



APPENDIX C: ETHERNET MODULE ACN-ETH

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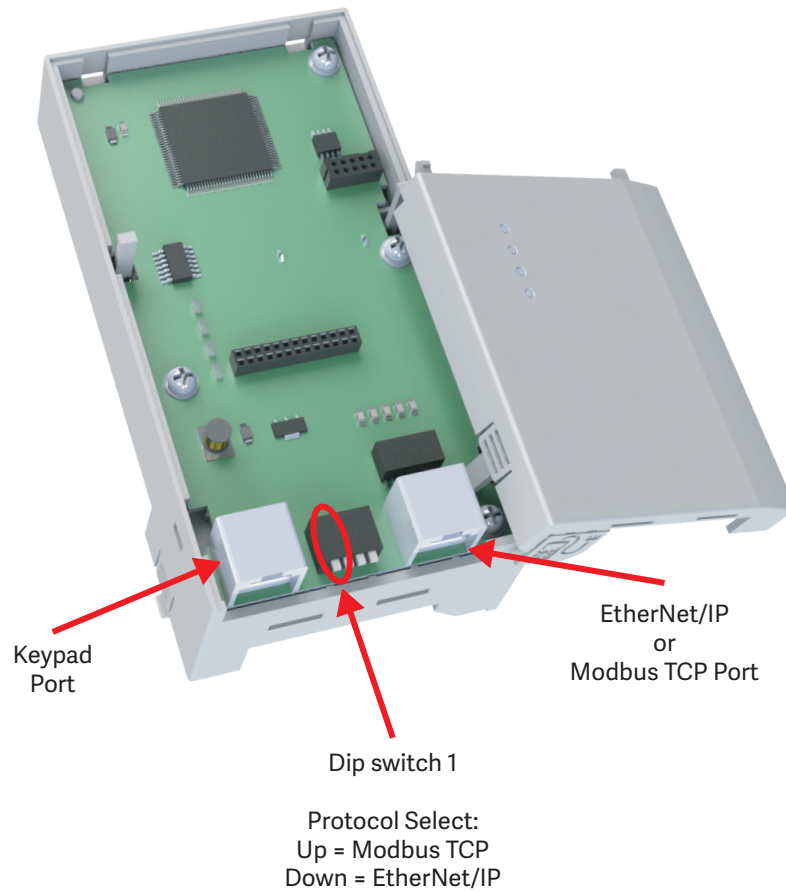
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ETHERNET/MODBUS CARD QUICK START

HARDWARE

- 1) Install card with no power applied to the drive.
- 2) Protocol select: Set dip switch 1 to UP for Modbus TCP or DOWN for EtherNet/IP



PARAMETERS

Pr. Code	Parameter Name	Range	Setting for ETH Control	Definition	Protocol
CM-10	Opt Parameter1	0 ~ 255	192	Set up the IP Address.	M/E
CM-11	Opt Parameter2	0 ~ 255	192		
CM-12	Opt Parameter3	0 ~ 255	168		
CM-13	Opt Parameter4	0 ~ 255	3		
CM-14	Opt Parameter5	0 ~ 255	255	Set up the Subnet Mask.	M/E
CM-15	Opt Parameter6	0 ~ 255	255		
CM-16	Opt Parameter7	0 ~ 255	255		
CM-17	Opt Parameter8	0 ~ 255	0		
CM-18	Opt Parameter9	0 ~ 255	255	Set up the Gateway Address.	M/E
CM-19	Opt Parameter10	0 ~ 255	255		
CM-20	Opt Parameter11	0 ~ 255	255		
CM-21	Opt Parameter12	0 ~ 255	3		
CM-22	Opt Parameter13	0~2	0 - Auto Speed Select	Set up the Ethernet communication rate.	M/E
CM-29	In Instance	0~11	0 - 70	CIP Input Instance.	E
CM-49	Out Instance	0~11	0 - 20	CIP Output Instance.	E
CM-94	Comm Update	0: No 1: Yes	1	Update communication relating to keypad parameters.	M/E
dr.06	Command source	4-FieldBus	0-5	Set for Run/Stop by ETH card.	M/E
dr.07	Frequency Reference Source	8-FieldBus	0 - 16	Set for Speed Control by ETH card.	M/E

After setting these parameters:

- **Apply all changes by setting CM.94 = 1:** This parameter setting will return to '0' after being set.
- **If using LCD keypad, set CNF.48 = 1:** Makes the drive retain the parameter settings after a power loss.



NOTE: If this step is not completed, the drive will NOT retain the communication parameters after a power cycle.

INTRODUCTION

ACN-ETH MODULE

The ACN-ETH is an option module for connecting any ACN series drive to an ethernet network. The module supports both the EtherNet/IP and Modbus TCP protocols.

COMPONENTS

Product Contents:

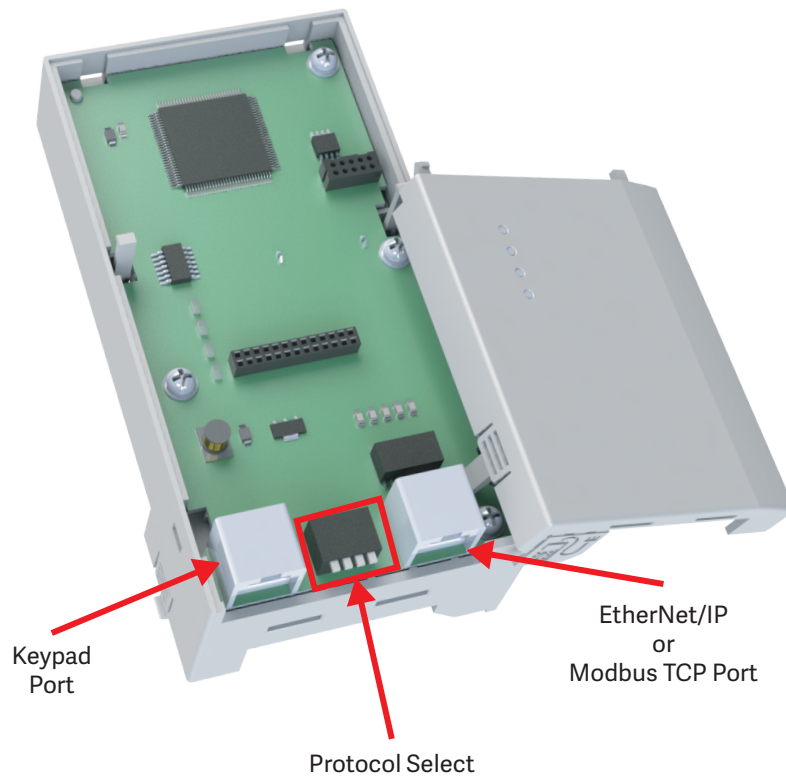
- *Ethernet Communication Module board (CENTACN): 1 ea*
- *Installation Instructions Insert: 1 ea*
- *Brass Bar(M3xL23): 1 ea*
- *Brass Bar(M3xL17.3): 1 ea*
- *Fixed Screw(M3xL8): 2 ea*

ETHERNET COMMUNICATION MODULE FEATURES

COMMON FEATURES

Transmission Speed	10Mbps, 100Mbps
Transmission Method	Baseband
Max. Extensible Distance between Nodes	100m (Node-Hub)
Max. Node Number	Hub connection
Auto-Negotiation	Supported
Max. Frame Size	1,500 bytes
Communication Zone Access Method	CSMA/CD
Frame Error Checking Method	CRC32
Recommended TCP Socket	2 Sockets

LAYOUT OF ETHERNET COMMUNICATION MODULE



INSTALLATION

The following steps illustrate how to install the ACN-EIO or the ACN-ETH Option Card on the IronHorse ACN series drive.



