# TOSVERT VF-MB1/S15

# EtherNet/IP™ - Modbus® TCP option Function Manual

# IPE002Z

NOTICE

1. Read this manual before installing or operating. Keep this instruction manual on hand of the end user, and make use of this manual in maintenance and inspection.
2. All information contained in this manual will be changed without notice. Please contact your Toshiba distributor to confirm the latest information.

# Introduction

Thank you for purchasing the “EtherNet/IP™ - Modbus® TCP option (IPE002Z)” for TOSVERT VF-MB1/S15 inverter. Before using EtherNet/IP™ - Modbus® TCP module, carefully read this function manual in order to completely and correctly utilize its excellent performance.

This option needs the option adaptor to connect VF-S15 which type form is SBP009Z. Please match here and buy it when SBP009Z is not at hand yet.

After reading this function manual, please keep it handy for future reference.

For details of its general handling, see an instruction manual attached with the option unit.

- TOSVERT VF-MB1 Instruction Manual ····· E6581697
- TOSVERT VF-S15 Instruction Manual ····· E6581611
- TOSVERT VF-MB1/S15 communication option Precautions Manual ····· E6581739
- TOSVERT VF-MB1 Communication Function Instruction Manual ····· E6581726
- TOSVERT VF-S15 Communication Function Instruction Manual ····· E6581913

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Modbus® TCP is a registered trademark of AEG Schneider Automation International S.A.S.

■ **Handling in general**

| ⚠ Warning | |
|---|---|
| Prohibited | ▼ Do not connect or disconnect a network cable while the Inverter power is on. It may lead to electric shocks or fire. |
| Mandatory | ▼ See the instruction manual attached with the option unit for cautions the handling. Otherwise, it may lead to electric shocks, fire, injuries or damage to product. |

■ **Network control**

| ⚠ Warning | |
|---|---|
| Prohibited | ▼ Do not send the value out of the valid range to objects and attributes. Otherwise, the motor may suddenly start/stop and that may result in injuries. |
| Mandatory | ▼ Use an additional safety device with your system to prevent a serious accident due to the network malfunctions. Usage without an additional safety device may cause an accident. |
| **⚠ Caution** | |
| Mandatory | ▼ Set up “Communication error trip function (see below)” to stop the Inverter when the option unit is deactivated by an unusual event such as tripping, an operating error, power outage, failure, etc.<br>- Network Time-Out, Inverter operation at disconnection, Preset speed operation selection<br>(Refer to "3.2.3 Network error detection (c100 - C103 .C5239." for details)<br>Deactivated the option module may cause an accident, if the “Communication error trip function” is not properly set up.<br>▼ Make sure that the operation signals are STOP before resetting Inverter’s fault. The motor may suddenly start and that may result in injuries. |

■ **Notes on operation**

| Notes | |
|---|---|
| | ▼ When the control power is shut off by the instantaneous power failure, communication will be unavailable for a while.<br>▼ The Life of EEPROM is approximately 100,000 times. Avoid writing a command more than 100,000 times to the same parameter of the Inverter and the option module. |

# Table of Contents

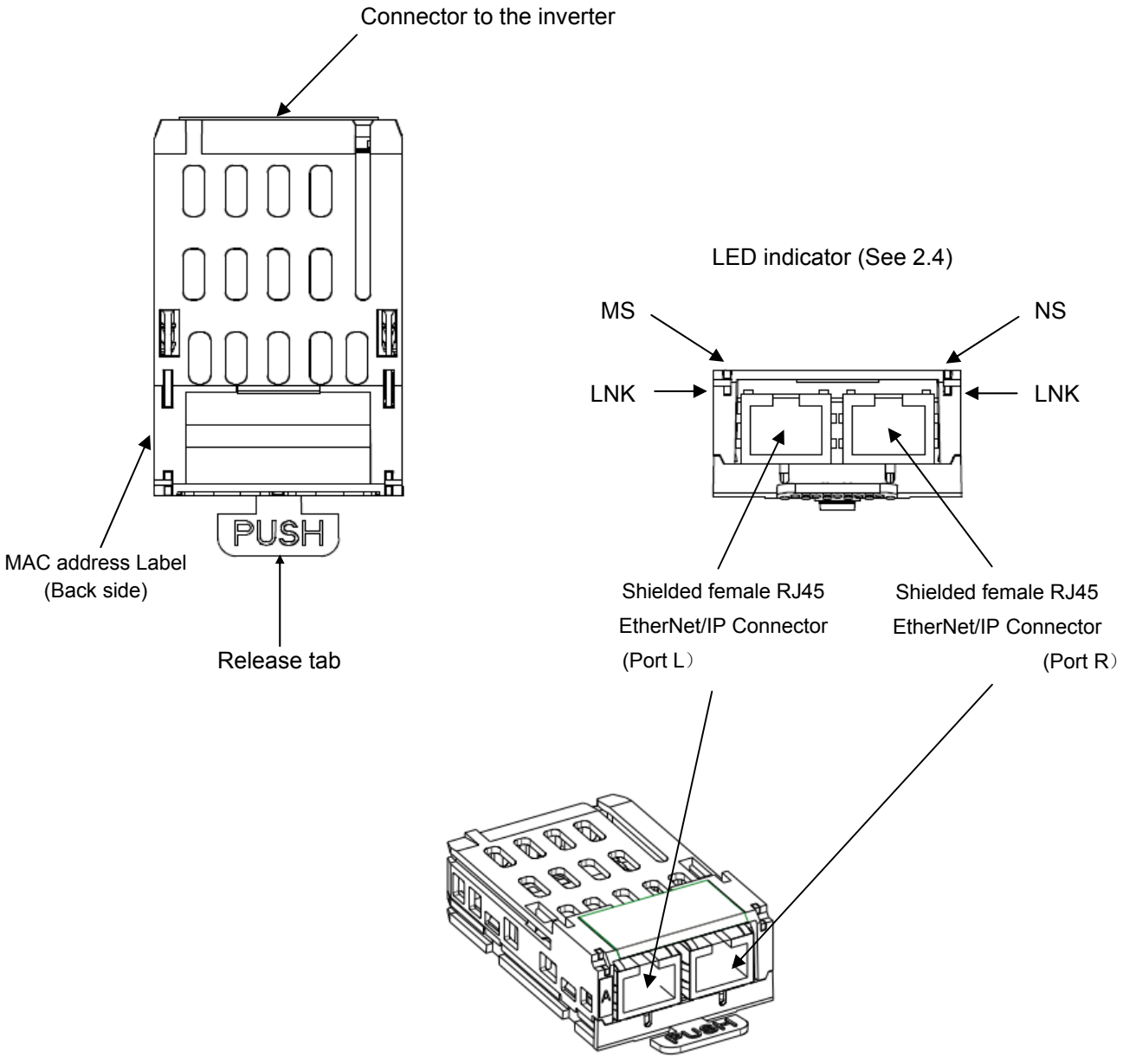
# 1. Overview

The EtherNet/IP™ - Modbus® TCP option (IPE002Z) allows the VF-MB1/S15 inverter to be connected into the EtherNet/IP™ - Modbus® TCP network.

# 2. Names and functions

The drawing below shows names and functions of main parts.

## 2.1. Outline



## 2.2. RJ45 connector pin layout

The EtherNet/IP™ - Modbus® TCP option is equipped with two shielded RJ45 connectors.

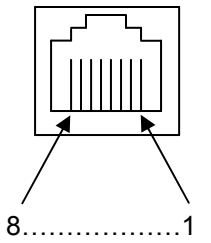
When you use VF-MB1, the shielding is connected to the drive ground. When you use VF-S15, the shielding is connected to the grounding terminal of option adapter.

Use an STP (shielded twisted pair) Ethernet cable.

The transmission speed is detected automatically by the unit (10 Mbps or 100 Mbps).

The card can operate in half duplex or full duplex mode, whether connected to a hub or a switch and regardless of the transmission speed (10 Mbps or 100 Mbps).

Port L and Port R

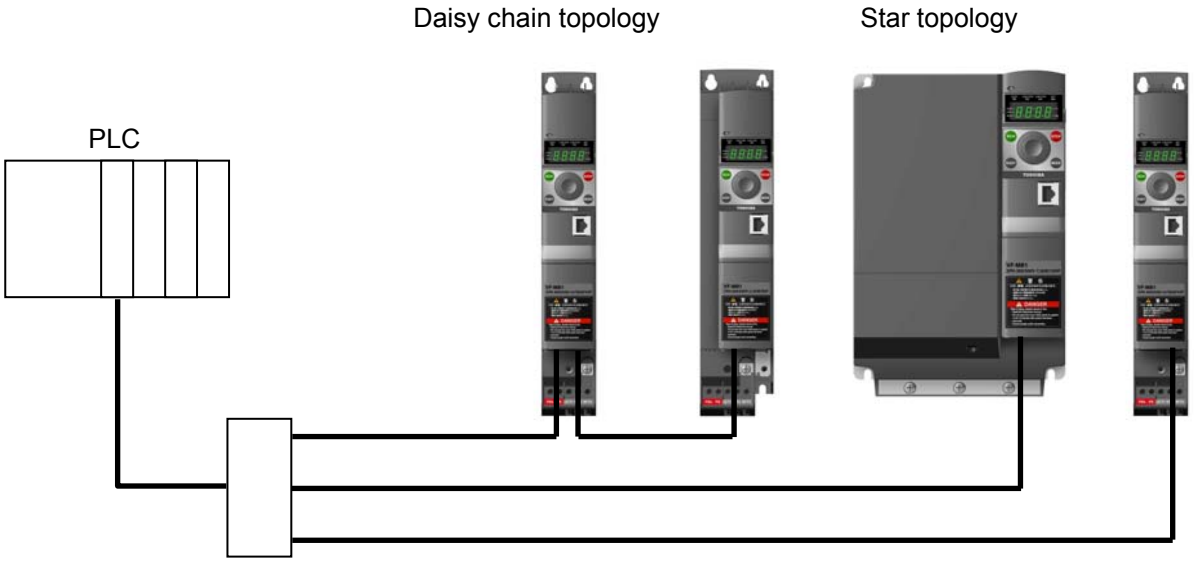



| Pin | Signal |
|---|---|
| 1 | TD+ |
| 2 | TD- |
| 3 | RD+ |
| 4 | - |
| 5 | - |
| 6 | RD- |
| 7 | - |
| 8 | - |

* Fix a cable so that a communication connector may be not taken the weight of wire.

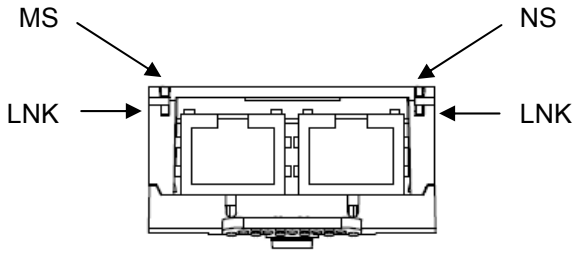
## 2.3. Example of connection to an EtherNet/IP™ and Modbus® TCP

Example of daisy chain topology and star topology



## 2.4. LED indicator

The LED shows the present status of the network and module.




■The behavior of LNK LED

| *Link Activity* | | |
|---|---|---|
| Protocol | Color and behavior | Meaning |
| EtherNet/IP & Modbus TCP | OFF | No link |
| | Flashing Green/Red | Power up testing |
| | Green ON | Link at 100Mbps |
| | Yellow ON | Link at 10Mbps |
| | Green Blink | Activity at 100Mbps |
| | Yellow Blink | Activity at 10Mbps |

■The behavior of MS LED

| *Module Status* | | |
|---|---|---|
| Protocol | Color and behavior | Meaning |
| EtherNet/IP | OFF | No power is supplied to the device |
| | Flashing Green/Red | Power up testing |
| | Green ON | The option is operating correctly |
| | Green flashing | The option has not been configured |
| | Red flashing | The option has detected a recoverable minor fault |
| | Red on | The option has detected a non-recoverable major fault |
| Modbus TCP | OFF | The option does not have an IP address or powered off |
| | Flashing Green/Red | Power up testing |
| | Green ON | The option is ready |
| | Green flashing | The option is not ready (waiting for cable connection or etc.) |
| | Red flashing | The option has detected a communication error (Err 8) |
| | Red ON | The option has detected a option module error (E-23) |

■The behavior of NS LED

| *Network Status* | | |
|---|---|---|
| Protocol | Color and behavior | Meaning |
| EtherNet/IP | OFF | The option does not have IP address or powered off |
| | Flashing Green/Red | Power up testing |
| | Green ON | The option has at least one established connection |
| | Green flashing | The option does not have at least one established connection |
| | Red flashing | One or more of the connections in which this device is the target has time out. This shall be left only if all time out connections are re-established or if the device is reset |
| | Red on | Error: duplicate IP address |
| Modbus TCP | OFF | The option does not have an IP address or powered off |
| | Flashing Green/Red | Power up testing |
| | Green ON | At least one port is connected and an IP address has been obtained |
| | Green flashing 3 times | All ports are unplugged, but the card has an IP address |
| | Green flashing 4 times | Error: duplicate IP address |
| | Green flashing 5 times | The card is performing a BOOTP or DHCP sequence |

# 3. Parameters

## 3.1. Communication parameters

Set up the inverter parameters as follows. It is necessary to reset the inverter to update the parameter. This option doesn't operate if these parameters are not correctly set.

| Title | Communication No. | Function | Description | Factory setting |
|---|---|---|---|---|
| CMOd | 0003 | Command mode selection | 0: Terminal board<br>1: Panel keypad (including remote keypad)<br>2: RS485 communication<br>3: CANopen communication<br>4: Communcation option | 1 |
| FMOd | 0004 | Frequency setting mode selection 1 | 0: Setting dial 1 (save even if power is off)<br>1: Terminal board VIA<br>2: Terminal board VIB<br>3: Setting dial 2 (press in center to save)<br>4: RS485 communication<br>5: UP/DOWN from external logic input<br>6: CANopen communication<br>7: Communication option<br>8: Terminal board VIC<br>9, 10: -<br>11: Pulse train input<br>12, 13: - (*1)<br>14: Sr0 (*1) | 0 |
| F856 | 0856 | Number of motor pole pair for communication | 1: 2 poles<br>2: 4 poles<br>3: 6 poles<br>4: 8 poles<br>5: 10 poles<br>6: 12 poles<br>7: 14 poles<br>8: 16 poles | 2 |
| F899 | 0899 | Communication function reset | 0: -<br>1: Reset (after execution: 0) | 0 |

(*1): There selections are effective in only VF-S15.

| Title | Communication No. | Function | Description | Factory setting |
|---|---|---|---|---|
| C001 | C001 | Scanner input 1 address (*3) | 0: -<br>1: FA06 (Communication command 1)<br>2: FA23 (Communication command 2)<br>3: FA01 (Frequency command, 0.01Hz)<br>5: FA50 (Terminal output data)<br>6: FA51 (FM analog output)<br>8: F601 (Stall prevention level, %)<br>13: ACC (Acceleration time 1, 0.1s) (*2)<br>14: dEC (Deceleration time 1, 0.1s) (*2)<br>15: UL (Upper limit, 0.01Hz)<br>16: ub (Torque boost value 1, 0.1%)<br>17: uLu (Base frequency voltage 1, 0.1V) | 1 |
| C002 | C002 | Scanner input 2 address (*3) | 0-17 (Same as C001) | 3 |
| C003 | C003 | Scanner input 3 address (*3) | 0-17 (Same as C001) | 0 |
| C004 | C004 | Scanner input 4 address (*3) | 0-17 (Same as C001) | 0 |
| C005 | C005 | Scanner input 5 address (*3) | 0-17 (Same as C001) | 0 |
| C006 | C006 | Scanner input 6 address (*3) | 0-17 (Same as C001) | 0 |

(*2): The unit depends on the F519 setting.

(*3): This parameter is effective by reset. Please reset (power supply reset or F899= 1) after changing a set point.

| Title | Communication No. | Function | Description | Factory setting |
|---|---|---|---|---|
| C021 | C021 | Scanner output 1 address (*3) | 0: -<br>1: Fd01 (Status information 1)<br>2: Fd00 (Output frequency, 0.01Hz)<br>3: Fd03 (Output current, 0.01%)<br>4: Fd05 (Output voltage, 0.01%)<br>5: FC91 (Alarm information)<br>6: Fd22 (PID feedback value, 0.01Hz)<br>7: Fd06 (Input terminal board status)<br>8: Fd07 (Output terminal status)<br>9: FE36 (VIB input, 0.01%)<br>10: FE35 (VIA input, 0.01%)<br>11: FE37 (VIC input, 0.01%)<br>12: Fd04 (Input voltage (DC detection), 0.01%)<br>13: Fd16 (Estimated speed 0.01Hz)<br>14: Fd18 (Torque, 0.01%)<br>15: -<br>16: -<br>17: -<br>18: -<br>19: F880 (Free notes)<br>20: Fd29 (Input power, 0.01kW)<br>21: Fd30 (Output power, 0.01kW)<br>22: FE14 (Cumulative operation time, hour)<br>23: FE40 (FM terminal output monitor, 0.01%)<br>24: -<br>25: Fd20 (Torque current, 0.01%)<br>26: Fd23 (Motor overload factor, 0.01%)<br>27: Fd24 (Drive overload factor, 0.01%)<br>28: Fd25 (PBR overload factor, %)<br>29: Fd26 (Motor load factor, %)<br>30: Fd27 (Drive load factor, %)<br>31: FE56 (Pulse train input, pps)<br>32: FE70 (Drive rated current, 0.1A)<br>33: FE76 (Input Watt-hour, 0.1kWh × $10^{F749}$)<br>34: FE77 (Output Watt-hour, 0.1kWh × $10^{F749}$)<br>35: Fd83 (IGBT temperature, degree C) | 1 |
| C022 | C022 | Scanner output 2 address (*3) | 0-35 (Same as C021) | 2 |
| C023 | C023 | Scanner output 3 address (*3) | 0-35 (Same as C021) | 0 |
| C024 | C024 | Scanner output 4 address (*3) | 0-35 (Same as C021) | 0 |
| C025 | C025 | Scanner output 5 address (*3) | 0-35 (Same as C021) | 0 |
| C026 | C026 | Scanner output 6 address (*3) | 0-35 (Same as C021) | 0 |
| C081-C096 | C081-C096 | Device Name 1-16 (*4) | 16 characters<br>The device name is required if the card uses DHCP to obtain its IP Address.<br>Refer to "3.2.1 Device name (c081-c096) for the details. | 0,0,0,0,<br>0,0,0,0 |
| C100 | C100 | Communication error detection delay time | 0.0 - 100.0 sec. | 0.0 |
| C101 | C101 | Inverter operation at the communication loss action | 0: Stop and controlled by CMod, FMod<br>1: Operation continue<br>2: Deceleration stop<br>3: Coast stop<br>4: Network error stop (Err8 trip)<br>5: Preset speed operation (by C102 setting) | 4 |
| C102 | C102 | Preset speed operation selection | 0: None<br>1 to 15: Preset speed | 0 |
| C103 | C103 | Communication time-out condition selection | 0: Disconnection detection<br>1: When communication mode enable (Both CMod and FMod are set CANopen or communication option) only<br>2: 1 + Driving operation | 0 |

(*3): This parameter is effective by reset. Please reset (power supply reset or F899=1) after changing a set point.
(*4): (EYP) does not work for this parameter.

| Title | Communication No. | Function | Description | Factory setting |
|---|---|---|---|---|
| C500 | C500 | Protocol (*3) | This parameter is used to set the protocol of the option card.<br>0: Modbus TCP (default)<br>1: EtherNet/IP | 0 |
| C501 | C501 | Rate Setting (*3) | This field is used to set the transmission speed and the transmission mode of the card.<br>0: Autodetect(default)<br>1: 10Mbps Full<br>2: 10Mbps Half<br>3: 100Mbps Full<br>4: 100Mbps Half | 0 |
| C502 | C502 | Actual Rate (L port) | This field displays the baud rate and the transmission mode currently used by the communication card. **(Display only)**<br>0: unconnected<br>1: 10Mbps Full<br>2: 10Mbps Half<br>3: 100Mbps Full<br>4: 100Mbps Half | - |
| C503 | C503 | Actual Rate (R port) | | |
| C504 | C504 | IP mode (*3) | Use this parameter to select the IP address assignment method.<br>0: Manual<br>1: BOOTP<br>2: DHCP<br>Refer to "3.2.2 Assigning IP addresses" for the details. | 0 |
| C505-C508 | C505-C508 | IP address (*3) | The IP address of the option module.<br>These fields are effective settings at C504 = 0.<br>Refer to "3.2.2 Assigning IP addresses" for the details. | 0.0.0.0 |
| C509-C512 | C509-C512 | Subnet Mask (*3) | The subnet mask of the option module.<br>These fields are effective settings at C504 = 0.<br>Refer to "3.2.2 Assigning IP addresses" for the details. | 0.0.0.0 |
| C513-C516 | C513-C516 | IP Gate (*3) | The gateway IP address of the option module.<br>These fields are effective settings at C504 = 0.<br>Refer to "3.2.2 Assigning IP addresses" for the details. | 0.0.0.0 |
| C517-C522 | C517-C522 | MAC address (*5) | The MAC address of the option module.<br>[C517 - C518 - C519 - C520 - C521 - C522] | ---- |
| C523 | C523 | Time out | The waiting time from the occurrence of the network error to detection can be adjusted.<br>* When you are using unconnected communication of the EtherNet/IP protocol, time out is not detected.<br>0.0: Disable<br>0.5 - 60 sec. | 2 |
| C524-C527 | C524-C527 | IP address actual | The current IP address of the option module.<br>Refer to "3.2.2 Assigning IP addresses" for the details. | - |
| C528-C531 | C528-C531 | IP Mask actual | The subnet mask actual of the option module.<br>Refer to "3.2.2 Assigning IP addresses" for the details. | - |
| C532-C535 | C532-C535 | IP Gate actual | The gateway IP address actual of the option module.<br>Refer to "3.2.2 Assigning IP addresses" for the details. | - |

(*3): This parameter is effective by reset. Please reset (power supply reset or F899= 1) after changing a set point.

(*5): .These values are displayed by decimal number format on panel of VFMB1/S15.

EtherNet/IP parameters

| Title | Communication No. | Function | Description | Factory setting |
|---|---|---|---|---|
| C536 | C536 | EtherNet Error | Monitor of the EtherNet error.<br>0: No error/clear error<br>1: Modbus TCP IO Scanning timeout<br>2: Network overload<br>3: Loss of Ethernet carrier | - |
| C554 | C554 | Web service (*3) | Enables web server.<br>0: Disable<br>1: Enable | 1 |
| C555 | C555 | Drive Status | Monitor the inverter status.<br>3: Gate Block<br>4: Run<br>23: Fault | - |

Modbus TCP parameters

| Title | Communication No. | Function | Description | Factory setting |
|---|---|---|---|---|
| C600-C603 | C600-C603 | IP Master (*3) | The IP address for PLC(Master) of the Modbus TCP. | 0.0.0.0 |
| C604 | C604 | IO Scan active (*3) | Enables IO Scan function.<br>0: Non-active<br>1: Active | 0 |

(*3): This parameter is effective by reset. Please reset (power supply reset or F899= 1) after changing a set point.

## ⚠ Warning

Mandatory action

- ▼ Set up “Communication error trip function (C100 to C103 and C523)” to stop the inverter when EtherNet/IP™ - Modbus® TCP communication is deactivated.
- ▼ When the parameters are changed, please reset (power supply reset or F899= 1) the inverter for the changes to take effect.

## 3.2. The details of the parameter setting

### 3.2.1. Device name (C081-C096)

This option module can set the "Device name" of 16 characters.
(Device name (C081-C096) is 1 character within one parameter.)
The device name is required if the option module uses DHCP to obtain its IP Address.

Please set the setting of the device name according to the following rules.
1. The parameter is displayed by the hexadecimal number.
2. One parameter shows an ASCII character.
3. The relation between the device name and the parameter is as follows.

Example for Device Name ='VFMB1-4007PL'

| Chars No. | Parameter | Character (Ex.) | ASCII (Ex.) |
|---|---|---|---|
| 1 | C081 | 'V' | 56H |
| 2 | C082 | 'F' | 46H |
| 3 | C083 | 'M' | 4DH |
| 4 | C084 | 'B' | 42H |
| 5 | C085 | '1' | 31H |
| 6 | C086 | '-' | 2DH |
| 7 | C087 | '4' | 34H |
| 8 | C088 | '0' | 30H |
| 9 | C089 | '0' | 30H |
| 10 | C090 | '7' | 37H |
| 11 | C091 | 'P' | 50H |
| 12 | C092 | 'L' | 4CH |
| 13 | C093 | - | - |
| 14 | C094 | - | - |
| 15 | C095 | - | - |
| 16 | C096 | - | - |

## 3.2.2. Assigning IP addresses (C504, C505 - C516)

The drive needs 3 (4-Modbus TCP) IP addresses.

*The drive IP address.

*The subnet mask.

*The gateway IP address.

(*The IP Master address.- Modbus TCP protocol only)

These parameters are effective settings at C504 = 0 (IP mode: Manual).

If the address has been given by a BOOTP or a DHCP server, these parameters are invalidity.

- After dynamic addressing by a BOOTP or DHCP server, the new address value is displayed in the parameters. (C524-C535)

They can be provided by:

*BOOTP server (correspondence between the MAC address and the IP addresses).

*DHCP server (correspondence between Device Name and the IP addresses).

The address is assigned according to the IP mode parameter.

| C504: IP mode | Comments |
|---|---|
| 0 | The option uses the address defined in C505-C516. |
| 1 | The option receives its address from a BOOTP server. |
| 2 | The option receives its address from a DHCP server.<br>*Device name contains (C081-C096) a valid name. |

Note: The IP mode parameter may be modified according to the configuration control attribute of the TCP/IP interface object (CIP standard).

## 3.2.3. Network error detection (C100 - C103, C523)

▼Display of trip information

Err8 (Optional unit fault 1: 1BH): Network error stop

▼Related parameter

| Title | Function | Setting range | Description |
|---|---|---|---|
| C100 | Communication error detection delay time | 0.0-100.0 sec | The waiting time from when a network error occurs can be adjusted. If a network error continues past the time set in C100, it is recognized as a communication error and the operation of the inverter follows the setting of C101.<br>When normal communication returns during the setting time, a communication error is not displayed and operation is continued.<br><br>*The case of Modbus® TCP protocol<br>The time-out detection time provides by C523 parameter.<br>Disconnection detection time =<br>C523 (Time out) +<br>C100 (Communication error detection delay time)<br><br>*The case of EtherNet/IP™ protocol<br>*-At I/O scanning and connected communication*<br>Time-out time =<br>RPI×4×$2^{\text{Connection Timeout Multiplier}}$ [μs] + C100 (communication error detection delay time) [0.1s]<br>RPI: Request Packet Interval<br><br>*-At Unconnected communication*<br>Time-out is not operating. |
| C101 | Inverter operation at the communications loss action | 0-5 | The operation of the inverter when the communication fault occurs can be specified. |
| C102 | Preset speed operation selection | 1-15 | The operation frequency of the inverter when the communication fault occurs can be specified. (Only when C101 is set to 5) |
| C103 | Communication time-out condition selection | 0-2 | Select the communication time-out condition. |
| C523 | Time out | 0.0: Disable<br>0.5 - 60 sec. | The waiting time from the occurrence of the network error to detection can be adjusted.<br>* When you are using unconnected communication of the EtherNet/IP protocol, time-out is not detected. |

## 3.2.4. Command data (C001-C006), Monitor data (C021-C026)

The outline is indicated about the setting item of parameter C001 – C006 and C021 – C026 in Instance 102/152 and 105/155 of use. Please refer to a communication functional description for details.

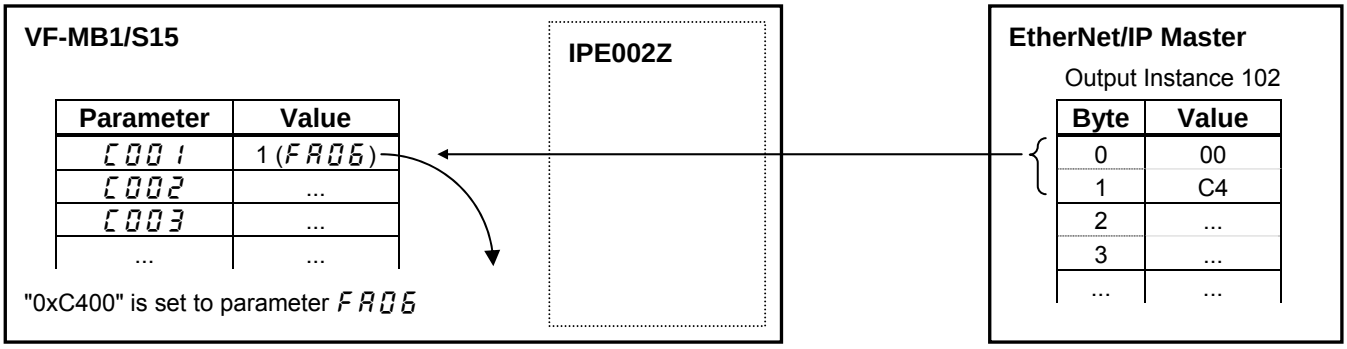
### 3.2.4.1. How to use Instance 102/152 and 105/155

Instance 102/152 and 105/155 choose a command or the monitor of the driving state by a menu of C001 - C006 and C021 - C026 and can perform the communication that is cyclic of EtherNet/IP™ and Modbus® TCP (ID = 255).

