Max Query] Tab (when "Auto adjust to frame length" is selected)
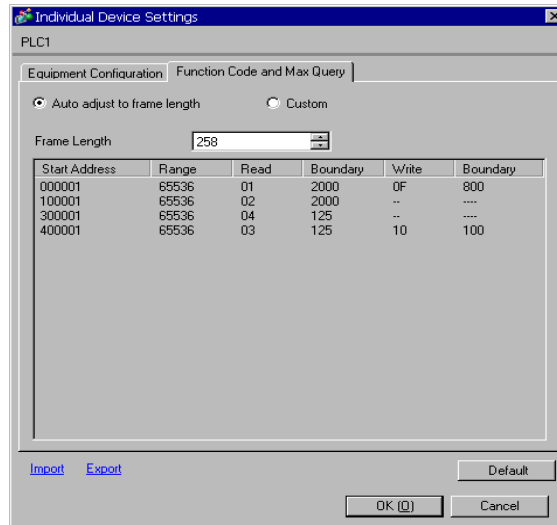


| Setup Items | Setup Description |
|---|---|
| Auto adjust to frame length | Automatically set each function code and the boundary for one communication according to the frame length. Function codes cannot be changed. To change a function code, use "Custom". |
| Frame Length | Set the frame length from "10 to 258". After setting, click the device list to display the boundary. |
| Import | Import the device settings described in the xml file.<br>☞ " ◆ Import Procedure in the Device Setting" (page 14) |
| Export | Export the device settings into the xml file.<br>☞ " ◆ Export Procedure in the Device Setting" (page 14) |

NOTE

• When "Auto adjust to frame length" is selected, use the following function codes. The read/write boundary is automatically calculated according to "Frame Length".

| Device | Function Code | |
|---|---|---|
| | Read | Write |
| Coil | 01 | 0F: Force Multiple Coils |
| Discrete Input | 02 | Disabled |
| Input Register | 04 | Disabled |
| Holding Register | 03 | 10: Preset Multiple Register |

• Use "Custom" in the following cases:
  • When you use a different function code depending on an address.
  • When you use the function code "05: Force Single Coil" or "06: Preset Single Register".
  • When the read/write boundary depends on the device.

• [Function Code and Max Query] Tab (when "Custom" is selected)



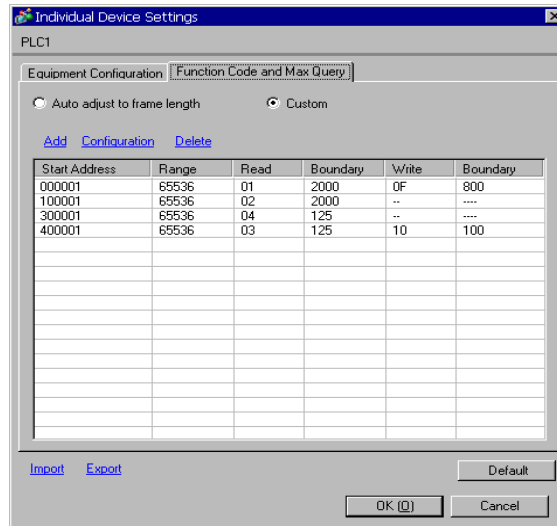| Setup Items | Setup Description |
|---|---|
| Custom | Manually set each function code and the boundary for one communication. |
| Add | Add the function code and its data boundary settings.<br>Up to 20 settings can be added.<br>Add the settings in the [Add setting] dialog box. |
| Configuration | Change the selected device settings.<br>Change the settings in the [Configuration setting] dialog box. |
| Delete | Delete the selected device settings. |
| Import | Import the device settings described in the xml file.<br>)" ◆ Import Procedure in the Device Setting" (page 14) |
| Export | Export the device settings into the xml file.<br>)" ◆ Export Procedure in the Device Setting" (page 14) |

