

MOTOR CONTROL

**REGAL**

# MDHP Series High Performance Variable Frequency Drive

Ethernet Option Manual



**marathon**<sup>™</sup>  
Drives

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Before using the product, thank you for using our **MDLV-HP Ethernet option module**.

### Safety Instruction

- To prevent injury and danger in advance for safe and correct use of the product, be sure to follow the Safety Instructions.
- The instructions are divided as '**WARNING**' and '**CAUTION**' which mean as follow.



**WARNING**

This symbol indicates the possibility of death or serious injury.



**CAUTION**

This symbol indicates the possibility of injury or damage to property.

- The meaning of each symbol in this manual and on your equipment is as follows.



**This is the safety alert symbol.**



**This is the dangerous voltage alert symbol.**

- After reading the manual, keep it in the place that the user always can Contact easily.
- Before you proceed, be sure to read and become familiar with the safety precautions at the beginning of this manual. If you have any questions, seek expert advice before you proceed. Do not proceed if you are unsure of the safety precautions or any procedure.



### WARNING

- **Be cautious about dealing with CMOS elements of option board.**  
It can cause malfunction by static electricity.
- **Connection changing like communication wire change must be done with power off.**  
It can cause communication faulty or malfunction.
- **Be sure to connect exactly between Inverter and option board.**  
It can cause communication faulty or malfunction.
- **Check parameter unit when setting parameter.**  
It can cause communication faulty.

## 1. Introduction

Ethernet communication option module connects the MDHP inverter to the Ethernet network. It supports 2 kinds of protocol, Modbus/TCP and Ethernet/IP.

Controlling and monitoring of inverter can be done by PLC sequence program or any Master Module. Since Ethernet which constitutes Internet has been used and IPv4 has been supported, wherever Internet can be done, controlling and monitoring is possible. But, Ethernet network of the factory has to be connected to Internet through Gateway.

With simple wiring, installation time can be reduced and maintenance becomes easier.

## 2. Ethernet Technical Features

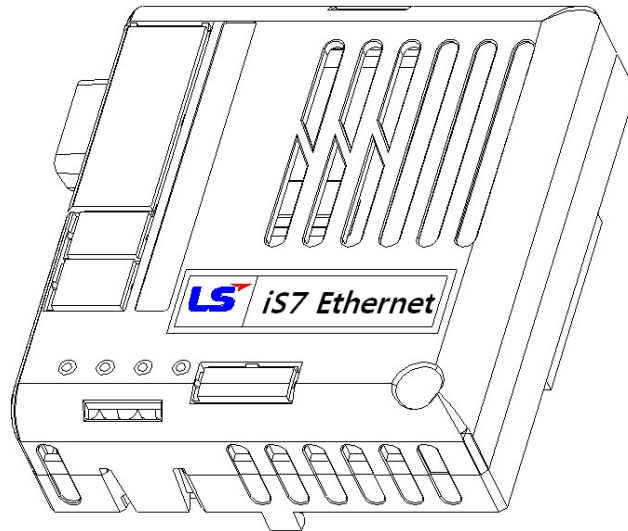
<b>Transmission Speed</b>	10Mbps, 100Mbps
<b>Transmission Method</b>	Baseband (Half, Full Duplex)
<b>Max. Extended Distance between Nodes</b>	100m (Node - Hub)
<b>Max. Node Number</b>	Hub connection
<b>Auto Negotiation</b>	Supported
<b>Max. Frame size</b>	1500 Bytes
<b>Communication Zone Access Method</b>	CSMA/CD
<b>Frame Error Checking Method</b>	CRC32
<b>Recommended Connecting Socket</b>	3 Socket
<b>Recommended Cable</b>	UTP, FTP, STP (Refer to page 6 for details.)

## 3. Product Constituents

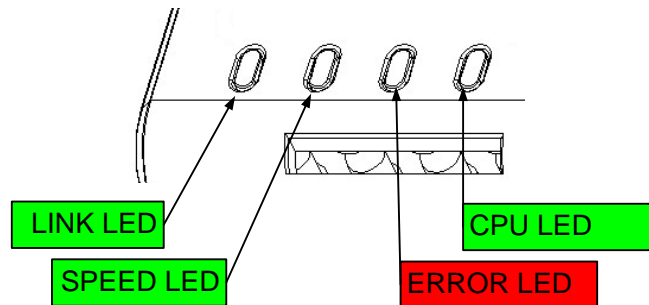
This product is consisting of the Ethernet communication module, a screw and User Manual.