NOTE: Ensure all control board cables are terminated *BEFORE* installing the option card. Once the option card is installed, there is no access to the control terminals.

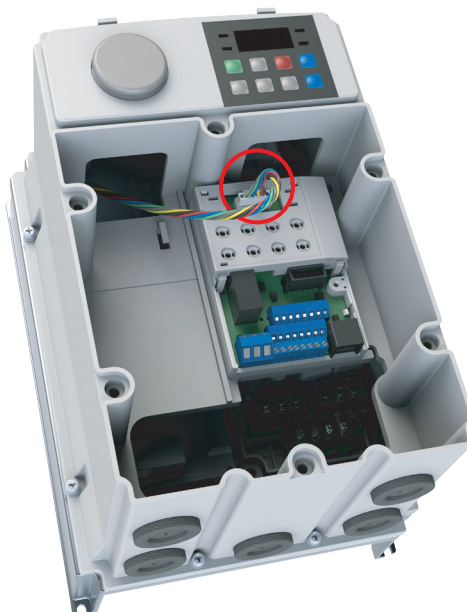


WARNING; ENSURE ALL POWER IS REMOVED FROM THE DRIVE BEFORE INSTALLING OR REMOVING ANY OPTION CARD. FAILURE TO COMPLY WILL DAMAGE THE DRIVE.

- 1) Loosen all front cover screws and remove the cover plate. Remove the face plate from the front of the Option card.



- 2) Remove keypad connector.

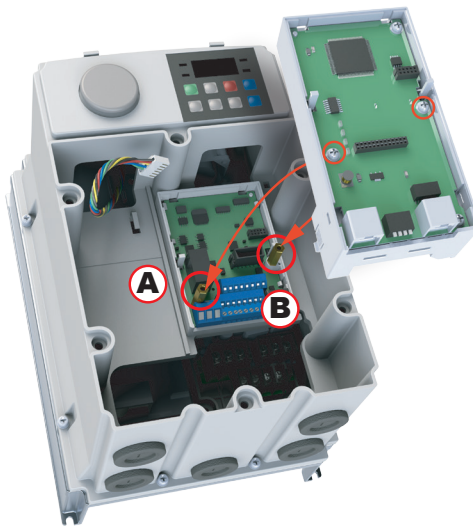


- 3) Remove the white keypad adapter PCB. It may be helpful to use a screwdriver to clear the plastic tabs

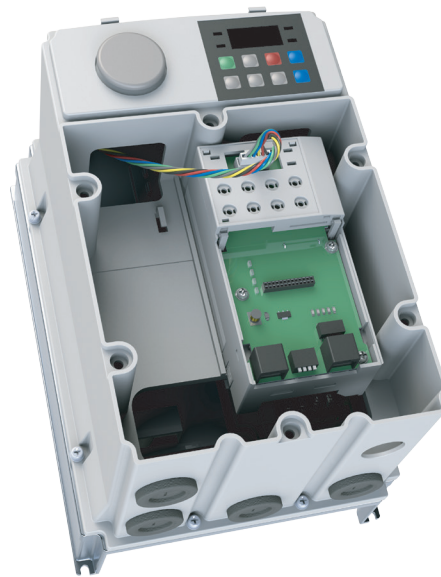
(circled).



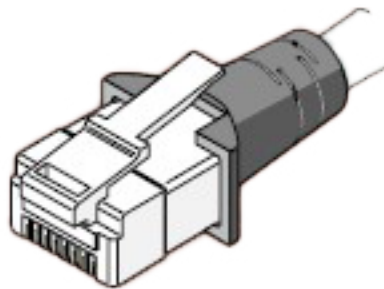
- 4) Once the keypad PCB adapter is removed, remove the existing bottom left screw (A) on the IO board. Keep this screw for later use. Fasten the included brass bar (M3xL23) to (A), and (M3xL17.3) to (B).



- 5) Install the Option Card and fasten the screws to the brass bars installed in the previous step.
- 6) Snap the keypad adapter PCB back into place on the Option Card and reconnect the keypad connector cable. Connect the field cables to the Option Card and install the Option Card cover (not shown). Re-install the drive front cover and tighten the screws.



TERMINAL BLOCK OF ETHERNET COMMUNICATION SPECIFICATIONS



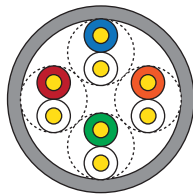
Pin No.	Signal	Description	Cable color
1	TX+	Transmitting data Plus	White / Yellow
2	TX-	Transmitting data Minus	Yellow
3	RX+	Receiving data Plus	White / Green
4	NONE	Not used	Blue
5	NONE	Not used	White / Blue
6	RX-	Receiving data Minus	Green
7	NONE	Not used	White / Brown
8	NONE	Not used	Brown

*Make sure that cables connected to Pin1 and 2 are twisted together.
Make sure that cables connected to Pin3 and 6 are twisted together.*

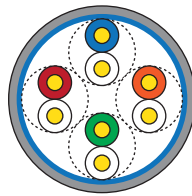
NETWORK CABLE SPECIFICATION

Category 5 is used. Transmission speed of category 5 is 100MHz and available up to 100Mbps.

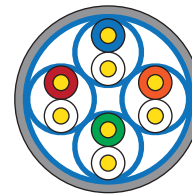
Classification	Detail	Used
UTP (U.UTP)	Unshielded twisted pair cable	Maximum 200MHz, Voice + Information (Data)+Low video signal
FTP (S.UTP)	Foil screened twisted pair cable	Maximum 100MHz Electromagnetic interruption (EMI) or electric stability considered, Voice+ Information (Data) + Low Video signal
STP (S.STP)	Shielded twisted pair cable	Maximum 500MHz, Voice +Information(Data)+Video signal, Replacement for 75Ω coaxial cable



UTP



FTP



STP

PROTOCOL SELECTION

The ACN Ethernet module can utilize either the Modbus TCP or EtherNet/IP protocol. Ensure the drive is powered off and use Switch 1 to select the protocol. Switch 2,3,4 are not used.