• [Add setting] Dialog Box / [Configuration setting] Dialog Box

| Setup Items | | Setup Description |
|---|---|---|
| Start Address | | Set the start address of the device. |
| Range | | Set the range of the device specified in the start address. |
| Read | | Set the function codes to be used for read and the read boundary in one communication. |
| | Function Code | The function code is assigned by the specified start address. |
| | Boundary | The boundary depends on the device. Refer to the following table for details. |
| Write | | Set the function code to be used for write and the write boundary in one communication. |
| | Function Code | The function code depends on the device. Refer to the following table for details. |
| | Boundary | The boundary depends on the device. Refer to the following table for details. |

NOTE

• When "Custom" is selected, use the following function codes.

| Device | Function Code (Boundary) | | |
|---|---|---|---|
| | Read | Write | |
| | | Multiple | Single |
| Coil | 01(2000) | 0F: Force Multiple Coils (800) | 05: Force Single Coil (Fixed to 1) |
| Discrete Input | 02(2000) | Disabled | Disabled |
| Input Register | 04(125) | Disabled | Disabled |
| Holding Register | 03(125) | 10: Preset Multiple Register (100) | 06: Preset Single Register ( Fixed to 1) |

• If the set device address is disabled to write, you cannot set the write function code and boundary.

• When you select the function code "05" or "06", the write boundary will be fixed to "1", and cannot be changed.

◆ Import Procedure in the Device Setting

　1　Create the xml file based on the following format sample.

　•　Format sample when "Auto adjust to frame length" is selected

```
<?xml version="1.0" encoding="utf-8" ?>
<ModbusConfiguration version="1">
 <ClearBits>OFF</ClearBits>
 <AddressMode>ModiconSyntax</AddressMode>
 <DWORD>L/H</DWORD>
 <FunctionCode>
  <Mode>AutoAdjust</Mode>
  <FrameLength>258</FrameLength>
 </FunctionCode>
</ModbusConfiguration>
```

Bit manipulation to Holding Register
Address Mode
Double Word word order

Mode
Frame Length

　•　Format sample when "Custom" is selected

```
<?xml version="1.0" encoding="utf-8" ?>
<ModbusConfiguration version="1">
 <ClearBits>OFF</ClearBits>
 <AddressMode>ModiconSyntax</AddressMode>
 <DWORD>L/H</DWORD>
 <FunctionCode>
  <Mode>Custom</Mode>
  <Setting>
  <Address>000001</Address>
  <Range>65535</Range>
  <Read>
   <FunctionCode>01</FunctionCode>
   <Boundary>2000</Boundary>
  </Read>
  <Write>
   <FunctionCode>0F</FunctionCode>
   <Boundary>800</Boundary>
  </Write>
  </Setting>
 </FunctionCode>
</ModbusConfiguration>
```

Bit manipulation to Holding Register
Address Mode
Double Word word order

Mode

Start Address
Range

Read Function Code
Read Boundary

Write Function Code
Write Boundary

　2　Click [Import] on the [Individual Device Settings] dialog box to display the [Open] dialog box.

　3　Select the created xml file and click [Open].

◆ Export Procedure in the Device Setting

　1　Click [Export] on the [Individual Device Settings] dialog box to display the [Save as] dialog box.

　2　Enter a name and click [Save].

## 5.2    Setup Items in Off-line Mode

NOTE
- Refer to the Maintenance/Troubleshooting manual for information on how to enter off-line mode or about the operation.

    Cf.    Maintenance/Troubleshooting Manual "2.2 Off-line Mode"

◆ Communication Settings

To display the setting screen, touch [Device/PLC Settings] from [Peripheral Equipment Settings] in off-line mode. Touch the External Device you want to set from the displayed list.

```
┌─────────┬─────────┬─────────┬─────────┬─────────┐
│  Comm.  │ Device  │         │         │         │
├─────────┴─────────┴─────────┴─────────┴─────────┤
│                                                 │
├─────────────────────────────────────────────────┤
│ General MODBUS TCP Master          [TCP]  Page 1/1│
│                                                 │
│                                                 │
│     Port No.              ○ Fixed   ● Auto      │
│                               1024 ▼ ▲          │
│                                                 │
│     Timeout(s)                  3  ▼ ▲          │
│     Retry                       0  ▼ ▲          │
│     Wait To Send(ms)            0  ▼ ▲          │
│                                                 │
│                                                 │
│                                                 │
│                                                 │
│                                                 │
├─────────┬─────────┬─────────┬─────────┬─────────┤
│         │  Exit   │         │  Back   │2008/06/13│
│         │         │         │         │09:49:17 │
└─────────┴─────────┴─────────┴─────────┴─────────┘
```

