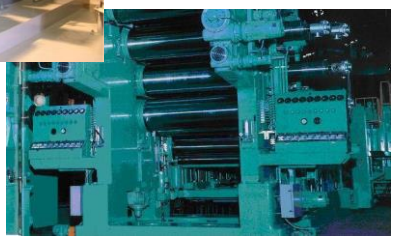
TOYODENKI

VF66

TOYO INTELLIGENT INVERTER

EIP66-Z Communication Protocol Manual



Preface

Thank you very much for choosing our inverter optional board.

This manual describes the communication protocol of the optional board EIP66-Z designed for VF66 inverter. Please read this manual thoroughly to use the EIP66-Z communication function properly.

This manual describes the EIP66-Z EtherNet/IP communication function. For the terminal block functions of EIP66-Z board, wiring, switch settings and VF66 inverter settings, refer to "**EIP66-Z Operating Instructions**."

To use various functions according to intended use as well as the VF66 inverter functions, read the operating instructions of VF66 inverter main unit or dedicated manual thoroughly before use.

The following shows the EtherNet/IP specification versions used by EIP66-Z.

Volume1 : Edition 3.15　November 2013

Volume2 : Edition 1.16　November 2013

Be Sure To Read This Before Use

Safety Notice

To use the EIP66-Z correctly, be sure to completely read this manual and all other attached documents before installation, operation, maintenance, and inspection. You need to have a good knowledge of equipment, safety information, and all notices before using the EIP66-Z. Read also the operating instructions of VF66 inverter main unit thoroughly before use for safe operations.

In this manual, safety notices are ranked as "Danger," "Warning," and "Caution."

When improper use may cause a dangerous situation, and death or serious injury may result.

When improper use may cause a dangerous situation, medium-level or minor injury may result, and only physical damage may result. However, it can cause serious results depending on the situation. Cautions described in this manual are all important. Be sure to observe them.

CAUTION [Installation]

- Do not use the product if it is found damaged or deformed in unpacking.
  It may cause failure/malfunction.
- Do not put a flammable material near the product.
  It may catch fire.
- Do not give a shock to the product by dropping or toppling it.
  It may cause failure/damage to the product.
- Do not install an optional board with damage or missing part to perform operations.
  It may cause injury.

WARNING [Wiring]

- Check that the input power is turned off before wiring.
  Otherwise, electric shock/fire may result.
- After turning off the power, wait at least ten minutes before opening the inverter front cover.
- Be sure to connect a ground wire.
  Otherwise, electric shock/fire may result.
- Let an electrical engineering technician do the wiring work.
  Otherwise, electric shock/fire may result.
- Be sure to install the main unit before wiring.
  Otherwise, electric shock/fire may result.

CAUTION [Wiring]

- Be sure to attach and lock the communication cable and connector.
  Otherwise, failure/malfunction may result.

WARNING [Operation]

- Be sure to attach the inverter front cover before turning on the input power.
  Do not remove the cover while the inverter is energized.
  Ignoring this may cause electric shock.
- Do not operate the switch with wet hands.
  Ignoring this may cause electric shock.
- While the inverter is energized, do not touch the inverter terminal even when the inverter is stopped.
  Ignoring this may cause electric shock.
- Resetting an alarm with the operation signal input causes a sudden restart.
  Perform resetting after making sure that the operation signal is off.
  Otherwise, you may be injured.
- The inverter operation setting is available from low to high speed. Check the allowable range of motor or machine carefully before starting operation.
  Otherwise, injury/failure/damage may result.

CAUTION [Operation]

- Do not touch the inverter radiation fin or discharge resistor because it can be very hot.
  Ignoring this may cause burn injury.

WARNING [Maintenance/inspection and part replacement]

- Be sure to turn off the power before performing inspection.
  Otherwise, electric shock/injury/fire may result.
- Only the specified person must perform maintenance/inspection and part replacement.
  Use an insulated tool for maintenance/inspection.
  Otherwise, electric shock/injury may result.

CAUTION [Others]

- Never modify the product.
  Otherwise, electric shock/injury may result.

CAUTION [General cautions]

Some figures in this manual are shown with the cover or safety shield removed for the purpose of detailed descriptions. However, for actual operations, be sure to attach the specified cover or safety shield and follow the instructions in this manual.

Note that these safety precautions and specifications described in each manual are subject to change without notice.

Contents

CHAPTER 1 Function Overview

EIP66-Z is attached to the connector of the board (VFC66-Z) inside the VF66 inverter to use. EIP66-Z is equipped with the EtherNet/IP adapter function (slave station), analog input/output function, multifunction input and PG input/output function.

EtherNet/IP is a public network standard, and the specification and protocol are made public by ODVA (Open DeviceNet Vendor Association, Inc.) to provide mutual compatibility between the devices of the same type by multiple vendors.

The EIP66-Z EtherNet/IP communication function allows users to input a command related to operation, speed, torque, etc. to the VF66 inverter or monitor the situations including the inverter operation/protection status, current and voltage. In addition, reading/rewriting of inverter settings and reading of traceback data, protection history and monitoring data are available. This function can also be used as an input/output signal of the internal PLC function of the VF66 inverter. For the internal PLC function, refer to the VF66 PC Tool manual.

CAUTION [Safety precautions]

Read this manual thoroughly before use for proper handling.

Our inverter is not designed/manufactured for the devices or systems used in a life-threatening situation.

Do not use this inverter for special use, such as riding mobile object, medical care, aerospace, nuclear power control, submarine repeater/system, etc.

This inverter is manufactured under stringent quality control; however, install safety equipment to avoid a serious accident for the important facility which may put human lives in danger by failure of the inverter
or the facility to which a serious loss is caused by failure of the inverter.

Contact us to use this product for the load other than three-phase AC motors.

Electrical work is required for this inverter. Let an electrical engineering technician do the work.

CHAPTER 2 Function Specifications

2. 1 EtherNet/IP Communication Function Connector/Terminal Specifications

Table 2.1 Communication function connector specifications (RJ-45 8 poles)

	Pin No.	Usage	Description
EIP66-Z connector CN3/4	1	TX＋	Transmission signal line (+)
	2	TX－	Transmission signal line (-)
	3	RX＋	Reception signal line (+)
	4	－	Unused
	5	－	
	6	RX－	Reception signal line (-)
	7	－	Unused
	8	－	

Table 2.2 Communication function terminal specifications

	Terminal name	Usage	Description
EIP66-Z terminal block TB3	FG	Safety ground terminal	Shielded terminal (M4) for CN3/CN4

2. 2 EtherNet/IP Communication Specifications

Table 2.3 EtherNet/IP communication specifications

Ethernet	Compliance standard	IEEE802.3i (10BASE-T)/IEEE802.3u (100BASE-TX)
	Transmission speed	10/100 Mbps (automatic switching)
	Communication mode	Full-duplex/half-duplex (automatic switching)
	Connection type	Star/daisy chain connection
	Interface	RJ-45 connector
	Transmission distance (between nodes or node and hub)	Within 100 m (depends on the specification of used cable)
	Connected cable	Shielded twisted pair cable (STP): Category 5 or higher Straight, cross (automatic switching)
EtherNet／IP	IP address setting	Set by the setting parameter of VF66 inverter main unit.
	Communication function	Cyclic communication (Implicit message) Message communication (Explicit message)
	Vendor ID	178
	Product Code	13
	Device Type	AC Drive Profile
	Product Name	EIP66 Series
	ACD function (Address Conflict Detection)	Supported
	Conformance test	EtherNet/IP CT-11
	EDS file	EIP66 Series 1_0.eds

2. 3 Device Profile

An ODVA certified AC drive profile and Toyo original profile that works as a vendor-specific expanded profile are available for EIP66-Z.

Standard profile	AC drive profile
Expanded profile	Toyo original profile

Select a profile to use using the inverter setting parameter. (Refer to Section 3.3.)

2. 4 Others

For the terminal block and other specifications, refer to "**EIP66-Z Operating Instructions**."

WARNING [Wiring]

- Check that the input power is turned off before wiring.
  Otherwise, electric shock/fire may result.

CAUTION [Wiring]

- Never connect the G and G2 terminals to a ground.
  Ignoring this may cause failure/damage.
- Do not bring the PS and G terminals into contact or connect them.
  Ignoring this may cause failure/damage.