## 4. The External and Mounting of Ethernet Option Module

### (1) The External of Ethernet option module

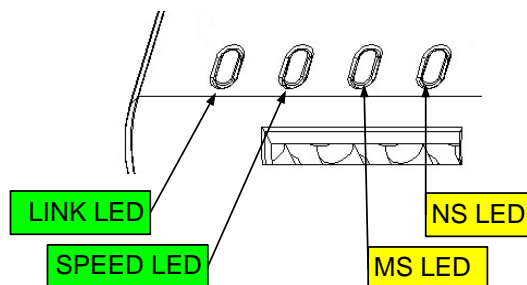


#### <Modbus TCP LED Composition>



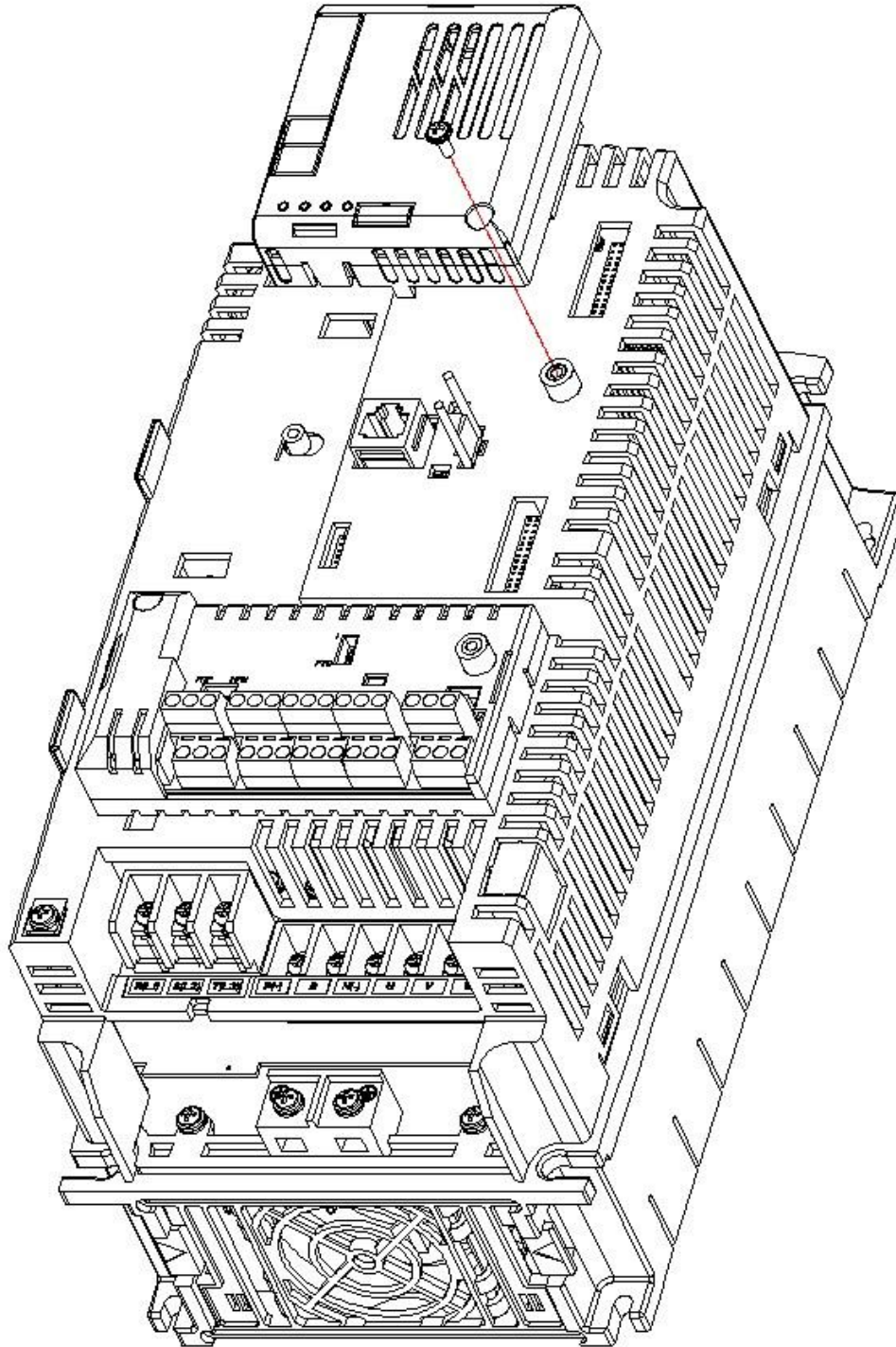
LINK, SPEED and CPU LED have a green color. ERROR LED has a red color.

#### <Ethernet IP LED Composition>



LINK and SPEED LED are a green color.  
MS and NS LED have two colors. (Green and Red)

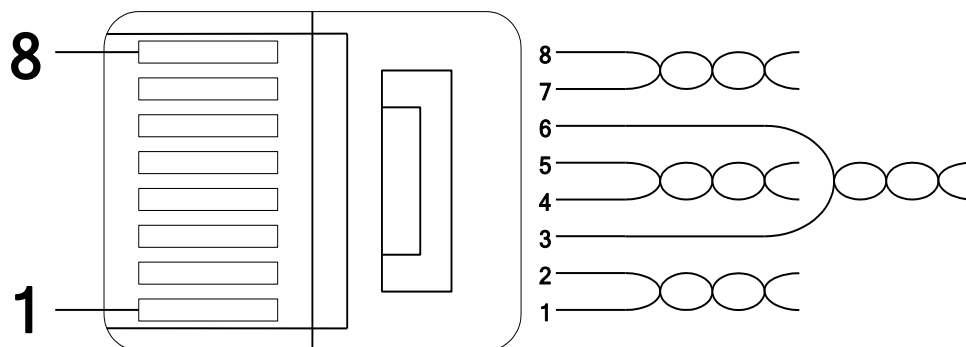
(2) Mounting the communication option module on MDHP inverter



## 5. Network Connection

Terminal block for communication cable

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.

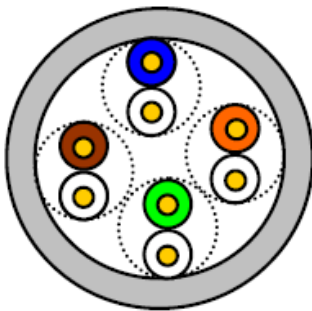
## 6. Network Cable Standard

### (1) Used frequency band

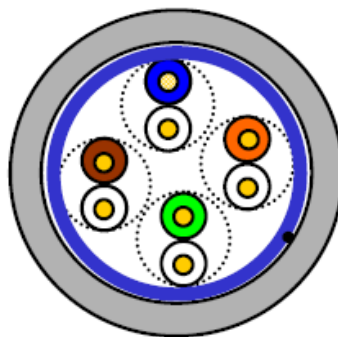
Category 5 is used. The frequency band is up to 100 MHz, Channel performance is up to 60MHz and Transmission speed is up to 100Mbps.