| Setup Items | Setup Description |
|---|---|
| Port No. | Set the Port No. of the Display. Select either of [Fixed] or [Auto]. When you select [Fixed], use an integer from "1024 to 65535" to enter the port number of the Display.When you select [Auto], the port number will be automatically assigned regardless of the entered value. |
| Timeout | Use an integer from 1 to 127 to enter the time (s) for which the Display waits for the response from the External Device. |
| Retry | In case of no response from the External Device, enter how many times the Display retransmits the command, from "0 to 255". |
| Wait To Send | Enter the standby time (ms) from when the Display receives packets until it transmits the next command, from "0 to 5000". |

◆ Device Setting

To display the setting screen, touch [Device/PLC Settings] from [Peripheral Equipment Settings]. Touch the

External Device you want to set from the displayed list, and touch [Device].

(Page 1/22)

| Comm. | Device | | | |
|-------|--------|--|--|--|
| | | | | |

General MODBUS TCP Master                    [TCP]         Page 1/22

      Device/PLC Name   [PLC1               ▼]

       IP Address           [192 168  0   1]
       Port No.            [      502] ▼ ▲
       Unit ID             [      255] ▼ ▲

       Bit manipulation to HR   Rest of bits in word are not cleared
       Double Word word order   Low word first
       IEC61131 Syntax         OFF

                                                ➡

| | Exit | | Back | 2008/06/13 09:49:30 |
|--|------|--|------|---------------------|

| Setup Items | Setup Description |
|-------------|-------------------|
| Device/PLC Name | Select the External Device to set. The device name is the title of the External Device set with GP-Pro EX.(Initial value [PLC1]) |
| IP Address | Set the IP address of the External Device.<br><br>**NOTE**<br>• Check with your network administrator about the IP address you want to use.<br>• Do not duplicate IP addresses on the same network. |
| Port No. | Use an integer from "1 to 65535" to enter the port number of the External Device. |
| Unit ID | Use an integer from 1 to 247 (or 255) to enter the unit ID of the External Device. |
| Bit manipulation to HR | Displays how other bits in the same word are handled when you manipulate bits in the holding register, as "Rest of bits in word are cleared" or "Rest of bits in word are not cleared". (Not available to set in off-line mode.) |
| Double Word word order | Displays the currently set order of storing double word data as "Low word first" or "High word first". (Not available to set in off-line mode.) |
| IEC61131 Syntax | Displays the usage status of the currently set IEC61131 syntax in ON/OFF. (Not available in off-line mode.) |

(Page 2/22)

| Comm. | Device | | | |
|-------|--------|--|--|--|
| | | | | |

General MODBUS TCP Master                            [TCP]          Page 2/22

      Device/PLC Name    PLC1                              ▼

      Function Code and Max Query

                                  Auto adjust to Frame Length

      Auto adjust Setting

       Frame Length             258

← →

| | Exit | | Back | 2008/06/13 09:49:36 |

| Setup Items | | Setup Description |
|-------------|--|-------------------|
| Device/PLC Name | | Select the External Device to set. The device name is the title of the External Device set with GP-Pro EX.(Initial value [PLC1]) |
| Function Code and Max Query | | Displays the option to set the function code and boundary. (Not available to set in off-line mode.) |
| Auto adjust Setting | | Displays the set frame length when "Auto adjust to frame length" is selected in the online mode. (Not available to set in off-line mode.) |
| | Frame Length | |

NOTE • When "Custom" is selected, the setup items of the frame length are invalid.