CHAPTER 3 Communication Function Description

3. 1 Parameter Setting

The EIP66-Z EtherNet/IP communication function allows users to input a command related to operation, speed, torque, etc. to the VF66 inverter or monitor the situations including the inverter operation/protection status, current and voltage. In addition, reading/rewriting of inverter setting parameters and reading of traceback data, protection history and monitoring data are available. This function can also be used as an input/output signal of the internal PLC function of the VF66 inverter. For the internal PLC function, refer to the VF66 PC Tool manual.

To communicate with the EtherNet/IP scanner (master), the following VF66 inverter setting parameters need to be set. Read also "**EIP66-Z Operating Instructions**" and operating instructions of VF66 inverter main unit and scanner to use.

As for the direction of EtherNet/IP communication in this chapter, "Input" indicates the direction of input from EIP66-Z to the network, and "Output" indicates the direction of output from the network to EIP66-Z. This does not apply to the descriptions of the internal PLC function and multifunction input.

Table 3.1.1 EtherNet/IP communication related settings

Display	Item	Setting band (selection item)	Default	Driving ReWrite
J-00	1: Digital communication option selection	0: Communication option not used 8: Use EIP66-Z 1 to 7: Set to use other options	0	x
J-07	IP address setting (high-order 2 bytes)	Set an IP address in hexadecimal notation. For the case of 192. 168. 100. 1, set J-07 to C0A8, and J-08 to 6401.	0	x
J-08	IP address setting (low-order 2 bytes)		0	x
J-09	Output Assembly Instance number setting	0: Instance No. 20 (standard profile) 2: Instance No. 100 (expanded profile) 10: Instance No. 108 (expanded profile) (refer to Section 3.3)	0	x
J-10	Input Assembly Instance number setting	0: Instance No. 70 (standard profile) 14: Instance No. 132 (expanded profile) 15: Instance No. 140 (expanded profile) (refer to Section 3.3)	0	x
J-11	SpeedScale setting	-126 to 127	3	x
J-12	MonitorDataNo. setting	0 to 119	3	○
J-16	Subnet mask setting (high-order 2 bytes)	Set a subnet mask in hexadecimal notation.	0	x
J-17	Subnet mask setting (low-order 2 bytes)		0	x
J-18	Default gateway setting (high-order 2 bytes)	Set a default gateway in hexadecimal notation.	0	x
J-19	Default gateway setting (low-order 2 bytes)		0	x

＊When a change is made in these settings, turn off the inverter power and then turn it on again.

・ "J-11" is used to set the speed scaling coefficient (AC/DC Drive object attribute 22 "SpeedScale") used by the standard profile (AC drive). This speed scaling coefficient determines the resolution of speed detection value (SpeedActual) and speed setting value (SpeedRef).

$$\text{Resolution} = \text{r/min}/2^{\text{SpeedScale}}$$

With the default value (= 3), the resolution becomes 0.125 r/min.

・"J-12" is used to set MonitorDataNo. used by the instance 140.
For more information about the setting value, refer to Section 4.2.4.

EIP66-Z allows the use of internal PLC function when the expanded profile is selected. Whether to use the internal PLC function can be set using the VF66 inverter setting parameters (area i) as shown in the following table. For more information, refer to the operating instructions of VF66 inverter main unit.

Table 3.1.2 Selecting use of internal PLC function

Display	Item	Selection item	Default	Driving ReWrite
i-00	PLC-L function usage selection	off: Unused on: Used	off	x
i-01	PLC-H function usage selection	0: Unused 1: Used 2: Used (PLCH output recognized as speed command input)	0	x

・ Use the internal PLC function when "J-09" and "J-10" are set to 2 or more (expanded profile).

・ For the internal PLC function, refer to the VF66 PC Tool manual.

＊In using the PLC-L function, each bit of the first and second words does not function as an operation control or multifunction input signal. In this case, create a sequence to operate the operation control signal by the internal PLC function.

3. 2 Speed Commanding Place Setting

To enable various commands on the VF66 inverter via communication, the following inverter setting parameters need to be set appropriately. To enable the operation control signal of first word, turn on the forward operation terminal "ST-F" on the terminal block TB1 of VF66 inverter control board VFC66-Z. For more information, refer to the operating instructions of VF66 inverter main unit.

Table 3.2 Commanding place selection setting

Display	Item	Setting band (selection item)	Default	Driving ReWrite
b-09	Commanding place when coupled	0: Terminal block 1: Console (SET66-Z) 2: Digital communication option	1	x
b-10	Speed commanding place selection(*1)	0: Coupled 1: Analog input (1) (AIN1) 2: Console (SET66-Z) 3: Digital communication option 4: Analog input (2) (AIN2) 5: (For external extension option) 6: Analog input (3) (AIN3) 7: Internal PLC	0	x
b-11	Operation commanding place selection	0: Coupled 1: Terminal block 2: Console (SET66-Z) 3: Digital communication option	0	x
b-12	JOG commanding place selection	0: Coupled 1: Terminal block 2: Console (SET66-Z) 3: Digital communication option	0	x
i-07	Operation mode selection(*2)	0: Speed control (ASR) mode 1: Torque command negative direction prioritized 2: Torque command positive direction prioritized 3: Torque control (ATR) mode 4: Speed/torque control setting change	0	x
i-08	Torque command input place selection(*2)	1: Analog input (1) (AIN1) 1: Analog input (2) (AIN2) 2: Digital communication option 3: Internal PLC output	1	x
J-14	Date/time data selection from communication	0: Without date/time data 1: With date/time data	0	x

(*1) This becomes "Frequency commanding place selection" when V/f mode is selected for the inverter mode.

(*2) This cannot be set when V/f mode is selected for the inverter mode.

- To control the inverter via a scanner (master) on the network using the standard profile (AC drive), set the parameter "b-10" (Speed commanding place selection) to 3 (Digital communication option).
  With "b-10" set to 3, EIP66-Z sets the speed commanding place (AC/DC Drive object attribute 4 "NetRef") to network control at power-on to receive a speed command from a scanner on the network.
  With "b-10" set to a value other than 3, EIP66-Z sets the speed commanding place to local control and ignores a speed command from a scanner.

・ To control the inverter via a scanner (master) on the network using the standard profile (AC drive), set the parameter "b-11" (Operation commanding place selection) to 3 (Digital communication option).
With "b-11" set to 3, EIP66-Z sets the operation commanding place (Control Supervisor object attribute 5 "NetCtrl") to network control at power-on to receive an operation command from a scanner on the network.
With "b-11" set to a value other than 3, EIP66-Z sets the operation commanding place to local control and ignores an operation command from a scanner.

3. 3 I/O Assembly Instance Number Setting

The EIP66-Z I/O Assembly instance number is set by the inverter setting parameters "J-09" (Output Assembly instance number setting) and "J-10" (Input Assembly instance number setting). These values are set on EIP66-Z at power-on. The default values are both 0.

Table 3.3

Parameter name	Device profile	Setting value	Instance number	Name	Size (word)
"J-09" Output Assembly instance number setting	Standard profile (AC drive)	0	20	Basic Speed Control Output	2
	Expanded profile (Toyo original)	2	100	Special 1 Control Output	4
		10	108	Special 9 Control Output	12
"J-10" Input Assembly instance number setting	Standard profile (AC drive)	0	70	Basic Speed Control Input	2
	Expanded profile (Toyo original)	14	132	Special 13 Control Input	18
		15	140	Special 14 Control Input	4

・ When the "J-09" instance number is set to 20, select 70 for the "J-10" instance number.
When the "J-09" instance number is set to a value other than 20, select a value other than 70 for the "J-10" instance number.
The standard profile and expanded profile cannot be set together.

・ Specifying 1 for "J-09" selects the instance number 20, and specifying any value from 3 to 9 selects the instance number 108.

・ Specifying 1 for "J-10" selects the instance number 70, and specifying any value from 2 to 13 selects the instance number 132.

CHAPTER 4 I/O Assembly

4. 1 Standard I/O Assembly Data Attribute Format

The following shows the data format for the case of selecting the standard profile (AC drive profile).