Switch State	Protocol
OFF (Switch at the upper position)	Modbus TCP
ON (Switch at the lower position)	EtherNet/IP

If the option module is operating, the protocol will not be changed even if the switch selection is changed. The protocol is determined by the state of switch when the option module is turned on or the drive is initialized by 'Yes' execution of COM-94 Comm Update.

LED INFORMATION

LED DISPLAY FEATURE

Four LEDs are located on the ACN Ethernet Communication Module. Each LED indicates different functions and displays the status of Ethernet Protocol.

ETHERNET LINE LED (ETHERNET/IP AND MODBUS TCP ARE SAME)

LED	Color	Status	Function
SPEED	Green	ON	The communication speed is 100Mbps.
		OFF	The communication speed is 10Mbps.
LINK	Green	ON	The communication module is ready to communicate.
		OFF	Communication cable wiring has a fault, Link LED is turned Off. Check if wiring is correct.

MODBUS TCP LED & TROUBLESHOOTING

LED	Color	Status	Function and Troubleshooting
CPU	Green	Flash	The CPU of Modbus TCP is operating normally when the power is well supplied to the communication module.
		OFF	Failure in power supply to the communication module. Re-install the module.
ERROR	Red	OFF	The communication module is normal without error.
		ON	IP address set to 0.0.0.0 or 255.255.255.255. Set to a different address.
		CPU and Flash	1. The communication is interrupted. Turn off the power and then reinstall the module. 2. The data from drive is not updated to Ethernet Module. Execute Comm. Update or cycle power.
		Flashing slower than CPU	IP address is conflicted in a network. Check if IP address is appropriate.

ETHERNET/IP LED & TROUBLESHOOTING

LED	Color	Status	Function and Troubleshooting
NS	Green	ON	IO communicating normally. Class 1 connection is established.
		OFF	Client and TCP are not connected.
		Flash	UCMM communication is available by the registration after Client and TCP are connected.
	Red	ON	Displayed if an IP address clashes with the same IP address in a network. Check whether IP address is duplicated.
		OFF	Communication module is normal.
		Flash	Class 1 connection is disconnected abnormally. Check if the Network cable and connection state are correct.
MS	Green	ON	Communication module board is normal.
		OFF	Communication module has a problem.
	Red	ON	IP address set to 0.0.0.0 or 255.255.255.255. Please do not use the address IP Address because it can be only used for the specific case.
		OFF	Communication module is normal.
		Flash	1. The communication is interrupted. Turn off the power and then reinstall the module. 2. The data from drive is not updated to Ethernet Module. Execute Comm update or cycle power.



NOTE:

1. When the module is initialized by the selection of EtherNet/IP, LED turns on and off in order as below.

(MS LED(GREEN) -> NS LED(RED) -> MS LED(RED) -> NS LED(GREEN) -> NS LED(RED)-> NS LED(OFF)->MS LED(GREEN))

2. When IP address is conflicted, please reset IP and execute Comm. Update.

3. Do not use Comm Update (CM.94 ▶ 1) when the drive is working or in cyclic communication.

KEYPAD PARAMETER OF ETHERNET COMMUNICATION

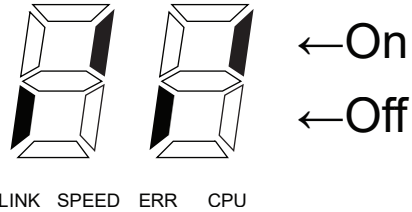
FBUS S/W VER (CM.06)

CM.06 automatically indicates the version of the communication module presently installed in the ACN.

FBUS LED (CM.09)

Modbus TCP

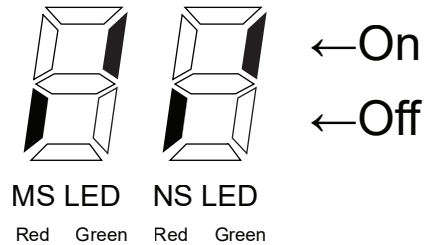
The On/off state of the 4 LEDs on the Ethernet module are displayed in parameter Cm.09.



LINK LED	SPEED LED	ERR LED	CPU LED
OFF	ON	OFF	ON

EtherNet/IP

The On/off state of the 4 LEDs on the Ethernet module are displayed in parameter Cm.09.



MS LED(Red)	MS LED(Green)	NS LED(Red)	NS LED(Green)
OFF	ON	OFF	ON

IP ADDRESS, SUBNET MASK, GATEWAY (CM.10~21) SETTING

Ethernet communication cards must have their own unique IP address. While the card addresses can be set for DHCP (IP address is set and can be changed by the network), we recommend using static IP addresses. Either method requires the IP addresses (and subnet masks) of the communication cards to be compatible with any other devices that connect to the drive. For an easy subnet mask calculator, please visit www.subnet-calculator.com.

The IP ver. supported by Ethernet Module is v4. All the addresses and masks are expressed with (decimal).(decimal).(decimal) and each decimal number is within 0~255. In Ethernet communication Module, decimal numbers can be entered in Opt Parameter directly. Each Opt Parameters has the value 0 through 255, which is implemented with each field of addresses divided with ‘.’.

Ex) To set up IP Address 196.168.10.131, enter the Opt Parameter as shown in the table below.

Code Number	Parameter Name	Opt Parameter
CM.10	Opt Para-1	196
CM.11	Opt Para-2	168
CM.12	Opt Para-3	10
CM.13	Opt Para-4	131

ETHERNET SPEED (CM.22)

Ethernet speed can be set up within the range of 0~2

Set Value	Speed
0	Set the speed automatically
1	100Mbps
2	10Mbps

Automatic speed setting function automatically sets up the highest speed in the network.

CIP INPUT INSTANCE (CM.29)

This parameter is displayed when the protocol setting is EtherNet/IP. It sets up the data format of the drive status sent from the drive to the Client (Originator) during the I/O communication module of the CIP (Common Industrial Protocol). Refer to the Assembly Object of the EtherNet/IP.

Set Value	Input Instance Value	Data Size	Parameter Number
0	70	4	X
1	71	4	X
2	110	4	X
3	111	4	X
4	141	2	1
5	142	4	2
6	143	6	3
7	144	8	4
8	145	10	5
9	146	12	6
10	147	14	7
11	148	16	8



NOTE: For proper EtherNet/IP communications, CM.29 and CM.49 must be manually set to the same value.

CIP OUTPUT INSTANCE(CM.49)

This parameter is displayed only when protocol is set to EtherNet/IP. It sets up the data format of the drive command sent from the Client (Originator) to control the drive during the I/O communication module of the CIP (Common Industrial Protocol). Refer to the Assembly Object of the EtherNet/IP.