### (2) Cable type of twisted pair cable

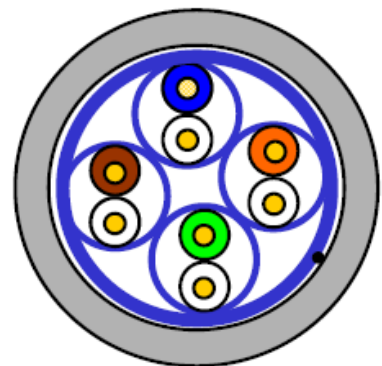
Classi- fication	Details	Purpose of cable
UTP (U.UTP)	Unshielded Twisted Pair cable for high-speed signal	Maximum 200MHz Voice + Information (Data)+Low video signal
FTP (S.UTP)	Foil screened Twisted Pair cable	Maximum 100MHz Electromagnetic interruption (EMI) or electric stability considered Voice + Information (Data) + Low Video signal
STP (S.STP)	Shielded Twisted Pair cable	Maximum 500MHz Voice +Information(Data)+ Video signal 75Ω coaxial cable replacement



UTP



FTP



STP

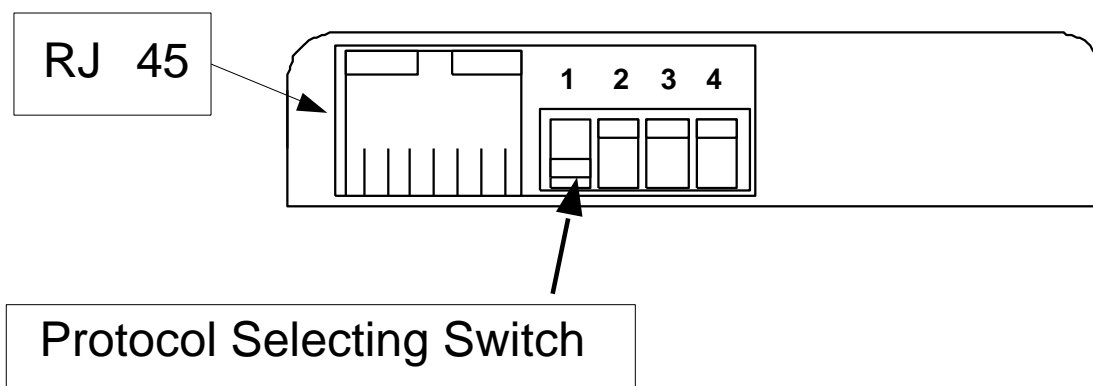
## 7. Selecting Protocol

For using the MDHP Ethernet option module, there are 2 kinds of protocol, Modbus TCP and Ethernet IP. You can select one of the protocols by selecting the No.1 switch. The switch is placed next to the RJ45 connector for Ethernet cable. No. 2, 3 and 4 of switch are not available.

Switch State	Protocol
OFF (Switch at the upper position)	<b>Modbus TCP</b>
ON (Switch at the lower position)	<b>Ethernet IP</b>

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

### <Front side of Ethernet Option module>





## 8. Ethernet Option and Related Keypad Parameters

The functions below are the inverter parameters which shows the information related with the Modbus TCP and Ethernet IP. In the parameter column, the “M” stands for the parameters used for Modbus TCP, and “E” stands for the parameters used for Ethernet IP.

Related keypad parameter with MDHP Ethernet					
Code Number	Parameter Name	Default	Set value	Description	Protocol
CNF-30	Option-1 Type	-	-	Indicates name of the communication card installed in the inverter (Ethernet).	M/E
COM-06	FBus S/W Ver	-	-	Indicates version of the communication card installed in the inverter.	M/E
COM-09	FBus Led	-	-	Shows the ON/OFF data of the LED on the Ethernet communication card.	M/E
COM-10	Opt Parameter1	0x0000	0x0000 ~0xFFFF	Sets up the IP Address.	M/E
COM-11	Opt Parameter2	0x0000	0x0000 ~0xFFFF		
COM-12	Opt Parameter3	0x0000	0x0000 ~0xFFFF	Sets up the Subnet Mask.	M/E
COM-13	Opt Parameter4	0x0000	0x0000 ~0xFFFF		
COM-14	Opt Parameter5	0x0000	0x0000 ~0xFFFF	Sets up the Gateway Address.	M/E
COM-15	Opt Parameter6	0x0000	0x0000 ~0xFFFF		
COM-16	Opt Parameter7	0	0~2	Sets up the Ethernet communication rate.	M/E
COM-17	Opt Parameter8 <sup>(Note1)</sup>	0	0~11	CIP Input Instance	E
COM-18	Opt Parameter9 <sup>(Note1)</sup>	0	0~11	CIP Output Instance	E
COM-30	ParaStatus Num	3	0~8	Automatically set up according to the CIP Input Instance.	E
COM-31	Para Status-1	0x000A	0x0000 ~0xFFFF	Sets up the inverter data address which will be read by the client.	E
COM-32	Para Status-2	0x000D	0x0000 ~0xFFFF	Sets up the inverter data address which will be read by the client.	E