Example 1: Command transmitting by output Instance 102

If the command value "C400" set to parameter FA06, Choose parameter FA06 (a communication option command) for command data (C001 = 1 (FA06)).

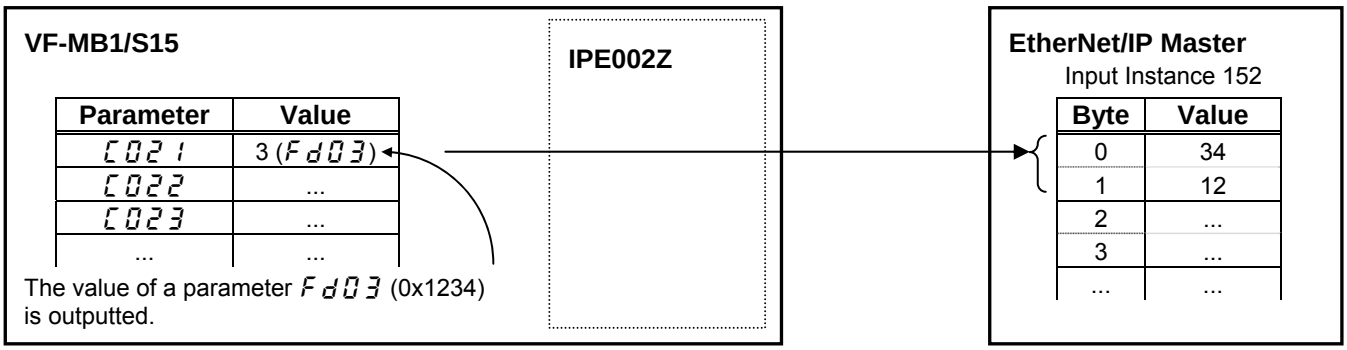
For example, please set C400 in FA06 when you want to send the command from an EtherNet/IP™ option and the availability of the frequency order and a driving order. (Please refer to "3.2.4.2")




Example 2: State monitoring by the input instance 152.

When you want to monitor the output current, set "3 (Fd03)" to parameter C021.

The value of the parameter Fd03 specified as 0 and 1 byte of the input instance 152 with the parameter C021 is inputted.



### 3.2.4.2. FA06 (Communication command1)

| bit | Function | 0 | 1 | Note |
|---|---|---|---|---|
| 0 | Preset speed operation frequencies 1 | 0000: Preset speed operation OFF (*1)<br>0001-1111: Setting of preset speed operation frequencies (1-15) | | Preset speed operation is disabled or preset speed operation frequencies (1-15) are set by specifying bits for preset speed operation frequencies 1-4. |
| 1 | Preset speed operation frequencies 2 | | | |
| 2 | Preset speed operation frequencies 3 | | | |
| 3 | Preset speed operation frequencies 4 | | | |
| 4 | Motor selection (1 or 2) (THR 2 selection) | Motor 1 (THR 1) | Motor 2 (THR 2) | THR 1: Pt = setting value, tHr<br>THR 2: Pt = 0, F170, F171, F172, F173 |
| 5 | PI D control | Normal operation | PI D off | - |
| 6 | Acceleration/deceleration pattern selection (1 or 2) (AD2 selection) | Acceleration/deceleration pattern 1 (AD1) | Acceleration/deceleration pattern 2 (AD2) | AD1: ACC, dEC<br>AD2: F500, F501 |
| 7 | DC braking | OFF | Forced DC braking | - |
| 8 | Jog run | OFF | Jog run | - |
| 9 | Forward/reverse run selection | Forward run | Reverse run | - |
| 10 | Run/stop | Stop | Run | - |
| 11 | Coast stop command | Standby | Cost stop | - |
| 12 | Emergency stop | OFF | Emergency stop | Always enable, "E" trip |
| 13 | Fault reset | OFF | Reset | No data is returned from the drive |
| 14 | Frequency priority selection | OFF | Enabled | Enabled regardless of the setting of FMOd |
| 15 | Command priority selection | OFF | Enabled | Enabled regardless of the setting of CMOd |

(*1): When 14(Sr0) is set to FMOd, preset speed operation frequency 0 is selected in using VFS15,.

### 3.2.4.3. FA23 (Communication command 2)

| bit | Function | 0 | 1 | Note |
|---|---|---|---|---|
| 0 | (Reserved) | - | - | - |
| 1 | Electric power quantity reset | OFF | Reset | Electric power quantity (FE76, FE77) reset |
| 2 | (Reserved) | - | - | - |
| 3 | (Reserved) | - | - | - |
| 4 | (Reserved) | - | - | - |
| 5 | (Reserved) | - | - | - |
| 6 | (Reserved) | - | - | - |
| 7 | Maximum deceleration forced stop | Normal | Enabled | - |
| 8 | Acceleration/deceleration selection 1 | 00: Acceleration/deceleration 1<br>01: Acceleration/deceleration 2<br>10: Acceleration/deceleration 3 | | Select acceleration/deceleration 1-3 by combination of two bits..<br>AD1: ACC, dEC<br>AD2: F500, F501<br>AD3: F510, F511 |
| 9 | Acceleration/deceleration selection 2 | | | |
| 10 | (Reserved) | - | - | - |
| 11 | (Reserved) | - | - | - |
| 12 | OC stall level switch | OC stall 1 | OC stall 2 | OC stall 1: F601<br>OC stall 2: F185 |
| 13 | (Reserved) | - | - | - |
| 14 | (Reserved) | - | - | - |
| 15 | (Reserved) | - | - | - |

Note: Set 0 to reserved bit.

### 3.2.4.4. FA07 (frequency reference from internal option)

Frequency reference is set up by 0.01Hz unit and the hexadecimal number.
For example, when "Frequency reference" is set up to 80Hz, since the minimum unit is 0.01Hz,
80 / 0.01 = 8000 = 0x1F40 (Hex.)

### 3.2.4.5. FA50 (Terminal output data from communication)

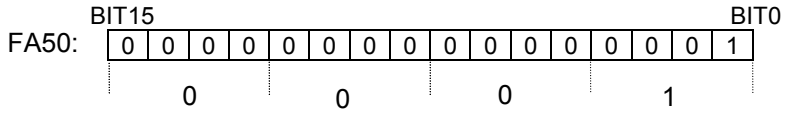
The output data on the terminal board can be directly controlled with the computer.
To use this function, select functions from 92 to 95 in advance for the output terminal selection parameters F130, F131, F132. If bit 0 through bit1 of the data (FA50) is set with the computer, the specified data (0 or 1) can be output to the selected output terminal.

Data composition of output data on the terminal board (FA50)

| bit | Output TB function name | 0 | 1 |
|---|---|---|---|
| 0 | Specified data output 1<br>(Output terminal No.: 92, 93) | OFF | ON |
| 1 | Specified data output 2<br>(Output terminal No.: 94, 95) | OFF | ON |
| 2-15 | (Reserved) | - | - |

Note: Set 0 to reserved bit

Example of use: To control only the RY-RC terminal with the computer
To turn on the RY terminal, set the output terminal selection 1A parameter (F130) to 92 (Designated data output 1) and set 0001H to FA50.




### 3.2.4.6. FA51 (Analog output (FM) data from communication)

Use this function, set the FM terminal meter selection parameter (FM5L) to 18 (communication data output).
This makes it possible to send out the data specified as FM analog output data (FA51) though the FM analog output terminal. Data can be adjusted in a range of 0 to 1000 (resolution of 10 bit).

Please refer to "Meter setting and adjustment" Section of the inverter's instruction manual.

### 3.2.4.7. FD01 (Inverter operating status 1)

| bit | Function | 0 | 1 | Note |
|---|---|---|---|---|
| 0 | Failure FL | No output | Under in progress | - |
| 1 | Failure | Not tripped | Tripped | Trip status includes rtry and the trip retention status are also regarded as tripped statuses. |
| 2 | Alarm | No alarm | Alarm issued | - |
| 3 | Under voltage (NOFF) | Normal | Under voltage | - |
| 4 | Motor selection (1 or 2) (THR 2 selection) | Motor 1 (THR1) | Motor 2 (THR2) | THR1: PE = setting value, uL, uLu, ub, tHr<br>THR2: PE = 0, F170, F171, F172, F173 |
| 5 | PID control off | PID control permitted | PID control prohibits | - |
| 6 | Acceleration/deceleration pattern selection (1 or 2) | Acceleration/deceleration pattern 1 (AD1) | Acceleration/deceleration pattern 2 (AD2) | AD1: ACC, dEC<br>AD2: F500, F501 |
| 7 | DC braking | OFF | Forced DC braking | - |
| 8 | Jog run | OFF | Jog run | - |
| 9 | Forward / reverse run | Forward run | Reverse run | - |
| 10 | Run/stop | Stop | Run | - |
| 11 | Coast stop (ST = OFF) | ST=ON | ST=OFF | - |
| 12 | Emergency stop | No emergency stop status | Emergency stop status | - |
| 13 | Standby ST=ON | Start-up process | Standby | Standby: Initialization completed, not failure stop status, not alarm stop status (NOFF, LL forced stop), ST=ON, and RUN=ON |
| 14 | Standby | Start-up process | Standby | Standby: Initialization completed, not failure stop status and not alarm stop status (NOFF, LL forced stop) |
| 15 | (Reserved) | Undefined | | - |

Note: Don't use the reserved bit for the judgment.

### 3.2.4.8. FD00 (Output frequency)

The current output frequency is read into 0.01Hz of units and by the hexadecimal number.
For example, when the output frequency is 80Hz, 0x1F40 (hexadecimal number) are read.

Since the minimum unit is 0.01%,
0x1F40 (Hex.) = 8000(Dec.) * 0.01 = 80 (Hz)

Also about the following parameters, these are the same as this.
- FD22 (Feedback value of PID)..... Unit: 0.01Hz
- FD16 (Estimated speed) ..... Unit: 0.01Hz
- FD29 (Input power) ..... Unit: 0.01kW
- FD30 (Output power) ..... Unit: 0.01kW

### 3.2.4.9. Fd03 (Output current)

The output current is read into 0.01% of units and by the hexadecimal number.
For example, when the output current of the rated current 4.8A drive is 50% (2.4A), 0x1388 (hexadecimal number) is read out.

Since the minimum unit is 0.01%,
0x1388 (Hex.) = 5000 (Dec.) * 0.01 = 50 (%)
Also about the following parameters, these are the same as this.
- Fd05 (Output voltage (real time)) ..... Unit: 0.01% (V)
- Fd04 (Voltage at DC bus (real time)) ..... Unit: 0.01% (V)
- Fd18 (Torque) ..... Unit: 0.01% (Nm)*

* When the motor information connected to the drive set to the parameter (F405 - F415), torque monitor value "100%" is same as the rated torque of a motor in general.

### 3.2.4.10. FE35, FE36, FE37 (Monitoring of the analog input VIA, VIB, VIC)

VIA terminal board monitor: "Communication Number FE35"
VIB terminal board monitor: "Communication Number FE36"
VIC terminal board monitor: "Communication Number FE37"

These monitors can also be used as A/D converters irrespective of the drive's control.

VIA / VIC terminal board monitor is capable of reading the data from external devices in a range of 0.01 to 100.00% (unsigned data: 0x0000 to 0x2710).

VIB terminal board monitor is capable of reading the data from external devices in a range of -100.00 to 100.00% (signed data: 0xD8F0 to 0x2710).

If analog input mode is selected with the frequency setting mode selection parameter, however, keep in mind that any data entered via an analog terminal is regarded as a frequency command.

### 3.2.4.11. FE14 (Cumulative run time)

The operated cumulative time is read by the hexadecimal number.
For example, when cumulative operation time is 18 hours, 0x0012 (18 hours) is read.
0x0012 = 18 (Dec., hour)

### 3.2.4.12. FE40 (Analog output (FM))

The output value of FM terminal is read.
The value range is set to 0 to 10000 (0x0000 to 2710H) which is corresponded to 0.00% to 100.00%.

For example, when analog output is 50.00%, 0x1388 is read.
0x1388 = 50.00(Dec., %)

### 3.2.4.13. FC91 (Alarm code)

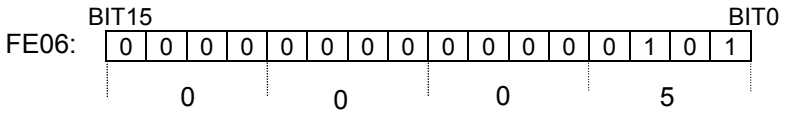
| bit | Function | 0 | 1 | Remarks (Code displayed on the panel) |
|---|---|---|---|---|
| 0 | Over-current alarm | Normal | Alarming | C flicking |
| 1 | Inverter over load alarm | Normal | Alarming | L flicking |
| 2 | Motor over load alarm | Normal | Alarming | L flicking |
| 3 | Over heat alarm | Normal | Alarming | H flicking |
| 4 | Over voltage alarm | Normal | Alarming | P flicking |
| 5 | Main circuit undervoltage alarm | Normal | Alarming | - |
| 6 | main device overheat alarm | Normal | Alarming | L flicking |
| 7 | Under current alarm | Normal | Alarming | - |
| 8 | Over-torque alarm | Normal | Alarming | - |
| 9 | Braking resistor overload alarm | Normal | Alarming | - |
| 10 | Cumulative operation hours alarm | Normal | Alarming | - |
| 11 | Option communication alarm | Normal | Alarming | - |
| 12 | Serial communication alarm | Normal | Alarming | - |
| 13 | MOFFMS (MSrelay off or MOFF) | Normal | Alarming | - |
| 14 | Stop after instantaneous power off | - | Dec., Under stop | Refer to F302 value |
| 15 | Stop after LL continuance time | - | Dec., Under stop | Refer to F256 value |

### 3.2.4.14. Fd06 (Input TB Status)

| bit | TB Name | Function (Parameter) | 0 | 1 |
|---|---|---|---|---|
| 0 | F | Input terminal function selection 1 (F111) | OFF | ON |
| 1 | R | Input terminal function selection 2 (F112) | | |
| 2 | RES | Input terminal function selection 3 (F113) | | |
| 3 | S1 | Input terminal function selection 4 (F114) | | |
| 4 | S2 | Input terminal function selection 5 (F115) | | |
| 5 | S3 | Input terminal function selection 6 (F116) | | |
| 6 | VIB*1 | Input terminal function selection 7 (F117) | | |
| 7 | VIA*1 | Input terminal function selection 8 (F118) | | |
| 5 to 15 | (Reserved) | - | Undefined | |

Note: Don't use the reserved bit for the judgment.
*1: VIA/ VIB are input terminal function when F109 is logic input.
*The input terminal function is selected by each parameter.

Example: Data set for FE06 when the F and RES terminals are ON = 0005H

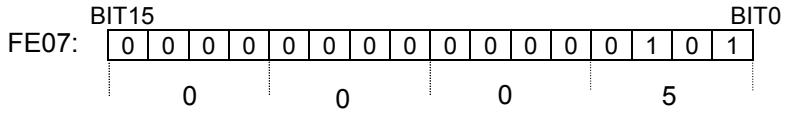


### 3.2.4.15. FD07 (Output TB Status)

| bit | TB Name | Function (Parameter) | 0 | 1 |
|---|---|---|---|---|
| 0 | RY-RC | Output terminal function selection 1A (F130) | OFF | ON |
| 1 | OUT | Output TB Function select 2A (F131) | OFF | ON |
| 2 | FL | Output TB Function select 3 (F132) | OFF | ON |
| 3 - 15 | (Reserved) | - | Undefined | |

Note: Don't use the reserved bit for the judgment.

Example: Data set for FE07 when the RY and FL terminals are ON = 0005H



# 4. Objects

This section contains the object specifications for all EtherNet/IP objects currently supported by the “IPE002Z”. Table 1 outlines those objects covered:

| Class Code | | Object Class | Page |
|---|---|---|---|
| Hex. | Dec. | | |
| 0x01 | 1 | Identity Object | 23 |
| 0x02 | 2 | Message Router Object | 25 |
| 0x04 | 4 | Assembly Object | 26 |
| 0x06 | 6 | Connection Manager Object | 27 |
| 0x28 | 40 | Motor Data Object | 28 |
| 0x29 | 41 | Control Supervisor Object | 29 |
| 0x2A | 42 | AC/DC Drive Object | 32 |
| 0x64 | 100 | Parameter Object | 33 |
| 0x65 | 101 | Parameter Object | 35 |
| 0xF4 | 244 | Port Object | 36 |
| 0xF5 | 245 | TCP/IP Interface Object | 37 |
| 0xF6 | 246 | Ethernet Link Object | 39 |

**Table 1: Supported Objects**

For definitions of all data types referred to in these object specifications, refer to the ODVA EtherNet/IP™ Specifications. In general, however, the following are some of the most prevalent types:

| | | |
|---|---|---|
| BOOL | Boolean | 0(False) or 1(TRUE) |
| SINT | Signed Short Integer | -128 to 127 |
| INT | Integer | -32768 to 32767 |
| DINT | Double Integer | $-2^{31}$ to $2^{31}-1$ |
| USINT | Unsigned Short Integer | 0 to 255 |
| UINT | Unsigned Integer | 0 to 65535 |
| UDINT | Unsigned Double Integer | 0 to $2^{32}-1$ |
| STRING | character string (1 byte per character) | |
| SHORT_STRING | character string (1 byte per character, 1 byte length indicator) | |
| BYTE | Bit string - 8-bits | |
| WORD | Bit string - 16-bits | |
| DWORD | Bit string - 32-bits | |
| EPATH | CIP path segments | |

## 4.1. Identity Object (0x01)

Class code 0x01.

This object provides identification of and general information about the device.

**Class Attributes**

| Instance | Attribute ID | Access | Name | Data type | Details | Value |
|---|---|---|---|---|---|---|
| 0 | 1 | Get | Revision | UINT | Revision of this object | 1 |
| | 2 | Get | Max Instances | UINT | Maximum instance number of an object currently created in this class level of the device. | 1 |
| | 3 | Get | Number of Instances | UINT | Number of object instances currently created at this class level of the device. | 1 |
| | 4 | Get | Optional attribute list | STRUCT of | List of optional instance attributes utilized in an object class implementation. | 0 |
| | | | Number of attributes | UNIT | Number of attribute in the optional attribute list. | - |
| | | | Optional attributes | ARRAY of UNIT | List of optional attribute numbers. | - |
| | 6 | Get | Max ID of class attributes | UINT | The attribute ID number of the last class attribute of the class definition implemented in the device. | 7 |
| | 7 | Get | Max ID of instance attribute | UINT | The attribute ID number of the last instance attribute of the class definition implemented in the device. | 7 |

**Class Service**

| Service Code | Service Name | Description of Service |
|---|---|---|
| 0x01 | Get_Attribute_All | Read all attributes |
| 0x0E | Get_Attribute_Single | Read one attribute |

**Instance Attributes**

| Instance | Attribute ID | Access | Name | Data type | Details | Value |
|---|---|---|---|---|---|---|
| 1 | 1 | Get | Vendor ID | UINT | Identification of vendor by number | 377 |
| | 2 | Get | Device type | UINT | AC/DC Drive profile | 2 |
| | 3 | Get | Product code | UINT | Identification No. of a drive | |
| | | | | | (case of VF-MB1) | 32000 |
| | | | | | (case of VF-S15) | 32001 |
| | 4 | Get | Revision | STRUCT of | Revision of the item the Identity Object represents | |
| | | | Major revision | USINT | Major revision of drive | 1 (*1) |
| | | | Minor revision | USINT | Minor revision of drive | 8 (*1) |
| | 5 | Get | Status | WORD | See “Attribute 5 State Description” | * |
| | 6 | Get | Serial number | UDINT | 4 last bytes of MAC Address | - |
| | 7 | Get | Product name | SHOT_ STRING | Human readable identification | |
| | | | | | (case of VF-MB1 drive) | 6, VF-MB1 |
| | | | | | (case of VF-S15 drive) | 6, VF-S15 |

*1: These values depend on firmware version and revision.

**Instance Services**

| Service Code | Service Name | Description of Service |
|---|---|---|
| 0x01 | Get_Attribute_All | Read all attributes |
| 0x05 | Reset | Invokes the Reset for the device |
| 0x0E | Get_Attribute_Single | Read one attribute |

**Attribute 5 State Descriptions**

Adapted from document [CIP] “THE CIP NETWORKS LIBRARY”

| Bit | Called | Definition | |
|---|---|---|---|
| 0 | Owned | TRUE indicates the device (or an object within the device) has an owner. Within the Master/Slave paradigm the setting of this bit means that the Predefined Master/Slave Connection Set has been allocated to a master. Outside the Master/Slave paradigm the meaning of this bit is TBD. → **unsupporteed** | |
| 1 | - | (System reserved) | |
| 2 | Configured. | TRUE indicates the application of the device has been configured to do something different than the “out–of–box” default. This shall not include configuration of the communications. | |
| 3 | - | (System reserved) | |
| 4-7 | Extended Device Status | 0000 | Self-Testing or unknown |
| | | 0001 | Firmware update in progress |
| | | 0010 | At least one faulted I/O connection |
| | | 0011 | No I/O connections established |
| | | 0100 | Non-Volatile configuration bad |
| | | 0101 | Major Fault – either bit 10 or bit 11 is true (1) |
| | | 0110 | At least one I/O connection in run mode |
| | | 0111 | At least one I/O connection established, all in idle mode |
| | | 1000-1111 | Unused |
| 8 | Minor Recoverable Fault | TRUE indicates the device detected a problem with itself, which is thought to be recoverable. The problem does not cause the device to go into one of the faulted states. | |
| 9 | Minor Unrecoverable Fault. | TRUE indicates the device detected a problem with itself, which is thought to be unrecoverable. The problem does not cause the device to go into one of the faulted states. | |
| 10 | Major Recoverable Fault. | TRUE indicates the device detected a problem with itself, which caused the device to go into the “Major Recoverable Fault” state. | |
| 11 | Major Unrecoverable Fault | TRUE indicates the device detected a problem with itself, which caused the device to go into the “Major Unrecoverable Fault” state. | |
| 12-15 | - | (System reserved) | |

Note: Don’t use the “System reserved” bit and Bit0 for the judgement.

## 4.2. Message Router Object (0x02)

Class code 0x02.

The Message Router Object provides a messaging connection point through which a Client may address a service to any object class or instance residing in the physical device.

**Class Attributes**

| Instance | Attribute ID | Access | Name | Data type | Details | Value |
|---|---|---|---|---|---|---|
| 0 | 1 | Get | Revision | UINT | Revision of this object | 1 |
| | 2 | Get | Max Instances | UINT | Maximum instance number of an object currently created in this class level of the device. | 1 |
| | 3 | Get | Number of Instances | UINT | Number of object instances currently created at this class level of the device. | 1 |
| | 4 | Get | Optional attribute list | STRUCT of | List of optional instance attributes utilized in an object class implementation. | 2 |
| | | | Number of attributes | UNIT | Number of attribute in the optional attribute list. | 2 |
| | | | Optional attributes | ARRAY of UNIT | List of optional attribute numbers. | 3 |
| | 6 | Get | Max ID of class attributes | UINT | The attribute ID number of the last class attribute of the class definition implemented in the device. | 7 |
| | 7 | Get | Max ID of instance attribute | UINT | The attribute ID number of the last instance attribute of the class definition implemented in the device. | 3 |

**Class Service**

| Service Code | Service Name | Description of Service |
|---|---|---|
| 0x0E | Get_Attribute_Single | Read one attribute |

**Instance Attribute**

| Instance | Attribute ID | Access | Name | Data type | Details | Value |
|---|---|---|---|---|---|---|
| 1 | 2 | Get | Number Available | UNIT | Maximum number of connections supported | 16 |
| | 3 | Get | Number active | UNIT | Number of connections currently used by system components | 0 |

**Instance Services**

| Service Code | Service Name | Description of Service |
|---|---|---|
| 0x0E | Get_Attribute_Single | Read one attribute |

## 4.3. Assembly Object (0x04)

Class code 0x04.

The Assembly Object binds attributes of multiple objects, which allows data to or from each object to be sent or received over a single connection. Assembly objects can be used to bind input data or output data. The terms ”input” and ”output” are defined from the network’s point of view. An input will produce data on the network and an output will consume data from the network

**Class Attributes**

| Instance | Attribute ID | Access | Name | Data type | Details | Value |
|---|---|---|---|---|---|---|
| 0 | 1 | Get | Revision | UINT | Revision of this object | 2 |
| | 2 | Get | Max Instances | UINT | Maximum instance number of an object currently created in this class level of the device. | 199 |
| | 3 | Get | Number of Instances | UINT | Number of object instances currently created at this class level of the device. | 13 |
| | 6 | Get | Max ID of class attributes | UINT | The attribute ID number of the last class attribute of the class definition implemented in the device. | 7 |
| | 7 | Get | Max ID of instance attribute | UINT | The attribute ID number of the last instance attribute of the class definition implemented in the device. | 4 |

**Class Service**

| Service Code | Service Name | Description of Service |
|---|---|---|
| 0x0E | Get_Attribute_Single | Read one attribute |

**Instance Attribute**

| Instance | Attribute ID | Access | Name | Details |
|---|---|---|---|---|
| **See below** | 3 | Get/Set* | Data | Settable Only on Output Assembly. **See below** |
| **See below** | 4 | Get | Size | Number of bytes in Attribute 3. |

**Output Assembly:**

| Instance | Type | Size | Page |
|---|---|---|---|
| 20 | CIP basic speed control output | 2 words (4 bytes) | 45 |
| 21 | CIP extended speed control output | 2 words (4 bytes) | 46 |
| 100 | Native drive output | 2 to 8 words (4 to 16 bytes) | 47 |
| 101 | Native drive output | 4 words (8 bytes) | 49 |
| 102 | Native drive output | 6 words (12 bytes) | 51 |
| 105 | TOSHIBA specific output | 9 words (18 bytes) | 52 |

**Input Assembly:**

| Instance | Type | Size | Page |
|---|---|---|---|
| 70 | CIP basic speed control input | 2 words (4 bytes) | 45 |
| 71 | CIP extended speed control input | 2 words (4 bytes) | 46 |
| 150 | Native drive input | 2 to 8 words (4 to 16 bytes) | 47 |
| 151 | Native drive input | 4 words (8 bytes) | 49 |
| 152 | Native drive input | 6 words (12 bytes) | 51 |
| 155 | TOSHIBA specific output | 9 words (18 bytes) | 52 |

**Instance Services**

| Service Code | Service Name | Description of Service |
|---|---|---|
| 0x0E | Get_Attribute_Single | Read one attribute |
| 0x10 | Set_Attribute_Single | Write one attribute |

## 4.4. Connection Manager Object (0x06)

Class code 0x06.

Use this object for connection and connectionless communications, including establishing connections across multiple subnets.

**Class Attributes**

| Instance | Attribute ID | Access | Name | Data type | Details | Value |
|---|---|---|---|---|---|---|
| 0 | 1 | Get | Revision | UINT | Revision of this object | 1 |
| | 2 | Get | Max Instances | UINT | Maximum instance number of an object currently created in this class level of the device. | 1 |
| | 3 | Get | Number of Instances | UINT | Number of object instances currently created at this class level of the device. | 1 |
| | 4 | Get | Optional attribute list | STRUCT of | List of optional instance attributes utilized in an object class implementation. | - |
| | | | Number of attributes | UNIT | Number of attribute in the optional attribute list. | 8 |
| | | | Optional attributes | ARRAY of UNIT | List of optional attribute numbers. | 1, 2, 3, 4, 5, 6, 7, 8 |
| | 6 | Get | Max ID of class attributes | UINT | The attribute ID number of the last class attribute of the class definition implemented in the device. | 7 |
| | 7 | Get | Max ID of instance attribute | UINT | The attribute ID number of the last instance attribute of the class definition implemented in the device. | 8 |

**Class Services**

| Service Code | Service Name | Description of Service |
|---|---|---|
| 0x0E | Get_Attribute_Single | Read one attribute |

**Instance 1 Attribute**

| Instance | Attribute ID | Access | Name | Data type | Details |
|---|---|---|---|---|---|
| 1 | 1 | Get | Open Requests | UINT | Number of Forward Open service requests received. |
| | 2 | Get | Open Format Rejects | UINT | Number of Forward Open service requests which were rejected due to bad format. |
| | 3 | Get | Open Resources Rejects | UINT | Number of Forward Open service requests which were rejected due to lack of resources. |
| | 4 | Get | Open Other Rejects | UINT | Number of Forward Open service requests which were rejected for reasons other than bad format or lack of resources. |
| | 5 | Get | Close Requests | UINT | Number of Forward Close service requests received. |
| | 6 | Get | Close Format Requests | UINT | Number of Forward Close service requests which were rejected due to bad format. |
| | 7 | Get | Close Other Requests | UINT | Number of Forward Close service requests which were rejected for reasons other than bad format. |
| | 8 | Get | Connection Timeouts | UINT | Total number of connection timeouts that have occurred in connections controlled by this Connection Manager |

**Instance Services**

| Service Code | Service Name | Description of Service |
|---|---|---|
| 0x0E | Get_Attribute_Single | Read one attribute |
| 0x4E | Forward_Close | Closes a connection |
| 0x54 | Forward_Open | Opens a connection, maximum data size is 511 bytes |

## 4.5. Motor Data Object (0x28)

Class code 0x28.