Set Value	Output Instance Value	Data Size	Parameter Number
0	20	4	X
1	21	4	X
2	100	4	X
3	101	4	X
4	121	2	1
5	122	4	2
6	123	6	3
7	124	8	4
8	125	10	5
9	126	12	6
10	127	14	7
11	128	16	8



NOTE: Ensure Cm.29 and Cm.49 are set to the same value for communications to work properly.

Cm.29 & CM.49 Parameter Value	Cm.29 Input Instance		Cm.49 Output Instance
0	70	↔	20
1	71	↔	21
2	110	↔	100
3	111	↔	101
4	141	↔	121
5	142	↔	122
6	143	↔	123
7	144	↔	124
8	145	↔	125
9	146	↔	126
10	147	↔	127
11	148	↔	128

NUMBER OF OUTPUT PARAMETERS (CM.30)

This parameter is not used in case of Modbus TCP. This parameter updates only when the value of the Input Instance (CM.29) is set to 4 or above and Comm Update(CM-94:YES) is initialized. CM.30 Para Status is read only and will display the number of parameters configured in CM.29.

PARAMETER STATUS (CM.31~CM.38)

These parameters can be utilized by Modbus TCP or EtherNet/IP. Enter the hex address of the desired drive parameter or common address. This is sent for the reference data of the Client (Originator) at the same number as that of the set parameters in the CM.31~CM.38.

NUMBER OF INPUT PARAMETERS (CM.50)

This parameter is not used in case of Modbus TCP. This parameter updates only when the set value of the Output Instance (CM.49) is 4 or above and Comm Update(CM-94:YES) is initialized. CM.50 Para Ctrl Num is read only and will display the number of parameters configured in CM.49.

PARAMETER CONTROL (CM.51~CM.58)

These parameters can be utilized by Modbus TCP or EtherNet/IP. Enter the hex address of the desired drive parameter or common address. This is used for the reference data of the Client (Originator) at the same number as that of the set parameters in the CM.51~CM.58.

COMM UPDATE (CM.94)

When Communication settings parameters are changed, the value is not applied immediately. The Communication update parameter (CM.94) must be set to 1 to apply the change. After any Comm settings changes be sure to set CM.94=1. This action will restart Ethernet Communication. In addition, this action will prevent any data loss from a drive power loss.

MODBUS TCP

MODBUS TCP FRAME STRUCTURE

MBAP Header(7 bytes)	PDU (5 bytes ~)
------------------------------	-----------------

Generally, Ethernet uses Ethernet II Frame.

Header	Length	Description
Transaction Identifier	2 Bytes	It is increased by 1 each time as an unique transmitting number when Data Frame is sent from Client to Server.
Protocol Identifier	2 Bytes	Fixed as 0
Length	2 Bytes	It is Modbus Data Frame length which means the length by Byte from MBAP Header to Unit Identifier.
Unit Identifier	1 Bytes	When Modbus TCP and Modbus/RTU are connected by Gate, Slave number is written. When Modbus TCP is only used, it is fixed as 0xFF.

Protocol Data Unit (PDU): AS an actual Data of Modbus TCP, It is composed of Function Code and Data.

FUNCTION CODE DESCRIPTION

Modbus TCP can be divided into Client and Server. Client gives the command and Server responds to the command. Generally, as Client, there are PLC, HMI and PC so on, and Server means drive.

READ HOLDING REGISTER

This is a function for reading data from drive (Server).



NOTE: For Modbus TCP addresses, refer to "Drive Expansion Common Area Parameter" on page 5-16.

FRAME CONFIGURATION REQUIRING TO SERVER FROM CLIENT

Required Frame	Length	Value
Function Code	1 Bytes	0x03
Comm. Address	2 Bytes	0x0000 ~ 0xFFFF
Required Data Number	2 Bytes	1~16

FRAME CONFIGURATION RESPONDING TO MASTER FROM SERVER

Responded Frame	Length	Value
Function Code	1 Bytes	0x03
Comm. Address	1 Bytes	2 x Required Data Number
Required Data Number	Required Data Number x 2 Bytes	The required data number according to the number of communication address

READ INPUT REGISTER

This is a function for reading data from Drive (Server).

FRAME CONFIGURATION REQUIRING TO SERVER FROM CLIENT

Required Frame	Length	Value
Function Code	1 Bytes	0x04
Comm. Address	2 Bytes	0x0000 ~ 0xFFFF
Required Data Number	2 Bytes	1~16

FRAME CONFIGURATION RESPONDING TO MASTER FROM SERVER

Required Frame	Length	Value
Function Code	1 Bytes	0x04
Comm. Address	1 Bytes	2 x Required Data Number
Required Data Number	Required Data Number x 2 Bytes	The required data number according to the number of communication address

WRITE SINGLE REGISTER

This is a function for modifying a data of Drive (Server).

FRAME CONFIGURATION REQUIRING TO SERVER FROM CLIENT

Required Frame	Length	Value
Function Code	1 Bytes	0x06
Comm. Address	2 Bytes	0x0000 ~ 0xFFFF
Required Data Number	2 Bytes	0x0000 ~ 0xFFFF

FRAME CONFIGURATION RESPONDING TO MASTER FROM SERVER

Required Frame	Length	Value
Function Code	1 Bytes	0x06
Comm. Address	2 Bytes	0x0000 ~ 0xFFFF
Required Data Number	2 Bytes	0x0000 ~ 0xFFFF

WRITE MULTIPLE REGISTER

This is a function for modifying the consecutive data of drive (Server) from 1 up to 16.

FRAME CONFIGURATION REQUIRING TO SERVER FROM CLIENT

Required Frame	Length	Value
Function Code	1 bytes	0x10
Comm. Address	2 bytes	0x0000 ~ 0xFFFF
Modifying data number	2 bytes	1~16
Byte Count	1 bytes	2 X Number of data
Data value to be modified	Number of data x 2 bytes	Data for modifying

FRAME CONFIGURATION RESPONDING TO MASTER FROM SERVER

Required Frame	Length	Value
Function Code	1 Bytes	0x10
Comm. Address	2 Bytes	0x0000 ~ 0xFFFF
Modifying Data number	2 Bytes	1~16

EXCEPT FRAME

This is a responding frame from server in case of an error that happens when it sends the required frame from Client.