(Page 3/22 to 22/22)

| Comm. | Device | | | |

General MODBUS TCP Master                          [TCP]          Page 3/22

Device/PLC Name    PLC1    ▼

Custom Setting 1
Start Address      000001
Range              65536
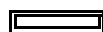Read               01 / 2000
Write              0F / 0800

← →

| | Exit | | Back | 2008/06/13 09:49:45 |

| Setup Items | Setup Description |
| --- | --- |
| Device/PLC Name | Select the External Device to set. The device name is the title of the External Device set with GP-Pro EX. (Initial value [PLC1]) |
| Start Address | Displays the start address of the device. (Not available to set in off-line mode.) |
| Range | Displays the range of the device specified in the start address. (Not available to set in off-line mode.) |
| Read | Displays the device function codes and boundaries to be read for one communication. (Not available to set in off-line mode.) |
| Write | Displays the device function codes and boundaries to be written for one communication. (Not available to set in off-line mode.) |
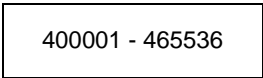
NOTE

• Page 3 and the following pages display the set descriptions in order.
• When "Auto adjust to frame length" is selected, the Custom setup items are invalid.

# 6 Supported Device

The range of supported device addresses is shown in the table below. Please note that the actual supported range for devices varies depending on the external device that is used. Please check the actual range in the external device manual.

⬜️⬜️ : This address can be specified as system data area.

| Device | Bit Address | Word Address | 32 bits | Remarks |
|---|---|---|---|---|
| Coil | 000001 - 065536 | 000001 - 065521 | | ÷16+ 1 |
| Discrete Input | 100001 - 165536 | 100001 - 165521 | L / H | ÷16+ 1 *2 |
| Input Register | ----- | 300001 - 365536 | or | Bit 15 *2 |
| Holding Register | 400001,00 - 465536,15 | 400001 - 465536 | H / L | Bit 15 *3 |
| Input Register | ----- | D300001 - D365535 | *1 | Bit 31 *2 |
| Holding Register | D400001,00 - D465535,31 | D400001 - D465535 | | Bit 31 *4 |

*1 Whether the data is stored as higher or lower is determined by the [Double Word word order] setting in [Device Setting].
☞ "5.1 Setup Items in GP-Pro EX" (page 8)

*2 Write disable.

*3 An access method at the time of Bit Set varies depending on the [Rest of the bits in this word] setting of [Device Setting].

"Clear"........................................ Bit 15

"Do not clear"............................. 400001,00 - 465536,15

*4 An access method at the time of Bit Set varies depending on the [Rest of the bits in this word] setting of [Device Setting].

"Clear"........................................ Bit 31

"Do not clear"............................. D400001,00 - D465535,31

## ■ IEC61131 Syntax Address Description

The following table compares IEC61131 and MODBUS syntax descriptions.

| Device | MODBUS Syntax | | | IEC61131 Syntax | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | | | | | 0-based | | 1-based | |
| | Format | Range | First element | Format | Range | First element | Range | First element |
| Coil | 000001+i | i = 0 to 65535 | 000001 | %Mi | i = 0 to 65535 | %M00000 | i = 1 to 65536 | %M00001 |
| Discrete Input | 100001+i | i = 0 to 65535 | 100001 | - | - | - | - | - |
| Input Register (Word) | 300001+i | i = 0 to 65535 | 300001 | - | - | - | - | - |
| Input Register (Word bit) | 300001+i,j | i = 0 to 65535 j = 0 to 15 | 300001,00 | - | - | - | - | - |
| Holding Register (Word) | 400001+i | i = 0 to 65535 | 400001 | %MWi | i = 0 to 65535 | %MW00000 | i = 1 to 65536 | %MW00001 |
| Holding Register (Word bit) | 400001+i,j | i = 0 to 65535 j = 0 to 15 | 400001,00 | %Mwi: Xj | i = 0 to 65535 j=0 to 15 | %MW00000 :X00 | i = 1 to 65536 j=0 to 15 | %MW00001 :X00 |
| Input Register (D Word) | D300001+i | i = 0 to 65534 | D300001 | - | - | - | - | - |
| Input Register (D Word bit) | D300001+i,j | i = 0 to 65534 j = 0 to 31 | D300001,00 | - | - | - | - | - |
| Holding Register (D Word) | D400001+i | i = 0 to 65534 | D400001 | %MDi | i = 0 to 65534 | %MD00000 | i = 1 to 65535 | %MD00001 |
| Holding Register (D Word bit) | D400001+i,j | i = 0 to 65534 j = 0 to 31 | D400001,00 | %MDi:Xj | i = 0 to 65534 j=0 to 31 | %MD00000 :X00 | i = 1 to 65535 j=0 to 31 | %MD00001 :X00 |