4. 1. 1 Output Assembly Instance

Table 4.1.1

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
20	0						Fault Reset		Run Fwd
J-09 = 0	1								
(2 words)	2	Speed Reference (low-order byte)							
	3	Speed Reference (high-order byte)							

Name	Description
Run Fwd	Forward operation command 0: Stop, 1: Run
Fault Reset	Fault reset 0 -> 1 = Fault reset
Speed Reference	Speed setting value

4. 1. 2 Input Assembly Instance

Table 4.1.2

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
70	0						Running1		Faulted
J-10 = 0	1								
(2 words)	2	Speed Actual (low-order byte)							
	3	Speed Actual (high-order byte)							

Name	Description
Faulted	Abnormal 0: Normal, 1: Run
Running1	Running 0: Stop, 1: Running
Speed Actual	Speed detection value

4. 1. 3 SpeedRef/SpeedActual Calculation Method

The inverter provides the following three modes, and the calculation method of SpeedRef/SpeedAcutal varies by the mode.

(1) Induction motor V/f mode
(2) Induction motor vector mode
(3) ED motor vector mode

SpeedRef/SpeedAcutal calculation method in the vector mode

In the vector mode (2 and 3), SpeedRef and SpeedAcutal are calculated using SpeedScale as follows.

SpeedRef (AC/DC Drive object attribute 8)
= Rotational speed command x $2^{SpeedScale}$
SpeedActual (AC/DC Drive object attribute 7)
= Motor speed x $2^{SpeedScale}$

SpeedRef calculation example in the vector mode

- SpeedRef = 4567
- SpeedScale = 3

Speed command = SpeedRef/$2^{SpeedScale}$
= 570.875 r/min

SpeedRef/SpeedAcutal calculation method in the V/f mode

In the V/f mode (1), a motor pole number is required as well as SpeedScale to calculate SpeedRef and SpeedAcutal.

The motor pole number is specified by the inverter setting parameter "A-06."

SpeedRef (AC/DC Drive object attribute 8)
= {(Frequency command x 60)/(Motor pole number/2)} x $2^{Speedscale}$
SpeedActual (AC/DC Drive object attribute 7)
= {(Rotational frequency x 60)/(Motor pole number/2)} x $2^{Speedscale}$

SpeedRef calculation example in the V/f mode

- Number of motor poles = 4 poles
- Frequency command = 30 Hz
- SpeedScale = 3

SpeedRef = {(30 Hz x 60)/(4 poles/2)} x 2^3
= 7200

4. 2 Expanded I/O Assembly Data Attribute Format

The following shows the data format for the case of selecting the expanded profile (Toyo original profile).

4. 2. 1 Output Assembly Instance

Table 4.2.1

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
100 J-09 = 2 (4 words)	0	Preset2	Preset1	Protection status reset Fault Reset2	DC brake command DC-Brake	Initial excitation command Excit.	Reverse operation command Rev	JOG command Jog	Operation command Start
		[I00027]	[I00026]	[I00025]	[I00024]	[I00023]	[I00022]	[I00021]	[I00020]
	1	Max-SPD Reduce	S-ARC off	Speed hold Spd Hold	MRH deceleration MRH down	MRH acceleration MRH up	Acc/DecSel2	Acc/DecSel1	Preset3
		[I0002F]	[I0002E]	[I0002D]	[I0002C]	[I0002B]	[I0002A]	[I00029]	[I00028]
	2	Ex-Fail.1 (no 86A)	External failure 4 Ex-Fail.4	External failure 3 Ex-Fail.3	External failure 2 Ex-Fail.2	External failure 1 Ex-Fail.1	Rev Cmd	ATRMode	Droop control OFF Droop off
		[I00037]	[I00036]	[I00035]	[I00034]	[I00033]	[I00032]	[I00031]	[I00030]
	3	SPD.Ref. Term	Unused	Emergency stop (Normally open) input EMG.Stop	Second Motor	Trace Trg.	Ex-Fail.4 (no 86A)	Ex-Fail.3 (no 86A)	Ex-Fail.2 (no 86A)
		[I0003F]	[I0003E]	[I0003D]	[I0003C]	[I0003B]	[I0003A]	[I00039]	[I00038]
	4	Communication speed command: Speed Reference2 (20000/top)			(Low-order byte)				
		Communication input register 1 [i00010]			(Low-order byte)				
	5	Communication speed command: Speed Reference2 (20000/top)			(High-order byte)				
		Communication input register 1 [i00010]			(High-order byte)				
	6	Communication torque command: Torque Reference (5000/100 %)			(Low-order byte)				
		Communication input register 2 [i00011]			(Low-order byte)				
	7	Communication torque command: Torque Reference (5000/100 %)			(High-order byte)				
		Communication input register 2 [i00011]			(High-order byte)				
108 J-09 = 10 (12 words)	8	Date			(Low-order byte)				
		Communication input register 3 [i00012]			(Low-order byte)				
	9	Month			(High-order byte)				
		Communication input register 3 [i00012]			(High-order byte)				
	10	Minute			(Low-order byte)				
		Communication input register 4 [i00013]			(Low-order byte)				
	11	Hour			(High-order byte)				
		Communication input register 4 [i00013]			(High-order byte)				
	12	(Not specified)							
		Communication input register 5 [i00014]			(Low-order byte)				
	13	(Not specified)							
		Communication input register 5 [i00014]			(High-order byte)				
	14	(Not specified)							
		Communication input register 6 [i00015]			(Low-order byte)				
	15	(Not specified)							
		Communication input register 6 [i00015]			(High-order byte)				
	16	(Not specified)							
		Communication input register 7 [i00016]			(Low-order byte)				
	17	(Not specified)							
		Communication input register 7 [i00016]			(High-order byte)				
	18	(Not specified)							
		Communication input register 8 [i00017]			(Low-order byte)				
	19	(Not specified)							

		Communication input register 8 [iO0017]	(High-order byte)
	20	(Not specified)	
		Communication input register 9 [iO0018]	(Low-order byte)
	21	(Not specified)	
		Communication input register 9 [iO0018]	(High-order byte)
	22	(Not specified)	
		Communication input register 10 [iO0019]	(Low-order byte)
	23	(Not specified)	
		Communication input register 10 [iO0019]	(High-order byte)

- When the instance 100 (J-09 = 2) is used, the Output Assembly data length becomes four words.

- When the instance 108 (J-09 = 10) is used, the Output Assembly data length is 12 words.
  When the internal PLC function is not used, the seventh word and the followings will be ignored.

- When the internal PLC function is used, each bit of the first and second words of Output Assembly data becomes an input relay of the internal PLC function. The third word and the followings become input registers of the internal PLC function.
  For the allocation of Output Assembly data to the input relay/register of the internal PLC function, see Table 4.2.1.