EXCEPTION FRAME STRUCTURE

Error Frame	Length	Value
Error Code	1bytes	0x80 + Function Code that client requires
Exception Code	1bytes	0x0000 ~ 0xFFFF

EXCEPTION CODE TYPE

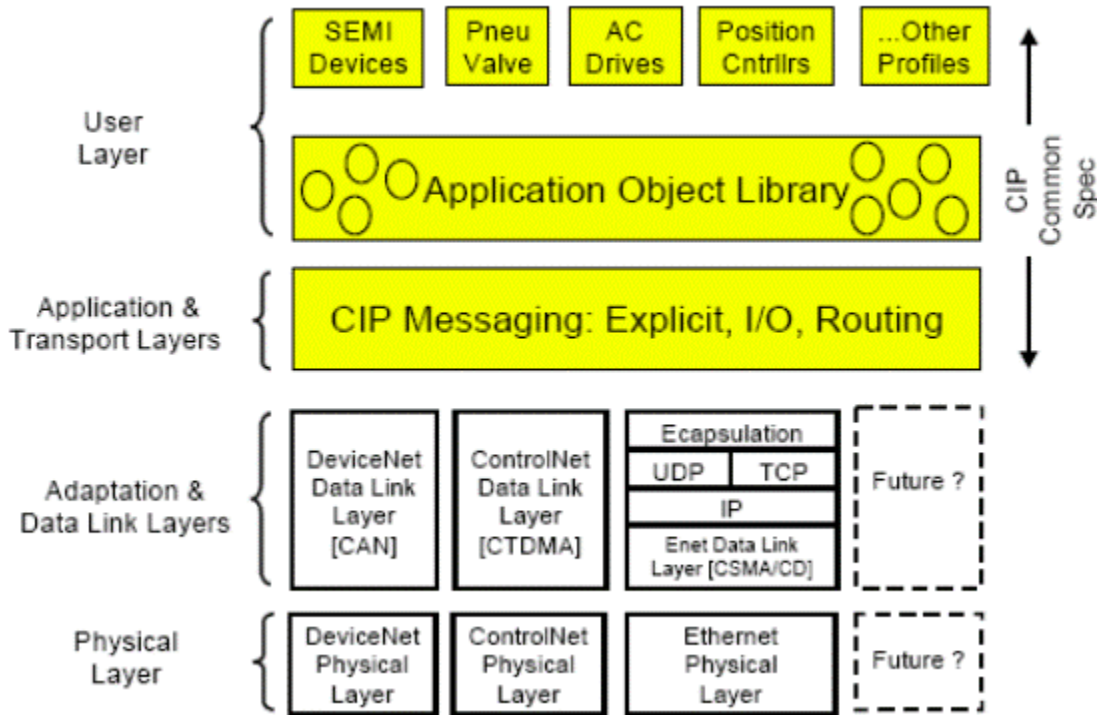
Type	Code	Description
ILLEGAL FUNCTION	0x01	In case non-supported Function is required.
ILLEGAL DATA ADDRESS	0x02	Unused address is required or to be modified.
ILLEGAL DATA VALUE	0x03	The modified data exceeds the permitted range when it needs to modify the data.
SLAVE DEVICE FAILURE	0x04	In case there is an error in server (Communication failure with drive, Initialization failure, Communication failure between drive and Data)
SLAVE DEVICE BUSY	0x06	In case the server can't respond due to other process (such as Drive parameter initialization or module initialization setting)
WRITE PERMISSION ERROR	0x20	In case the value cannot be modified because the value is prohibited to modify.

ETHERNET/IP

BASIC PROTOCOL CONFIGURATION

The EtherNet/IP is a protocol implemented with the CIP (Common Industrial Protocol), defined by the ODVA, by using TCP and UDP.

- *Originator:* It is the device requesting connection, called Client. The device represents a PLC or a scanner.
- *Target:* It is the device responded to the connection, called Server. The device represents an Drive.



IMPLICIT MESSAGE

The Implicit Message is also called I/O Message, which is the data communicated between the Client (Originator) and Server (Target) at preset period by the Input Instance and Output Instance. The connection is a Class 1 Connection

Supported range

- Transport Type
 - » Originator->Target: Point to Point
 - » Target->Originator: Multicast
- Transport Trigger: Cyclic
- Configuration Connection: 1
- Connection Tag: Not supported
- Priority
 - » Originator->Target: Scheduled
 - » Target->Originator: Scheduled
 - » Configuration Data: Not supported

Input Instance

The data of the Drive status periodically sent from the Drive to PLC or a Client device.

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
70	0						Running1 (Fwd)		Faulted
	1								
	2	Speed Actual (Low Byte) – RPM unit (note 1)							
	3	Speed Actual (High Byte) – RPM unit							
71	0	At Reference	Ref From Net	Ctrl From Net	Ready	Running 2 (Rev)	Running1 (Fwd)	Warning	Faulted
	1	Drive State							
	2	Speed Actual (Low Byte) – RPM unit							
	3	Speed Actual (High Byte) – RPM unit							
110	0						Running1 (Fwd)		Faulted
	1								
	2	Speed Actual (Low Byte) – Hz unit (note 1)							
	3	Speed Actual (High Byte) – Hz unit							
111	0	At Reference	Ref From Net	Ctrl From Net	Ready	Running 2 (Rev)	Running1 (Fwd)	Warning	Faulted
	1	Drive State							
	2	Speed Actual (Low Byte) – Hz unit							
	3	Speed Actual (High Byte) – Hz unit							
141	0	Status Parameter - 1 data (Low Byte)							
	1	Status Parameter - 1 data (Hi Byte)							
142	0	Status Parameter - 1 data (Low Byte)							
	1	Status Parameter - 1 data (Hi Byte)							
	2	Status Parameter - 2 data (Low Byte)							
	3	Status Parameter - 2 data (Hi Byte)							

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
143	0	Status Parameter - 1 data (Low Byte)							
	1	Status Parameter - 1 data (Hi Byte)							
	2	Status Parameter - 2 data (Low Byte)							
	3	Status Parameter - 2 data (Hi Byte)							
	4	Status Parameter - 3 data (Low Byte)							
	5	Status Parameter - 3 data (Hi Byte)							
144	0	Status Parameter - 1 data (Low Byte)							
	1	Status Parameter - 1 data (Hi Byte)							
	2	Status Parameter - 2 data (Low Byte)							
	3	Status Parameter - 2 data (Hi Byte)							
	4	Status Parameter - 3 data (Low Byte)							
	5	Status Parameter - 3 data (Hi Byte)							
	6	Status Parameter - 4 data (Low Byte)							
	7	Status Parameter - 4 data (Hi Byte)							
145	0	Status Parameter - 1 data (Low Byte)							
	1	Status Parameter - 1 data (Hi Byte)							
	2	Status Parameter - 2 data (Low Byte)							
	3	Status Parameter - 2 data (Hi Byte)							
	4	Status Parameter - 3 data (Low Byte)							
	5	Status Parameter - 3 data (Hi Byte)							
	6	Status Parameter - 4 data (Low Byte)							
	7	Status Parameter - 4 data (Hi Byte)							
	8	Status Parameter - 5 data (Low Byte)							
	9	Status Parameter - 5 data (Hi Byte)							
146	0	Status Parameter - 1 data (Low Byte)							
	1	Status Parameter - 1 data (Hi Byte)							
	2	Status Parameter - 2 data (Low Byte)							
	3	Status Parameter - 2 data (Hi Byte)							
	4	Status Parameter - 3 data (Low Byte)							
	5	Status Parameter - 3 data (Hi Byte)							
	6	Status Parameter - 4 data (Low Byte)							
	7	Status Parameter - 4 data (Hi Byte)							
	8	Status Parameter - 5 data (Low Byte)							
	9	Status Parameter - 5 data (Hi Byte)							
	10	Status Parameter - 6 data (Low Byte)							
	11	Status Parameter - 6 data (Hi Byte)							