This object serves as a database for motor parameters.

**Class Attributes**

| Instance | Attribute ID | Access | Name | Data type | Details | Value |
|---|---|---|---|---|---|---|
| 0 | 1 | Get | Revision | UINT | Revision of this object | 1 |
| | 2 | Get | Max Instances | UINT | Maximum instance number of an object currently created in this class level of the device. | 1 |
| | 3 | Get | Number of Instances | UINT | Number of object instances currently created at this class level of the device. | 1 |
| | 6 | Get | Max ID of class attributes | UINT | The attribute ID number of the last class attribute of the class definition implemented in the device. | 7 |
| | 7 | Get | Max ID of instance attribute | UINT | The attribute ID number of the last instance attribute of the class definition implemented in the device. | 15 |

**Class Services**

| Service Code | Service Name | Description of Service |
|---|---|---|
| 0x0E | Get_Attribute_Single | Read one attribute |

**Instance 1 Attribute**

| Instance | Attribute ID | Access | Name | Data type | Details |
|---|---|---|---|---|---|
| 1 | 1 | Get | AttrNb | UINT | Number of attributes supported |
| | 2 | Get | AttrList | ARRAY of USINT | List of attributes supported<br>1, 2, 3, 6, 7, 8, 9, 12, 15 |
| | 3 | Get | MotorType | USINT | 7:<br>Squirrel Cage Induction Motor |
| | 6 | Get/Set | RatedCurrent | UINT | Motor Rated Current (F415) |
| | 7 | Get/Set | RatedVoltage | UINT | Motor Rated Volt (uLu) |
| | 8 | Get/Set | RatedPower | UDINT | Motor rated Power (F405) |
| | 9 | Get/Set | RatedFreq | UINT | Motor Base Freq (uL) |
| | 12 | Get | PoleCount | UINT | Motor pole number<br>(F856 (number of motor pole pair) × 2) |
| | 15 | Get/Set | BaseSpeed | UINT | Motor Base Speed (F417) |

**Instance Services**

| Service Code | Service Name | Description of Service |
|---|---|---|
| 0x0E | Get_Attribute_Single | Read one attribute |
| 0x10 | Set_Attribute_Single | Write one attribute |

## 4.6. Control Supervisor Object (0x29)

Class code 0x29.

This object models all the management functions for devices within the “Hierarchy of Motor Control Devices”. The behavior of motor control devices is described by the State Transition Diagram.

**Class Attributes**

| Instance | Attribute ID | Access | Name | Data type | Details | Value |
|---|---|---|---|---|---|---|
| 0 | 1 | Get | Revision | UINT | Revision of this object | 1 |
| | 2 | Get | Max Instances | UINT | Maximum instance number of an object currently created in this class level of the device. | 1 |
| | 3 | Get | Number of Instances | UINT | Number of object instances currently created at this class level of the device. | 1 |
| | 6 | Get | Max ID of class attributes | UINT | The attribute ID number of the last class attribute of the class definition implemented in the device. | 7 |
| | 7 | Get | Max ID of instance attribute | UINT | The attribute ID number of the last instance attribute of the class definition implemented in the device. | 15 |

**Class Services**

| Service Code | Service Name | Description of Service |
|---|---|---|
| 0x0E | Get_Attribute_Single | Read one attribute |

**Instance 1 Attribute**

| Instance | Attribute ID | Access | Name | Data type | Details |
|---|---|---|---|---|---|
| 1 | 1 | Get | Number of attributes | UINT | Number of attributes supported |
| | 2 | Get | AttrList | LIST of USINT | List of attributes supported |
| | 3 | Get/Set | Run 1 | BOOL | Refer to "4.6.1 Run/Stop Event Matrix."<br>00 = Stop<br>01 = Run (On edge) |
| | 4 | Get/Set | Run 2 | BOOL | Refer to "4.6.1 Run/Stop Event Matrix."<br>00 = Stop<br>01 = Run (On edge) |
| | 5 | Get/Set | NetCtrl | BOOL | Request Run/Stop control to be local or from network.<br>0 = Local Control(default)<br>1 = Network Control<br>Note that the actual status of Run/Stop control is reflected in attribute 15, CtrlFromNet. |
| | 6 | Get | State | USINT | Refer to "4.6.2 State of the drive." |
| | 7 | Get | Running 1 | BOOL | 1 = (Enabled and Run1) or<br>(Stopping and Running1) or<br>(Fault Stop and Running1)<br>0 = Other state |
| | 8 | Get | Running 2 | BOOL | 1 = (Enabled and Run2) or<br>(Stopping and Running2) or<br>(Fault Stop and Running2)<br>0 = Other state |
| | 9 | Get | Ready | BOOL | 1 = Ready or Enabled or Stopping<br>0 = Other state |
| | 10 | Get | Faulted | BOOL | 1 = Fault Occurred (latched)<br>0 = No Faults present |
| | 11 | Get | Warning | BOOL | 1 = Warning (not latched)<br>0 = No Warnings present |
| | 12 | Get/Set | FaultRst | BOOL | 0->1 = Fault Reset<br>0 = No action |
| | 15 | Get | CtrlFromNet | BOOL | Status of Run/Stop control source.<br>0 = Control is local<br>1 = Control is from network |

**Instance Services**

| Service Code | Service Name | Description of Service |
|---|---|---|
| 0x05 | Reset | Resets the drive to the start-up state. |
| 0x0E | Get_Attribute_Single | Read one attribute |
| 0x10 | Set_Attribute_Single | Write one attribute |

## 4.6.1. Run/Stop Event Matrix

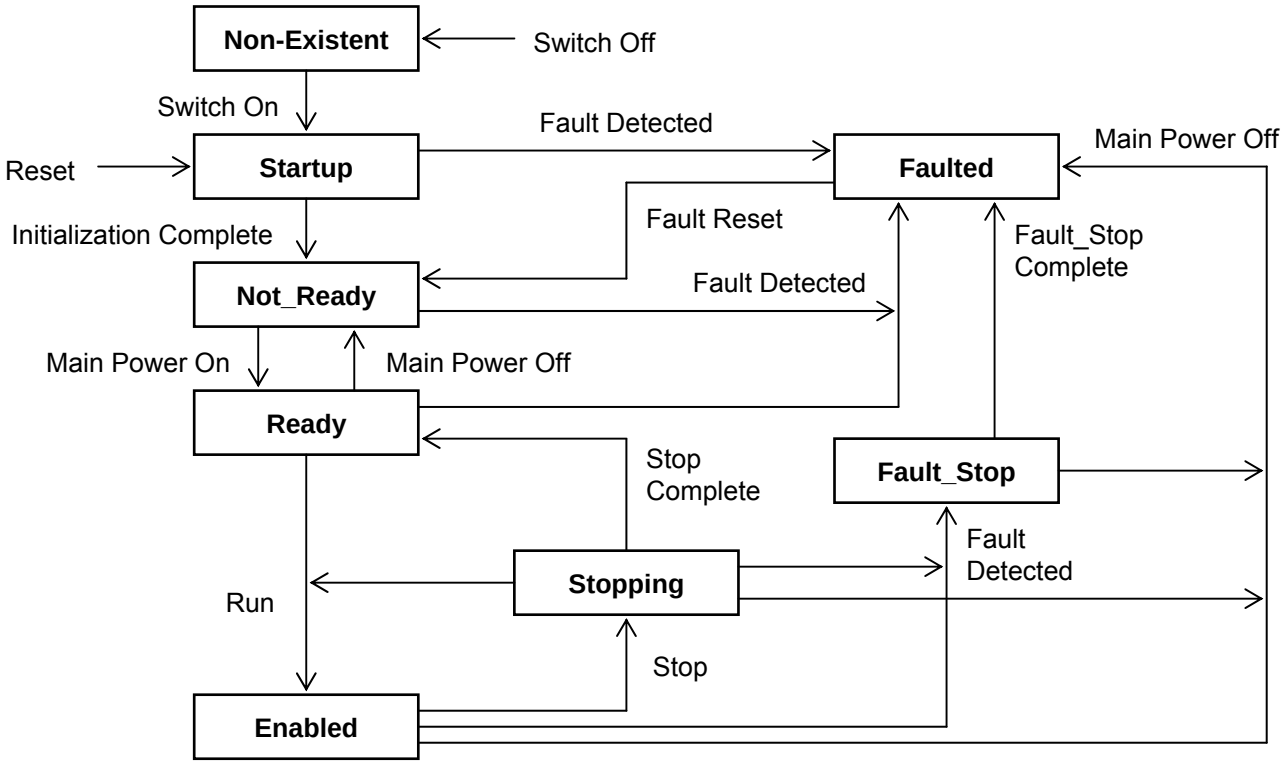
| Run1 | Run2 | Trigger Event | Run Type |
|---|---|---|---|
| 0 | 0 | Stop | No Action |
| 0 -> 1 | 0 | Run | Run1 |
| 0 | 0 -> 1 | Run | Run2 |
| 0 -> 1 | 0 -> 1 | No Action | No Action |
| 1 | 1 | No Action | No Action |
| 1 -> 0 | 1 | Run | Run2 |
| 1 | 1 -> 0 | Run | Run1 |

## 4.6.2. State of the drive

The Control Supervisor class State attribute (Att. ID= 6) shows state of the drive.

1 (=BN: 00000001): Startup
2 (=BN: 00000010): Not ready
3 (=BN: 00000011): Ready
4 (=BN: 00000100): Enabled
5 (=BN: 00000101): Stopping
6 (=BN: 00000110): Fault Stop
7 (=BN: 00000111): Faulted

## 4.6.3. Control Supervisor State Transition Diagram



## 4.7. AC/DC Drive Object (0x2A)

Class code 0x2A.

This object models the functions specific to an AC or DC Drive. e.g. speed ramp, torque control etc.

**Class Attributes**

| Instance | Attribute ID | Access | Name | Data type | Details | Value |
|---|---|---|---|---|---|---|
| 0 | 1 | Get | Revision | UINT | Revision of this object | 1 |
| | 2 | Get | Max Instances | UINT | Maximum instance number of an object currently created in this class level of the device. | 1 |
| | 3 | Get | Number of Instances | UINT | Number of object instances currently created at this class level of the device. | 1 |
| | 6 | Get | Max ID of class attributes | UINT | The attribute ID number of the last class attribute of the class definition implemented in the device. | 7 |
| | 7 | Get | Max ID of instance attribute | UINT | The attribute ID number of the last instance attribute of the class definition implemented in the device. | 46 |

**Class Services**

| Service Code | Service Name | Description of Service |
|---|---|---|
| 0x0E | Get_Attribute_Single | Read one attribute |

**Instance 1 Attribute**

| Instance | Attribute ID | Access | Name | Data type | Details | Value or Unit |
|---|---|---|---|---|---|---|
| 1 | 1 | Get | NumAttr | USINT | Number of Attributes supported | 19 |
| | 2 | Get | Attrbutes | ARRAY of USINT | List of Attributes supported | 1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 15, 18,19, 20, 21, 26, 28, 29, 46 |
| | 3 | Get | AtReference | BOOL | 1 = Drive actual at reference | - |
| | 4 | Get/Set | NetRef | BOOL | Requests torque and speed reference to be local or from the network.<br>0 = Set Reference not DN Control<br>1 = Set Reference at DN Control | - |
| | 6 | Get | Drive mode | USINT | Drive Mode | - |
| | 7 | Get | SpeedActual | INT | Actual Speed | rpm |
| | 8 | Get/Set | SpeedRef * | INT | Reference Speed | rpm |
| | 9 | Get | CurrentActual | UINT | Drive Current | 0.1 A |
| | 10 | Get/Set | CurrentLimit | UINT | Drive Current Limit | 0.1 A |
| | 11 | Get | Torque Actual | UINT | Drive Actual Torque | Nm |
| | 15 | Get | PowerActual | UINT | Drive Power | W |
| | 18 | Get/Set | AccelTime | UINT | Drive Acceleration | ms |
| | 19 | Get/Set | DecelTime | UINT | Drive Deceleration | ms |
| | 20 | Get/Set | LowSpdLimit | UINT | Drive minimum speed | rpm |
| | 21 | Get/Set | HighSpdLimit | UINT | Drive maximum speed | rpm |
| | 26 | Get/Set | Power scaling | UINT | Power scaling factor | 0 |
| | 28 | Get/Set | Time scaling | UINT | Time scaling factor | 0 |
| | 29 | Get | RefFromNet | BOOL | Status of speed reference<br>0=Local speed reference<br>1=Network speed reference | - |
| | 46 | Get | HoursOn | UDINT | Number of hours | h |

* The output frequency of the drive follows FH though the frequency of FH or more can be written.

**Instance Services**

| Service Code | Service Name | Description of Service |
|---|---|---|
| 0x0E | Get_Attribute_Single | Read one attribute |
| 0x10 | Set_Attribute_Single | Write one attribute |

## 4.8. Parameter Objects (0x64)

Class code 0x64. This object provides VF-MB1/ S15's Parameter access.

Range Address accessed:

| Input Instance | Real Logical address in Drive accessed |
|---|---|
| 0x4000-0x4FFF | 0x0000-0x0FFF |
| 0x7000-0x7FFF | 0xF000-0xFFFF |

**Class Attributes**

| Instance | Attribute ID | Access | Name | Data type | Details | Value |
|---|---|---|---|---|---|---|
| 0 | 1 | Get | Revision | UINT | Revision of this object | 1 |
| | 2 | Get | Max Instances | UINT | Maximum instance number of an object currently created in this class level of the device. | 32767 |
| | 3 | Get | Number of Instances | UINT | Number of object instances currently created at this class level of the device. | 8190 |
| | 6 | Get | Max ID of class attributes | UINT | The attribute ID number of the last class attribute of the class definition implemented in the device. | 7 |
| | 7 | Get | Max ID of instance attribute | UINT | The attribute ID number of the last instance attribute of the class definition implemented in the device. | 3 |

**Class Services**

| Service Code | Service Name | Description of Service |
|---|---|---|
| 0x0E | Get_Attribute_Single | Read one attribute |

**Instance 1 Attribute**

| Instance | Attribute ID | Access | Name | Data type | Details |
|---|---|---|---|---|---|
| **See below** | 3 | Get/Set | parameter | UINT | Parameter corresponding to the Instance address |

**Instance Services**

| Service Code | Service Name | Description of Service |
|---|---|---|
| 0x0E | Get_Attribute_Single | Read one attribute |
| 0x10 | Set_Attribute_Single | Write one attribute |

Attribute ID of all parameters are 3. Moreover, about the instance ID of each parameter, it becomes "parameter communication number + 4000H".
In the case of the parameter from which a communication number begins in "F", it becomes "parameter communication number - 0x8000 (same as bit15 set to 0)".
About the detail contents of a parameter, please refer to a VF-MB1 or VF-S15 instructions manual.

Example 1:

In case of Basic parameter "CMOd - Command mode selection",
Communication No: **0**003 -> Instance ID: **4**003

Example 2:

In case of Extended parameter "F268 - Updown frequency default value",
Communication No: **0**268 -> Instance ID: **4**268

Example 3:

In case of Monitor parameter "FE03 - Output current",
Communication No: **F**E03 -> Instance ID: **7**E03
* Monitor parameter can access "Get" only.

For example, when "Acc. time" is set to 5 sec., since the minimum unit is 0.1s,
5 / 0.1 = 50 = 32H
Since the communication number of "Acc. time" is "0009", it writes "32H" in instance ID "4009."

Moreover, when the "highest frequency" is read, "1F40H" is read.
0x1F40 = 8000 (Dec.)
Since the minimum unit is 0.01Hz,
8000 * 0.01 = 80Hz

## 4.9. Parameter Objects (0x65)

Class code 0x65. This object provides VF-MB1/S15's Parameter access.

Range Address accessed:

| Input Instance | Real Logical address in Drive accessed |
|---|---|
| 0x0001-0xFFFF | 0x0001-0xFFFF |

* Refer to "Class Attributes" when the instance is 0.

* If you want to access the AU 1, please use the "Application Objects (64 hex)."

**Class Attributes**

| Instance | Attribute ID | Access | Name | Data type | Details | Value |
|---|---|---|---|---|---|---|
| 0 | 1 | Get | Revision | UINT | Revision of this object | 1 |
| | 2 | Get | Max Instances | UINT | Maximum instance number of an object currently created in this class level of the device. | 65535 |
| | 3 | Get | Number of Instances | UINT | Number of object instances currently created at this class level of the device. | 65535 |
| | 6 | Get | Max ID of class attributes | UINT | The attribute ID number of the last class attribute of the class definition implemented in the device. | 7 |
| | 7 | Get | Max ID of instance attribute | UINT | The attribute ID number of the last instance attribute of the class definition implemented in the device. | 3 |

**Class Services**

| Service Code | Service Name | Description of Service |
|---|---|---|
| 0x0E | Get_Attribute_Single | Read one attribute |

**Instance 1 Attribute**

| Instance | Attribute ID | Access | Name | Data type | Details |
|---|---|---|---|---|---|
| See below | 3 | Get/Set | parameter | UINT | Parameter corresponding to the Instance address |

**Instance Services**

| Service Code | Service Name | Description of Service |
|---|---|---|
| 0x0E | Get_Attribute_Single | Read one attribute |
| 0x10 | Set_Attribute_Single | Write one attribute |

Attribute ID of all parameters are 3. Moreover, about the instance ID of each parameter, it becomes "parameter communication number".
About the details of the contents of a parameter please refer to VF-MB1 instruction manual or VF-S15 instruction manual.

Example 1:

When "ACC. time" is set to 5 s, since the minimum unit is 0.1s,
5 / 0.1 = 50 = 32H
Since the communication umber of "Acc. time" is "0009", it writes "32H" is instance ID "0009."

## 4.10. Port Object (0xF4)

Class code 0xF4.

The Port Object enumerates the CIP ports present on the device.

One instance exists for each CIP port.

**Class Attributes**

| Instance | Attribute ID | Access | Name | Data type | Details | Value |
|---|---|---|---|---|---|---|
| 0 | 1 | Get | Revision | UINT | Revision of this object | 1 |
| | 2 | Get | Max Instances | UINT | Maximum instance number of an object currently created in this class level of the device. | 1 |
| | 3 | Get | Number of Instances | UINT | Number of object instances currently created at this class level of the device. | 1 |
| | 6 | Get | Max ID of class attributes | UINT | The attribute ID number of the last class attribute of the class definition implemented in the device. | 9 |
| | 7 | Get | Max ID of instance attribute | UINT | The attribute ID number of the last instance attribute of the class definition implemented in the device. | 7 |
| | 8 | Get | Entry Port | UINT | Returns the instance of the Port Object that describes the port through which this request entered the device. | 1 |
| | 9 | Get | All Ports | STRUCT of Port Type Port Number | Array of structures containing instance attributes 1 and 2 from each instance. | 0000 0000 0000 0200 |

Note: Attribute 9
00 00 00 00 -> port type = 0 (Connection terminated) / instance number = 0 (class)
00 00 02 00 -> port type = 2 (TCP/IP Port) / port number = 2

**Class Services**

| Service Code | Service Name | Description of Service |
|---|---|---|
| 0x01 | Get_Attribute_All | Read all attributes |
| 0x0E | Get_Attribute_Single | Read one attribute |

**Instance 1 Attribute**

| Instance | Attribute ID | Access | Name | Data type | Details | Value |
|---|---|---|---|---|---|---|
| 1 | 1 | Get | Port Type | UINT | Enumerate the type of port. (0 = TCP/IP) | 0 |
| | 2 | Get | Port Number | UINT | CIP port associated with this port (identify each communication port). Value '1' is reserved. | 2 |
| | 3 | Get | Link Object | STRUCT of UINT Padded EPATH | Identify Object attached to this port. For EtherNet/IP, this path corresponds to TCP/IP Interface object. | 02 00 20 F5 24 01 |
| | 4 | Get | Port Name | SHORT_ STRING | String which names the port. 11, EtherNet/IP | 0B 45 74 68 65 72 4E 65 74 2F 49 50 |
| | 7 | Get | Node address | Padded EPATH | Node number of this device on port. The range within this data type is restricted to a Port Segment. | - |

**Instance Services**

| Service Code | Service Name | Description of Service |
|---|---|---|
| 0x01 | Get_Attribute_All | Read all attributes |
| 0x0E | Get_Attribute_Single | Read one attribute |

# 4.11. TCP/IP interface Object (0xF5)

Class code 0xF5.

The TCP/IP Interface Object provides the mechanism to configure a device's TCP/IP network interface.

**Class Attributes**

| Instance | Attribute ID | Access | Name | Data type | Details | Value |
|---|---|---|---|---|---|---|
| 0 | 1 | Get | Revision | UINT | Revision of this object | 1 |
| | 2 | Get | Max Instances | UINT | Maximum instance number of an object currently created in this class level of the device. | 1 |
| | 3 | Get | Number of Instances | UINT | Number of object instances currently created at this class level of the device. | 1 |
| | 4 | Get | Optional attribute list | STRUCT of | List of optional instance attributes utilized in an object class implementation. | - |
| | | | Number of attributes | UNIT | Number of attribute in the optional attribute list. | 2 |
| | | | Optional attributes | ARRAY of UINT | List of optional attribute numbers. | 8, 9 |
| | 5 | Get | Optional service list | STRUCT of | List of optional services utilized in an object class implementation. | - |
| | | | number services | UINT | Number of services in the optional service list. | 0 |
| | | | optional services | ARRAY of UINT | List of optional service codes. | - |
| | 6 | Get | Max ID of class attributes | UINT | The attribute ID number of the last class attribute of the class definition implemented in the device. | 7 |
| | 7 | Get | Max ID of instance attribute | UINT | The attribute ID number of the last instance attribute of the class definition implemented in the device. | 9 |

**Class Services**

| Service Code | Service Name | Description of Service |
|---|---|---|
| 0x01 | Get_Attribute_All | Read all attributes |
| 0x0E | Get_Attribute_Single | Read one attribute |

**Instance 1 Attribute**

| Instance | Attribute ID | Access | Name | Data type | Details |
|---|---|---|---|---|---|
| 1 | 1 | Get | Status | DWORD | Bits 0 -3 : Interface configuration<br>000 : The Interface Configuration attribute has not been configured.<br>001 : The Interface Configuration attribute contains valid configuration.<br>Bit 6 : ACD Status<br>0 (Clear) : No Address conflict Detected<br>1 (Set) : Address conflict Detected |
| | 2 | Get | Configuration capability | DWORD | Bit 0 = 1 (TRUE) shall indicate the device is capable of obtaining its network configuration via BOOTP.<br>Bit 1 = 1 (TRUE) shall indicate the device is capable of resolving host names by querying a DNS server.<br>Bit 2 = 1 (TRUE) shall indicate the device is capable of obtaining its network configuration via DHCP.<br>Bit 3 = 1 (TRUE) shall indicate the device is capable of sending its host name in the DHCP request.<br>Bit 4 = 1 (TRUE) shall indicate the Interface Configuration attribute is settable.<br>Bit 7 = 1 (TURE) shall indicate that the device is ACD capable.<br>Bit 5,6 and 8-31 : (System reserved) |
| | 3 | Get/Set | Configuration control | DWORD | Bits 0-3 : Start-up configuration<br>000 : The device shall use the interface configuration values previously stored.<br>001 : The device shall obtain its interface configuration values via BOOTP.<br>010 : The device shall obtain its interface configuration values via DHCP upon start-up.<br>011-111 : Unused<br><br>Bit 4 = 1 (TRUE), the device shall resolve host names by querying a DNS server.<br>Bit 5-31 : (System reserved) |
| | 4 | Get | Physical Link Object | STRUCT of UINT EPATH | Path Size<br>Path: Logical segments identifying the physical link object<br>Example [20][F6][24][01] : [20] = 8 bit class segment type; [F6] = Ethernet Link Object class; [24] = 8 bit instance segment type; [01] = instance 1. |
| | 5 | Get/Set | Interface Configuration | STRUCT of | TCP/IP network interface configuration |
| | | | IP Address | UDINT | IP address (0 : no address configured) |
| | | | Network Mask | UDINT | Network Mask (0 : no Network mask configured) |
| | | | Gateway Address | UDINT | Gateway IP address (0 : no address configured) |
| | | | Name Server | UDINT | Name server address<br>(0 : no address configured) |
| | | | Name Server 2 | UDINT | Name server address 2<br>(0 : no address configured) |
| | | | Domain Name | STRING | Domain Name |
| | 6 | Get/Set | Host Name | STRING | Device Name* |
| | 8 | Get/Set | TTL value | USINT | TTL value for EtherNet/IP multicast packets. |

| Instance | Attribute ID | Access | Name | Data type | Details |
|---|---|---|---|---|---|
| 1 | 9 | Get/Set | Mcast Config | STRUCT of | IP Multicast address configuration |
| | | | Alloc Config | USINT | 0 - Use default allocation algorithm to generate multicast addresses.<br>1 – Multicast addresses shall be allocated according to the values in Num Mcast and Mcast Start Address. |
| | | | Reserved | USINT | (System reserved) |
| | | | Num Mcast | UINT | Number of multicast addressees to allocate for EtherNet/IP. |
| | | | Mcast Start Addr | UDINT | Starting multicast address from which to begin allocation. |
| | 10 | Get/Set | SelectedAcd | BOOL | Activate the use of ACD<br>0 - Disable ACD<br>1 - Enable ACD |
| | 11 | Get/Set | LastConflictDeteced | STRUCT of | Structure containing information related to the last conflict detected. |
| | | | AcdActivity | USINT | State of ACD activity when last conflict detected. |
| | | | RemoteMAC | Array of 6 USINT | MAC address of remote node from the ARP PDU in which a conflict was detected. |
| | | | ArpPdu | Array of 28 USINT | Copy of the raw ARP PDU in which a conflict was detected. |

Note: Don't use the "System reserved" bit and Bit0 for the judgement.
*Only 16 characters in 64 characters can be set in the drive.

**Instance Services**

| Service Code | Service Name | Description of Service |
|---|---|---|
| 0x01 | Get_Attribute_All | Read all attributes |
| 0x0E | Get_Attribute_Single | Read one attribute |
| 0x10 | Set_Attribute_Single | Write one attribute |

## 4.12. Ethernet link object (0xF6)

Class code 0xF6:

The Ethernet Link Object maintains link-specific counters and status information for IEEE 802.3 communications interface.