Related keypad parameter with MDHP Ethernet					
Code Number	Parameter Name	Default	Set value	Description	Protocol
COM-33	Para Status-3	0x000F	0x0000 ~0xFFFF	Sets up the inverter data address which will be read by the client.	E
COM-34	Para Status-4	0x0000	0x0000 ~0xFFFF	Sets up the inverter data address which will be read by the client.	E
COM-35	Para Status-5	0x0000	0x0000 ~0xFFFF	Sets up the inverter data address which will be read by the client.	E
COM-36	Para Status-6	0x0000	0x0000 ~0xFFFF	Sets up the inverter data address which will be read by the client.	E
COM-37	Para Status-7	0x0000	0x0000 ~0xFFFF	Sets up the inverter data address which will be read by the client.	E
COM-38	Para Status-8	0x0000	0x0000 ~0xFFFF	Sets up the inverter data address which will be read by the client.	E
COM-50	Para Ctrl Num	2	0~8	Automatically set up according to the CIP Output Instance.	E
COM-51	Para Control-1	0x0005	0x0000 ~0xFFFF	The Client sets up the reference Inverter Data Address.	E
COM-52	Para Control-2	0x0006	0x0000 ~0xFFFF	The Client sets up the reference Inverter Data Address.	E
COM-53	Para Control-3	0x0000	0x0000 ~0xFFFF	The Client sets up the reference Inverter Data Address.	E
COM-54	Para Control-4	0x0000	0x0000 ~0xFFFF	The Client sets up the reference Inverter Data Address.	E
COM-55	Para Control-5	0x0000	0x0000 ~0xFFFF	The Client sets up the reference Inverter Data Address.	E
COM-56	Para Control-6	0x0000	0x0000 ~0xFFFF	The Client sets up the reference Inverter Data Address.	E
COM-57	Para Control-7	0x0000	0x0000 ~0xFFFF	The Client sets up the reference Inverter Data Address.	E
COM-58	Para Control-8	0x0000	0x0000 ~0xFFFF	The Client sets up the reference Inverter Data Address.	E
COM-94	Comm Update	-	-	Updates communication related keypad parameters.	M/E

\* (Note1) Since this is an optional parameter exclusively for Ethernet IP, it is not displayed on the Loader in case of Modbus TCP.

**(1) Option Type (Option card information, CFG-30)**

Automatically indicates the type of the communication card presently installed in the MDHP. When the MDHP Ethernet communication card is installed, “Ethernet” is displayed.

**(2) Option Version (Option version information, COM-06)**

Automatically indicates the version of the communication card presently installed in the MDHP.

**(3) FBus Led (COM-09) – Indication of LED information**

**① In case of Modbus/TCP**

Displays the ON/OFF statuses of the 4 LEDs on the communication card on the keypad parameter COM-09. Looking up the COM-9 FBus LED with keypad, 4 bits can be seen. In the order of the LED of the COM-09 (right to left), information is displayed in the said order of CPU, ERR, SPEED, and LINK LED.

If the LED is ON, the bit is 1, and if it is OFF, the bit is 0.

Bit	LED Indication
0	CPU LED
1	ERROR LED
2	SPEED LED
3	LINK LED

**COM-09 LED status example)**



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

**② In case of Ethernet IP**

Displays the ON/OFF statuses of the 2 two-colored LEDs on the right side of the 4 LEDs on the communication card on the keypad parameter COM-09.

Looking up the COM-9 FBus LED with keypad, 4 bits can be seen. The information respective to the Bit of the COM-09 is presented in the table below.

If the LED is ON, the bit is 1, and if it is OFF, the bit is 0.

Bit	LED Indication
0	NS GREEN LED
1	NS RED LED
2	MS GREEN LED
3	MS RED LED

**COM-09 LED status example)**



MS Red LED	MS Green LED	NS Red LED	NS Green LED
OFF	ON	OFF	ON

**(4) Ethernet Option의 IP Address, Subnet Mask, Gateway Address (COM-10~15) Setting**

The IP version supported by Ethernet option is v4. All the addresses and masks are expressed with (decimal).(decimal).(decimal).(decimal) and each decimal number is 0~255.

In the Ethernet option, decimal numbers are entered with hexadecimals. In particular, (hexadecimal) . (hexadecimal) . (hexadecimal) . (hexadecimal) and each hexadecimal is 00~FF. The hexadecimals are entered by being divided into two upper scale hexadecimals and two lower scale hexadecimals. The higher code number represents the lower hexadecimals.

**E.g.)** To set up IP Address 196.168.10.131;  
 Convert 196.168.10.131 into hexadecimal: C4.A8.0A.83  
 Into the COM-10 Opt Parameter1, enter 0xC4A8, and

Into the COM-11 Opt Parameter2, enter 0x0A83.

**(5) Ethernet Speed (COM-16)**

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.

If the Link LED does not light up when connected to the hub in automatic speed setting mode (Auto Negotiation), the connection will be made at changed speed.

**(6) CIP Input Instance(COM-17)**

This parameter is shown only when the protocol has been set up with the Ethernet IP sets up the format of the inverter state data which are sent by the inverter to the Client (Originator) during the I/O communication of CIP (Common Industrial Protocol). See the Assembly Object section of the Ethernet IP.

Set Value	Input Instance	Data Size	The number or Parameter
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

**(7) CIP Output Instance(COM-17)**

This parameter is shown only when the protocol has been set up with the Ethernet IP sets up the format of the inverter reference data which are sent by the Client (Originator) to the inverter for inverter control during the I/O communication of CIP (Common Industrial Protocol). See the Assembly Object section of the Ethernet IP.

Set Value	Input Instance	Data Size	The number of Parameter
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

**(8) Para Status (COM-30~38)**

This parameter is not used in case of Modbus TCP.

This parameter appears only when the set value of the Input Instance (COM-17) in the Ethernet IP is 4 or above.

COM-30 Para Status Num cannot be set up but the number of the set up parameters of the instance is shown. Enter the address of the inverter data at the same number as that of the said parameters in the COM-31~38.

**(9) Para Control (COM-50~58)**

This parameter is not used in case of Modbus TCP.

This parameter appears only when the set value of the Output Instance (COM-18) in the Ethernet IP is 4 or above.

COM-50 Para Ctrl Num cannot be set up but the number of the set up

parameters of the instance is shown. Enter the address of the inverter data, which will make use of the reference data of the Client (Originator), at the same number as that of the said parameters in the COM-51~58.

**(10) Comm UpDate (COM-94)**

At power on, the Option Parameters are expressed by the values set up in the Option, however, not reflected immediately when set up.

If the Comm Update is set to 'Yes,' this value is reflected on the Modbus/TCP communication card and only this card will be restarted.

**9. Inverter Communication Address**

See Chapter 11. Communication Function, Inverter IS-7 Manual.