4. 2. 2 Input Assembly Instance

Table 4.2.2

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
132 J-10 = 14 (18 words)	0	Gate driving	Auto measurement (auto tuning) in operation	Power failure	DC excitation	Reverse operation command	JOG operation	Inverter running (deceleration stop included)	Operation/JOG command input
	1	External signal input 4	External signal input 3	External signal input 2	External signal input 1	Second setting block selected	External DB protection operation or communication abnormality	DC brake	Initial excitation
	2	Current sensor abnormality	Overload protection	DC part overvoltage	Gate board abnormality	Unused (unspecified)	Unused (unspecified)	IGBT protection operation	Overcurrent protection
	3	Optional error	Memory abnormality	Unit overheat	Overtorque protection	Insufficient voltage (power failure)	Overfrequency protection	Overspeed protection	Start delay
	4	Open phase	Setting error	FCL operation	Charging resistance overheat	Motor overheat	Speed control error	Communication timeout error	Sensorless start error
	5	External failure 4	External failure 3	External failure 2	External failure 1	Sensor error	PG error	Fan failure	CPU abnormal process
	6	Setting reached	Speed detection 2 (spd <= detect2)	Speed detection 2 (spd >= detect2)	Speed detection 2 (spd = detect2)	Speed detection 1 (spd <= detect1)	Speed detection 1 (spd >= detect1)	Speed detection 1 (spd = detect1)	Unused (unspecified)
		[000047]	[000046]	[000045]	[000044]	[000043]	[000042]	[000041]	[000040]
	7	Cooling fan failure	Second setting block selected	Reverse operation	Retry by failure	Overload pre-alarm	Power failure detected	Absolute torque value detection	Torque detection
		[00004F]	[00004E]	[00004D]	[00004C]	[00004B]	[00004A]	[000049]	[000048]
	8	Motor speed: Speed Actual2 (20000/top)							(Low-order byte)
		Communication output register 1 [o00010]							(Low-order byte)
	9	Motor speed: Speed Actual2 (20000/top)							(High-order byte)
		Communication output register 1 [o00010]							(High-order byte)
	10	ARC output: ARC out (20000/top)							(Low-order byte)
		Communication output register 2 [o00011]							(Low-order byte)
	11	ARC output: ARC out (20000/top)							(High-order byte)
		Communication output register 2 [o00011]							(High-order byte)
	12	Effective current: RMS Motor Current (10000/100 % [Inv.rated])							(Low-order byte)
		Communication output register 3 [o00012]							(Low-order byte)
	13	Effective current: RMS Motor Current (10000/100 % [Inv.rated])							(High-order byte)
		Communication output register 3 [o00012]							(High-order byte)
	14	Torque Command (5000/100 %)							(Low-order byte)
		Communication output register 4 [o00013]							(Low-order byte)
	15	Torque Command (5000/100 %)							(High-order byte)
		Communication output register 4 [o00013]							(High-order byte)
	16	DC Voltage (10/1 V [200 V class], 5/1 V [400 V class])							(Low-order byte)
		Communication output register 5 [o00014]							(Low-order byte)
	17	DC Voltage (10/1 V [200 V class], 5/1 V [400 V class])							(High-order byte)
		Communication output register 5 [o00014]							(High-order byte)
	18	Output Voltage (20/1 V [200 V class], 10/1 V [400 V class])							(Low-order byte)
		Communication output register 6 [o00015]							(Low-order byte)
	19	Output Voltage (20/1 V [200 V class], 10/1 V [400 V class])							(High-order byte)
		Communication output register 6 [o00015]							(High-order byte)
	20	Output Frequency (20000/top)							(Low-order byte)
		Communication output register 7 [o00016]							(Low-order byte)
	21	Output Frequency (20000/top)							(High-order byte)
		Communication output register 7 [o00016]							(High-order byte)
	22	OL Pre-counter (10000/100 %)							(Low-order byte)
		Communication output register 8 [o00017]							(Low-order byte)
	23	OL Pre-counter (10000/100 %)							(High-order byte)
		Communication output register 8 [o00017]							(High-order byte)

	24	Motor Temperature (10/1 ℃) (Low-order byte)							
		Communication output register 9 [o00018] (Low-order byte)							
	25	Motor Temperature (10/1 ℃) (High-order byte)							
		Communication output register 9 [o00018] (High-order byte)							
	26	Motor Flux (1024/100 %) (Low-order byte)							
		Communication output register 10 [o00019] (Low-order byte)							
	27	Motor Flux (1024/100 %) (High-order byte)							
		Communication output register 10 [o00019] (High-order byte)							
	28	(Not specified)							
		Communication output register 11 [o0001A] (Low-order byte)							
	29	(Not specified)							
		Communication output register 11 [o0001A] (High-order byte)							
	30	(Not specified)							
		Communication output register 12 [o0001B] (Low-order byte)							
	31	(Not specified)							
		Communication output register 12 [o0001B] (High-order byte)							
	32	(Not specified)							
		Communication output register 13 [o0001C] (Low-order byte)							
	33	(Not specified)							
		Communication output register 13 [o0001C] (High-order byte)							
	34	(Not specified)							
		Communication output register 14 [o0001D] (Low-order byte)							
	35	(Not specified)							
		Communication output register 14 [o0001D] (High-order byte)							
140 J-10 = 15 (4 words)	0	Gate driving	Auto measurement (auto tuning) in operation	Power failure	DC excitation	Reverse operation command	JOG operation	Inverter running (deceleration stop included)	Operation/JOG command input
	1	Failure code: ProtectErrorCode (See Table 4.2.3)						DC brake	Initial excitation
	2	Monitor Number 1 Data (low-order byte) (See Table 4.2.4)							
	3	Monitor Number 1 Data (high-order byte) (See Table 4.2.4)							
	4	Monitor Number 2 Data (high-order byte) (See Table 4.2.4)							
	5	Monitor Number 2 Data (low-order byte) (See Table 4.2.4)							
	6	Monitor Number 3 Data (high-order byte) (See Table 4.2.4)							
	7	Monitor Number 3 Data (low-order byte) (See Table 4.2.4)							

- When the instance 132 (J-10 = 14) is used, the Input Assembly data length is 18 words.
  When the internal PLC function is not used, the 15th word and the followings will be unspecified.

- When the instance 140 (J-10 = 15) is used, the Input Assembly data length is four words.

- When the internal PLC function is used, each bit of the fourth word of Input Assembly data becomes an output relay of the internal PLC function. The fifth word and the followings become output registers of the internal PLC function.
  For the allocation of Input Assembly data to the output relay/register of the internal PLC function, see Table 4.2.2.

4. 2. 3 Failure Code

The following shows failure codes of the Input Assembly instance 140 (ProtectErrorCode). If multiple failures/protection operations occur at the same time, a smaller number is used.

Table 4.2.3

Code	Failure/protection item	Code	Failure/protection item
0	No failure/protection	17	Sensorless start error
1	Overcurrent protection	18	Communication timeout error
2	IGBT protection operation	19	Speed control error
3		20	Motor overheat
4		21	Charging resistance overheat
5	GAC abnormality	22	FCL operation
6	DC part overvoltage	23	Setting error
7	Overload protection	24	Open phase
8	DCCT abnormality	25	CPU abnormal process
9	Start delay	26	FAN failure
10	Overspeed protection	27	PG error
11	Overfrequency protection	28	Sensor abnormality
12	Insufficient voltage (power failure)	29	External failure 1
13	Overtorque protection	30	External failure 2
14	Unit overheat	31	External failure 3
15	Memory abnormality	32	External failure 4
16	Optional error		

4. 2. 4 Monitor Output Data

This section describes the 2 - 7-byte data of Input Assembly instance 140. The following table shows the monitor output data.

Table 4.2.4

Data No.	Monitor output data
1	Motor speed: Speed Actual2 (20000/top)
2	ARC output: ARC out (5000/100 %)
3	Effective current: RMS Motor Current (10000/100 % (Inv. Rated))
4	Torque Command (5000/100 %)
5	DC Voltage (10/1 V (200 V class), 5/1 V (400 V class))
6	Output Voltage (20/1 V (200 V class), 10/1 V (400 V class))
7	Output Frequency (20000/top)/Power Con Racio (1024/1)
8	OL Pre-counter (10000/100 %)
9	Motor Temperature (10/1 ℃)
10	Motor Flux (1024/100 %)

Table 4.2.5 shows ten types of monitor output data; however, the number of data available for actual monitoring is three. Ten types of monitor output data exist in three regions: Monitor Number 1 Data, Monitor Number 2 Data and Monitor Number 3 Data. Select desired data using the inverter setting parameter "J-12" (MonitorDataNo.). The following shows a list of data combinations which can be monitored using the "J-12" setting.