**Class Attributes**

| Instance | Attribute ID | Access | Name | Data type | Details | Value |
|---|---|---|---|---|---|---|
| 0 | 1 | Get | Revision | UINT | Revision of this object | 3 |
| | 2 | Get | Max Instances | UINT | Maximum instance number of an object currently created in this class level of the device. | 2 |
| | 3 | Get | Number of Instances | UINT | Number of object instances currently created at this class level of the device. | 2 |
| | 6 | Get | Max ID of class attributes | UINT | The attribute ID number of the last class attribute of the class definition implemented in the device. | 7 |
| | 7 | Get | Max ID of instance attribute | UINT | The attribute ID number of the last instance attribute of the class definition implemented in the device. | 10 |

**Class Services**

| Service Code | Service Name | Description of Service |
|---|---|---|
| 0x01 | Get_Attribute_All | Read all attributes |
| 0x0E | Get_Attribute_Single | Read one attribute |

**Instance 1 Attribute**

| Instance | Attribute ID | Access | Name | Data type | Details |
|---|---|---|---|---|---|
| 1 | 1 | Get | Interface Speed | UDINT | Interface speed currently in use<br>0 : indeterminate (Auto baudrate)<br>10: 10Mbps<br>100: 100Mbps |
| | 2 | Get | Interface Flags | DWORD | Bit 0 : Link Status Indicates whether or not the Ethernet 802.3 communications interface is connected to an active network. 0 indicates an inactive link; 1 indicates an active link.<br>Bit 1 : Half/Full Duplex Indicates the duplex mode currently in use. 0 indicates the interface is running half duplex; 1 indicates full duplex.<br>Bit 2-4 : Negotiation Status<br>000 : Auto-negotiation in progress.<br>001 : Auto-negotiation and speed detection failed.<br>010 : Auto negotiation failed but detected speed. Duplex was defaulted.<br>011 : Successfully negotiated speed and duplex.<br>100 : Auto-negotiation not attempted. Forced speed and duplex.<br>101-111 : Unused<br><br>Bit 5 : Manual Setting Requires Reset. 0 indicates the interface can activate changes to link parameters (auto-negotiate, duplex mode, interface speed) automatically. 1 indicates the device requires a Reset service be issued to its Identity Object in order for the changes to take effect.<br>Bit 6: Local Hardware Fault.<br>0 indicates the interface detects no local hardware fault<br>1 indicates a local hardware fault is detected. The meaning of this is product-specific.<br>Bit 7-31 : (System reserved) |
| | 3 | Get | Physical Address | ARRAY of 6 USINTs | MAC layer address |
| | 4 | Get | Interface Counters | STRUCT of | |
| | | | In Octets | UDINT | Octets received on the interface |
| | | | In Ucast Packets | UDINT | Unicast packets received on the interface |
| | | | In NUcast Packets | UDINT | Non-unicast packets received |
| | | | In Discards | UDINT | Inbound packets received on the interface but discarded |
| | | | In Errors | UDINT | Inbound packets that contain errors (does not include In Discards) |
| | | | In Unknown Protos | UDINT | Inbound packets with unknown protocol |
| | | | Out Octets | UDINT | Octets sent on the interface |
| | | | Out Ucast Packets | UDINT | Unicast packets sent on the interface |
| | | | Out NUcast Packets | UDINT | Non-unicast packets sent on the interface |
| | | | Out Discards | UDINT | Outbound packets discarded |
| | | | Out Errors | UDINT | Outbound packets that contain errors |

Note: Don’t use the “System reserved” bit and Bit0 for the judgement.

| Instance | Attribute ID | Access | Name | Data type | Details |
|---|---|---|---|---|---|
| 1 | 5 | Get | Media Counters | STRUCT of | Media-specific counters |
| | | | Alignment Errors | UDINT | Frames received that are not an integral number of octets in length |
| | | | FCS Errors | UDINT | Frames received that do not pass the FCS check |
| | | | Single Collisions | UDINT | Successfully transmitted frames which experienced exactly one collision |
| | | | Multiple Collisions | UDINT | Successfully transmitted frames which experienced more than one collision |
| | | | SQE Test Errors | UDINT | Number of times SQE test error message is generated |
| | | | Deferred Transmissions | UDINT | Frames for which first transmission attempt is delayed because the medium is busy |
| | | | Late Collisions | UDINT | Number of times a collision is detected later than 512 bit times into the transmission of a packet |
| | | | Excessive Collisions | UDINT | Frames for which transmission fails due to excessive collisions |
| | | | MAC Transmit Errors | UDINT | Frames for which transmission fails due to an internal MAC sublayer transmit error |
| | | | Carrier Sense Errors | UDINT | Times that the carrier sense condition was lost or never asserted when attempting to transmit a frame |
| | | | Frame Too Long | UDINT | Frames received that exceed the maximum permitted frame size |
| | | | MAC Receive Errors | UDINT | Frames for which reception on an interface fails due to an internal MAC sublayer receive error |
| | 6 | Set | Interface Control | STRUCT of | Configuration for physical interface |
| | | | Control Bits | WORD | Interface Control Bits |
| | | | Forced Interface Speed | UINT | Speed at which the interface shall be forced to operate |
| | 7 | Get | Interface Type | USINT | Type of interface: twisted pair, fiber, internal, etc. |
| | 10 | Get | Interface Label | SHORT_STRING | Human readable identification<br>4, Left |

**Instance 2 Attribute**

| Instance | Attribute ID | Access | Name | Data type | Details |
|---|---|---|---|---|---|
| 2 | 1 | Get | Interface Speed | UDINT | Interface speed currently in use<br>0: indeterminate (Auto baudrate)<br>10: 10Mbps<br>100: 100Mbps |
| | 2 | Get | Interface Flags | DWORD | Bit 0: Link Status Indicates whether or not the Ethernet 802.3 communications interface is connected to an active network. 0 indicates an inactive link; 1 indicates an active link.<br>Bit 1: Half/Full Duplex Indicates the duplex mode currently in use. 0 indicates the interface is running half duplex; 1 indicates full duplex.<br>Bit 2-4: Negotiation Status<br>000 : Auto-negotiation in progress.<br>001 : Auto-negotiation and speed detection failed.<br>010 : Auto negotiation failed but detected speed. Duplex was defaulted.<br>011 : Successfully negotiated speed and duplex.<br>100 : Auto-negotiation not attempted. Forced speed and duplex.<br><br>Bit 5: Manual Setting Requires Reset. 0 indicates the interface can activate changes to link parameters (auto-negotiate, duplex mode, interface speed) automatically. 1 indicates the device requires a Reset service be issued to its Identity Object in order for the changes to take effect.<br>Bit 6: Local Hardware Fault.<br>0 indicates the interface detects no local hardware fault<br>1 indicates a local hardware fault is detected. The meaning of this is product-specific.<br>Bit 7-31 (System reserved) |
| | 3 | Get | Physical Address | ARRAY of 6 USINTs | MAC layer address |
| | 6 | Get/Set | Interface Control | STRUCT of | Configuration for physical interface |
| | | | Control Bits | WORD | Interface Control Bits |
| | | | Forced Interface Speed | UINT | Speed at which the interface shall be forced to operate |
| | 7 | Get | Interface Type | USINT | Type of interface: twisted pair, fiber, internal, etc. |
| | 10 | Get | Interface Label | SHORT_STRING | Human readable identification<br>5, Right |

Note: Don’t use the “System reserved” bit and Bit0 for the judgement.

**Instance Services**

| Service Code | Service Name | Description of Service |
|---|---|---|
| 0x01 | Get_Attribute_All | Read all attributes |
| 0x0E | Get_Attribute_Single | Read one attribute |
| 0x10 | Set_Attribute_Single | Write one attribute |
| 0x4C | Get_and_Clear | Gets then clears the specified attribute (Interface Counters or Media Counters). |

# 5. Configuration of the assemblies

## 5.1. List of Assembly Object Instance

### Output Instance

| Instance name | Number (Hex) | Size |
|---|---|---|
| CIP basic speed control output | 20 (0x14) | 2 words (4 bytes) |
| CIP extended speed control output | 21 (0x15) | 2 words (4 bytes) |
| Native drive output | 100 (0x64) | 2 to 8 words (4 to 16 bytes) |
| Native drive output | 101 (0x65) | 4 words (8 bytes) |
| Native drive output | 102 (0x66) | 6 words (12 bytes) |
| TOSHIBA specific output | 105 (0x69) | 9 words (18 bytes) |

### Input Instance

| Instance name | Number (Hex) | Size |
|---|---|---|
| CIP basic speed control input | 70 (0x46) | 2 words (4 bytes) |
| CIP extended speed control input | 71 (0x47) | 2 words (4 bytes) |
| Native drive input | 150 (0x96) | 2 to 8 words (4 to 16 bytes) |
| Native drive input | 151 (0x97) | 4 words (8 bytes) |
| Native drive input | 152 (0x98) | 6 words (12 bytes) |
| TOSHIBA specific input | 155 (0x9B) | 9 words (18 bytes) |

## 5.1.1. Instance 20: CIP basic speed control output

**Instance 20 mapping**

| Byte | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | - | - | - | - | - | Fault reset | - | Run Fwd |
| 1 | - | | | | | | | |
| 2 | Drive Speed Reference $min^{-1}$ (Low byte) * | | | | | | | |
| 3 | Drive Speed Reference $min^{-1}$ (High byte) * | | | | | | | |

## 5.1.2. Instance 70: CIP basic speed control input

**Instance 70 mapping**

| Byte | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | - | - | - | - | - | Running1* (Fwd) | - | Faulted |
| 1 | - | | | | | | | |
| 2 | Drive Actual Speed $min^{-1}$ (Low byte) | | | | | | | |
| 3 | Drive Actual Speed $min^{-1}$ (High byte) | | | | | | | |

* Running1 means "Running Forward."

**Examples of Instance 20/70**

(1) Stop

| Instance | Byte | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Hex. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Output Instance 20 | 1, 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0x0000 |
| | 3, 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Input Instance 70 | 1, 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0x0000 |
| | 3, 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0x0000 |

(2) Forward running 1800 rpm **

| Instance | Byte | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Hex. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Output Instance 20 | 1, 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **1** | 0x0001 |
| | 3, 2 | 0 | 0 | 0 | 0 | 0 | **1** | **1** | **1** | 0 | 0 | 0 | 0 | **1** | 0 | 0 | 0 | 0x0708 |
| Input Instance 70 | 1, 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **1** | 0 | 0 | 0x0004 |
| | 3, 2 | 0 | 0 | 0 | 0 | 0 | **1** | **1** | **1** | 0 | 0 | 0 | 0 | **1** | 0 | 0 | 0 | 0x0708 |

(3) Fault reset ***

| Instance | Byte | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Hex. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Output Instance 20 | 1, 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **1** | 0 | 0 | 0x0004 |
| | 3, 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

** Drive Reference Speed is set up number of rotations by the hexadecimal number.
For example, when "Frequency reference" is set up to 1800 $min^{-1}$:
1800 = 708H

*** Fault reset works only 1 time when 0 -> 1.

## 5.1.3. Instance 21: CIP extended speed control output

**Instance 21 mapping**

| Byte | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | - | NetRef * | NetCtrl * | - | - | Fault reset | Run Rev | Run Fwd |
| 1 | - | | | | | | | |
| 2 | Drive Reference Speed $min^{-1}$ (Low byte) | | | | | | | |
| 3 | Drive Reference Speed $min^{-1}$ (High byte) | | | | | | | |

* Bit 5 and 6 of the instance 21 byte 0 are defined as follows.

Bit 5 (Net Ctrl)..... When "1" is set, bits 0 (Run forward) and 1 (Run reverse) of byte 0 are enabled. When "0" is set, Run/Stop is according to setup of the parameter CMOd.

Bit 6 (Net Ref)..... When "1" is set, bytes 2 and 3 are enabled. When "0" is set, Drive Reference Speed is according to setup of the parameter FMOd.

## 5.1.4. Instance 71: CIP extended speed control input

**Instance 71 mapping**

| Byte | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | At Reference ** | Ref From Net ** | Ctrl From Net ** | Ready | Running2 (Rev) | Running1 (Fwd) | Warning | Faulted |
| 1 | Drive Status ***) | | | | | | | |
| 2 | Drive Reference Speed $min^{-1}$ (Low byte) | | | | | | | |
| 3 | Drive Reference Speed $min^{-1}$ (High byte) | | | | | | | |

** Bit 5, 6, and 7 of the instance 71 byte 0 are defined as follows.

Bit 5 (Ctrl from Net).....When RUN/STOP command from EtherNet/IP is enabled, "1" is set.

Bit 6 (Ref from Net).....When frequency command from EtherNet/IP is enabled, "1" is set.

Bit 7 (At reference) .....When output frequency becomes the same as frequency command, "1" is set.

*** Drive Status is same as the Control Supervisor class State attribute (refer to section 4.6.2).

### ■Examples of Instance 21/71

(1) Stop

| Instance | Byte | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Hex. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Output Instance 21 | 1, 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0x0000 |
| | 3, 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Input Instance 71 | 1, 0 | 0 | 0 | 0 | 0 | 0 | 0 | **1** | **1** | 0 | 0 | 0 | **1** | 0 | 0 | 0 | 0 | 0x0310 |
| | 3, 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0x0000 |

(2) Forward running 1800 $min^{-1}$

| Instance | Byte | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Hex. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Output Instance 21 | 1, 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **1** | **1** | 0 | 0 | 0 | 0 | **1** | 0x0061 |
| | 3, 2 | 0 | 0 | 0 | 0 | 0 | **1** | **1** | **1** | 0 | 0 | 0 | 0 | **1** | 0 | 0 | 0 | 0x0708 |
| Input Instance 71 | 1, 0 | 0 | 0 | 0 | 0 | 0 | **1** | 0 | 0 | **1** | **1** | **1** | **1** | 0 | **1** | **0** | 0 | 0x04F4 |
| | 3, 2 | 0 | 0 | 0 | 0 | 0 | **1** | **1** | **1** | 0 | 0 | 0 | 0 | **1** | 0 | 0 | 0 | 0x0708 |

(3) Fault reset *

| Instance | Byte | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Hex. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Output Instance 21 | 1, 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **1** | 0 | 0 | 0x0004 |
| | 3, 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

* Fault reset works only 1 time when 0 -> 1.

## 5.1.5. Instance 100: Native drive output

**Instance 100 mapping**

| Byte | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | DC braking | ACC1/ ACC2 | PI off | THR2 | Preset Speed4 | Preset Speed3 | Preset Speed2 | Preset Speed1 |
| 1 | Net Ctrl* | Net Ref * | Reset trip | Emergency stop | Free run (ST) | Run/stop | Forward/ Reverse | Jog |
| 2 | Drive Reference Speed Hz (Low byte) ** | | | | | | | |
| 3 | Drive Reference Speed Hz (High byte) ** | | | | | | | |

* Bit 6 and 7 of the instance 100 byte 1 are defined as follows.

Bit 7 (Net Ctrl)..... When “1” is set, all commands of byte 0 and 1 are enabled. When “0” is set, each command is according to setup of the parameter CMOd.

Bit 6 (Net Ref)..... When “1” is set, bytes 2 and 3 are enabled. When “0” is set, Drive Reference Speed is according to setup of the parameter FMOd.

** Drive Reference Speed is set up by 0.01Hz unit and the hexadecimal number.
For example, when "Frequency reference" is set up to 60Hz, since the minimum unit is 0.01Hz,
60 / 0.01 = 6000 = 1770H

## 5.1.6. Instance 150: Native drive input

**Instance 150 mapping**

| Byte | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | DC braking | ACC2 | PI | THR 2 (uF2 + tH2) | - | ALARM (FC91) | EMG | FL |
| 1 | - | READY without ST/RUN | READY with ST/ RUN | Emergency stop | Free run (ST) | Run/Stop | Forward / Reverse | Jog |
| 2 | Drive Actual Speed Hz (Low byte) | | | | | | | |
| 3 | Drive Actual Speed Hz (High byte) | | | | | | | |

■**Examples of Instance 100/150**

**① Stop**

| Instance | Byte | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Hex. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Output Instance 100 | 1, 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0x0000 |
| | 3, 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Input Instance 150 | 1, 0 | 0 | **1** | 0 | 0 | **1** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0x4800 |
| | 3, 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0x0000 |

**② Forward running 60Hz**

| Instance | Byte | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Hex. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Output Instance 100 | 1, 0 | **1** | **1** | 0 | 0 | 0 | **1** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0xC400 |
| | 3, 2 | 0 | 0 | 0 | **1** | 0 | **1** | **1** | **1** | 0 | **1** | **1** | **1** | 0 | 0 | 0 | 0 | 0x1770 |
| Input Instance 150 | 1, 0 | 0 | **1** | **1** | 0 | 0 | **1** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0x6400 |
| | 3, 2 | 0 | 0 | 0 | **1** | 0 | **1** | **1** | **1** | 0 | **1** | **1** | **1** | 0 | 0 | 0 | 0 | 0x1770 |

**③ Reverse running 60Hz**

| Instance | Byte | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Hex. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Output Instance 100 | 1, 0 | **1** | **1** | 0 | 0 | 0 | **1** | **1** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0xC600 |
| | 3, 2 | 0 | 0 | 0 | **1** | 0 | **1** | **1** | **1** | 0 | **1** | **1** | **1** | 0 | 0 | 0 | 0 | 0x1770 |
| Input Instance 150 | 1, 0 | 0 | **1** | **1** | 0 | 0 | **1** | **1** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0x6600 |
| | 3, 2 | 0 | 0 | 0 | **1** | 0 | **1** | **1** | **1** | 0 | **1** | **1** | **1** | 0 | 0 | 0 | 0 | 0x1770 |

**④ Preset speed 1 with forward running (Sr 1)**

| Instance | Byte | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Hex. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Output Instance 100 | 1, 0 | **1** | 0 | 0 | 0 | 0 | **1** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **1** | 0x8401 |
| | 3, 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Input Instance 150 | 1, 0 | 0 | **1** | **1** | 0 | 0 | **1** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0x6400 |
| (Sr 1 is set 5Hz.) | 3, 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **1** | **1** | **1** | **1** | **1** | 0 | **1** | 0 | 0 | 0x01F4 |

**⑤ Fault reset ***

| Instance | Byte | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Hex. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Output Instance 100 | 1, 0 | 0 | 0 | **1** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0x2000 |
| | 3, 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

About the other command, refer to section 3.2.4.2.

* Fault reset works only 1 time when 0 -> 1.

## 5.1.7. Instance 101: Native drive output

**Instance 101 mapping**

| Byte | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | - | Net Ref* | Net Ctrl* | - | - | Fault reset | Run reverse | Run forward |
| 1 | - | | | | | | | |
| 2 | Drive Reference Speed $min^{-1}$ (Low byte) | | | | | | | |
| 3 | Drive Reference Speed $min^{-1}$ (High byte) | | | | | | | |
| 4 | Index (Low byte) | | | | | | | |
| 5 | Write | Index (High byte) | | | | | | |
| 6 | Data (Low byte) | | | | | | | |
| 7 | Data (High byte) | | | | | | | |

* Bit 5 and 6 of the instance 101 byte 0 are defined as follows.
Bit 5 (Net Ctrl)..... When “1” is set, all commands of byte 0 and 1 are enabled. When “0” is set, each command is according to setup of the parameter $CMod$.
Bit 6 (Net Ref)..... When “1” is set, bytes 2 and 3 are enabled. When “0” is set, Drive Reference Speed is according to setup of the parameter $FMod$.

## 5.1.8. Instance 151: Native drive input

**Instance 151 mapping**

| Byte | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | At reference** | Ref from Net** | Ctrl from Net** | Ready | Running Reverse | Running Forward | Warning | Faulted/ tripped |
| 1 | Drive Status * | | | | | | | |
| 2 | Drive Actual Speed $min^{-1}$ (Low byte) | | | | | | | |
| 3 | Drive Actual Speed $min^{-1}$ (High byte) | | | | | | | |
| 4 | Index (Low byte) | | | | | | | |
| 5 | Write | Error | Index (High byte) | | | | | |
| 6 | Data (Low byte) | | | | | | | |
| 7 | Data (High byte) | | | | | | | |

** Bit 5, 6, and 7 of the instance 151 byte 0 are defined as follows.
Bit 5 (Ctrl from Net).....When command from communication is enabled, “1” is set.
Bit 6 (Ref from Net).....When frequency command from communication is enabled, “1” is set.
Bit 7 (At reference) .....When output frequency becomes the same as frequency command, “1” is set.

* Drive Status is same as the Control Supervisor class State attribute (refer to 4.6.2).

## ■Examples of Instance 101/151

Access the inverter parameter is enabled using byte 4 to 6 of this Instance.
Set the communication number of the parameter to byte 4, 5 (Index), and the value to byte 6, 7 (Data).

**① Read the parameter CMOd (Command mode selection, communication number is 0003).**

| Instance | Byte | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Hex. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Output Instance 101 | 5, 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **1** | **1** | 0x0003 |
| | 7, 6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Input Instance 151 | 5, 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **1** | **1** | 0x0003 |
| (CMOd is 0.) | 7, 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0x0000 |

**② Read the parameter F268 (Initial value of UP/DOWN frequency).**

| Instance | Byte | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Hex. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Output Instance 101 | 5, 4 | 0 | 0 | 0 | 0 | 0 | 0 | **1** | 0 | 0 | **1** | **1** | 0 | **1** | 0 | 0 | 0 | 0x0268 |
| | 7, 6 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Input Instance 151 | 5, 4 | 0 | 0 | 0 | 0 | 0 | 0 | **1** | 0 | 0 | **1** | **1** | 0 | **1** | 0 | 0 | 0 | 0x0268 |
| (F268 is 60.0Hz.) | 7, 6 | 0 | 0 | 0 | **1** | 0 | **1** | **1** | **1** | 0 | **1** | **1** | **1** | 0 | 0 | 0 | 0 | 0x1770 |

**③ Write "60 (Hz)" to the parameter Sr 1 (Preset speed 1, communication number is 0018).**

| Instance | Byte | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Hex. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Output Instance 101 | 5, 4 | **1** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **1** | **1** | 0 | 0 | 0 | 0x8018 |
| | 7, 6 | 0 | 0 | 0 | **1** | 0 | **1** | **1** | **1** | 0 | **1** | **1** | **1** | 0 | 0 | 0 | 0 | 0x1770 |
| Input Instance 151 (OK) | 5, 4 | **1** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **1** | **1** | 0 | 0 | 0 | 0x8018 |
| | 7, 6 | 0 | 0 | 0 | **1** | 0 | **1** | **1** | **1** | 0 | **1** | **1** | **1** | 0 | 0 | 0 | 0 | 0x1770 |
| Input Instance 151 (NG) | 5, 4 | **1** | **1** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **1** | **1** | 0 | 0 | 0 | 0xC018 |
| (Error code *) | 7, 6 | 0 | 0 | 0 | **1** | 0 | 0 | 0 | **1** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0x1100 |

*Data of "Error code"

0x1100: Data out of range

0x1101: Bad address

## 5.1.9. Instance 102: Native drive output

**Instance 102 mapping**

| Byte | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | C001 Command data (Low byte) | | | | | | | |
| 1 | C001 Command data (High byte) | | | | | | | |
| 2 | C002 Command data (Low byte) | | | | | | | |
| 3 | C002 Command data (High byte) | | | | | | | |
| 4 | C003 Command data (Low byte) | | | | | | | |
| 5 | C003 Command data (High byte) | | | | | | | |
| 6 | C004 Command data (Low byte) | | | | | | | |
| 7 | C004 Command data (High byte) | | | | | | | |
| 8 | C005 Command data (Low byte) | | | | | | | |
| 9 | C005 Command data (High byte) | | | | | | | |
| 10 | C006 Command data (Low byte) | | | | | | | |
| 11 | C006 Command data (High byte) | | | | | | | |

Refer to "**Scanner Address** (C001 – C006) "

## 5.1.10. Instance 152: Native drive input

**Instance 152 mapping**

| Byte | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | C021 Monitor data (Low byte) | | | | | | | |
| 1 | C021 Monitor data (High byte) | | | | | | | |
| 2 | C022 Monitor data (Low byte) | | | | | | | |
| 3 | C022 Monitor data (High byte) | | | | | | | |
| 4 | C023 Monitor data (Low byte) | | | | | | | |
| 5 | C023 Monitor data (High byte) | | | | | | | |
| 6 | C024 Monitor data (Low byte) | | | | | | | |
| 7 | C024 Monitor data (High byte) | | | | | | | |
| 8 | C025 Monitor data (Low byte) | | | | | | | |
| 9 | C025 Monitor data (High byte) | | | | | | | |
| 10 | C026 Monitor data (Low byte) | | | | | | | |
| 11 | C026 Monitor data (High byte) | | | | | | | |

Refer to "**Scanner Address** (C021 – C026)"

## 5.1.11. Instance 105: TOSHIBA specific output

**Instance 105 mapping**

| Byte | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | |
| 1 | Function code (Read / Write) (*1) | | | | | | | |
| 2 | Index (Low byte) | | | | | | | |
| 3 | Index (High byte) | | | | | | | |
| 4 | Data (Low byte) | | | | | | | |
| 5 | Data (High byte) | | | | | | | |
| 6 | C001 Command data (Low byte) | | | | | | | |
| 7 | C001 Command data (High byte) | | | | | | | |
| 8 | C002 Command data (Low byte) | | | | | | | |
| 9 | C002 Command data (High byte) | | | | | | | |
| 10 | C003 Command data (Low byte) | | | | | | | |
| 11 | C003 Command data (High byte) | | | | | | | |
| 12 | C004 Command data (Low byte) | | | | | | | |
| 13 | C004 Command data (High byte) | | | | | | | |
| 14 | C005 Command data (Low byte) | | | | | | | |
| 15 | C005 Command data (High byte) | | | | | | | |
| 16 | C006 Command data (Low byte) | | | | | | | |
| 17 | C006 Command data (High byte) | | | | | | | |

Refer to "**Scanner Address** (C001 – C006) and **Scanner Value** (C041 – C046: details of command data)."

## 5.1.12. Instance 155: TOSHIBA specific input

**Instance 105 mapping**

| Byte | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | | | | | | | | |
| 1 | Function code (Read / Write) results | | | | | | | |
| 2 | Index (Low byte) | | | | | | | |
| 3 | Index (High byte) | | | | | | | |
| 4 | Data (Low byte) | | | | | | | |
| 5 | Data (High byte) | | | | | | | |
| 6 | C021 Command data (Low byte) | | | | | | | |
| 7 | C021 Command data (High byte) | | | | | | | |
| 8 | C022 Command data (Low byte) | | | | | | | |
| 9 | C022 Command data (High byte) | | | | | | | |
| 10 | C023 Command data (Low byte) | | | | | | | |
| 11 | C023 Command data (High byte) | | | | | | | |
| 12 | C024 Command data (Low byte) | | | | | | | |
| 13 | C024 Command data (High byte) | | | | | | | |
| 14 | C025 Command data (Low byte) | | | | | | | |
| 15 | C025 Command data (High byte) | | | | | | | |
| 16 | C026 Command data (Low byte) | | | | | | | |
| 17 | C026 Command data (High byte) | | | | | | | |

Refer to "**Scanner Address** (C021 – C026) and **Scanner Value** (C061 – C066: details of command data)."

(*1): Please set the function code as follow.

Read: 0x00

Write: 0x80

## ■Examples of Instance 105/155

Access the inverter parameter is enabled using byte 1 to 5 of this Instance.
Set the communication number of the parameter to byte 2, 3 (Index), and the value to byte 4, 5 (Data).

**① Read the parameter CMOd (Command mode selection, communication number is 0003).**

| Instance | Byte | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Hex. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Output Instance 105 | 1, 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0x0000 |
| | 3, 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **1** | **1** | 0x0003 |
| | 5, 4 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Input Instance 155 (CMOd is 0.) | 1, 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0x0000 |
| | 3, 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **1** | **1** | 0x0003 |
| | 5, 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0x0000 |

**② Read the parameter F268 (Initial value of UP/DOWN frequency).**

| Instance | Byte | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Hex. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Output Instance 105 | 1, 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0x0000 |
| | 3, 2 | 0 | 0 | 0 | 0 | 0 | 0 | **1** | 0 | 0 | **1** | **1** | 0 | **1** | 0 | 0 | 0 | 0x0268 |
| | 5, 4 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Input Instance 155 (F268 is 60.0Hz.) | 1, 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0x0000 |
| | 3, 2 | 0 | 0 | 0 | 0 | 0 | 0 | **1** | 0 | 0 | **1** | **1** | 0 | **1** | 0 | 0 | 0 | 0x0268 |
| | 5, 4 | 0 | 0 | 0 | **1** | 0 | **1** | **1** | **1** | 0 | **1** | **1** | **1** | 0 | 0 | 0 | 0 | 0x1770 |

**③ Write "60 (Hz)" to the parameter Sr 1 (Preset speed 1, communication number is 0018).**

| Instance | Byte | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | Hex. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Output Instance 105 | 1, 0 | **1** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0x8000 |
| | 3, 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **1** | **1** | 0 | 0 | 0 | 0x0018 |
| | 5, 4 | 0 | 0 | 0 | **1** | 0 | **1** | **1** | **1** | 0 | **1** | **1** | **1** | 0 | 0 | 0 | 0 | 0x1770 |
| Input Instance 155 (OK) | 1, 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0x0000 |
| | 3, 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **1** | **1** | 0 | 0 | 0 | 0x0018 |
| | 5, 4 | 0 | 0 | 0 | **1** | 0 | **1** | **1** | **1** | 0 | **1** | **1** | **1** | 0 | 0 | 0 | 0 | 0x1770 |
| Input Instance 155 (NG) (Error code *) | 1, 0 | 0 | **1** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0x4000 |
| | 3, 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **1** | **1** | 0 | 0 | 0 | 0x0018 |
| | 5, 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **1** | 0x0001 |

*Data of "Error code"
0x0001: Error

# 6. About EDS file

As for acquisition of an EDS file for VF-MB1 and VF-S15, please contact your Toshiba distributor.