**10. Modbus/TCP Frame**

**(1) Modbus/TCP Frame Composition**



Generally, Ethernet uses Ethernet II Frame.

**MODBUS Application Protocol Header (MBAP Header)**

MBAP Header constitution is presented below.

Section	Length	Description
Transaction Identifier	2 Bytes	Unique transmission number, which is increased by 1 each time the Client sends Data Frame to the Server.
Protocol Identifier	2 Bytes	Fixed at 0.
Length	2 Bytes	The Data Frame length of the Modbus, representing the length (in byte unit) from the Unit Identifier in the MBAP Header.
Unit Identifier	1 Bytes	When the Modbus TCP and Modbus RTU are connected via gate, Slave number is indicated. If Modbus TCP only is used, this is fixed to 0xFF.

**Protocol Data Unit (PDU)**

This is the practical data of the Modbus TCP consists of Function Code and Data.

Details will be described in the “(2) description on the Function Code” below.

## (2) Function Code Description

Modbus TCP is divided into Client and Server. The Client gives command and the Server responses to the command. Generally, Clients can be PLC, HMI, or PC and the Server is the inverter.

### ① Read Holding Registers

The function used to read the data in the Inverter (Server).

Constitution of the frame requested from Client to Server;

Requested Frame	Length	Value
Function code	1 Bytes	0x03
Comm. address	2 Bytes	0x0000 ~ 0xFFFF
The number of data requested	2 Bytes	1~16 (MD Inverter standard)

Constitution of the frame sent from Server to Master in response;

Response Frame	Length	Value
Function code	1 Bytes	0x03
Comm. address	1 Bytes	2 x The requested number of data
The number of data requested	The requested number of data x 2 Bytes	Value of the data of the given number from the communication address

### ② Read Input Registers

The function used to read the data in the Inverter (Server).

Constitution of the frame requested from Client to Server;



Requested Frame	Length	Value
Function code	1 Bytes	0x04
Comm. address	2 Bytes	0x0000 ~ 0xFFFF
The number of data requested	2 Bytes	1~16 (MD Inverter standard)

Constitution of the frame sent from Server to Master in response;

Response Frame	Length	Value
Function code	1 Bytes	0x03
Comm. address	1 Bytes	2 x The requested number of data
The number of data requested	The requested number of data x 2 Bytes	Value of the data of the given number from the communication address

### ③ Write Single Register

The function used to change one of the data in the Inverter (Server).

Constitution of the frame requested from Client to Server;

Requested Frame	Length	Value
Function code	1 Bytes	0x06
Comm. address	2 Bytes	0x0000 ~ 0xFFFF
Data value	2 Bytes	0x0000 ~ 0xFFFF

Constitution of the frame sent from Server to Master in response;

Response Frame	Length	Value
Function code	1 Bytes	0x06
Comm. address	2 Bytes	0x0000 ~ 0xFFFF

Data Value	2 Bytes	0x0000 ~ 0xFFFF
------------	---------	-----------------

#### ④ Write Multiple Register

The function used to change from 1 to 16 of the Inverter (Server) data consecutively.

Constitution of the frame requested from Client to Server;

Requested Frame	Length	Value
Function code	1bytes	0x10
Comm. address	2bytes	0x0000 ~ 0xFFFF
The number of data to revise	2byte	1~16 (MD Inverter standard)
Byte Count	1byte	2 X The number of data
Data value to revise	The number of data x 2 bytes	Data to revise

Constitution of the frame sent from Server to Master in response;

Response Frame	Length	Value
Function Code	1 Bytes	0x10
Comm. address	2 Bytes	0x0000 ~ 0xFFFF
The number of data to revise	2 Bytes	1~16 (MD Inverter standard)

#### (3) Except Frame

Except Frame is for the response of the Server in case of an error

occurred in the execution of the frame requested by a Client.

Exception Frame Composition

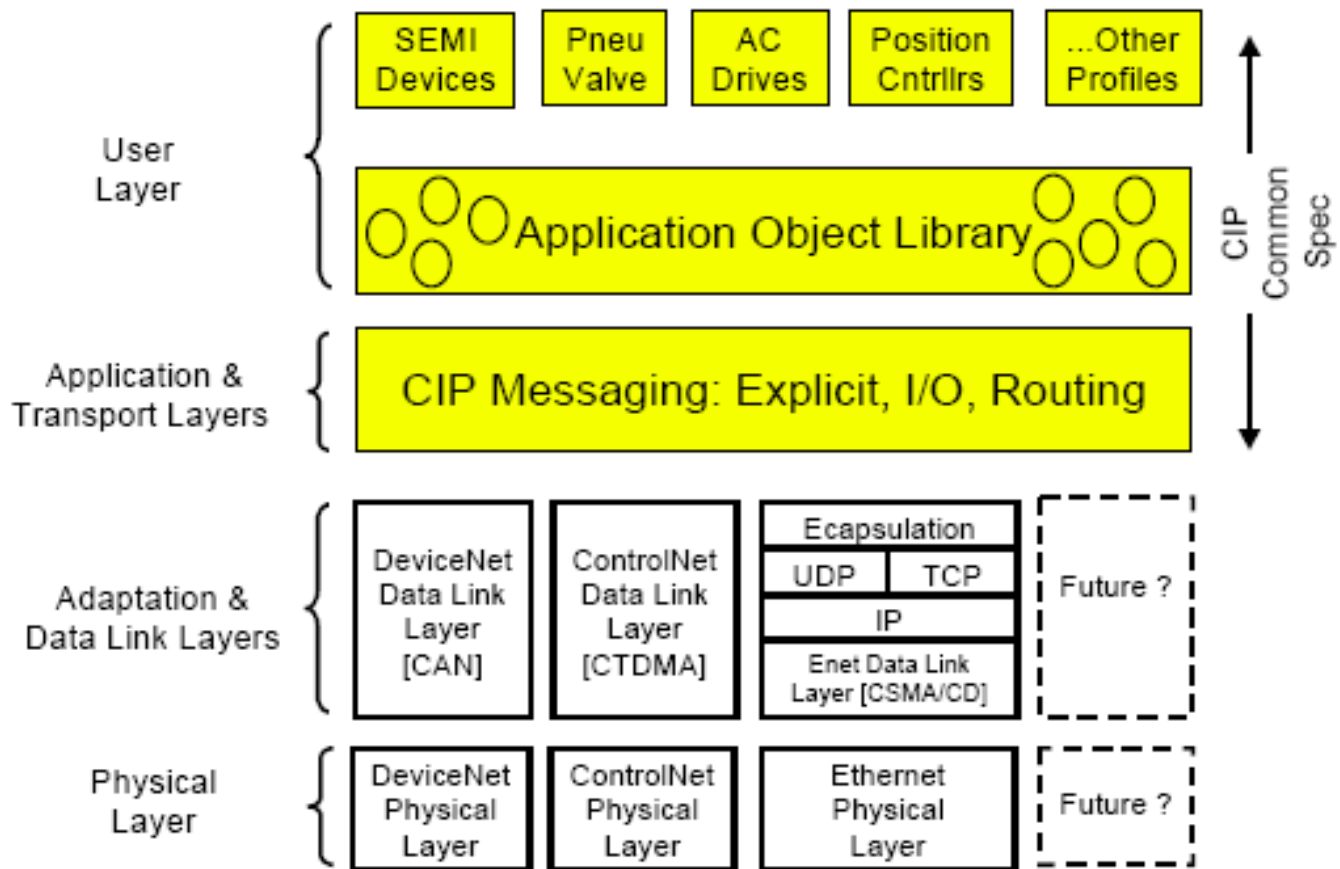
Error Frame	Length	Value
Error Code	1bytes	0x80 + Requested function code from client
Exception Code	1bytes	0x0000 ~ 0xFFFF