Table 4.2.5

J－１２	Monitor Number1 Data	Monitor Number2 Data	Monitor Number3 Data	J－１２	Monitor Number1 Data	Monitor Number2 Data	Monitor Number3 Data
0	1	2	3	16	1	4	6
1	1	2	4	17	1	4	7
2	1	2	5	18	1	4	8
3 Default	1	2	6	19	1	4	9
4	1	2	7	20	1	4	10
5	1	2	8	21	1	5	6
6	1	2	9	22	1	5	7
7	1	2	10	23	1	5	8
8	1	3	4	24	1	5	9
9	1	3	5	25	1	5	10
10	1	3	6	26	1	6	7
11	1	3	7	27	1	6	8
12	1	3	8	28	1	6	9
13	1	3	9	29	1	6	10
14	1	3	10	30	1	7	8
15	1	4	5	31	1	7	9

Table 4.2.5 (continued)

Ｊ－１２	Monitor Number1 Data	Monitor Number2 Data	Monitor Number3 Data	Ｊ－１２	Monitor Number1 Data	Monitor Number2 Data	Monitor Number3 Data
32	1	7	10	76	3	6	8
33	1	8	9	77	3	6	9
34	1	8	10	78	3	6	10
35	1	9	10	79	3	7	8
36	2	3	4	80	3	7	9
37	2	3	5	81	3	7	10
38	2	3	6	82	3	8	9
39	2	3	7	83	3	8	10
40	2	3	8	84	3	9	10
41	2	3	9	85	4	5	6
42	2	3	10	86	4	5	7
43	2	4	5	87	4	5	8
44	2	4	6	88	4	5	9
45	2	4	7	89	4	5	10
46	2	4	8	90	4	6	7
47	2	4	9	91	4	6	8
48	2	4	10	92	4	6	9
49	2	5	6	93	4	6	10
50	2	5	7	94	4	7	8
51	2	5	8	95	4	7	9
52	2	5	9	96	4	7	10
53	2	5	10	97	4	8	9
54	2	6	7	98	4	8	10
55	2	6	8	99	4	9	10
56	2	6	9	100	5	6	7
57	2	6	10	101	5	6	8
58	2	7	8	102	5	6	9
59	2	7	9	103	5	6	10
60	2	7	10	104	5	7	8
61	2	8	9	105	5	7	9
62	2	8	10	106	5	7	10
63	2	9	10	107	5	8	9
64	3	4	5	108	5	8	10
65	3	4	6	109	5	9	10
66	3	4	7	110	6	7	8
67	3	4	8	111	6	7	9
68	3	4	9	112	6	7	10
69	3	4	10	113	6	8	9
70	3	5	6	114	6	8	10
71	3	5	7	115	6	9	10
72	3	5	8	116	7	8	9
73	3	5	9	117	7	8	10
74	3	5	10	118	7	9	10
75	3	6	7	119	8	9	10

CHAPTER 5 Object

This chapter describes the objects which can be used by EIP66-Z.

Table 5.1 Object list

Object name	Class ID	
	Hexadecimal	Decimal
Identity object	0 x 01	1
Message Router object	0 x 02	2
Assembly object	0 x 04	4
Connection Manager object	0 x 06	6
Motor Data object	0 x 28	40
Control Supervisor object	0 x 29	41
AC/DC Drive object	0 x 2A	42
TCP/IP Interface object	0 x F5	245
Ethernet Link object	0 x F6	246
VF66 Parameter Table object	0 x 67	103
VF66 Traceback Data object	0 x 68	104
VF66 Protection History object	0 x 69	105
VF66 Monitor Data object	0 x 6A	106

The data types used for the object specification are defined as shown in the following Table 5.2. For more information, refer to the EtherNet/IP specifications.

Table 5.2 Object type list

Data type	Description	Range	
		Minimum	Maximum
BOOL	Boolean	0(False)	1(True)
SINT	Signed 8-bit integer	-128	127
INT	Signed 16-bit integer	-32768	32767
DINT	Signed 32-bit integer	-2^{31}	$2^{31}-1$
USINT	Unsigned 8-bit integer	0	255
UINT	Unsigned 16-bit integer	0	65535
UDINT	Unsigned 32-bit integer	0	$2^{32}-1$
STRING	Character string (1 byte/character)	—	—
SHORT_STRING	Character string (1 byte/character, 1-byte length information)	—	—
BYTE	Bit value (8-bit)	—	—
WORD	Bit value (16-bit)	—	—
DWORD	Bit value (32-bit)	—	—
EPATH	CIP path segment	—	—

5. 1 Identity Object (Class Code: 0x01)

The Identity object provides the device identification and general information.

5. 1. 1 Class

Class service

Supports Get_Attributes_All (01H), Reset (05H) and Get_Attribute_Single (0EH).

Class attribute

Instance	Attribute	Access rule	Name	Data Type	Description	Readout value
0	1	Get	Revision	UINT	Revision of this object	1
	2	Get	Max Instances	UINT	Maximum instance number of the object currently generated at this class level for a device	1
	6	Get	Max ID of class attributes	UINT	Last class attribute ID number of the class definition implemented in a device	7
	7	Get	Max ID of instance attribute	UINT	Last instance attribute ID number of the class definition implemented in a device	10

5. 1. 2 Instance

Instance service

Supports Get_Attributes_All (01H), Reset (05H) and Get_Attribute_Single (0EH).

Instance attribute

Instance	Attribute	Access rule	Name	Data Type	Description	Readout value
1	1	Get	Vendor ID	UINT	Identification number of each vendor	178
	2	Get	Device Type	UINT	Identification of general device type of product	2
	3	Get	Product Code	UINT	Identification of individual products of each vendor	13
	4	Get	Revision	Structure	Revision of the item specified by Identity object	—
			Major Revision	USINT	Major revision	1
			Minor Revision	USINT	Minor revision	1
	5	Get	Status	WORD	Device status summary	
	6	Get	Serial Number	UDINT	Device serial number	Serial number
	7	Get	Product Name	SHORT_ STRING	Identification name recognized by user	"EIP66 Series"
	8	Get	State	USINT	Current device status similar to a state transition diagram 0 = Nonexistent 1 = Device Self Testing 2 = Standby 3 = Operational 4 = Major Recoverable Fault 5 = Major Unrecoverable Fault 6 to 254 = Reserved 255 = Get_Attributes_All Service Default	

	9	Get	Configuration Consistency Value	UINT	Content that identifies a device setting	0

5. 2 Message Router Object (Class Code: 0x02)

The Message Router object provides a connection point for message communication. A client can send a service to an arbitrary object class or object instance that exists in the actual device via this point.

5. 2. 1 Class

Class service/attribute

There is no class service/attribute.

5. 2. 2 Instance

Instance service/attribute

There is no instance service/attribute.

5. 3 Assembly Object (Class Code: 0x04)

The Assembly object binds multiple object attributes to enable data transmission between objects via a single connection. Input data can be bound using the Assembly object. The terms "input" and "output" are used in the perspective of network. That is, input means transmission of data to a network and output means reception of data from a network.

5. 3. 1 Class

Class service

Supports Get_Attribute_Single (0EH).

Class attribute

Instance	Attribute	Access rule	Name	Data Type	Description	Readout value (hexadecimal)
0	1	Get	Revision	UINT	Revision of this object	2
	2	Get	Max Instances	UINT	Maximum instance number of the object currently generated at this class level for a device	70

5. 3. 2 Instance

Instance service

Supports Get_Attribute_Single (0EH) and Set_Attribute_Single (10H).

Instance attribute

Instance	Attribute	Access rule	Name	Data Type	Description	Readout value
20, 70	3	Get/Set	Data	BYTE array	Refer to Section 4.1	
	4	Get	Size	UINT	Byte number of attribute 3	4

5. 4 Connection Manager Object (Class Code: 0x06)

The Connection Manager object is used for connection and connectionless communications, such as for the case of establishing a connection in multiple subnetworks.

5. 4. 1 Class

Class service

Supports Get_Attribute_Single (0EH).

Class attribute

Instance	Attribute	Access rule	Name	Data Type	Description	Readout value
0	1	Get	Revision	UINT	Revision of this object	1
	2	Get	Max Instances	UINT	Maximum instance number of the object currently generated at this class level for a device	1

5. 4. 2 Instance

Instance service

Supports Forward_Close (4EH) and Forward_Open (54H).

Instance attribute

There is no instance attribute.

5. 5 Motor Data Object (Class Code: 0x28)

This functions as a Motor Data object and motor parameter database.

5. 5. 1 Class

Class service/attribute

There is no class service/attribute.

5. 5. 2 Instance

Instance service

Supports Get_Attribute_Single (0EH) and Set_Attribute_Single (10H).

Instance attribute

Instance	Attribute	Access rule	Name	Data Type	Description	Readout value
1	3	Get/Set	MotorType	USINT	0 = Non-standard motor 1 = PM DC motor 2 = Separately excited DC motor 3 = PM synchronous motor 4 = Separately excited synchronous motor 5 = Switched reluctance motor 6 = Winding type induction motor 7 = Squirrel-cage induction motor 8 = Step motor 9 = AC servo motor 10 = Rectangular wave PM brushless motor	7
	6	Get/Set	RatedCurrent	USINT	Rated stator current unit: 100 mA	A-04 value
	7	Get/Set	RatedVoltage	USINT	Rated base voltage unit: V	A-03 value

5. 6 Control Supervisor Object (Class Code: 0x29)

The Control Supervisor object models all the device management functions in the "motor control device hierarchy." The behavior of motor control device is shown in the state transition diagram and status/event matrix.