# 7. Integration in RSLogix™

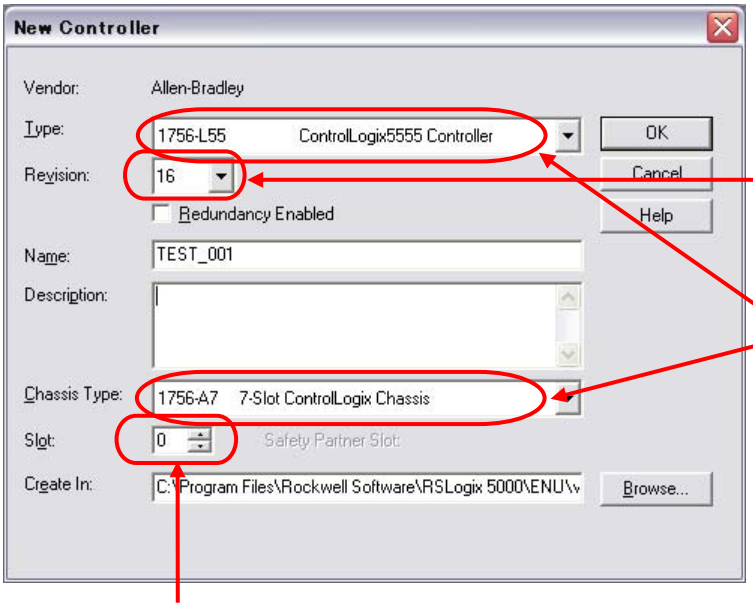
VF-MB1/S15 drive equipped with an EtherNet/IP module shall be configured as a "Generic Ethernet Module."

RSLogix™ is a trademark of Rockwell Automation, Inc.

## 7.1. Create a new project

Power on of PLC and launch the software of RSLogix™5000. (Set the key switch of PLC to "PROG" mode.)

Create a new project and configure the following contents.



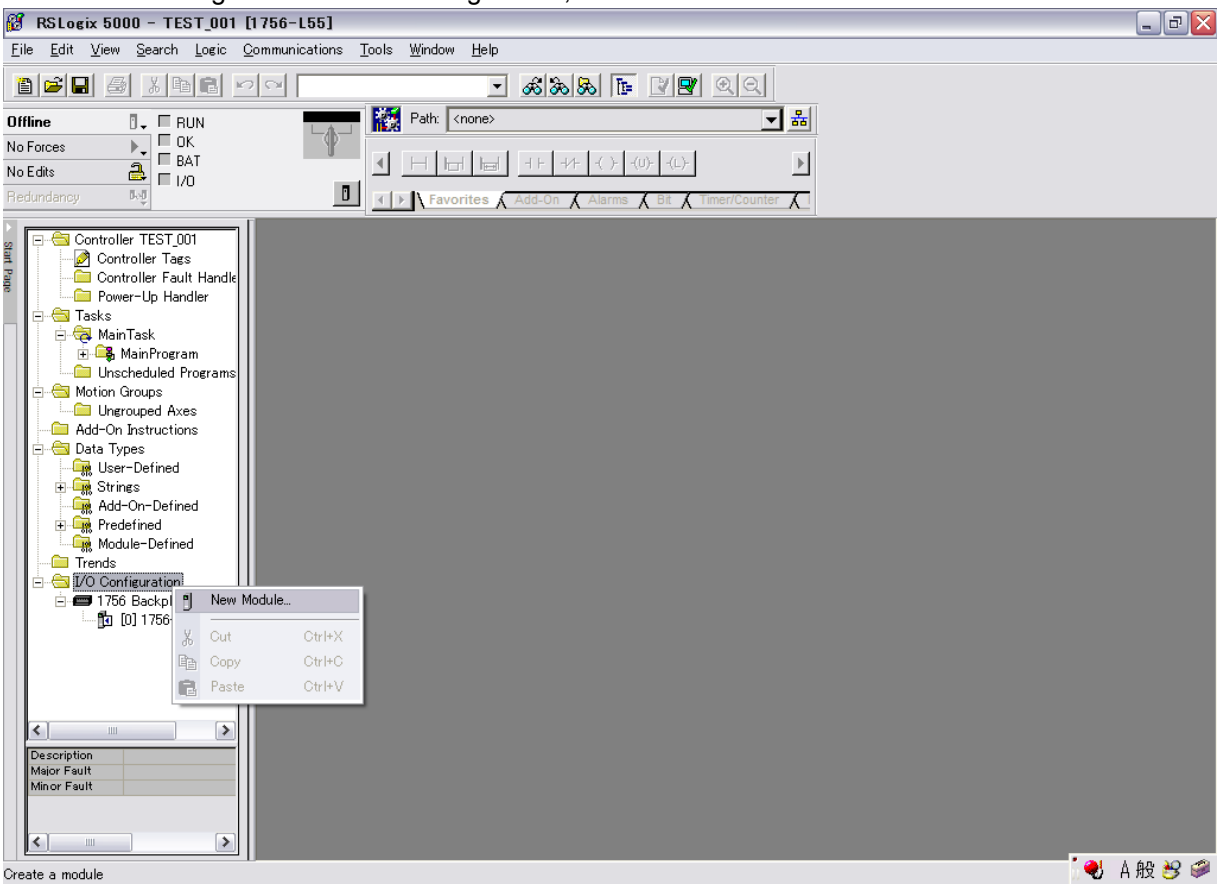

The meaning of revision is revision of the program.

Select the your PLC

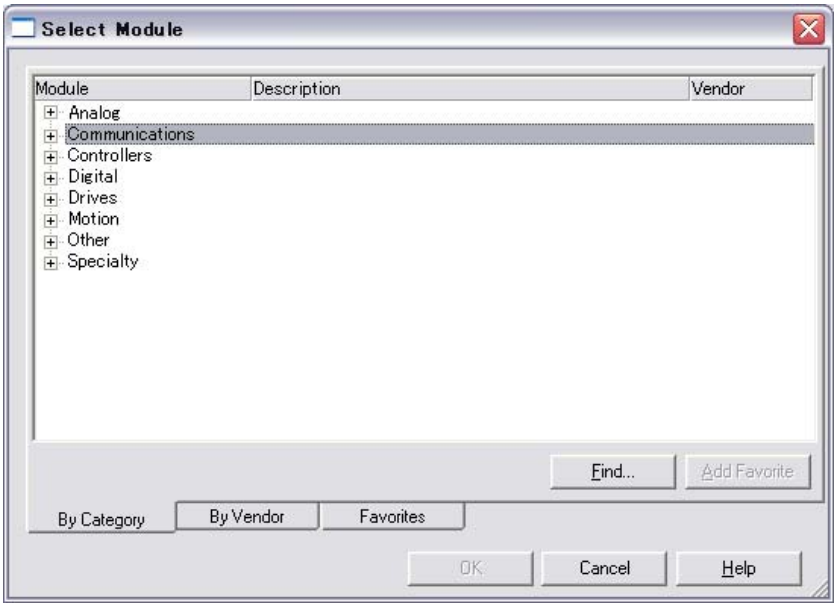
The slot is set to 0 in case of the leftmost slot.

## 7.2. Add a EtherNet/IP scanner to the I/O configuration

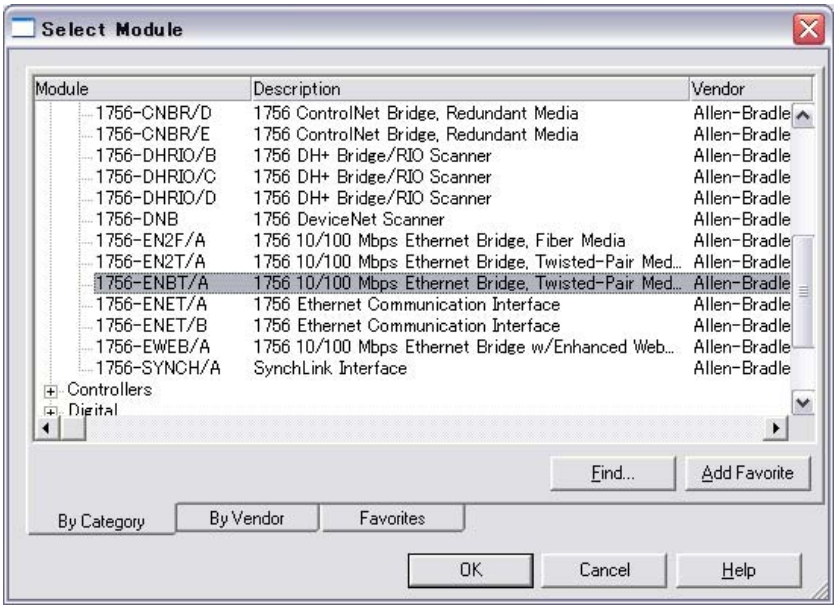
Right-click the I/O Configuration, and select “New Module”.



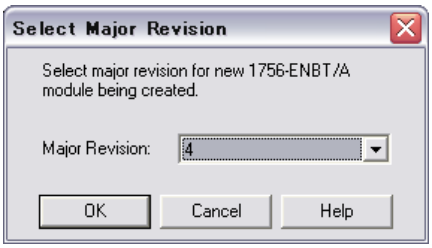

Click the “Communications” to expand “Communications” group.



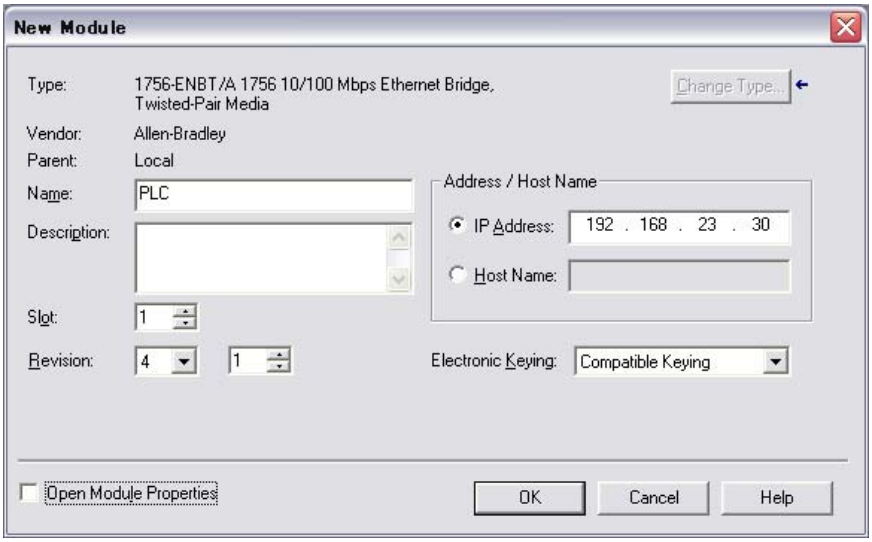
Select the Module as below.




Select revision of drive.

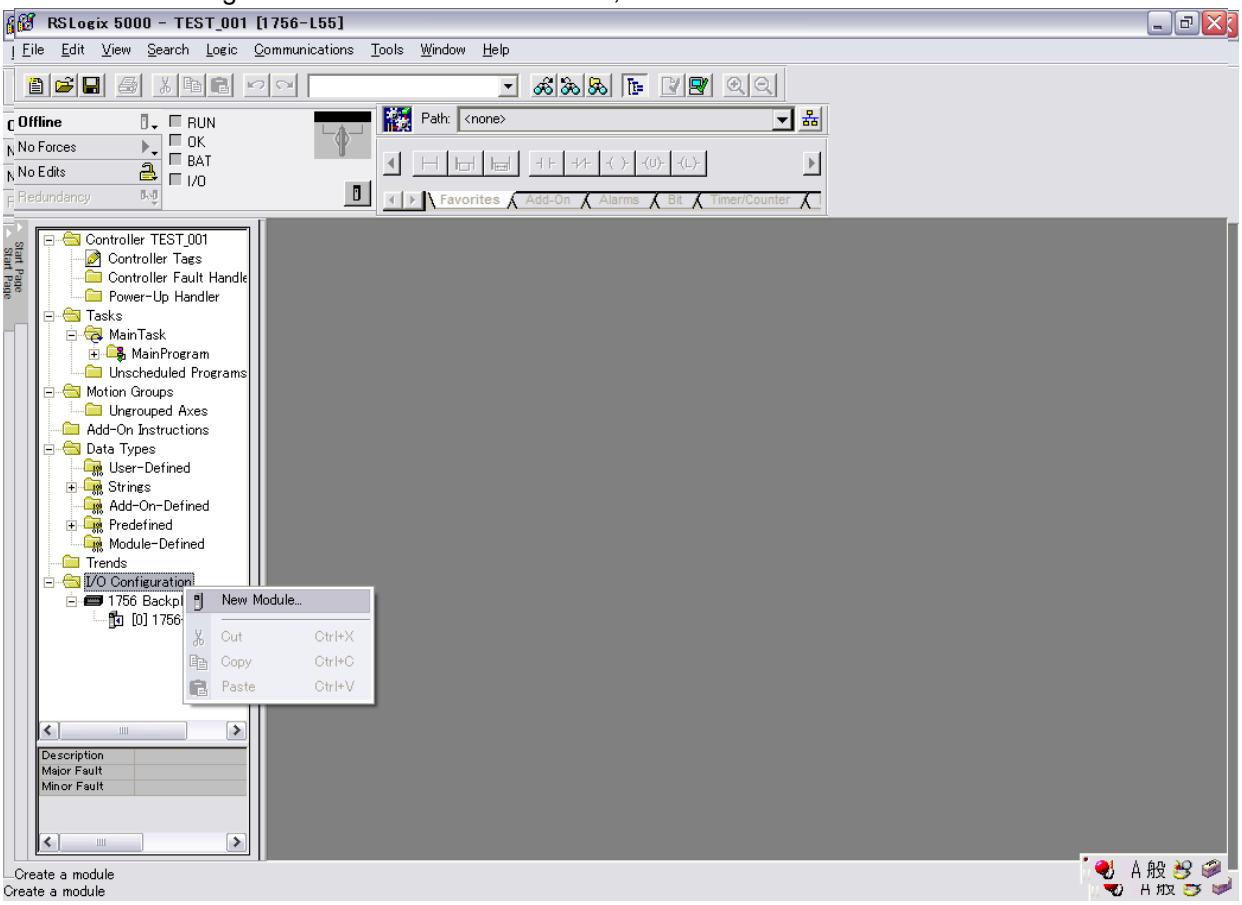



Put in Name and IP address, and press “OK” button.

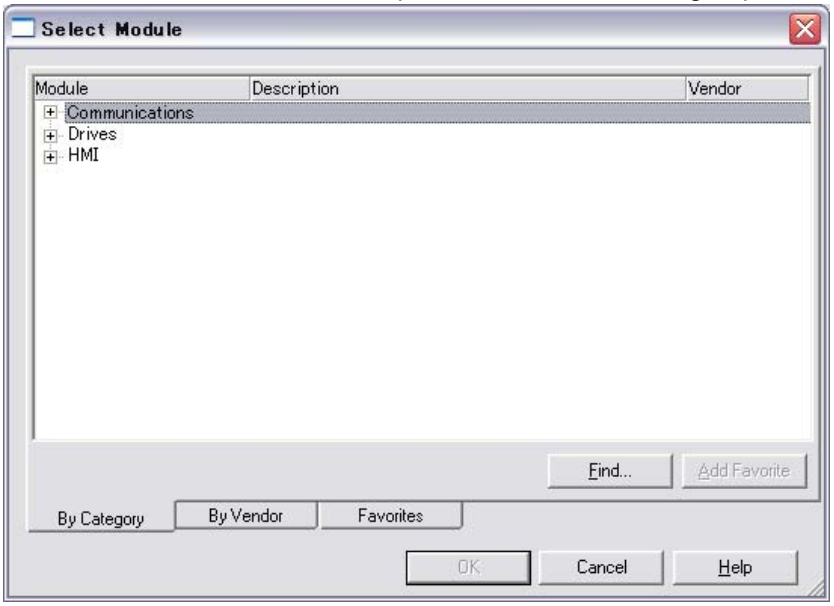


## 7.3. Configure the VF-MB1/S15 EtherNet/IP module

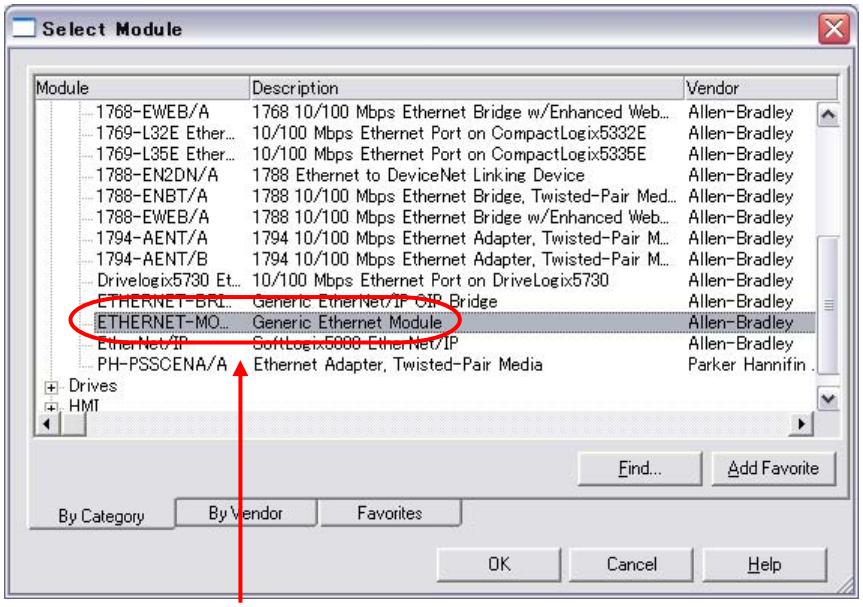
Right-click the EtherNet/IP scanner, and select “New Module”.




Click the “Communications” to expand “Communications” group.



Above the Allen-Bradley drive profile is selected.

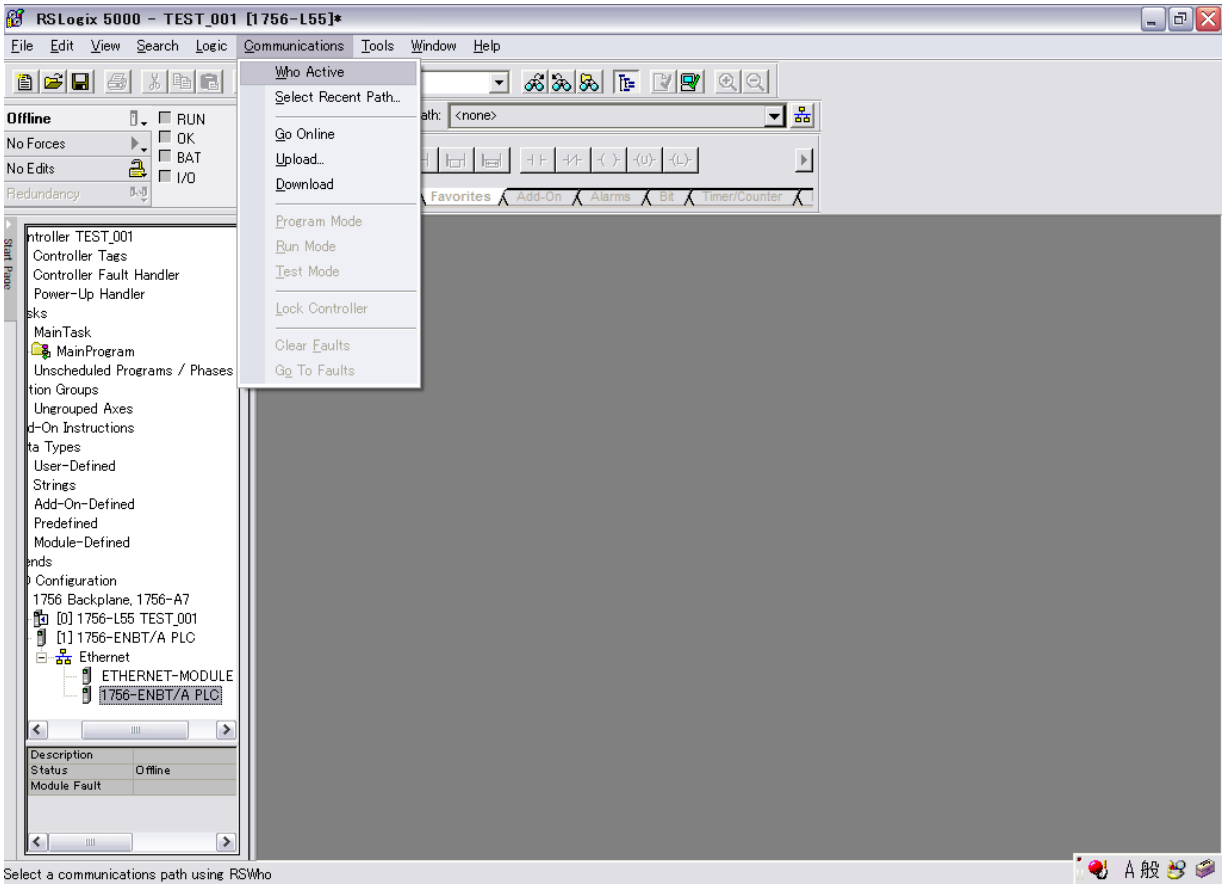



Select the format of the data.

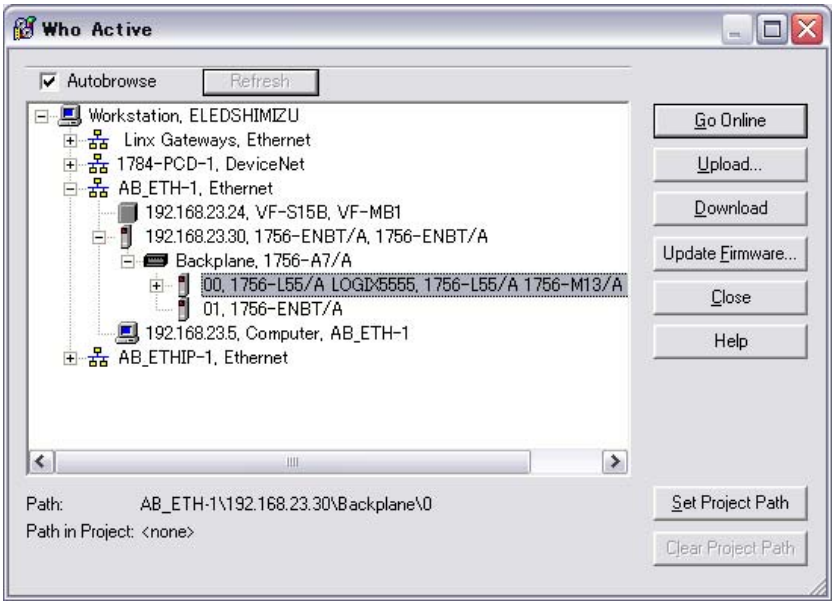
Above the CIP basic speed control profile is selected.

## 7.4. Download the program to the PLC

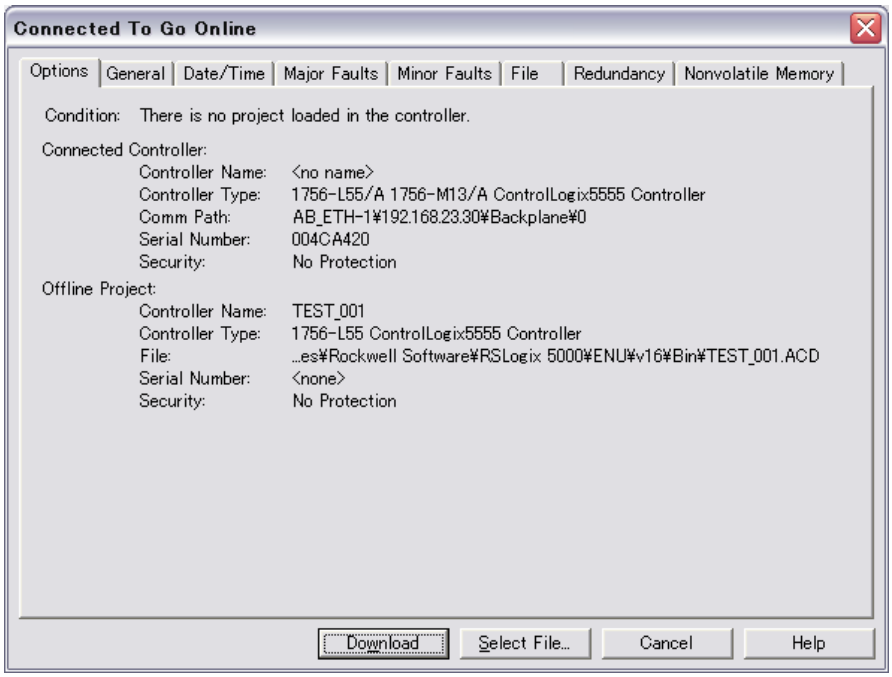
The first download follows the following procedure.



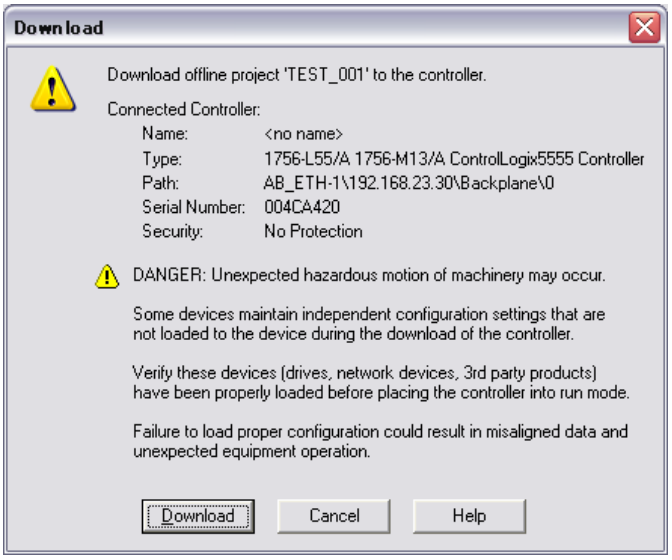

Select the using PLC.



Select the "Download."

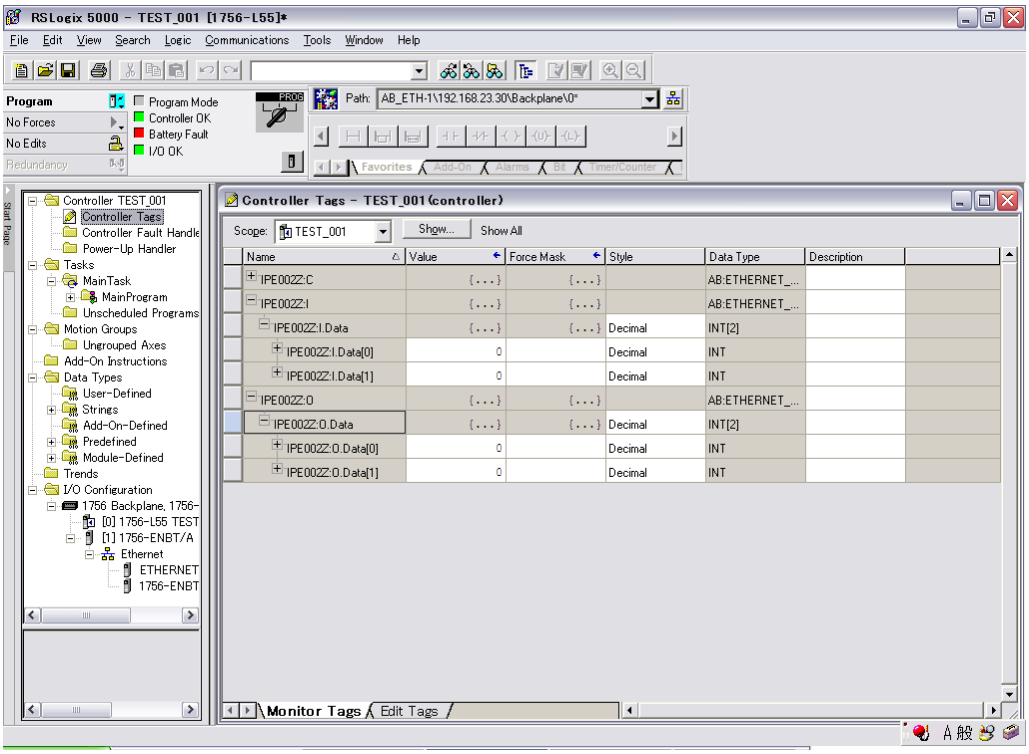



Once again, select the "Download."