Exception Code Type

Exception Code Type	Code	Description
ILLEGAL FUNCTION	0x01	When unsupported function is requested
ILLEGAL DATA ADDRESS	0x02	Request or modification of the data in unused address
ILLEGAL DATA VALUE	0x03	When trying to modify data to a value out of the allowable range
SLAVE DEVICE FAILURE	0x04	Server has an error (Error in CAN communication with Inverter, error in Option initialization, failure in data communication with Inverter)
SLAVE DEVICE BUSY	0x06	Server is unable to respond because it is executing another process (Inverter parameter initializing, initial setting of Option, etc.)
WRITE PERMISSION ERROR	0x20	When trying to change a parameter which is prohibited from changing. (A unique code of LS Inverters)

## 11. Ethernet IP

### (1) Basic Constitution of Protocol



The Ethernet IP is a protocol which is implemented with the CIP (Common Industrial Protocol), specified by the ODVA, using TCP and UDP.

**Originator:** the device which is requesting connection. Also called client. The device can be PLC or Scanner.

**Target:** the device which responds to the request for connection. Also called server. The device here is Inverter.

## (2) Implicit Message

An Implicit Message is also called an I/O Message. This is the data communicated between the Client (Originator) and Server (Target) with Input Instance and Output Instance, at preset period. Class 1 connection will be implemented.

### ① Supported range

#### Transport Type

**Originator->Target:** Point to Point

**Target->Originator:** Multicast

**Transport Trigger:** Cyclic

**Configuration Connection:** 1

**Connection Tag:** Not available

#### Priority

**Originator->Target:** Scheduled

**Target->Originator:** Scheduled

**Configuration Data:** Not available

### ② Input Instance

This is the data of Inverter status sent from Inverter to PLC or other

Client devices periodically.

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
70	0						Running 1 (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)	Running 1 (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)	Running 1 (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)							
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)							

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	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)							
147	0	Status Parameter - 1 data (Low Byte)							

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	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)								

Below is the description of the data for the 0,1Byte of 70,71,110,111.



Name	Description	Related Attribute	
		Class	Attr. ID
Faulted	Inverter 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

### ③ Output Instance

The reference data sent from PLC or other Client device to the Inverter

periodically.

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 (Note 2)	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)							

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
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)							
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)							

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	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)							
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)							

Instance	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	14	Control Parameter - 8 data (Low Byte)							
	15	Control Parameter - 8 data (Hi Byte)							

Below is the description of the data for the 0Byte of 20,21,100,101.

Name	Description	Related Attribute	
		Class	Attr. ID
Run Fwd <sup>(Note1)</sup>	Forward Run Command	0x29	3
Run Rev <sup>(Note1)</sup>	Reverse Run Command	0x29	4
Fault reset <sup>(Note1)</sup>	Fault Reset Command	0x29	12
NetRef <sup>(Note2)</sup>	Not used	0x2A	4
NetCtrl <sup>(Note2)</sup>	Not used	0x29	5
Speed Reference	Speed Command	0x2A	8

(Note1) See the Drive Run and Fault sections in the Control Supervisor Object (Class 0x29).

(Note2) Reference Control and Run/Strop Control can only be set up on the LCD Control Panel. Therefore, in the Instance 21 and 101, (NetRef, NetCtrl) are not used.

### (3) Explicit Message

A non-periodical communication method used when reading or writing the attribute value of Inverter or Ethernet IP.

Two methods are available; the UCMM method communicates data without connection between originator and target, and; another method which communicates data periodically with Class 3 connection.

### (4) Supported Object

## ① Identity Object (Class 0x01, Instance 1)

## ➤ Attribute

Attribute ID	Access	Attribute Name	Data Length	Attribute Value
1	Get	Vendor ID (LS Industrial System)	Word	259
2	Get	Device Type (AC Drive)	Word	2
3	Get	Product Code	Word	11 <sup>(Note1)</sup>
4	Get	Revision Low Byte - Major Revision High Byte - Minor Revision	Word	0x0102 <sup>(Note2)</sup>
5	Get	Status	Word	<sup>(Note3)</sup>
6	Get	Serial Number	Double Word	<sup>(Note4)</sup>
7	Get	Product Name	12 Byte	MDHP Ethernet

(Note1) Product Code 11 designates the MDHP Inverter.