5. 6. 1 Class

Class service/attribute

There is no class service/attribute.

5. 6. 2 Instance

Instance service

Supports Get_Attribute_Single (0EH) and Set_Attribute_Single (10H).

Instance attribute

Instance	Attribute	Access rule	Name	Data Type	Description	Readout value
1	3	Set/Get	Run 1	BOOL	Forward operation command Refer to Run/Stop event matrix.	
	4	Set/Get	Run 2	BOOL	Reverse operation command Refer to Run/Stop event matrix.	
	5	Set/Get	NetCtrl	BOOL	Request local/network Run/Stop control. 0 = Local control 1 = Network control Note that actual Run/Stop control status is reflected to attribute 15 "CtrlFromNet."	
	6	Get	State	USINT	0 = Vendor specific 1 = Startup 2 = Not_Ready 3 = Ready 4 = Enabled 5 = Stopping 6 = Fault_Stop 7 = Faulted	
	7	Get	Running 1	BOOL	1 = (Enabled and Run2) or (Stopping and Running2) or (Fault_Stop and Running2) 0 = Other states	
	8	Get	Running 2	BOOL	1 = (Enabled and Run2) or (Stopping and Running2) or (Fault_Stop and Running2) 0 = Other states	
	9	Get	Ready	BOOL	1 = Ready, Enabled or Stopping 0 = Other states	
	10	Get	Faulted	BOOL	1 = Fault occurs (latch state) 0 = No fault	
	11	Get	Warning	BOOL	1 = Warning (no latch) 0 = No warning This attribute is always 0 when warning is not supported.	
	12	Set/Get	FaultRst	BOOL	0 -> 1 = Fault reset 0 = No operation	
	15	Get	CtrlFromNet	BOOL	Run/Stop control side status 0 = Local control 1 = Network control	

Control Supervisor behavior

The following figure shows a state transition diagram that corresponds to the inverter status.

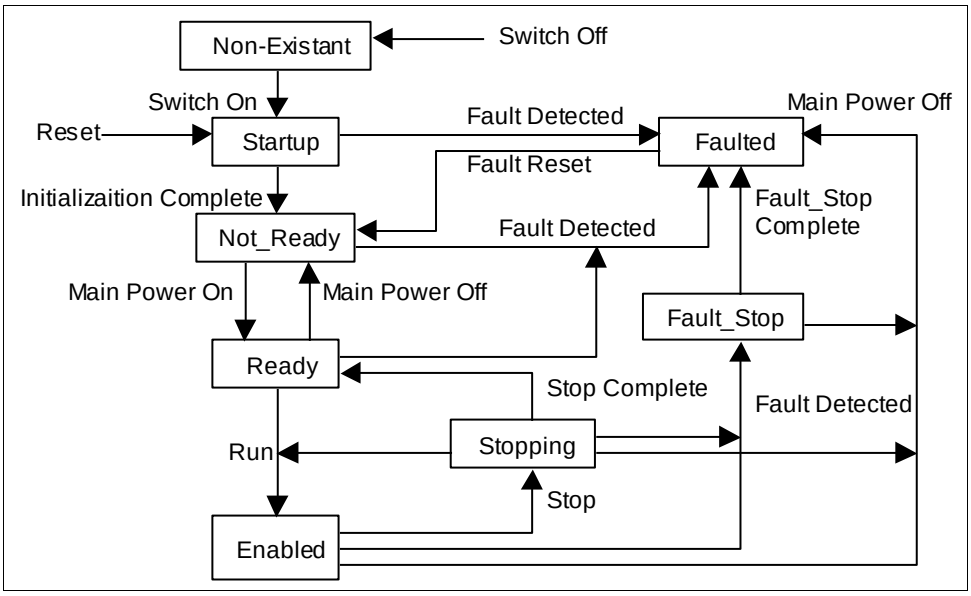


Figure 5.6.1 Control Supervisor state transition diagram

Run/Stop event matrix

The attribute 5 "NetCtrl" is used to request Run/Stop event control via network. However, there is a case that a user or application does not accept Run/Stop control via network depending on the situation. Therefore, an option to inhibit Run/Stop events from network for some device is provided. Only when a device sets the attribute 15 "CtrlFromNet" to 1 in response to a NetCtrl request, network Run/Stop control is actually performed.

With the attribute 15 "CtrlFromNet" set to 1, Run and Stop events are started by combining Run1 and Run2 attributes as shown in the following table.

With the "CtrlFromNet" attribute set to 0, Run and Stop events must be controlled by local input provided by vendor.

Table 5.6.1

Run1	Run2	Trigger event	Run type
0	0	Stop	--
0→1	0	Run	Run1
0	0→1	Run	Run2
0→1	0→1	No action	--
1	1	No action	--
1→0	1	Run	Run2
1	1→0	Run	Run1

Important: Local Stop and Run signals can be overridden or interlocked by Stop/Run control via network. These are vendor-specific characteristics.

5. 7 AC/DC Drive Object (Class Code: 0x2A)

The AC/DC Drive object models AC/DC drive-specific functions such as acceleration or deceleration time for speed setting and torque control.

5. 7. 1 Class

Class service/attribute

There is no class service/attribute.

5. 7. 2 Instance

Instance service

Supports Get_Attribute_Single (0EH) and Set_Attribute_Single (10H).

Instance attribute

Instance	Attribute	Access rule	Name	Data Type	Description	Readout value
1	3	Get	AtReference	BOOL	1 = Drive command issued based on the mode. (speed or torque command)	
	4	Set/Get	NetRef	BOOL	Request torque/speed command generation locally or via network. 0 = Network control not specified for commanding 1 = Network control specified for commanding Note that actual torque/speed setting status is reflected to attribute 29 "RefFromNet."	
	6	Set/Get	Devicemode	USINT	0 = Vendor-specific mode 1 = Opened loop speed (frequency) 2 = Closed loop speed control 3 = Torque control 4 = Process control (PI, etc.) 5 = Position control	
	7	Get	SpeedActual	INT	Speed detection value (approximate figure at highest available accuracy) Unit: r/min/2^SpeedScale (SpeedScale indicates attribute 22 value)	
	8	Set/Get	SpeedRef	INT	Speed setting value Unit: r/min/2^SpeedScale (SpeedScale indicates attribute 22 value)	
	22	Set/Get	SpeedScale	SINT	Speed scaling coefficient Scaling is processed as follows. ScaleSpeed = r/min/2^SpeedScale Range: -126 to 127	J-11 value
	29	Get	RefFromNet	BOOL	Torque/speed setting status 0 = Local torque/speed setting 1 = Network torque/speed setting	

5. 8 TCP/IP Interface Object (Class Code: 0xF5)

The TCP/IP Interface object provides a mechanism to set the TCP/IP network interface for a device.

5. 8. 1 Class

Class service

Supports Get_Attribute_Single (0EH).

Class attribute

Instance	Attribute	Access rule	Name	Data Type	Description	Readout value
0	1	Get	Revision	UINT	Revision of this object	3
	2	Get	Max Instances	UINT	Maximum instance number of the object currently generated at this class level for a device	1

5. 8. 2 Instance

Instance service

Supports Get_Attribute_Single (0EH) and Set_Attribute_Single (10H).