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
147	0	Status Parameter - 1 data (Low Byte)							
	1	Status Parameter - 1 data (Hi Byte)							
	2	Status Parameter - 2 data (Low Byte)							
	3	Status Parameter - 2 data (Hi Byte)							
	4	Status Parameter - 3 data (Low Byte)							
	5	Status Parameter - 3 data (Hi Byte)							
	6	Status Parameter - 4 data (Low Byte)							
	7	Status Parameter - 4 data (Hi Byte)							
	8	Status Parameter - 5 data (Low Byte)							
	9	Status Parameter - 5 data (Hi Byte)							
	10	Status Parameter - 6 data (Low Byte)							
	11	Status Parameter - 6 data (Hi Byte)							
	12	Status Parameter - 7 data (Low Byte)							
	13	Status Parameter - 7 data (Hi Byte)							
148	0	Status Parameter - 1 data (Low Byte)							
	1	Status Parameter - 1 data (Hi Byte)							
	2	Status Parameter - 2 data (Low Byte)							
	3	Status Parameter - 2 data (Hi Byte)							
	4	Status Parameter - 3 data (Low Byte)							
	5	Status Parameter - 3 data (Hi Byte)							
	6	Status Parameter - 4 data (Low Byte)							
	7	Status Parameter - 4 data (Hi Byte)							
	8	Status Parameter - 5 data (Low Byte)							
	9	Status Parameter - 5 data (Hi Byte)							
	10	Status Parameter - 6 data (Low Byte)							
	11	Status Parameter - 6 data (Hi Byte)							
	12	Status Parameter - 7 data (Low Byte)							
	13	Status Parameter - 7 data (Hi Byte)							
	14	Status Parameter - 8 data (Low Byte)							
	15	Status Parameter - 8 data (Hi Byte)							

The table below presents the description of the bit data for the 0, 1 byte of 70, 71, 110, 111.

Name	Description	Related Attribute	
		Class	Attr. ID
Faulted	Drive Error	0x29	10
Warning	Not Supported	0x29	11
Running1	Motor is running Forward	0x29	7
Running2	Motor is running Reverse	0x29	8
Ready	Motor is ready to running	0x29	9
Ctrl From Net	Run/Stop control	0x29	15
Ref From Net	Speed control	0x2A	29
At Reference	Reach at reference Speed	0x2A	3
Drive State	Current Motor State	0x29	6
Speed Actual	Speed Command	0x2A	7

Output Instance

The command data sent from PLC or a Client device to the Drive, on periodical frequency.

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
20	0						Fault Reset		Run Fwd
	1	0							
	2	Speed Reference (Low Byte) – RPM unit							
	3	Speed Reference (High Byte) – RPM unit							
21	0		NetRef (note2)	NetCtrl (note2)			Fault Reset	Run Rev	Run Fwd
	1	0							
	2	Speed Reference (Low Byte) – RPM unit							
	3	Speed Reference (High Byte) – RPM unit							
100	0						Fault Reset		Run Fwd
	1	0							
	2	Speed Reference (Low Byte) – Hz unit							
	3	Speed Reference (High Byte) – Hz unit							
101	0		NetRef	NetCtrl			Fault Reset	Run Rev	Run Fwd
	1	0							
	2	Speed Reference (Low Byte) – Hz unit							
	3	Speed Reference (High Byte) – Hz unit							
121	0	Control Parameter - 1 data (Low Byte)							
	1	Control Parameter - 1 data (Hi Byte)							
122	0	Control Parameter - 1 data (Low Byte)							
	1	Control Parameter - 1 data (Hi Byte)							
	2	Control Parameter - 2 data (Low Byte)							
	3	Control Parameter - 2 data (Hi Byte)							
123	0	Control Parameter - 1 data (Low Byte)							
	1	Control Parameter - 1 data (Hi Byte)							
	2	Control Parameter - 2 data (Low Byte)							
	3	Control Parameter - 2 data (Hi Byte)							
	4	Control Parameter - 3 data (Low Byte)							
	5	Control Parameter - 3 data (Hi Byte)							
124	0	Control Parameter - 1 data (Low Byte)							
	1	Control Parameter - 1 data (Hi Byte)							
	2	Control Parameter - 2 data (Low Byte)							
	3	Control Parameter - 2 data (Hi Byte)							
	4	Control Parameter - 3 data (Low Byte)							
	5	Control Parameter - 3 data (Hi Byte)							
	6	Control Parameter - 4 data (Low Byte)							
	7	Control Parameter - 4 data (Hi Byte)							

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
125	0	Control Parameter - 1 data (Low Byte)							
	1	Control Parameter - 1 data (Hi Byte)							
	2	Control Parameter - 2 data (Low Byte)							
	3	Control Parameter - 2 data (Hi Byte)							
	4	Control Parameter - 3 data (Low Byte)							
	5	Control Parameter - 3 data (Hi Byte)							
	6	Control Parameter - 4 data (Low Byte)							
	7	Control Parameter - 4 data (Hi Byte)							
	8	Control Parameter - 5 data (Low Byte)							
	9	Control Parameter - 5 data (Hi Byte)							
126	0	Control Parameter - 1 data (Low Byte)							
	1	Control Parameter - 1 data (Hi Byte)							
	2	Control Parameter - 2 data (Low Byte)							
	3	Control Parameter - 2 data (Hi Byte)							
	4	Control Parameter - 3 data (Low Byte)							
	5	Control Parameter - 3 data (Hi Byte)							
	6	Control Parameter - 4 data (Low Byte)							
	7	Control Parameter - 4 data (Hi Byte)							
	8	Control Parameter - 5 data (Low Byte)							
	9	Control Parameter - 5 data (Hi Byte)							
	10	Control Parameter - 6 data (Low Byte)							
	11	Control Parameter - 6 data (Hi Byte)							
127	0	Control Parameter - 1 data (Low Byte)							
	1	Control Parameter - 1 data (Hi Byte)							
	2	Control Parameter - 2 data (Low Byte)							
	3	Control Parameter - 2 data (Hi Byte)							
	4	Control Parameter - 3 data (Low Byte)							
	5	Control Parameter - 3 data (Hi Byte)							
	6	Control Parameter - 4 data (Low Byte)							
	7	Control Parameter - 4 data (Hi Byte)							
	8	Control Parameter - 5 data (Low Byte)							
	9	Control Parameter - 5 data (Hi Byte)							
	10	Control Parameter - 6 data (Low Byte)							
	11	Control Parameter - 6 data (Hi Byte)							
	12	Control Parameter - 7 data (Low Byte)							
	13	Control Parameter - 7 data (Hi Byte)							