(Note2) Revision agrees with the version of the Ethernet communication card. The upper Byte stands for the Major Revision, and the lower Byte stands for the Minor Revision. For example, 0x0102 means 2.01. The version of Ethernet communication card is indicated in the Keypad COM-6 FBus S/W Ver.

(Note3) Definition of Status Bit

Bit	Meaning
0	0: Master is not connected with any device 1: Master is connected with a device
1	Reserved
2	Configured (always '0' because MD Ethernet IP is not supported)
3	Reserved

Bit	Meaning
4	0: Unknown
5	2: in case of incorrect IO connection
6	3: in case of no IO connection has ever been made
7	5: Major Fault 6: IO in connection
8	Minor Recoverable Fault (when the Inverter is in Warning status)
9	Minor Unrecoverable Fault (N/A)
10	Major Recoverable Fault (when the Inverter is H/W tripped)
11	Major Unrecoverable Fault (when the Inverter is tripped excluding H/W )

(Note4) Serial No. uses the last 4 digits of the MAC ID.  
E.g.) if MAC ID is 00:0B:29:00:00:22, the Serial No. is 0x29000022.

➤ Service

Service Code	Definition	Support for Class	Support for Instance
0x0E	Get Attribute Single	No	Yes
0x05	Reset	No	Yes
0x01	Get Attribute All	No	Yes

② Motor Data Object (Class 0x28, Instance 1)

➤ Attribute

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 Curr	0.0~1000.0	<b>[Get]</b> Reads BAS-13 Rated Curr value. <b>[Set]</b> Set up value is reflected on the BAS-13 Rated Curr. Scale 0.1
7	Get/ Set	Motor Rated Volt	0~690	<b>[Get]</b> Reads BAS-15 Rated Voltage. <b>[Set]</b> Set up value is reflected on the BAS-15 Rated Voltage. Scale 1

➤ Service

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

### ③ Control Supervisor Object (Class 0x29, Instance 1)

➤ Attribute

Attribute ID	Access	Attribute Name	Range	Definition
3	Get / Set	Forward Run Cmd.	0	Stop
			1	Operation in normal direction <sup>(Note1)</sup>
4	Get / Set	Reverse Run Cmd.	0	Stop
			1	Operation in reverse direction <sup>(Note1)</sup>
5	N/A	Net Control	-	Can be set up as Inverter parameter only.
6	Get	Drive State	0	Vendor specific
			1	Startup
			2	Not Ready (being reset)
			3	Ready (stopping)
			4	Enabled (running, except decelerating to stop)
			5	Stopping (decelerating to stop)
			6	Fault Stop
			7	Faulted (tripped)
7	Get	Running Forward	0	Stopping
			1	Operating in normal direction
8	Get	Running Reverse	0	Stopping
			1	Operating in normal direction
9	Get	Drive Ready	0	Being reset or tripped
			1	Normal condition for Inverter operation
10	Get	Drive	0	Presently not tripped

Attribute ID	Access	Attribute Name	Range	Definition
		Fault	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 (Note2).
			1	
13	Get	Drive Fault Code		See the Drive Fault Code Table below (Note2).
14	Get	Control From Net.	0	Provide operation reference through a source other than DeviceNet communication.
			1	Provide operation reference through DeviceNet communication source.

(Note1) Drive Run Command

Inverter operation using Forward Run Cmd. and Reverse Run Cmd.

Run1	Run2	Trigger Event	Run Type
0	0	Stop	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

In the above table, 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 Inverter 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 Inverter, but for the operation command value of the Option.

**(Note2) Drive Fault**

If the Inverter is tripped, the Drive Fault becomes TRUE.

At this time, the Drive Fault Codes are as follow;

**Drive Fault Code**

Fault Code Number	Description
0x0000	None
0x1000	Ethermal                      Out Phase Open    InverterOLT 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
0x8401	SpeedDevTrip
0x8402	OverSpeed
0x9000	ExternalTrip    BX

**Drive Fault Reset**

At 0 → 1 (FALSE → TRUE), the Drive Fault Reset gives TRIP RESET reference to Inverter. Overwriting 1 (TRUE) on 1 (TRUE) does not

generate RESET reference to the Inverter trip. To send RESET reference from Option to Inverter in 1 (TRUE) status, write 0 (FAULT) and then write 1(TRUE) again.

➤ Service

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

④ AC Drive Object (Class 0x2A, Instance 1)

➤ Attribute

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 (Note1)	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	SpeedActual	0~24000	Displays present output frequency in [rpm] unit.
8	Get/Set	SpeedRef	0~24000	Give reference on the target frequency in [rpm] unit. For this, the DRV-07

Attribute ID	Access	Attribute Name	Range	Definition
				Freq Ref Src must have been set up to FieldBus.
9	Get	Actual Current	0~111.0 A	Monitors present current by 0.1 A unit basis.
29	Get	Ref.From Network	0	The frequency reference source is not the DeviceNet communication.
			1	The frequency reference source is the DeviceNet communication.
100	Get	Actual Hz	0~400.00 Hz	Monitors present operating frequency by Hz unit.
101	Get/Set	Reference Hz	0~400.00 Hz	When the DRV-07 Freq Ref Src is set to 8.FieldBus, the reference frequency can be set up through communication.
102	Get/Set	Acceleration Time (Note2)	0~600 0.0 sec	Set-up/monitor Inverter acceleration time.
103	Get/Set	Deceleration Time (Note3)	0~600 0.0 sec	Set-up/monitor Inverter deceleration time.