Instance attribute

Instance	Attribute	Access rule	Name	Data Type	Description	Readout value
1	1	Get	Status	DWORD	Interface status	
	2	Get	Configuration Capability	DWORD	Interface capability flag	
	3	Set/Get	Configuration Control	DWORD	Interface control flag	
	4	Get	Physical Link Object	Structure	Physical link object path	
			Path size	UINT	Path size	
			Path	Padded EPATH	Logical segment that identifies physical link object	
	5	Set/Get	Interface Configuration	Structure	TCP/IP network interface setting	
			IP Address	UDINT	Device IP address	
			Network Mask	UDINT	Device network mask	
			Gateway Address	UDINT	Default gateway address	
			Name Server	UDINT	Primary name server	
			Name Server 2	UDINT	Secondary name server	
			Domain Name	STRING	Default domain name	
	6	Set/Get	Host Name	STRING	Host name	
	10	Set/Get	SelectedAcd	BOOL	0: Address conflict detection prohibited 1: Address conflict detection permitted	
	11	Set/Get	LastConflict Deteced	Structure	Information about last detected conflict	
			AcdActivity	USINT	Status at last conflict detection	
			RemoteMAC	Array of 6	Remote node MAC address from conflict detected ARP PDU	

				USINT		
			ArpPdu	Array of 28 USINT	Copy of conflict detected ARP PDU	

5. 9 Ethernet Link Object (Class Code: 0xF6)

The Ethernet Link object holds the link-specific counter and IEEE802.3 communication interface status information.

5. 9. 1 Class

Class service

Supports Get_Attribute_Single (0EH).

Class attribute

Instance	Attribute	Access rule	Name	Data Type	Description	Readout value
0	1	Get	Revision	UINT	Revision of this object	3
	2	Get	Max Instances	UINT	Maximum instance number of the object currently generated at this class level for a device	2
	3	Get	Number of Instances	UINT	Number of object instances currently generated at this class level for a device	2

5. 9. 2 Instance

Instance service

Supports Get_Attribute_Single (0EH).

Instance attribute

Instance	Attribute	Access rule	Name	Data Type	Description	Readout value
1	1	Get	Interface Speed	UDINT	Currently used interface speed	
	2	Get	Interface Flags	DWORD	Interface status flag	
	3	Get	Physical Address	USINT array	MAC layer address	
	6	Set/Get	Interface Control	Structure	Physical interface setting	
			Control Bits	WORD	Interface management bit	
			Forced Interface Speed	UINT	Operation speed forced by interface	
	10	Get	Interface Label	SHORT_STRING	Identification name recognized by user	

5. 10 VF66 Parameter Table Object (Class Code: 0x67)

The VF66 Parameter Table object accesses the inverter parameter data.

5. 10. 1 Class

Class service/attribute

There is no class service/attribute.

5. 10. 2 Instance

Instance service

Supports Get_Attribute_Single (0EH) and Set_Attribute_Single (10H).

Instance attribute

Contact us for the instance attribute for inverter parameter.

5. 11 VF66 Traceback Data Object (Class Code: 0x68)

The VF66 Traceback Data object reads the inverter traceback data.

5. 11. 1 Class

Class service/attribute

There is no class service/attribute.

5. 11. 2 Instance

Instance service

Supports Get_Attribute_Single (0EH).

Instance attribute

Instance number 1: CH0 to 16: CH15

Instance	Attribute	Access rule	Name	Data Type	Description	Readout value
1～16	1	Get	TrcbkData1	INT array	Traceback data 1 (latest)	See Figure 5.11.1
	2	Get	TrcbkData2	INT array	Traceback data 2 (one before the latest)	See Figure 5.11.1
	3	Get	TrcbkData3	INT array	Traceback data 3 (two before the latest)	See Figure 5.11.1
	4	Get	TrcbkData4	INT array	Traceback data 4 (oldest)	See Figure 5.11.1

+0	Readout data 1 L
+1	Readout data 1 H
+2	Readout data 2 L
+3	Readout data 2 H
+199	Readout data 100 L
+200	Readout data 100 H

Figure 5.11.1 Traceback data reading format

Instance number 17

Instance	Attribute	Access rule	Name	Data Type	Description	Readout value
17	1	Get	TrcbkData1	USINT array	Traceback condition 1 (latest)	See Figure 5.11.2
	2	Get	TrcbkData2	USINT array	Traceback condition 2 (one before the latest)	See Figure 5.11.2
	3	Get	TrcbkData3	USINT array	Traceback condition 3 (two before the latest)	See Figure 5.11.2
	4	Get	TrcbkData4	USINT array	Traceback condition 4 (oldest)	See Figure 5.11.2

+0	0	
+1	Traceback point	50 H for the case of 80 %
+2	Day	
+3	Year	
+4	Minute	
+5	Hour	

Figure 5.11.2 Traceback condition reading format

5. 12 VF66 Protection History Object (Class Code: 0x69)

The VF66 Protection History object reads the inverter protection history data.

5. 12. 1 Class

Class service/attribute

There is no class service/attribute.

5. 12. 2 Instance

Instance service

Supports Get_Attribute_Single (0EH).

Instance attribute

Instance	Attribute	Access rule	Name	Data Type	Description	Readout value
1	1	Get	PrtctData	INT array	Protection history data	See Figure 5.12.1

+0	Protection history data 6 L	Latest
+1	Protection history data 6 H	
+2	Protection history data 5 L	
+3	Protection history data 5 H	
+10	Protection history data 1 H	Oldest
+11	Protection history data 1 L	

Figure 5.12.1 Protection history reading format

Table 5.12.1 Protection history data

Bit	Item	Description
0 to 7	Protection code	See Table 5.12.2
8, 9	Inverter mode	00: V/f mode 01: Induction motor vector mode 10: ED motor vector mode 11: Unused
10, 11	Unused (unspecified)	-
12	Setting block	0: First setting block 1: Second setting block
13 to 15	Unused (unspecified)	-

Table 5.12.2 Protection code

Protection code	Protection item	Protection operation description
1	Overcurrent protection	Functions when an instantaneous output current becomes more than or equal to a value 3.58 times the rated inverter current.
2	IGBT protection operation	Functions to protect IGBT from overcurrent or when the gate power supply drops (only for the models below 30 kW).
3	Emergency stop (Normally open) input	Functions when the input contact of emergency stop (Normally open) is turned on.
4	Emergency stop (Normally close) input	Functions when the input contact of emergency stop (Normally close) is turned off.
5	GAC abnormality	Functions when GAC protection is detected (only for the models using GAC).
6	DC part overvoltage	Protects when a DC part voltage exceeds 400 V (200 V class)/800 V (400 V class).
7	Overload protection	Protects when an effective output current reaches or exceeds the specified value for the specified period of time.
8	DCCT abnormality	Functions when the following condition is kept for ten current control cycles in a row. Stopped: Absolute value of each phase current is equal to or greater than 30 % of the rated current. Operating: Total sum of absolute values of three-phase currents is equal to or greater than 30 % of the rated current.
9	Start delay	Functions when operation is still unavailable 10 seconds after operation/JOG input.
10	Overspeed protection	Functions when the motor speed exceeds the overspeed setting value.
11	Overfrequency protection	Functions when an output frequency exceeds the overfrequency setting value.
12	Insufficient voltage (power failure)	Functions when a DC voltage falls to or below 180 V (200 V class)/360 V (400 V class) during operation.
13	Overtorque protection	Functions when an output torque reaches or exceeds the specified value for the specified period of time (when the overtorque protection operation is set to ON).
14	Unit overheat	Functions when an IGBT temperature reaches or exceeds the specified value (only for the models below 30 kW).
15	Memory abnormality	Functions when a sum value of the setting data stored in EEPROM disagrees at power-on.
16	Optional error	Functions when a communication option malfunctions while the use of communication option (J-00) is set to ON.
17	Sensorless start error	Functions when the phase detection at start-up fails.
18	Communication timeout	Functions when a communication error occurs between a communication option and communication master station.
19	Speed control error	Functions when a deviation of motor speed from a command value (speed control input) exceeds the setting value while the speed control abnormality detection (F-08) is set to ON.
20	Motor overheat	Functions when a motor temperature exceeds 150 ℃ while the temperature detection option is used and the motor overheat selection is set to ON.
21	Charging resistance overheat	Functions when a charging resistance temperature is kept high for 0.5 seconds (only for the models of 7.5 kW or below).
22	FCL operation	Functions when the instantaneous current limit (FCL) occurs continuously for 15 seconds (two seconds around 0 Hz).
23	Setting error	Functions when operation is started in the state producing overflow in constant calculation.
24	Open phase	Functions when a disconnection detected state lasts for two seconds.
25	CPU abnormal process	Functions when CPU executes an abnormal process due to instantaneous decrease of control power supply or other reasons.
26	Fan failure	Functions when a cooling fan fails (only for the models of 11 to 22 kW).
27	PG error	Functions when no change occurs in U, V and W signals of PG after the electrical phase is rotated by two cycles or more, or no input of Z signal of PG occurs after two rotations or more of the mechanical phase.