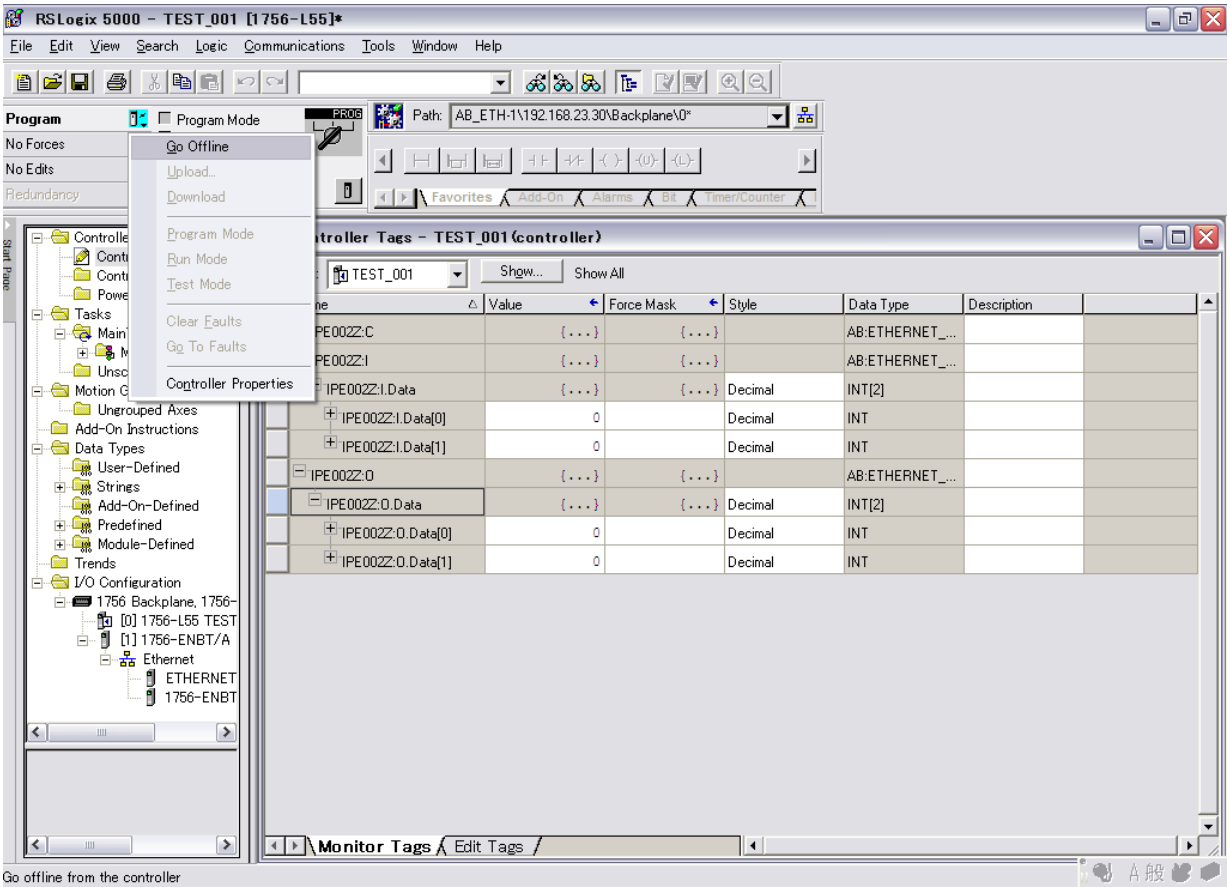
## 7.5. Edit the I/O scan data

Open the "Controller Tags."

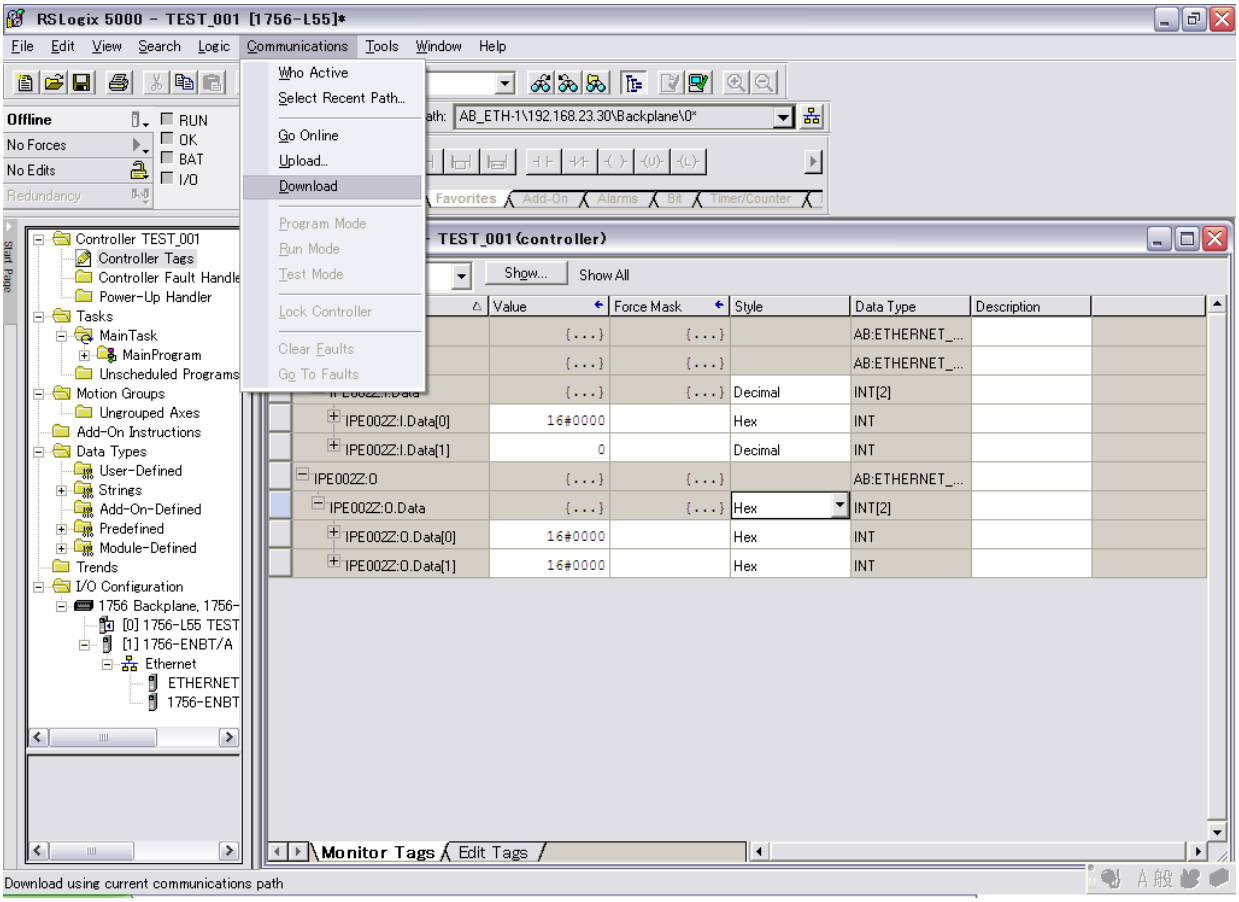



Set to the "Offline" if change the value and the type of data.

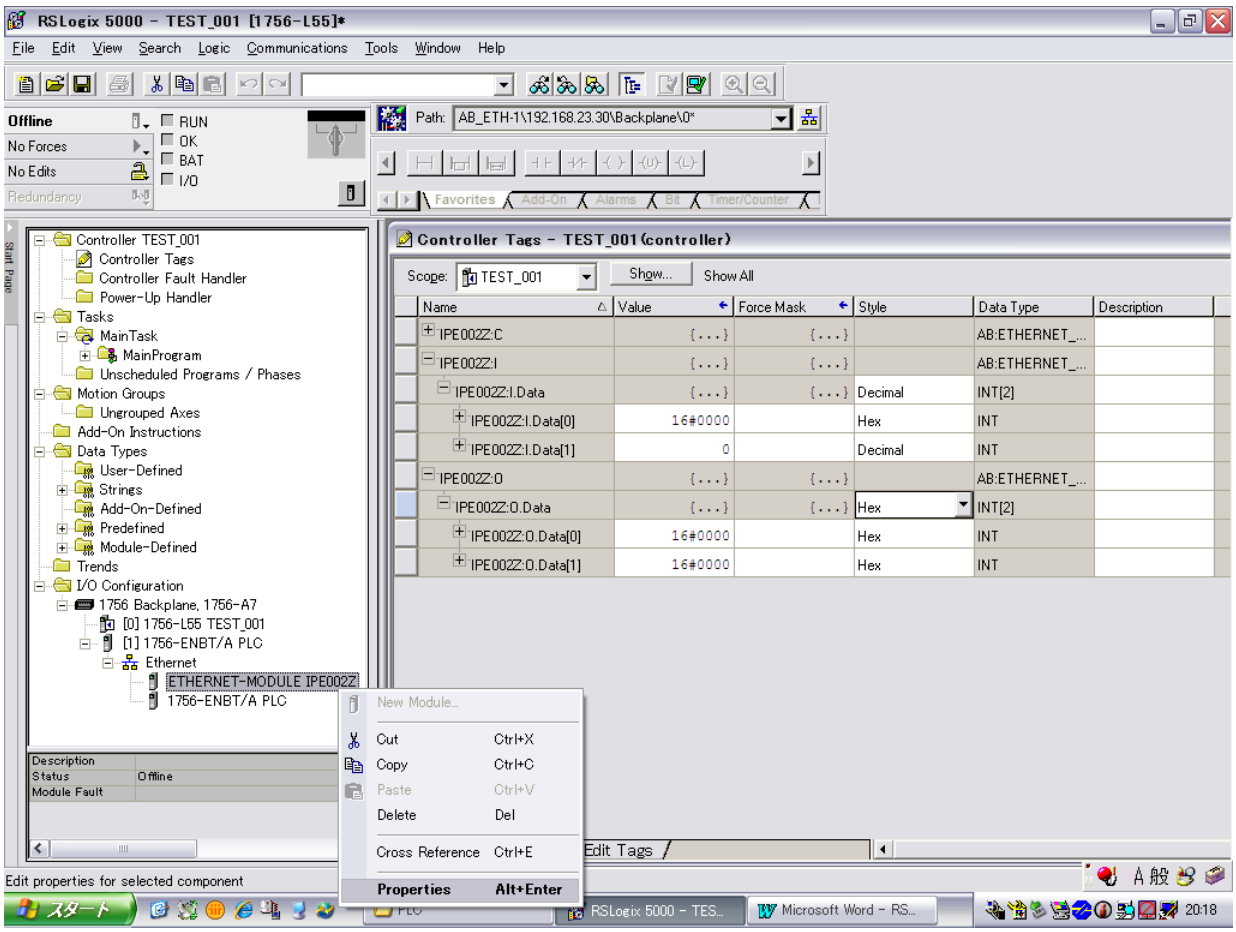
And, change by "Controller Tag" after "the SW of PLC is set to PROG".

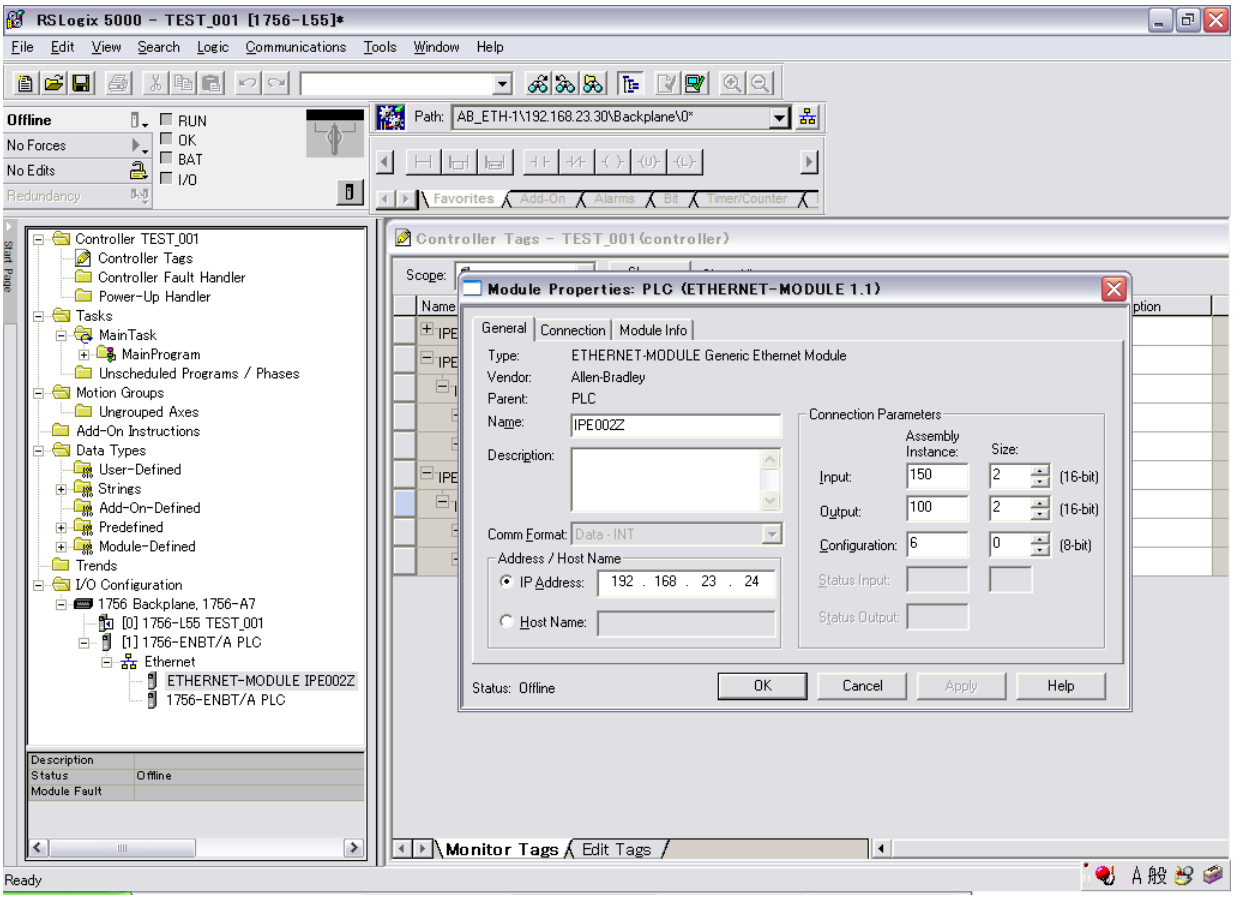


Download the changed data to the PLC. : "Communications" → "Download"




After the setting is downloaded, set to "RUN" the key SW of the PLC.





# 8. Modbus TCP server

## 8.1. Modbus TCP frames

Modbus TCP frames consist of a header and a Modbus request.

**Header format:**

| Byte | Description | | Comments |
|---|---|---|---|
| 0 | Transaction identifier | high order | |
| 1 | | low order | |
| 2 | Protocol identifier | high order | This identifier always equals 0. |
| 3 | | low order | |
| 4 | Length of data | high order | Number of bytes in the Modbus request +1. The frame length is always less than 256 bytes, the value of the significant byte therefore equals 0. |
| 5 | | low order | |
| 6 | Destination identifier (Unit ID) | | |
| 7 | Modbus request function code | | |

The frame header returned by the VF-MB1/S15 server is identical to that of the frame sent by the client.

## 8.2. Drive Modbus servers

The destination identifier (Unit ID) is used to access drive Modbus TCP servers:

| Unit ID | Modbus TCP server | Accessible parameters |
|---|---|---|
| 0-248 | Variable speed drive | See the VF-MB1/VF-S15 instruction manual. |
| 251 | Option board | |
| 255 | IO Scanner | See the “IO Scanner” section. |

## 8.3. List of Modbus functions supported

| Function code | Modbus name | Description | Size of data |
|---|---|---|---|
| 03 | Read Holding Registers | Read N output words | 63 words max. |
| 06 | Write Single Register | Write one output word | - |
| 16 (0x10) | Write Multiple Registers | Write N output words | 63 words max. |
| 23 (0x17) | Read/Write Multiple Registers | Read/write N words (IO Scanning) | 20/20 words max. |
| 43 (0x2B) | Read Device Identification | Identification | - |

## 8.4. "03 (0x03) Read Holding Registers" function

The Modbus request is used to read the values of a number (No. of Points) of adjacent words starting at the address indicated (Starting Address). The values read are restored one after another, at the end of the response (First Point Data -> Last Point Data).

Request Format:

| Byte | Meaning |
|---|---|
| 0 | Function Code = **03h** |
| 1 | Starting Address Hi |
| 2 | Starting Address Lo |
| 3 | No. of Points Hi (0) |
| 4 | No. of Points Lo (1 - 125) |

Response format:

| Byte | Meaning |
|---|---|
| 0 | Function Code = **03h** |
| 1 | Byte Count (B = 2 × No. of Points) |
| 2 | First Point Data Hi |
| 3 | First Point Data Lo |
| . . . | . . . . . |
| B | Last Point Data Hi |
| B+1 | Last Point Data Lo |

Exception response format:

| Byte | Meaning |
|---|---|
| 0 | Function Code = **83h** |
| 1 | Exception Code =<br>**01 (Illegal Function)**<br>**02 (Illegal Data Address)**<br>**03 (Illegal Data Value)** |

## Notes

▼ If the communication number that doesn't exist is read, the option returns 0x8000.

## 8.5. "06 (0x06) Write Single Register" function

This Modbus request is used to write a given value (Present Data) to the address supplied (Register Address).

Request format:

| Byte | Meaning |
|---|---|
| 0 | Function Code = **06h** |
| 1 | Register Address Hi |
| 2 | Register Address Lo |
| 3 | Preset Data Hi |
| 4 | Preset Data Lo |

Response format:

| Byte | Meaning |
|---|---|
| 0 | Function Code = **06h** |
| 1 | Register Address Hi |
| 2 | Register Address Lo |
| 3 | Preset Data Hi |
| 4 | Preset Data Lo |

Exception response format:

| Byte | Meaning |
|---|---|
| 0 | Function Code = **86h** |
| 1 | Exception Code =<br>**01 (Illegal Function)**<br>**02 (Illegal Data Address)**<br>**03 (Illegal Data Value)**<br>**04 (Slave Device Failure)** |

## Notes

- ▼ As for the EEPROM parameter, first the data is written to RAM, after that the data is written to EEPROM. Some EEPROM parameters cannot be changed during the inverter is running.
  When write to EEPROM parameter that will change inverter status from stop to run, the inverter must be in the state that it cannot run.
  For example: To write to EEPROM, the inverter must open ST-CC. (display shows "OFF")
  If not, the data is only written to RAM.
- ▼ The Life of EEPROM is approximately 100,000 times. Avoid writing a command more than 100,000 times to the same parameter of the Inverter.
- ▼ Please access only parameters in document.

## 8.6. "16 (0x10) Write Multiple Registers" function

This Modbus request is used to write a number (No. of Registers) of adjacent words starting at a given address (Starting Address). The values to be written are supplied one after another (First Register Data -> Last Register Data).

Request format:

| Byte | Meaning |
|---|---|
| 0 | Function Code = **10h** |
| 1 | Starting Address Hi |
| 2 | Starting Address Lo |
| 3 | No. of Registers Hi (0) |
| 4 | No. of Registers Lo (1 - 100) |
| 5 | Byte Count (B = 2 × No. of Registers) |
| 6 | First Register Data (Hi) |
| 7 | First Register Data (Lo) |
| . . . | . . . . . |
| B+4 | Last Register Data (Hi) |
| B+5 | Last Register Data (Lo) |

Response format:

| Byte | Meaning |
|---|---|
| 0 | Function Code = **10h** |
| 1 | Starting Address Hi |
| 2 | Starting Address Lo |
| 3 | No. of Registers Hi (0) |
| 4 | No. of Registers Lo (1 - 100) |

Exception response format:

| Byte | Meaning |
|---|---|
| 0 | Function Code = **90h** |
| 1 | Exception Code =<br>**01 (Illegal Function)**<br>**02 (Illegal Data Address)**<br>**03 (Illegal Data Value)**<br>**04 (Slave Device Failure)** |

## Notes

▼ As for the EEPROM parameter, first the data is written to RAM, after that the data is written to EEPROM. Some EEPROM parameters cannot be changed during the inverter is running.
When write to EEPROM parameter that will change inverter status from stop to run, the inverter must be in the state that it cannot run.
For example: To write to EEPROM, the inverter must open ST-CC. (display shows "OFF")
If not, the data is only written to RAM.

▼ The Life of EEPROM is approximately 100,000 times. Avoid writing a command more than 100,000 times to the same parameter of the Inverter.

▼ Please access only parameters in document.

## 8.7. "23 (0x17) Read/Write Multiple Registers" function

The "Read/Write Multiple Registers" service is reserved for setting up the IO Scanning service (see "IO Scanning" section)

Request format:

| Byte | Meaning |
|---|---|
| 0 | Function Code = **17h** |
| 1 | Starting Address Hi |
| 2 | Starting Address Lo |
| 3 | No. of Registers Hi (0) |
| 4 | No. of Registers Lo (1 - 100) |
| 5 | Byte Count (B = 2 × No. of Registers) |
| 6 | First Register Data (Hi) |
| 7 | First Register Data (Lo) |
| . . . | . . . . . |
| B+4 | Last Register Data (Hi) |
| B+5 | Last Register Data (Lo) |

Response format:

| Byte | Meaning |
|---|---|
| 0 | Function Code = **17h** |
| 1 | Starting Address Hi |
| 2 | Starting Address Lo |
| 3 | No. of Registers Hi (0) |
| 4 | No. of Registers Lo (1 - 100) |

Exception response format:

| Byte | Meaning |
|---|---|
| 0 | Function Code = **97h** |
| 1 | Exception Code =<br>**01 (Illegal Function)**<br>**02 (Illegal Data Address)**<br>**03 (Illegal Data Value)**<br>**04 (Slave Device Failure)** |

## Notes

- ▼ As for the EEPROM parameter, first the data is written to RAM, after that the data is written to EEPROM. Some EEPROM parameters cannot be changed during the inverter is running.
  When write to EEPROM parameter that will change inverter status from stop to run, the inverter must be in the state that it cannot run.
  For example: To write to EEPROM, the inverter must open ST-CC. (display shows "OFF")
  If not, the data is only written to RAM.
- ▼ The Life of EEPROM is approximately 100,000 times. Avoid writing a command more than 100,000 times to the same parameter of the Inverter.
- ▼ Please access only parameters in document.

## 8.8. "43 (0x2B) Read Device identification" function

The "Read/Write Multiple Registers" service is reserved for setting up the IO Scanning service (see "IO Scanning section").
Example in VF-MB1 is shown below.

Request format:

| Byte | Meaning | |
|---|---|---|
| 0 | Function Code = **2Bh** | **2Bh** |
| 1 | Type of MEI | 0Eh |
| 2 | Read Device ID code | 01: Basic<br>02: Regular<br>03: Extended |
| 3 | Object ID | 0 |

Response format: (ID = 248)

| Byte | Meaning | With the IPE002Z | |
|---|---|---|---|
| 0 | Function Code = **2Bh** | **2Bh** | |
| 1 | Type of MEI | 0Eh | |
| 2 | Read Device ID code | 01: Basic<br>02: Regular<br>03: Extended | |
| 3 | Conformity Level | 2 | |
| 4 | More Follows | 0 | |
| 5 | Next Object Id | 0 | |
| 6 | Number Of Objects | 3 for Basic.<br>6 for Regular or Extended | |
| 7 | Obj 0 Id → **Vendor Name** | 0 | |
| 8 | Obj 0 length | 7 | |
| 9-15 | Obj 0 value | “TOSHIBA” | |
| 16 | Obj 1 Id → **ProductCode** | 1 | |
| 17 | Obj 1 length | 13 | |
| 18-30 | Obj 1 value | “VFMB1S-2007PL” | |
| 31 | Obj 2 Id → **Version** | 2 | |
| 32 | Obj 2 length | 5 | |
| 33-37 | Obj 2 value | “10801” | |
| 38 | Obj 4 Id → **Product Name** | 4 | **Only for Regular and Extended** |
| 39 | Obj 4 length | 6 | |
| 40-45 | Obj 4 value | “VF-MB1” | |
| 46 | Obj 5 Id → **Model Name** | 5 | |
| 47 | Obj 5 length | 3 | |
| 44-58 | Obj 5 value | “TSB” | |
| 59 | Obj 6 Id → **UserApplicationName** | 6 | |
| 60 | Obj 6 length | 16 maximum | |
| 61-80 | Obj 6 value | “ModbusTCP” | |

Response format: (ID = 251)

| Byte | Meaning | With the IPE002Z |
|---|---|---|
| 0 | Function Code = **2Bh** | **2Bh** |
| 1 | Type of MEI | 0Eh |
| 2 | Read Device ID code | 01: Basic<br>02: Regular<br>03: Extended |
| 3 | Conformity Level | 2 |
| 4 | More Follows | 0 |
| 5 | Next Object Id | 0 |
| 6 | Number Of Objects | 3 for Basic.<br>6 for Regular or Extended |
| 7 | Obj 0 Id → **Vendor Name** | 0 |
| 8 | Obj 0 length | 7 |
| 9-15 | Obj 0 value | “TOSHIBA” |
| 16 | Obj 1 Id → **ProductCode** | 1 |
| 17 | Obj 1 length | 7 |
| 18-24 | Obj 1 value | “IPE002Z” |
| 25 | Obj 2 Id → **Version** | 2 |
| 26 | Obj 2 length | 4 |
| 27-30 | Obj 2 value | “0106” |

Exception response format:

| Byte | Meaning |
|---|---|
| 0 | Function Code = **ABh** |
| 1 | Exception Code =<br>**01 (Illegal Function)**<br>**02 (Illegal Data Address)**<br>**03 (Illegal Data Value)** |

## 8.9. Parameter data

It is explanation by the reference method of the list of parameters of the VF-MB1 or VF-S15 series as follows. For communication purpose, see the parameter list on inverter's instruction manual regarding the communication number, adjustment range and so forth.

<Example of excerpts from the inverter's instruction manual>

| Title | Communi-cation No. | Function | Adjustment range | Minimum setting unit (Panel/Communi-cation) | Default setting | Write during running | | Refer ence |
|---|---|---|---|---|---|---|---|---|
| AU H | - | History function | Displays parameters in groups of five in the reverse order to that in which their settings were changed. | 1/1 | - | - | | 4.3<br>5.1 |
| AU F | 0093 | Guidance function | 0 : -<br>1 : -<br>2 : Preset speed guidance<br>3 : Analog signal operation guidance<br>… | 1/1 | 0 | Disabled | | 4.3<br>5.2 |
| AU L | 0094 | Overload characteristic selection | 0 : -<br>1 : Constant torque characteristic (150%-60s)<br>2 : Variable torque characteristic (120%-60s) | 1/1 | - | Disabled | | 3.5<br>5.3<br>6.14 |
| : | : | : | : | : | : | : | | : |
| dE C | 0010 | Deceleration time 1 | 0.1 to 6000 sec. | 0.1/0.1 *2 | *1 | Enabled | | 5.2 |
| tY P | 0007 | Factory default setting | 0 : -<br>1 : 50 Hz default setting<br>2 : 60 Hz default setting<br>3 : Default setting 1 (Initialization)<br>… | 1/1 | - | Disabled | | 5.20 |
| | | | : | | | | | |

*1: Default values vary depending on the capacity.
*2: Changing the parameter tYP enables to set to 0.01 sec. (adjustment range: 0.01 - 600.0 sec.).

(1) "Title" means the display on the inverter panel.

(2) "Communication number" is affixed to each parameter that is necessary for designating the parameter for communication.

(3) "Adjustment range" means a data range adjustable for a parameter, and the data cannot be written outside the range. The data have been expressed in the decimal notation. For writing the data through the communication function, take the minimum setting unit into consideration, and use hexadecimal system.

(4) "Minimum setup unit" is the unit of a single data (when the minimum unit is "-", 1 is equal to 1).
For example, the "minimum setup unit" of acceleration time (ACC) is 0.01, and 1 is equal to 0.01s.
For setting a data to 10 seconds, transmit 0x03E8 [10÷0.01=1000d=0x03E8] by communication.

(5) Communication numbers "0xxxxA" to "0xxxxF" don't exist in VF-MB1 or VF-S15.
Therefore, these communication numbers are skipped when read or write.
For example:
When the data of two words is read from ACC(0009h), 0x000A doesn't exist because of this specification.
Consequently, in this case ACC(0009h) and DEC(0010h) are read.

# 9. IO Scanning service

## 9.1. Presentation

The IO Scanning service is used to exchange I/O data between:
· A controller or PLC (IO Scanner).
· Devices (IO Scanning servers).
This exchange is usually performed by implicit services, thus avoiding the need to program the controller (PLC).