(Note1) Related with the DRV-10 Torque Control and APP-01 App mode. If the DRV-10 Torque Control is set to 'Yes,' the Drive Mode becomes "Torque Control," and if the APP-01 App mode is set to Proc PID, MMC, the Drive Mode becomes "Process Control (e.g.PI)."

(Note2) DRV-03 Acc Time value.

(Note3) DRV-04 Dec Time value.

➤ Service

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

### ⑤ Class 0x64 (Inverter Object) – Manufacture Profile

The object to access the Keypad Parameters of the Inverter.

#### ➤ Attribute

Instance	Access	Attribute Number	Attribute Name	Attribute Value
1 (DRV Group)	Get/Set	Identical to MDHP Manual Code No.	MDHP Keypad Title (Refer to MDHP Manual)	Setting range of MDHP Parameter (Refer to MDHP Manual)
2 (BAS Group)				
3 (ADV Group)				
4 (CON Group)				
5 (IN Group)				
6 (OUT Group)				
7 (COM Group)				
8 (APP Group)				
9 (AUT Group)				
10 (APO Group)				
11 (PRT Group)				
12 (M2 Group)				

#### ➤ Service

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

## 12. Lost Command

### (1) Inverter Keypad Parameter

Code	Parameter	Default	Set Value	Description
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Number	Name			
PRT-12	Lost Cmd Mode	"None"	"None" "Free-Run" "Dec" "Hold Input" "Hold Output" "Lost Preset"	If a Lost Command occurs, sets up the Inverter action. (Note1)
PRT-13	Lost Cmd Time	1.0	0.1~120.0 sec	Sets up Lost Command occurrence time
PRT-14	Lost Preset F	0	0~600.00 Hz	Sets up speed of Lost Preset

(Note1) Lost Command Mode

Set Value	Function
"None"	Maintains the previous status.
"Free-Run"	Lost Command Trip occurs and Free Run stopped.
"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 PRT-14.

### (2) 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 PRT-13, the Inverter operates according to the settings in the PRT-12.

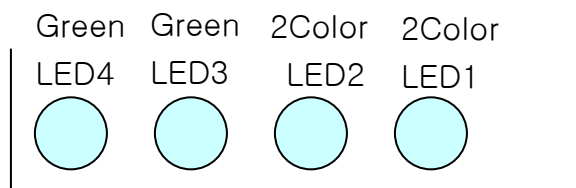
### (3) Ethernet IP Lost Command Status

If there is no Implicit Message Connection (Class1 Connection) between the Originator (PLC or Client) and Target (Inverter), the Option becomes Lost Command status, and after the time set up in the PRT-13, the

Inverter operates according to the settings in the PRT-12.

### 13. LED Information and Troubleshooting

MDHP Ethernet communication card has 4 LEDs which show the status of the protocol. These LED functions differ by the present Ethernet Protocol. Ref.) 4. Appearance and Installation of Ethernet Option



#### (1) Ethernet Communication Status LED

LED	Color	Function and Troubleshooting
LED3 (Speed)	Green	<b>ON</b> - communication speed is 100Mbps. <b>OFF</b> - communication speed is 10Mbps.
LED2 (Link)	Green	<b>ON</b> - ready for communication. <b>OFF</b> - Link LED is OFF if the communication cable has a problem. Check up the communication cable.

#### (2) Modbus TCP LED and Troubleshooting

LED	Color	Function and Troubleshooting
LED1 (CPU)	Green	<b>Flashing</b> - the MDHP Ethernet communication card is supplied with correct power, and the Modbus/TCP communication card CPU operates normally. <b>OFF</b> - the CPU is not supplied with power. Reinstall the card.



LED	Color	Function and Troubleshooting
LED2 (ERROR)	Red	<p><b>OFF</b> - the MDHP Ethernet communication card is operating normally without error.</p> <p><b>ON</b> - IP Address is set to 0x00.0x00.0x00.0x00 or 0xFF.0xFF.0xFF.0xFF. Since 0.0.0.0 and 255.255.255.255 are special IPs, it is recommended not to use them.</p> <p><b>CPU and ERROR flash alternatively</b> - the EEPROM of the Ethernet Option is bad. Replace the EEPROM.</p> <p><b>CPU and ERROR flash simultaneously</b> - Ethernet has lost communication with the Option. Reinstall the Option.</p> <p><b>ERROR flashes at longer intervals than that of the CPU</b> - IP conflicts with another device having the same IP in the Network. Check and set the IP again.</p>

**(3) Ethernet IP LED and Troubleshooting**

LED	Color	Function and Troubleshooting
LED1 (NS) Network State	Green	<p><b>OFF</b> - Client and TCP are not in connection.</p> <p><b>Flashing</b> - Client and TCP are connected and registered. UCMM communication is possible.</p> <p><b>ON</b> - Class 1 Connection has been made and being in I/O communication.</p>
	Red	<p><b>OFF</b> - the Network has no problem.</p> <p><b>Flashing</b> - Class 1 Connection was disconnected abnormally. Check Network cables and their connection.</p> <p><b>ON</b> - IP conflicts with another device having the same IP in the Network. Check and set the IP again.</p>

LED	Color	Function and Troubleshooting
LED2 (MS) Machine State	Green	<b>ON</b> - the Option is in normal condition. <b>OFF</b> - the Option is in problem.
	Red	<b>ON</b> - the IP Address is set to 0x00.0x00.0x00.0x00 or 0xFF.0xFF.0xFF.0xFF. Since 0.0.0.0 and 255.255.255.255 are special IPs, it is recommended not to use them. <b>Flashing</b> - Ethernet has lost communication with the Option. Reinstall the Option. <b>OFF</b> - the Option is in normal condition.

When Ethernet IP is selected and the Option is initialized, the LEDs light up and out in following sequence;

MS GREEN → MS RED → NS GREEN → NS RED.

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