Protection code	Protection item	Protection operation description
28	Sensor abnormality	Functions when PG or current sensor abnormality is detected for 20 current control cycles in a row.
29	External failure 1	Functions when the multifunction input: external failure 1 is input.
30	External failure 2	Functions when the multifunction input: external failure 2 is input.
31	External failure 3	Functions when the multifunction input: external failure 3 is input.
32	External failure 4	Functions when the multifunction input: external failure 4 is input.

* Read also the operating instructions of VF66 inverter main unit.
* The protection code 33 and the followings indicate GAC protection detection, and these are intended only for the models using GAC. Refer to the operating instructions of relevant VF66 inverter model.

5. 13 VF66 Monitor Data Object (Class Code: 0x6A)

The VF66 Monitor Data object reads the inverter monitoring data.

5. 13. 1 Class

Class service/attribute

There is no class service/attribute.

5. 13. 2 Instance

Instance service

Supports Get_Attribute_Single (0EH).

Instance attribute

Instance	Attribute	Access rule	Name	Data Type	Description	Readout value
1	1	Get	MonData	INT array	Monitoring data	See Figure 5.13.1

+0	Monitoring data 1 L
+1	Monitoring data 1 H
+2	Monitoring data 2 L
+3	Monitoring data 2 H
+48	Monitoring data 25 H
+49	Monitoring data 25 L

Figure 5.13.1 Monitoring data reading format

Table 5.13.1 Monitoring data list

	V/f mode		Induction motor vector mode ED motor vector mode	
No.	Item	Scale	Item	Scale
1	Output frequency	20000/maximum	Motor speed	20000/maximum
2	Frequency setting value	20000/maximum	Speed setting value	20000/maximum
3	Effective output current	10000/100 %(*3)	Effective output current	10000/100 %(*3)
4	Output torque	5000/100 %	Torque command	5000/100 %
5	DC voltage	10/V(*1)	DC voltage	10/V(*1)
6	Output voltage	20/V(*2)	Output voltage	20/V(*2)
7	Motor speed	20000/maximum	Output frequency	10/Hz
8	Overload counter	10000/100 %	Overload counter	10000/100 %
9	Line speed	20000/maximum	Line speed	20000/maximum
10	Motor temperature	10/℃	Motor temperature	10/℃
11	Input terminal check 1	-	Input terminal check 1	-
12	Input terminal check 2	-	Input terminal check 2	-
13	Input terminal check 3	-	Input terminal check 3	-
14	Input terminal check 4	-	Input terminal check 4	-
15	Output terminal check 1	-	Output terminal check 1	-
16	Output terminal check 2	-	Output terminal check 2	-
17	Cumulative operation time	1/hr	Cumulative operation time	1/hr

	V/f mode		Induction motor vector mode ED motor vector mode	
No.	Item	Scale	Item	Scale
18	Timer remaining time 1	1/hr	Timer remaining time 1	1/hr
19	Timer remaining time 2	1/hr	Timer remaining time 2	1/hr
20	Main unit version	—	Main unit version	—
21	PLC function version	—	PLC function version	—
22	Analog input voltage	100/V	Analog input voltage	100/V
23	Adjustment monitor	—	Adjustment monitor	—
24	Unused (unspecified)	—	Unused (unspecified)	—
25	Unused (unspecified)	—	Unused (unspecified)	—

*1: The scale for 400 V class is 5/V.

*2: The scale for 400 V class is 10/V.

*3: A 100 % value is a value obtained by multiplying the rated inverter current (A) by the gain shown in the following table. For the rated inverter current, refer to the operating instructions of VF66 inverter main unit.

CHAPTER 6 Status Code

The following table shows the status codes specified in the General Status field of Error Response message.

Table 6.1 General status code

Error code (hexadecimal)	Status name	Description
00	Success	Service was successfully performed by the object specified.
01	Connection failure	A connection related service failed along the connection path.
02	Resource unavailable	Resources needed for the object to perform the requested service were unavailable
03	Invalid parameter value	See Status Code 0x20, which is the preferred value to use for this condition.
04	Path segment error	The path segment identifier or the segment syntax was not understood by the processing node. Path processing shall stop when a path segment error is encountered.
05	Path destination unknown	The path is referencing an object class, instance or structure element that is not known or is not contained in the processing node. Path processing shall stop when a path destination unknown error is encountered.
06	Partial transfer	Only part of the expected data was transferred.
07	Connection lost	The messaging connection was lost.
08	Service not supported	The requested service was not implemented or was not defined for this Object Class/Instance.
09	Invalid attribute value	Invalid attribute data detected
0A	Attribute list error	An attribute in the Get_Attribute_List or Set_Attribute_List response has a non-zero status.
0B	Already in requested mode/state	The object is already in the mode/state being requested by the service
0C	Object state conflict	The object cannot perform the requested service in its current mode/state
0D	Object already exists	The requested instance of object to be created already exists.
0E	Attribute not settable	A request to modify a non-modifiable attribute was received.
0F	Privilege violation	A permission/privilege check failed
10	Device state conflict	The device' s current mode/state prohibits the execution of the requested service.
11	Reply data too large	The data to be transmitted in the response buffer is larger than the allocated response buffer
12	Fragmentation of a primitive value	The service specified an operation that is going to fragment a primitive data value, i.e. half a REAL data type.
13	Not enough data	The service did not supply enough data to perform the specified operation.
14	Attribute not supported	The attribute specified in the request is not supported
15	Too much data	The service supplied more data than was expected
16	Object does not exist	The object specified does not exist in the device.

Error code (hexadecimal)	Status name	Description
17	Service fragmentation sequence not in progress	The fragmentation sequence for this service is not currently active for this data.
18	No stored attribute data	The attribute data of this object was not saved prior to the requested service.
19	Store operation failure	The attribute data of this object was not saved due to a failure during the attempt.
1A	Routing failure, request packet too large	The service request packet was too large for transmission on a network in the path to the destination. The routing device was forced to abort the service.
1B	Routing failure, response packet too large	The service response packet was too large for transmission on a network in the path from the destination. The routing device was forced to abort the service.
1C	Missing attribute list entry data	The service did not supply an attribute in a list of attributes that was needed by the service to perform the requested behavior.
1D	Invalid attribute value list	The service is returning the list of attributes supplied with status information for those attributes that were invalid.
1E	Embedded service error	An embedded service resulted in an error.
1F	Vendor specific error	A vendor specific error has been encountered. The Additional Code Field of the Error Response defines the particular error encountered. Use of this General Error Code should only be performed when none of the Error Codes presented in this table or within an Object Class definition accurately reflect the error.
20	Invalid parameter	A parameter associated with the request was invalid. This code is used when a parameter does not meet the requirements of this specification and/or the requirements defined in an Application Object Specification.
21	Write-once value or medium already written	An attempt was made to write to a write-once medium (e.g. WORM drive, PROM) that has already been written, or to modify a value that cannot be changed once established.
22	Invalid Reply Received	An invalid reply is received (e.g. reply service code does not match the request service code, or reply message is shorter than the minimum expected reply size). This status code can serve for other causes of invalid replies.
23-24	Reserved	This is reserved by CIP for future extension.
25	Key Failure in path	The Key Segment that was included as the first segment in the path does not match the destination module. The object specific status shall indicate which part of the key check failed.
26	Path Size Invalid	The size of the path which was sent with the Service Request is either not large enough to allow the Request to be routed to an object or too much routing data was included.
27	Unexpected attribute in list	An attempt was made to set an attribute that is not able to be set at this time.
28	Invalid Member ID	The Member ID specified in the request does not exist in the specified Class/Instance/Attribute
29	Member not settable	A request to modify a non-modifiable member was received
2A-CF	Reserved	This is reserved by CIP for future extension.

Error code (hexadecimal)	Status name	Description
D0-FF	Reserved for object class and service errors	This range of error codes is to be used to indicate Object Class specific errors. Use of this range should only be performed when none of the Error Codes presented in this table accurately reflect the error that was encountered.

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TIM051[B]_20190618