The IO Scanner periodically generates the Read/Write Multiple Registers (23 = 0x17) request.
The IO Scanning service operates if it has been enabled in the PLC and the drive.
The drive parameters assigned to IO Scanning have been selected by default. This assignment can be modified by configuration.
The drive IO Scanning service can also be configured by the option Modbus server.

When the IO Scanning service has been enabled in the VF-MB1/S15 drive:
· A TCP connection is assigned to it.
· The parameters assigned in the periodic variables are exchanged cyclically between the option and the drive.
· The parameters assigned in the periodic output variables are reserved for IO Scanning. They cannot be written by another Modbus service, even if the IO Scanner is not sending its periodic output variables.

## 9.2. Periodic variables

| Word No. | Output variables (written by IO Scanner) | Input variables (read by IO Scanner) |
|---|---|---|
| 0 | Reserved | Reserved |
| 1 | Scanner write word 1 – configurable (C001) | Scanner read word 1 – configurable (C021) |
| 2 | Scanner write word 2 – configurable (C002) | Scanner read word 2 – configurable (C022) |
| 3 | Scanner write word 3 – configurable (C003) | Scanner read word 3 – configurable (C023) |
| 4 | Scanner write word 4 – configurable (C004) | Scanner read word 4 – configurable (C024) |
| 5 | Scanner write word 5 – configurable (C005) | Scanner read word 5 – configurable (C025) |
| 6 | Scanner write word 6 – configurable (C006) | Scanner read word 6 – configurable (C026) |
| 7-31 | Reserved | Reserved |

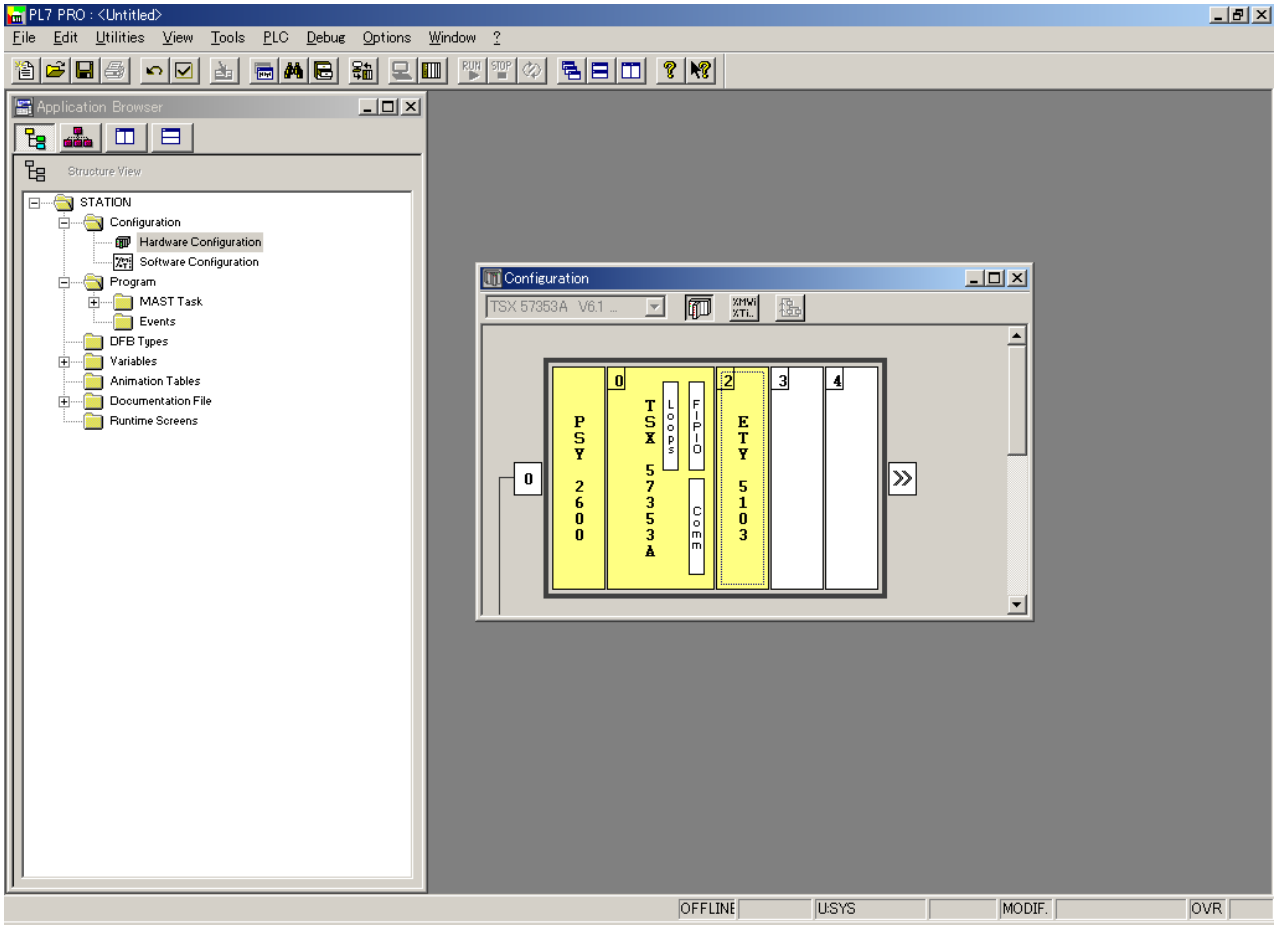
It is possible to configure the assignment of periodic variables 1 to 6.
Please refer to "parameter" about configurable.

# 10. Example of the setup with PL7™

It is an example of the setup using PLC (PL7™) made by Schneider electric as follows.

## 10.1. Defining the hardware configuration

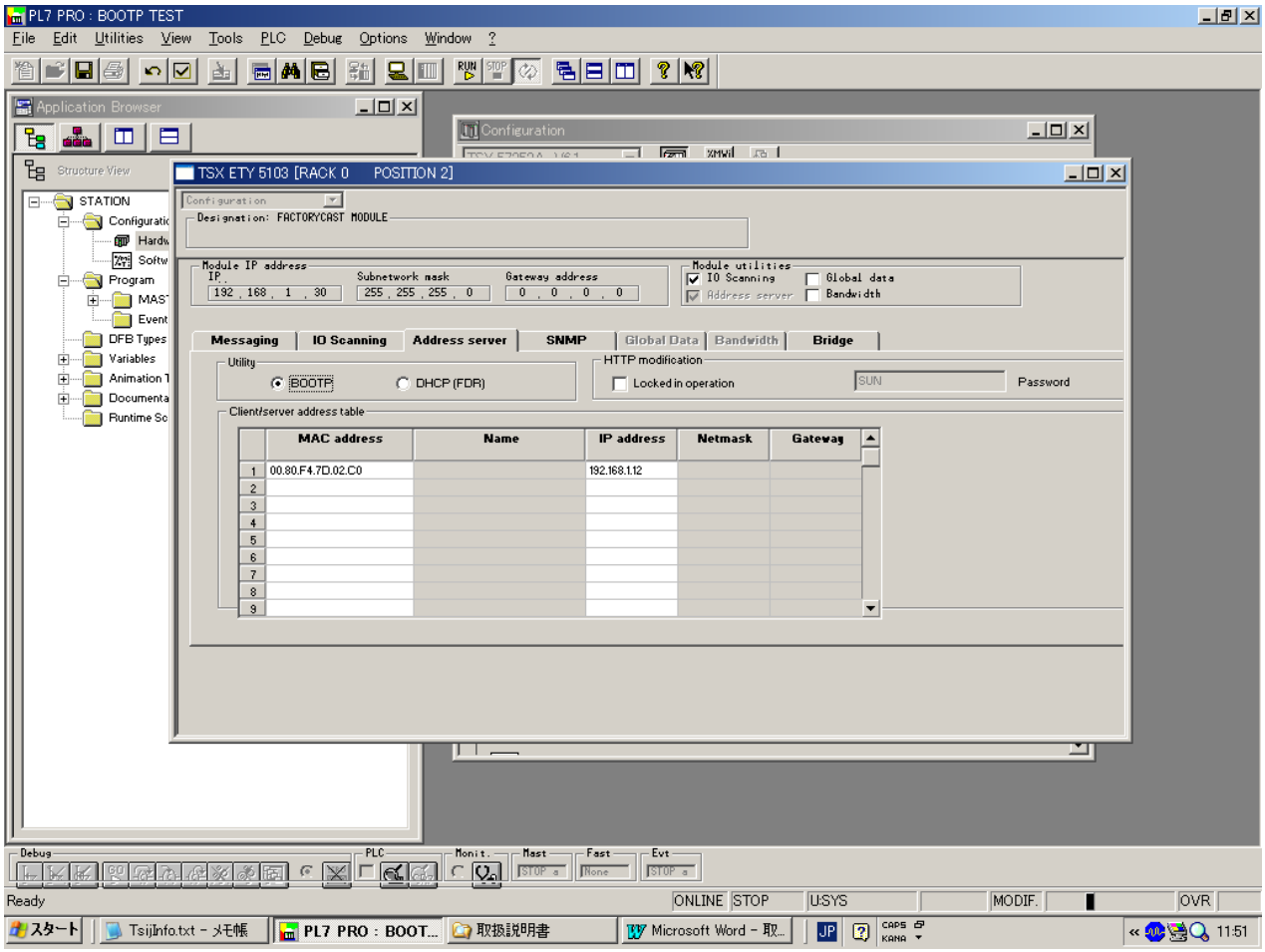
Configure an Ethernet module then configure the module so that it can communicate with the drive. The example shows a TSX Premium PLC equipped with a TSX ETY5102 module.




*PL7 is a trademark of Schneider Electric.

## 10.2. BOOTP configuration

The BOOTP server function consists of allocating BOOTP clients their IP addresses.
The activation conditions for the drive BOOTP client are described in the “Configuration - IP Addresses” section.




This window is used to configure the BOOTP server.
The drive MAC address is given on a label attached to its IPE002Z option module. The IP address assigned to the drive must be entered in the table against the MAC address.
In this example, the Ethernet module MAC address is 00.80.F4.7D.02.C0, and its IP address is 192.168.1.12.
Each line in the “Table of supplied addresses” can accept both the MAC and IP addresses of a BOOTP client.

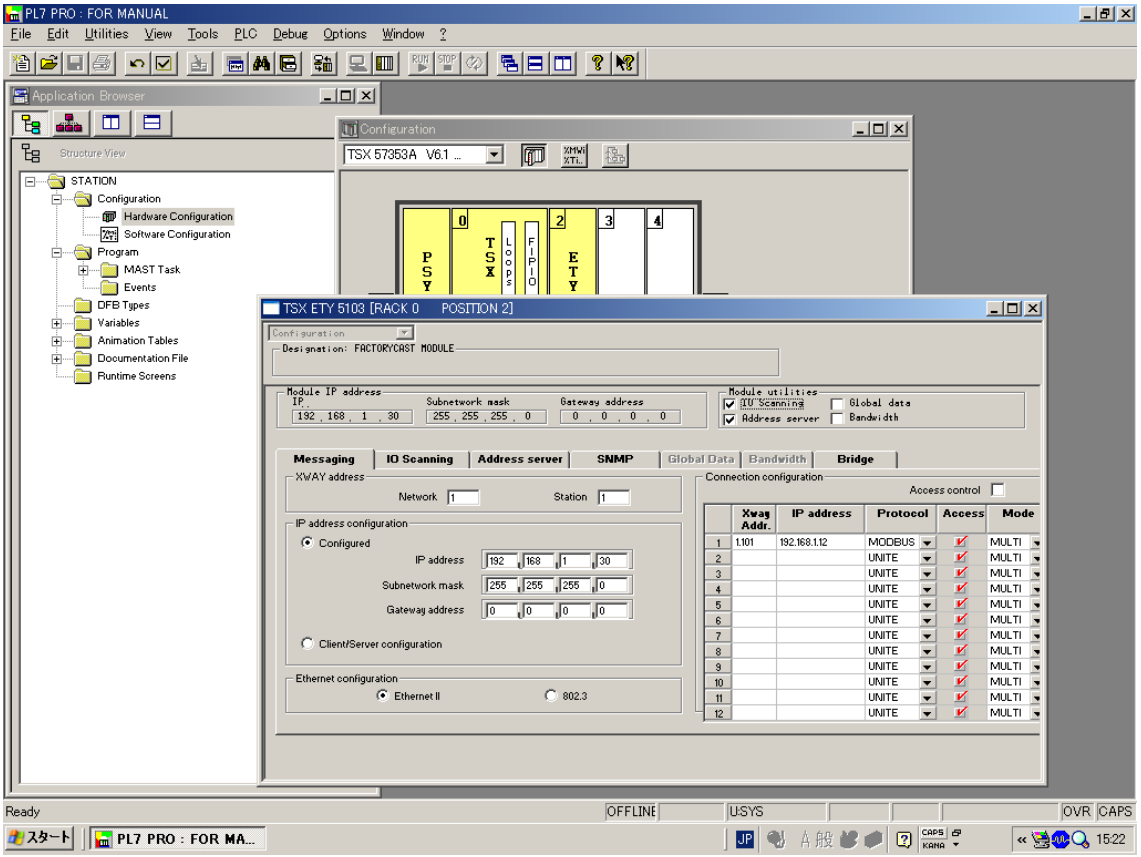
## 10.3. Configuring Modbus messaging

To use Modbus messaging in PL7, the “IP address”, “Subnet mask” and “Gateway address” parameters must be configured in the “Messaging” tab in the PLC Ethernet module configuration screen.
Data entered in the “Connection configuration” box is used to manage the PLC Modbus messaging service, but has no effect on IO Scanning which is an independent service.

Example:

| | |
|---|---|
| PLC IP address | 192.168.1.30 |
| Subnet mask | 255.255.255.0 |
| Gateway address | 0.0.0.0 |
| Drive IP address | 192.168.1.12 |

| | Xway address | IP address | Protocol | Access | Mode |
|---|---|---|---|---|---|
| 1 | 1,101 | 192.168.1.12 | MODBUS | ☑ | MULTI |

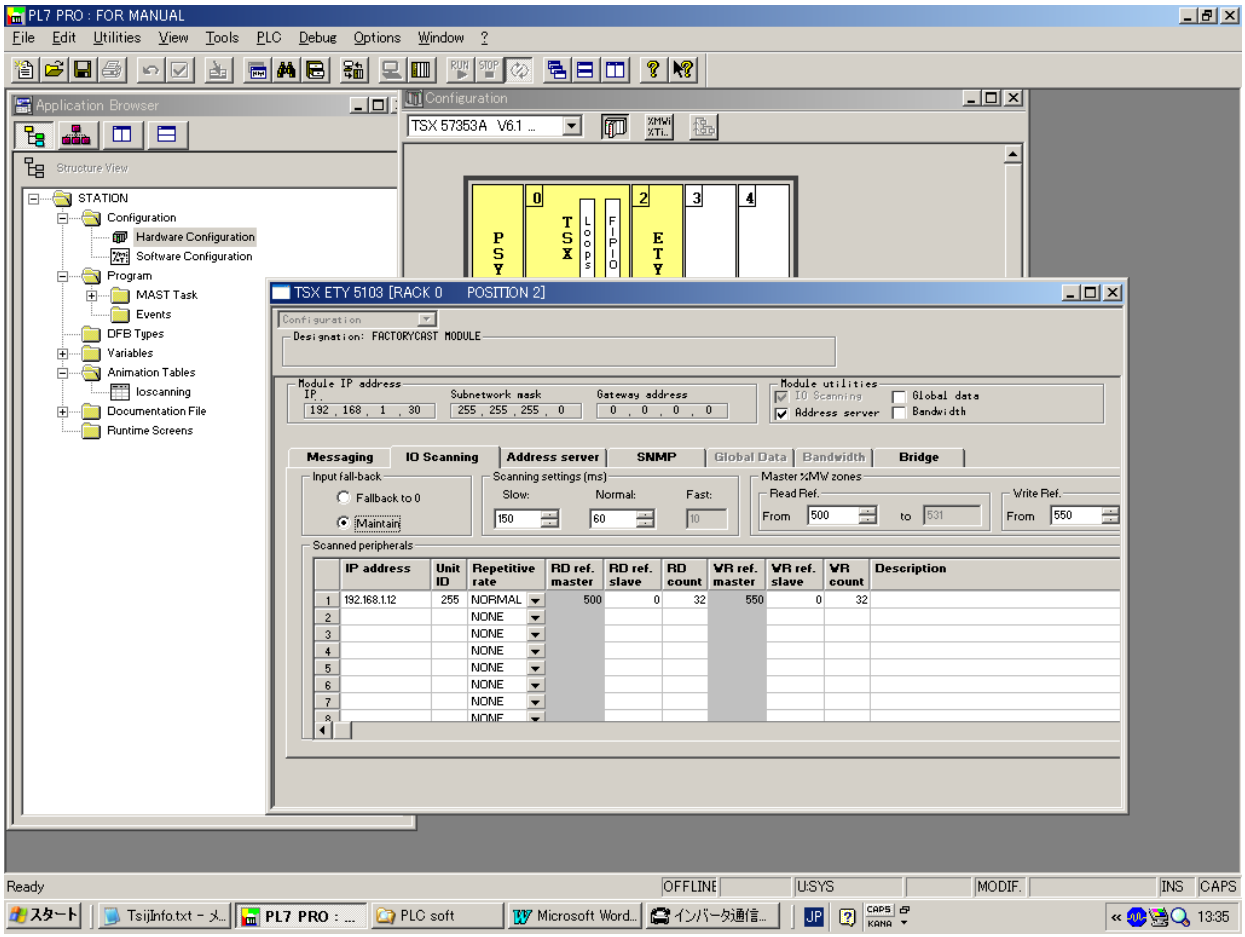


## 10.4. Configuring periodic variables

This window is used to configure the IO Scanning function, described in the IO Scanning Service section on page 72.

Example:

- The periodic variables of the drive at IP address 192.168.1.12 are associated with PLC data words.
- The drive periodic output variables (control) are associated with the 32 words (WR count) starting at PLC address %MW550 (Write Ref.).
- The drive periodic input variables (monitoring) are associated with the 32 words (RD count) starting at PLC address %MW500 (Read Ref.).




The addresses for the PLC %MW words correspond to the configuration in the previous example.

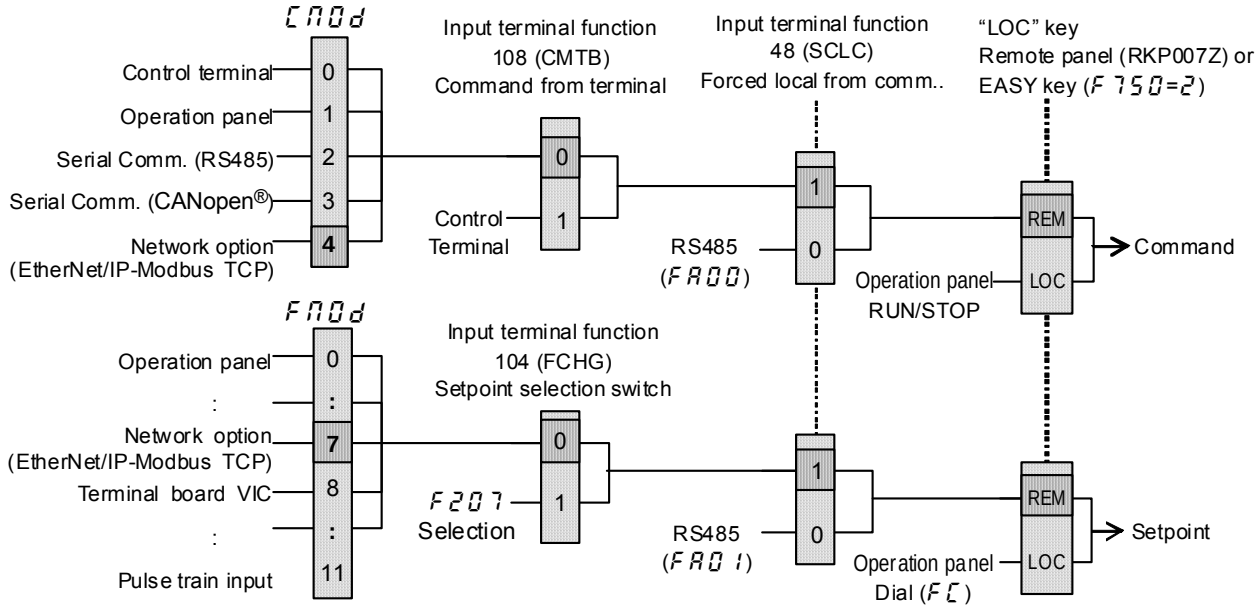
| PLC address | Periodic output variable (default assignment) | Configurable |
|---|---|---|
| %MW 550 | Reserved | No |
| %MW 551 | Scanner write word 1 | Yes (C001) |
| %MW 552 | Scanner write word 2 | Yes (C002) |
| %MW 553 | Scanner write word 3 | Yes (C003) |
| %MW 554 | Scanner write word 4 | Yes (C004) |
| %MW 555 | Scanner write word 5 | Yes (C005) |
| %MW 556 | Scanner write word 6 | Yes (C006) |
| %MW 557 to %MW 581 | Reserved | No |

| PLC address | Periodic output variable (default assignment) | Configurable |
|---|---|---|
| %MW 500 | Reserved | No |
| %MW 501 | Scanner read word 1 | Yes (C021) |
| %MW 502 | Scanner read word 2 | Yes (C022) |
| %MW 503 | Scanner read word 3 | Yes (C023) |
| %MW 504 | Scanner read word 4 | Yes (C024) |
| %MW 505 | Scanner read word 5 | Yes (C025) |
| %MW 506 | Scanner read word 6 | Yes (C026) |
| %MW 507 to %MW 531 | Reserved | No |

# 11. Command & Setpoint selection (Local/Remote)

Indication to display Local/Remote mode is on the inverter unit (Refer to the inverter instruction manual for details). EtherNet/IP™ - Modbus® TCP option command and setpoint are activated on Remote mode.

Inverters have some switches to select the command and setpoint location. Following figure shows the diagram. Refer to the inverter instruction manual for the parameter in detail.



<Example of setting>

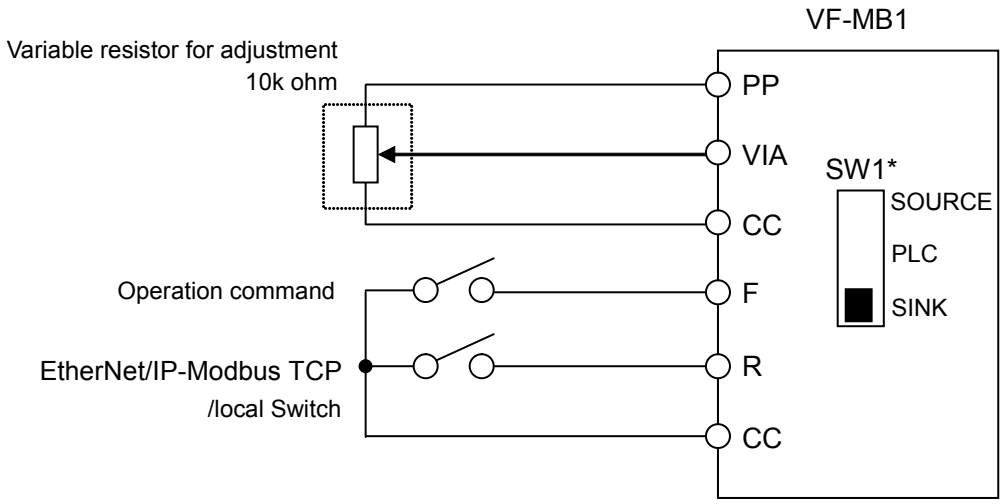
The example below shows how to configure the local/remote operation.

F terminal ..... Operating command

R terminal ..... EtherNet/IP-Modbus TCP local/remote
(Terminal in this example) switching

VIA terminal ..... Operation frequency command

<Wiring>




<Parameter setting>

CMOd (Command mode selection) = 0 (Terminal board)

FMOd (Frequency setting mode selection 1) = 1 (VIA)

F112 (Input terminal selection 2 (R)) = 48 (Remote/Local control)

<Operation>

R-CC terminal open: VF-MB1 is controlled as a slave device of the EtherNet/IP™ - Modbus® TCP.

R-CC terminal closed:

F-CC terminal short to RUN

F-CC terminal open to STOP

Output frequency is set up by the VIA signal input.

(Note)

When the local(HAND) / remote key (F750=2) is chosen as EASY key selection and the EASY key lamp of an inverter front panel is on, priority is most given to operation by a panel. (Refer to the inverter instruction manual for details).

# 12. Unusual diagnosis

## 12.1. Option error

An error message is displayed when the hardware error or software error or lose of connection of wire is occurred.
When an option and a combination of the inverter are bad, it is displayed.

■Display of trip information

E-23 (Error code : 55) : Optional unit fault 2

## 12.2. Disconnection error of network cable

When network trouble occurred by disconnection etc, the inverter does emergency stop with the following indication when the network disconnection detection (C100, C523) is set, and it was set in (C101=4).

■Display of trip information

Err8 (Error code: 27): Optional unit fault 1 (Communication error)

# 13. WebServer

The option has webserver function. Writing and reading the drive's parameter and the communication can be monitored by using this function through web network.

The chapter describes the function of the integrated webserver of the EtherNet/IP™ - Modbus® TCP module.

## 13.1. Access to the webserver

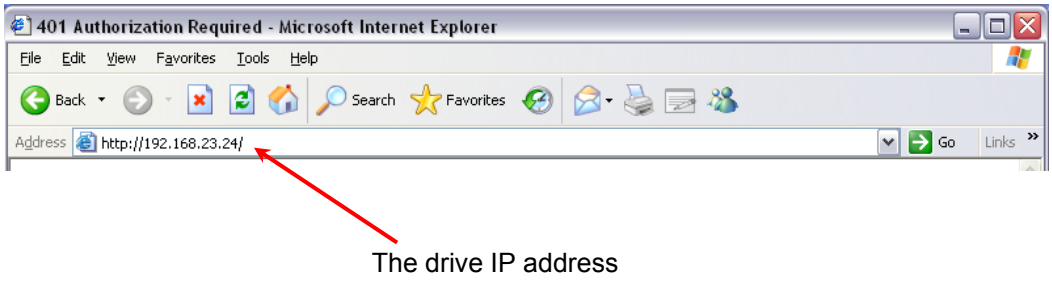
This web server can be accessed by the navigators listed below:

· Microsoft® Internet Explorer – Version 5.0 or greater

The navigator must support Java™ Virtual Machine because the factory loaded web server uses applets.

**NOTE:** As a TOSHIBA product, The EtherNet/IP™ option module uses internally Modbus® TCP for the webserver. (The Modbus® TCP port is not accessible.)

Startup the web browser and input IP address of the drive as the homepage address.



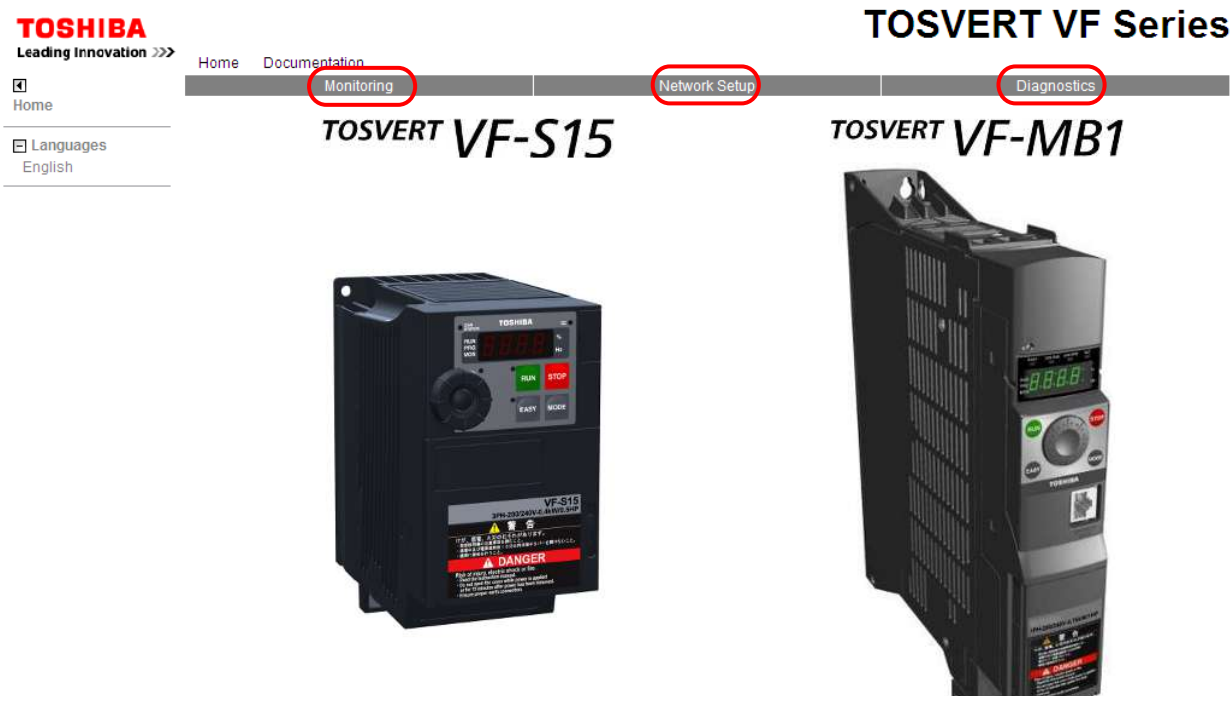

From your web browser, default http password and login are “USER”.