| NOTE | • The addresses 100000 and 300000 cannot be accessed using IEC61131 syntax. |
| --- | --- |
| | • If you apply IEC61131 syntax to a project that has a discrete input or input register already set, the addresses become "-Undefined-" and invalid. |

| NOTE | • Refer to the GP-Pro EX Reference Manual for system data area. |
| --- | --- |
| | Cf.    GP-Pro EXReference Manual "Appendix 1.4 LS Area (Direct Access Method)" |
| | • Refer to the precautions on manual notation for icons in the table. |
| | ☞ "Manual Symbols and Terminology" |

# 7 Device Code and Address Code

Use device code and address code when you set "Device Type & Address" for the address type of the data display or other devices.

| Device | Device Name | Device Code (HEX) | Address Code |
|---|---|---|---|
| Coil | 0 | 0080 | Value of (word address -1) divided by 16 |
| Discrete Input | 1 | 0081 | Value of (word address -1) divided by 16 |
| Input Register | 3 | 0001 | Value of (word address - 1) |
| Holding Register | 4 | 0000 | Value of (word address - 1) |
| Input Register | D3 | 0002 | Value of (word address -1) divided by 2 |
| Holding Register | D4 | 0003 | Value of (word address -1) divided by 2 |

# 8 Error Messages

Error messages are displayed on the screen of Display as follows: "No. : Device Name: Error Message (Error Occurrence Area)". Each description is shown below.

| Item | Description |
|---|---|
| No. | Error Number. |
| Device Name | Name of the External Device where an error has occurred. The Device name is the title of the External Device set with GP-Pro EX.(Initial value [PLC1]) |
| Error Message | Displays messages related to an error that has occurred. |
| Error Occurrence Area | Displays the IP address or device address of the External Device where an error has occurred, or error codes received from the External Device. **NOTE** • IP address is displayed as "IP address (Decimal): MAC address (Hex)". • Device address is displayed as "Address: Device address". • Received error codes are displayed as "Decimal [Hex]". |

Display Examples of Error Messages

"RHAA035: PLC1: Error has been responded for device write command (Error Code: 2[02H])"

**NOTE**
• Refer to your External Device manual for details on received error codes.
• Refer to "When an error is displayed (Error Code List)" in "Maintenance/Troubleshooting manual" for details on the error messages common to the driver.

## ■ Error Codes Specific to the External Device

Please refer to the manual of the External Device for error codes specific to the External Device.

General MODBUS error codes are shown below.

| Error Code (HEX) | Description |
|---|---|
| 01 | Does not support the corresponding Function Code. |
| 02 | The specified data address does not exist. |
| 03 | Data value error. |

■ Error Messages Specific to the External Device

| ID | Error Message | Description |
|---|---|---|
| RHxx128 | (Node Name): (Device Address) can't be read because of the limitation of the Read boundary | When reading the coil or discrete input as a word address while the boundary is less than 16 bits, or accessing the input or holding register as a double word while the boundary is set to 1 word, an error will be displayed. |
| RHxx129 | (Node Name): (Device Address) can't be written because of the limitation of the Write boundary | When writing the coil as a word address while the boundary is less than 16 bits, or accessing the holding register as a double word while the boundary is set to 1 word, an error will be displayed. |
| RHxx130 | (Node Name): (Device Address) is not defined on Function Code and Max Query setting | When accessing the device out of the defined area, an error will be displayed. |
| RHxx131 | (Node Name): (Device Address) can't be read because of the limitation of the Device Range setting | When reading the coil or discrete input as a word address while the range is less than 16 bits, or accessing the input or holding register as a double word while the range is set to 1 word, an error will be displayed. |
| RHxx132 | (Node Name): (Device Address) can't be written because of the limitation of the Device Range setting | When writing the coil as a word address while the range is less than 16 bits, or accessing the holding register as a double word while the range is set to 1 word, an error will be displayed. |