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
128	0	Control Parameter - 1 data (Low Byte)							
	1	Control Parameter - 1 data (Hi Byte)							
	2	Control Parameter - 2 data (Low Byte)							
	3	Control Parameter - 2 data (Hi Byte)							
	4	Control Parameter - 3 data (Low Byte)							
	5	Control Parameter - 3 data (Hi Byte)							
	6	Control Parameter - 4 data (Low Byte)							
	7	Control Parameter - 4 data (Hi Byte)							
	8	Control Parameter - 5 data (Low Byte)							
	9	Control Parameter - 5 data (Hi Byte)							
	10	Control Parameter - 6 data (Low Byte)							
	11	Control Parameter - 6 data (Hi Byte)							
	12	Control Parameter - 7 data (Low Byte)							
	13	Control Parameter - 7 data (Hi Byte)							
	14	Control Parameter - 8 data (Low Byte)							
	15	Control Parameter - 8 data (Hi Byte)							

The table below presents the data description of the 0Byte of 20, 21, 100 and 101.

Name	Description	Related Attribute	
		Class	Attr. ID
Run Fwd note1)	Forward Run Command	0x29	3
Run Rev note1)	Reverse Run Command	0x29	4
Fault reset note1)	Fault Reset Command	0x29	12
NetRef note2)	Not used	0x2A	4
NetCtrl note2)	Not used	0x29	5
Speed Reference	Speed Command	0x2A	8

note1) refer to the Drive Run and Fault in the Control Supervisor Object (Class 0x29).

note2) the setting of the Reference Control and Run/Strop Control can be made only by the LCD Control Panel. Therefore, NetRef and NetCtrl are not used at the Instances 21 and 101.

EXPLICIT MESSAGE

A non-periodic communication method used for reading or writing the attribute value of the Drive or EtherNet/IP. The UCMM method which can communicate data between Originator and Target without connection, and a periodic data communication method using Class 3 Connection are available.

SUPPORTED OBJECT***Identity Object (Class 0x01, Instance 1)***

Attribute ID	Access	Attribute Name	Data Length	Attribute Value
1	Get	Vendor ID	Word	259
2	Get	Device Type (AC Drive)	Word	2
3	Get	Product Code	Word	10*
4	Get	Low Byte - Major revision High Byte - Minor revision	Word	0x0102**
5	Get	Status	Word	See "Bit Status Definition" table below
6	Get	Serial Number	Double Word	Serial number is made by last four numbers of MAC ID. For example, if MAC ID is 00:0B:29:00:00:22, Serial number will be 0x29000022
7	Get	Product Name	12 Byte	ACN Ethernet

*Product code '6' means ACN AC drive.

**The Upper and Lower byte represent the Major Revision and Minor Revision, respectively. For example, 0x0102 means 2.01. The version of the Ethernet communication is indicated in the Keypad CM. 6 FBus S/W Ver.

Bit Status Definition	
Bit	Definition
0	0: Device is not connected to Master. 1: Device is connected to Master.
1	Reserved
2	Configured (always '0')
3	Reserved
4	0 : Unknown
5	2: in case of incorrect I/O connection.
6	3: in case of no previous I/O connection at all.
7	5: Major Fault
	6: I/O in connection.
8	Minor Recoverable Fault (In case of Warning state of drive)
9	Minor Unrecoverable Fault (N/A)
10	Major Recoverable Fault (In case of H/W trip state of drive)
11	Major Unrecoverable Fault (In case of trip state except for H/W trip of drive)

Service Code	Definition	Support for Class	Support for Instance
0x0E	Get Attribute Single	No	Yes
0x05	Reset	No	Yes
0x10	Set Attribute Single	No	Yes

Motor Data Object (Class 0x28, Instance 1)

Attribute ID	Access	Attribute Name	Range	Definition
3	Get	Motor Type	0~10	0 : Non-standard motor
				1 : PM DC Motor
				2 : FC DC Motor
				3 : PM Synchronous Motor
				4 : FC Synchronous Motor
				5 : Switched Reluctance Motor
				6 : Wound Rotor Induction Motor
				7 : Squirrel Cage Induction Motor
				8 : Stepper Motor
				9 : Sinusoidal PM BL Motor
				10 : Trapezoidal PM BL Motor
6	Get/Set	Motor Rated Current	0.0~1000.0	[Get] Read Rated Current of bA-13. [Set] The setting value is reflected on Rated Current of bA-13 Scale: 0.1
7	Get/Set	Motor Rated Voltage	0~690	[Get] Read Rated Voltage of bA-15 [Set] The setting value is reflected on Rated Voltage of bA-15 Scale: 1

Service Code	Definition	Support for Class	Support for Instance
0x0E	Get Attribute Single	No	Yes
0x10	Set Attribute Single	No	Yes

Control Supervisor Object (Class 0x29, Instance 1)

Attribute ID	Access	Attribute Name	Range	Definition
3	Get / Set	Forward Run Cmd.	0	Stop Operation in normal direction (See "Drive Run Command" table below)
			1	
4	Get / Set	Reverse Run Cmd.	0	Stop Operation in reverse direction (See "Drive Run Command" table below)
			1	
5	N/A	Net Control	-	Can be set up as Drive parameter only.
6	Get	Drive State	0	Vendor specific
			1	Startup
			2	Not_Ready
			3	Ready
			4	Enabled
			5	Stopping
			6	Fault_Stop
			7	Faulted
7	Get	Running Forward	0	Stopping
			1	Operating in normal direction
8	Get	Running Reverse	0	Stopping
			1	Operating in reverse direction
9	Get	Drive Ready	0	Being reset or tripped
			1	Normal condition for Drive operation

Attribute ID	Access	Attribute Name	Range	Definition
10	Get	Drive Fault	0	Presently not tripped
			1	Presently being tripped.
12	Get / Set	Drive Fault Reset	0	Trip Reset after a trip. Reset can be done only when TRUE is inputted in FALSE status (See the Drive Fault Code Table below).
			1	
13	Get	Drive Fault Code		See the Drive Fault Code Table below
14	Get	Control From Net.	0	Provide operation reference through a source other than FieldBus communication.
			1	Provide operation reference through FieldBus communication source.