From the TOSVERT home page, you can access to 3 main menus:

· Monitoring

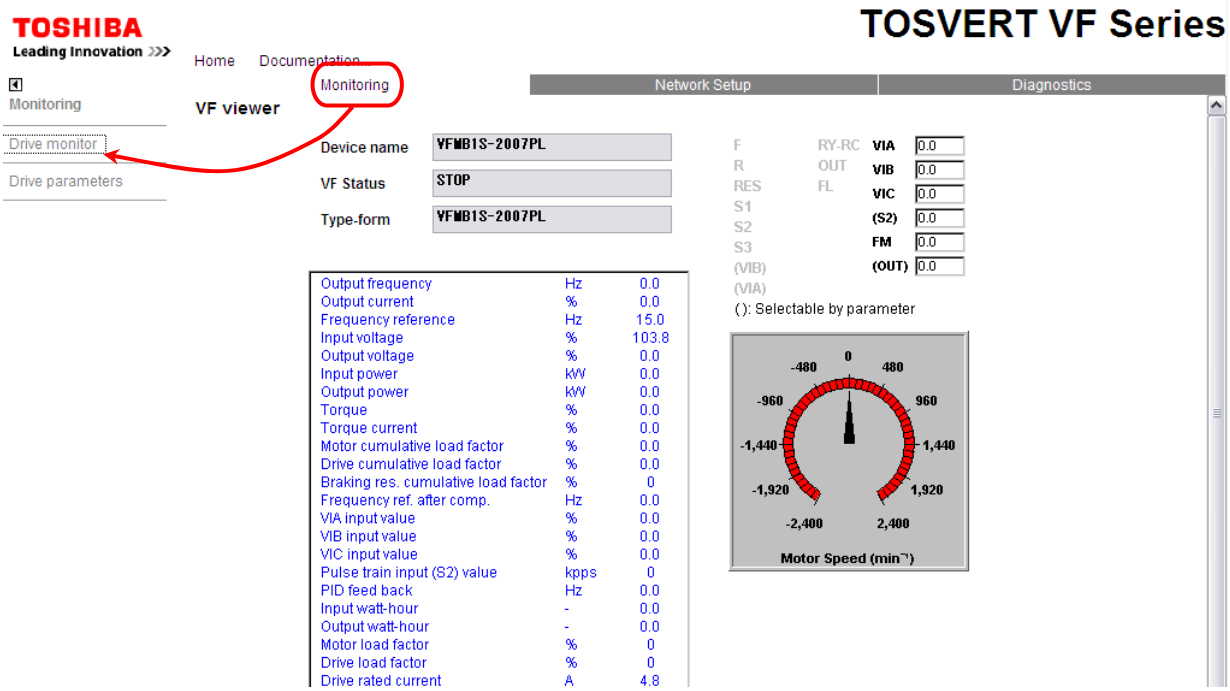
· Network setup

· Diagnostics




## 13.2. Web pages structure

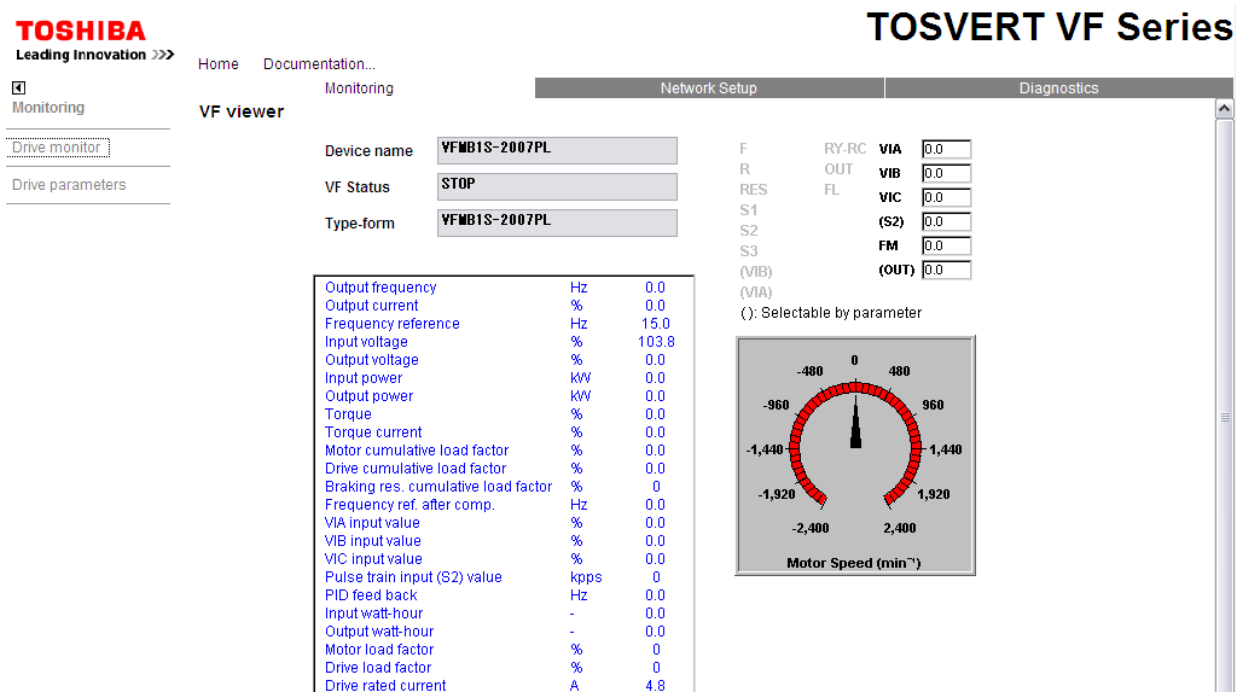
Each web page uses the same structure. Each main menu, "Monitoring", "Network Setup" and "Diagnostics" contains each own sub menu. This last one is displayed on the left side of web page.




The ◧ toggle button shows or hides the left sided menu.

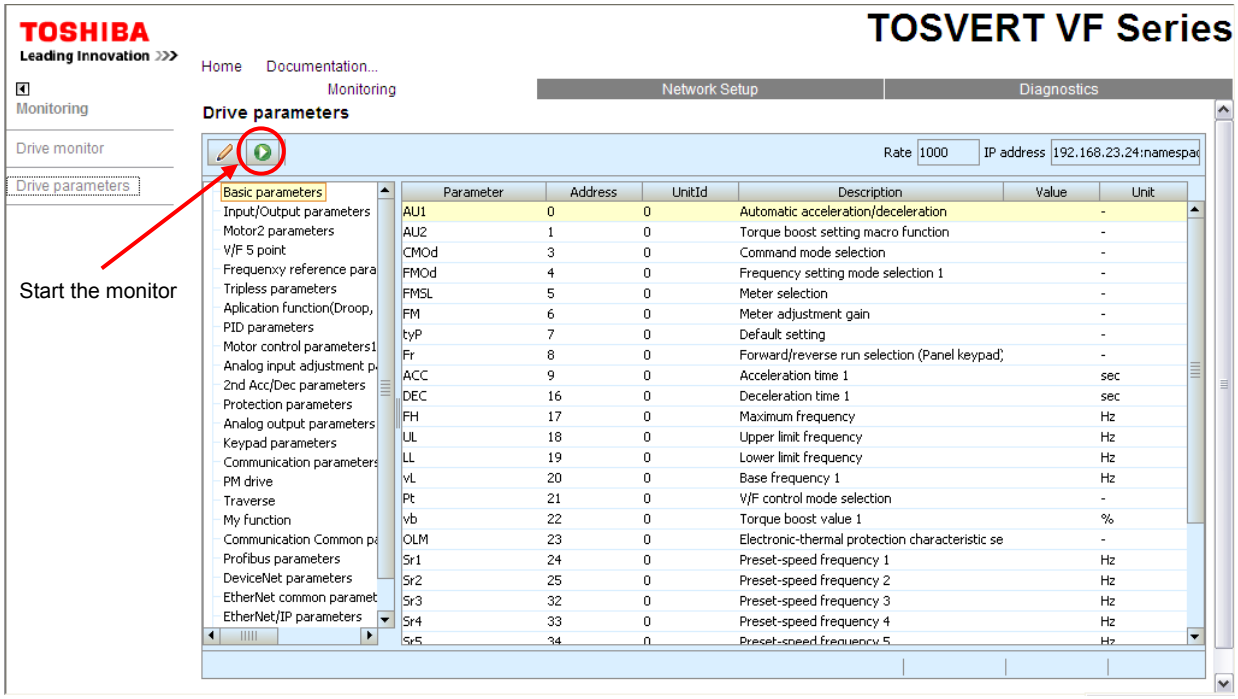
## 13.3. Drive monitor (Main menu: Monitoring)

The state of the drive can be confirmed on this page.



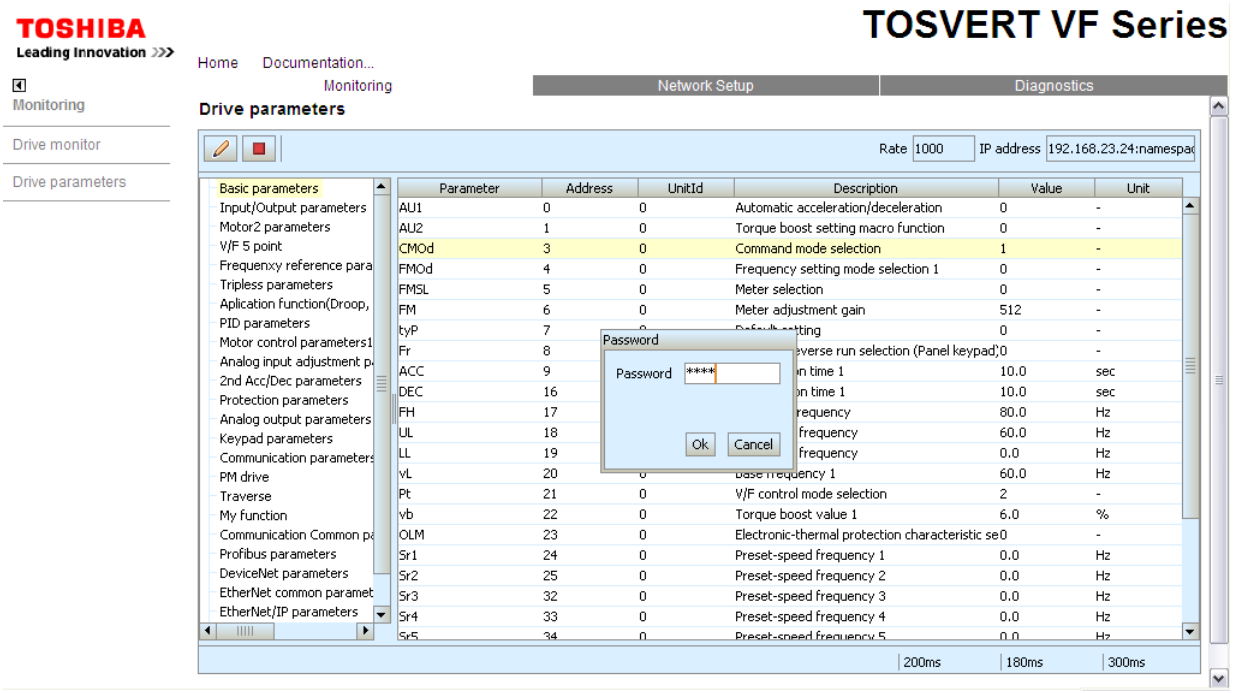
## 13.4. Drive parameters (Main menu: Monitoring)

The parameters of the drive can be set on this page.
The left column is used to select a modify group (or list) of parameters. The right column displays the parameters, its Modbus address and its current value.

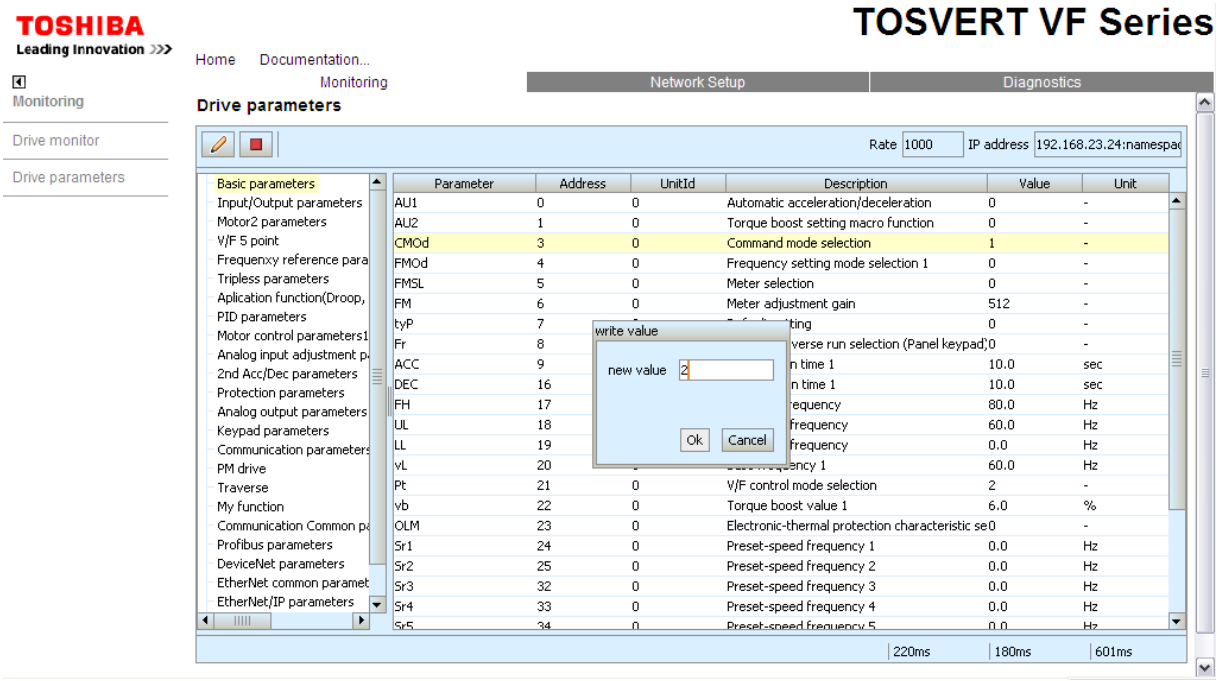



■Set the parameters

When parameters of the drive are modified from the webserver, you need to input the PASSWORD. (The default password is "USER.")
It is necessary to be monitoring it to change the parameter.

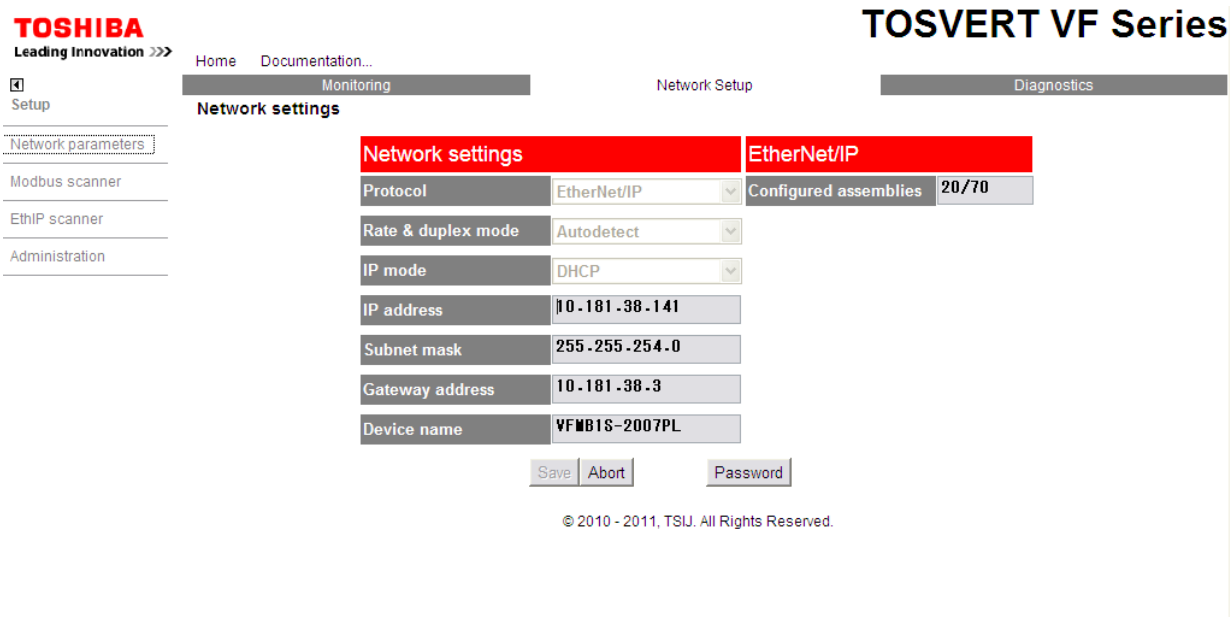


Input the write value to popup window.



## 13.5. Network parameters (Main menu: Network Setup)

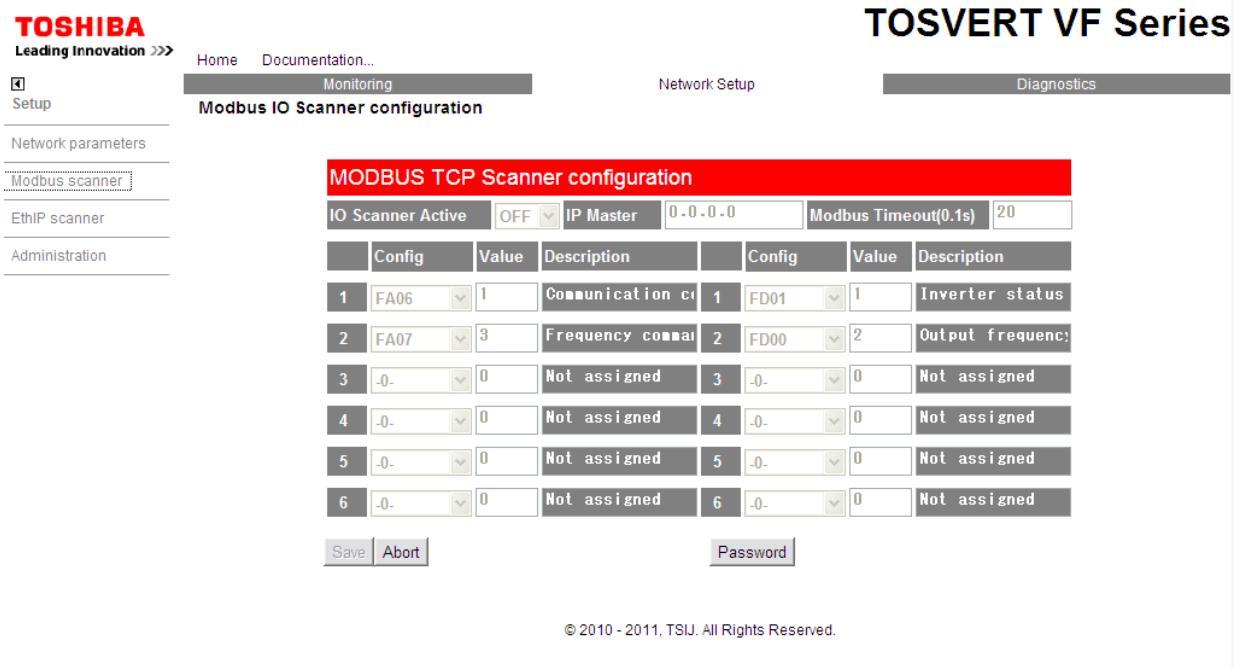
The network parameters of the drive can be confirmed on this page.




When network parameters of the drive are modified from the webserver, you need to input the PASSWORD. (The default password is "USER.")

## 13.6. Modbus scanner (Main menu: Network Setup)

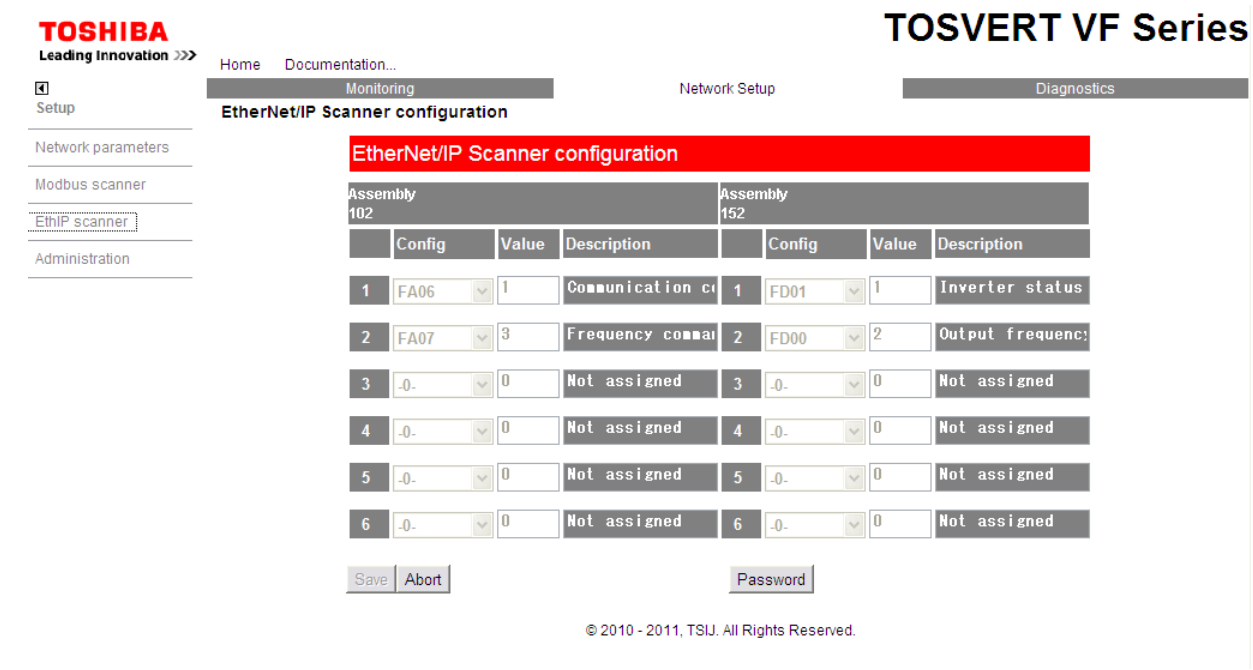
The I/O scanner of the Modbus® TCP protocol can be set on this page.




When I/O scanner of the Modbus® TCP protocol are modified from the webserver, input the PASSWORD. (The default password is "USER.")

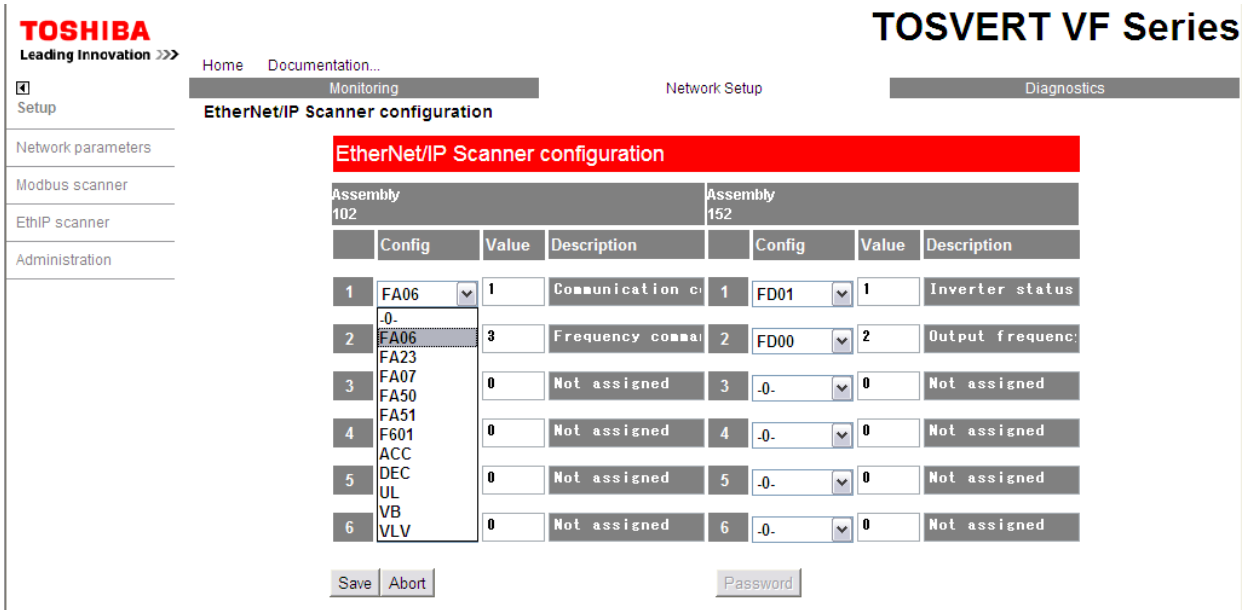
## 13.7. EthIP scanner (Main menu: Network Setup)

The I/O scanner of the EtherNet/IP protocol can be set on this page.



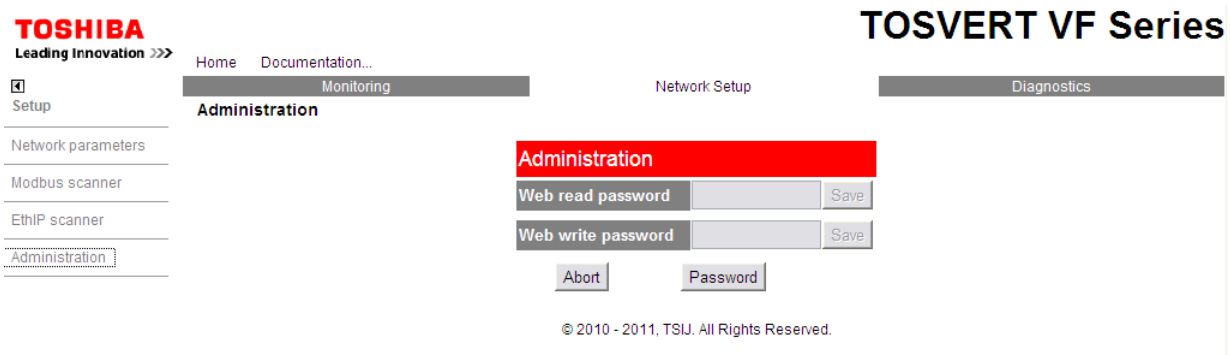

When I/O scanner of the Modbus® TCP protocol are modified from the webserver, input the PASSWORD. (The default password is "USER.")

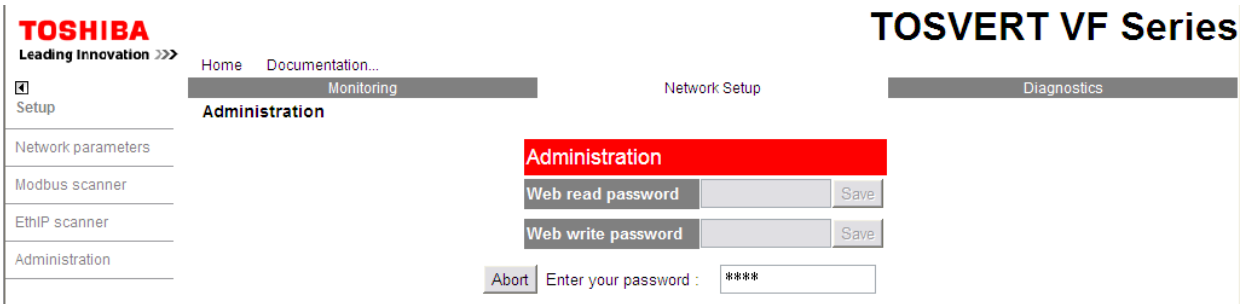
Select the I/O scan parameters in "Config" column.



## 13.8. Administration (Main menu: Network Setup)

The "web read password" and "web write password" of the webserver can be modify on this page.




## 13.9. TCP/IP statistics (Main menu: Diagnostics)

You can check TCP/IP status on this page.