Drive Run Command			
Run1	Run2	Trigger Event	Run Type
0	0	Stope	NA
0→1	0	Run	Run1
0	0→1	Run	Run2
0→1	0→1	No Action	NA
1	1	No Action	NA
1→0	1	Run	Run2
1	1→0	Run	Run1

Run1 stands for the Forward Run Cmd. and Run 2 stands for the Reverse Run Cmd. In other words, the Option gives an operation reference to the Drive at the moment of change from 0(FALSE) to 1(TRUE). When the Forward Run Cmd. value has been read, it does not represent the present operation status of the Drive, but the operation command value of the Option.

Drive Fault Codes			
Fault Code Number	Description		
0x0000	None		
0x1000	Ethermal	Out Phase Open	DriveOLT
	InPhaseOpen	ThermalTrip	UnderLoad
	ParaWriteTrip	IOBoardTrip	PrePIDFail
	OptionTrip1	OptionTrip2	OptionTrip3
	LostCommand	UNDEFINED	LostKeypad
0x2200	OverLoad		
0x2310	OverCurrent1		
0x2330	GFT		
0x2340	OverCurrent2		
0x3210	OverVoltage		
0x3220	LowVoltage		
0x2330	GroundTrip		
0x4000	NTCOpen		
0x4200	OverHeat		
0x5000	FuseOpen	HWDiag	
0x7000	FanTrip		
0x7120	No Motor Trip		
0x7300	EncorderTrip		

NOTE: If the Drive is tripped, the Drive Fault becomes TRUE.

Drive Fault Codes		
Fault Code Number	Description	
0x8401	SpeedDevTrip	
0x8402	OverSpeed	
0x9000	ExternalTrip	BX
<i>NOTE: If the Drive is tripped, the Drive Fault becomes TRUE.</i>		

At 0 → 1 (FALSE → TRUE), the Drive Fault Reset gives TRIP RESET reference to Drive. Overwriting 1 (TRUE) on 1 (TRUE) does not generate RESET reference to the Drive trip. To send RESET reference from Option to Drive in 1 (TRUE) status, write 0 (FAULT) and then write 1(TRUE) again.

Service Code	Definition	Support for Class	Support for Instance
0x0E	Get Attribute Single	No	Yes
0x10	Set Attribute Single	No	Yes

AC Drive Object (Class 0x2A, Instance 1)

Attribute ID	Access	Attribute Name	Range	Definition
3	Get	At Reference	0	Means that the output frequency has not reached the set up frequency, yet.
			1	Means that the output frequency has reached the set up frequency.
4	Not supported	Net Reference	-	-
6	Get	Drive Mode *	0	Vendor Specific Mode
			1	Open Loop Speed(Frequency)
			2	Closed Loop Speed Control
			3	Torque Control
			4	Process Control (e.g. PI)
7	Get	Speed Actual	0~24000	Displayed present output frequency in [rpm] unit.
8	Get/Set	Speed Ref	0~24000	Give reference after converting the target frequency in [rpm] unit. For this, the DRV-07 Freq Ref Src must have been set up to FieldBus.
9	Get	Actual Current	0~111.0 A	Monitor present current by 0.1 A unit basis.
29	Get	Ref.From Network	0	The frequency reference source is not the FieldBus communication.
			1	The frequency reference source is the FieldBus communication.
100	Get	Actual Hz	0~400.00 Hz	Monitor present operating frequency by Hz unit.
101	Get/Set	Reference Hz	0~400.00 Hz	When the dr-07 Freq Ref Src is set to FieldBus, the reference frequency can be set up by communication.
102	Get/Set	Acceleration Time **	0~6000.0 sec	Set-up/monitor Drive acceleration time.
103	Get/Set	Deceleration Time ***	0~6000.0 sec	Set-up/monitor Drive deceleration time.
<p><i>*Related with dr-10 Torque Control and AP-01 App mode. If the dr-10 Torque Control is set to 'Yes,' Drive Mode becomes "Torque Control," and if AP-01 App mode is set to Proc PID, the Drive Mode becomes "Process Control (e.g.PI)."</i></p> <p><i>**dr-03: Acc Time value.</i></p> <p><i>*** dr-04: Dec Time value.</i></p>				

Service Code	Definition	Support for Class	Support for Instance
0x0E	Get Attribute Single	No	Yes
0x10	Set Attribute Single	No	Yes

Class 0x64 (Drive Object) – Manufacture Profile

This is the object to access Keypad Parameters of the Drive.

Instance	Access	Attribute Number	Attribute Name	Attribute Value
1 (dr Group)	Get/Set	Refer to "Chapter 4: AC Drive Parameters"	ACN Keypad Title	Setting range of ACN Parameter
2 (bA Group)				
3 (Ad Group)				
4 (Cn Group)				
5 (In Group)				
6 (OU Group)				
7 (CM Group)				
8 (AP Group)				
9 (Reserved)				
10 (Reserved)				
11 (PRT Group)				
12 (M2 Group)				

Service Code	Definition	Support for Class	Support for Instance
0x0E	Get Attribute Single	No	Yes
0x10	Set Attribute Single	No	Yes

LOST COMMAND

DRIVE KEYPAD PARAMETER

Code Number	Parameter Name	Default	Set Value	Description
Pr-12	Lost Cmd Mode	"None"	"None"	If Lost Command occurs, sets up the Drive action. (See "Lost Command Mode" table below)
			"Free-Run"	
			"Dec"	
			"Hold Input"	
			"Hold Output"	
			"Lost Preset"	
Pr-13	Lost Cmd Time	1.0	0.1~120.0 sec	Sets up Lost Command occurrence time
Pr-14	Lost Preset F	0	0~600.00 Hz	Sets up speed of Lost Preset

Lost Command Mode	
Set Value	Function
"None"	Maintains the previous status.
"Free-Run"	Lost Command Trip occurs and Free Run stops.
"Dec"	Lost Command Trip occurs and stops by Trip deceleration time.
"Hold Input"	Lost Command Warning occurs and operates by the previous operation reference.
"Hold Output"	Lost Command Warning occurs and operates at the previous operation speed.
"Lost Preset"	Lost Command Warning occurs and operates at the speed set up in the Pr-14.

MODBUS TCP LOST COMMAND STATUS

If the Modbus TCP receives no data from Client for 100msec, the Option becomes Lost Command status, and after the time set up in the Pr-13, the Drive operates according to the settings in the Pr-12.

ETHERNET/IP LOST COMMAND STATUS

If there is no Implicit Message Connection (Class1 Connection) between the Originator (PLC or Client) and Target (Drive), the Option becomes Lost Command status, and after the time set up in the Pr-13, the Drive operates according to the settings in the Pr-12.