FnIO G - Series:

GN-9289

GN-9289 (MODBUS TCP/UDP Network Adapter)

Date: 2016. 4.7

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History

REV.	PAGES	REMARKS	DATE	Editor
Preliminary		Preliminary	Dec 04, 2015	Jun, seok hyun
1.04			Mar 3, 2016	DHLEE
1.05		General Specification	Mar 25, 2016	DHLEE
1.06		Special Register	Apr 14, 2016	DHLEE
1.07		Special Register 1041	May 26, 2016	DHLEE
1.10		Special Register(0x1100)Master fault action option	Nov 8, 2017	GWLEE
1.11		EthernetIP	Nov, 21 2017	GWLEE

1. ENVIRONMENT SPECIFICATION

Environmentalspecification	
Operating Temperature	60℃ ~ 70℃ : Power dissipation is limited to 0.8A. -40℃ ~ 60℃ : 1.5A full load is allowed.
UL Temperature	-20℃~60℃
Storage Temperature	-40℃~85℃
Relative Humidity	5% ~ 90% non-condensing
Mounting	DIN rail
General specification	
Shock Operating	IEC 60068-2-27
Vibration Resistance	Based on IEC 60068-2-6 Sine Vibration 5 ~ 25Hz : 1.6mm 25 ~ 300Hz : 4g Sweep Rate : 1 Oct/min, 20 cycles Random Vibration 10 ~ 40Hz : 0.0125g^2/Hz 40 ~ 100Hz : 0.0125 → 0.002g^2/Hz 100 ~ 500Hz : 0.002g^2/Hz 500 ~ 2000Hz : 0.002 → 1.3 x 10-$^4g^2$/Hz Test time : 1hrs for each test
EMC Resistance Burst/ESD	EN 61000-6-2 : 2005 EN 61000-6-4/A11 : 2011
Installation Pos. / Protect. Class	Variable/IP20
Product Certifications	CE, UL

2. GN-9289 (MODBUS TCP/UDP NETWORK ADAPTER)

2.1. GN-9289 Specification

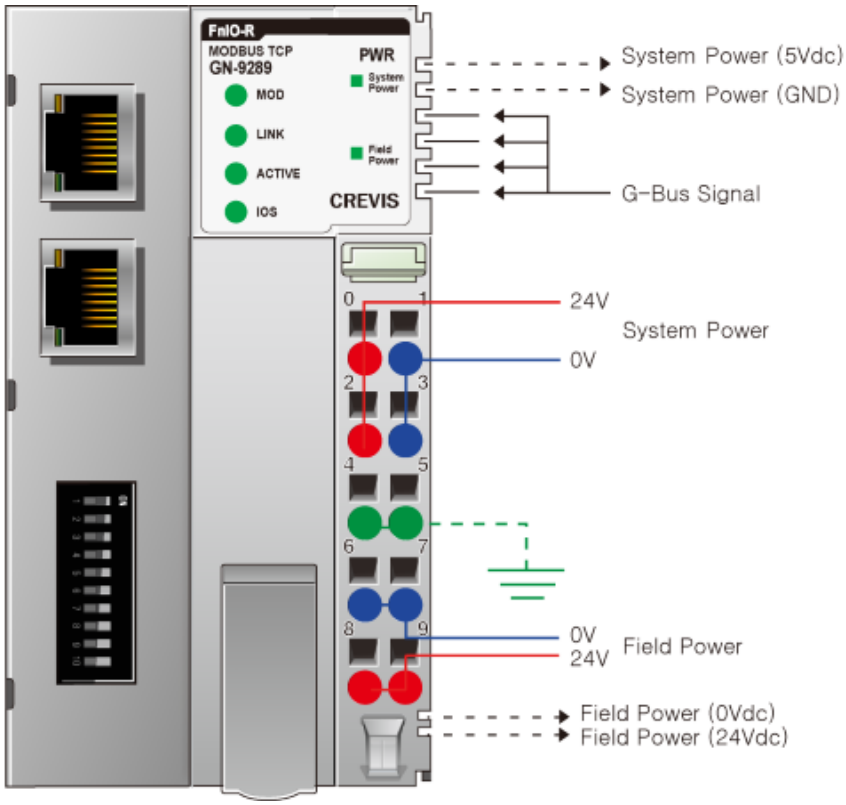
Items	Specification
Input Specification	
Adapter Type	Slave node (MODBUS/TCP,MODBUS/UDP Server)
Protocol	MODBUS/TCP,MODBUS/UDP,HTTP,DHCP,10 TCP Connections
Sub-Protocol	*Ethernet/IP
Max. Expantsion Module	63 slots
Max. Data Size(Input + Output)	Max 128 bytes each slot
Max Length Bus Line	Up to 100m from Ethernet Hub/Switch with twisted CAT5 UTP/STP
Max. Nodes	Limited by Ethernet Specification.
Baud Rate	10/100Mbps, Auto-negotiation, Full duplex
Interface Connector	RJ-45 socket * 2pcs
IP-Address Setup	Via DHCP/BOOTP or IOGuide(Crevis Software)
IP-Address Range	xxx.xxx.xxx.1 ~ 253 (User area) xxx.xxx.xxx.254 ~ 255 (Reserved for IAP Function)
Serial Port	RS232 for MODBUS/RTU, Touch Pannel or IOGuide
Serial Configuration (RS232)	Node : 1 (Fixed) Baud Rate : 115200 (Fixed) Data bit : 8 (Fixed) Parity bit : No parity (Fixed) Stop bit : 1 (Fixed)
Indicator	6 LEDs 1 Green/Red, Module Status (MOD) 1 Green, Physical Connection (LINK) 1 Green, Exchange Data/Traffic Present (ACTIVE) 1 Green/Red, Expansion I/O Module Statsus (IOS) 1 Green, System Power Status 1 Green, Field Power Status 2 LEDs (each RJ45 Connector) 1 Yellow, Link/Active 1 Green, Not used
Module Location	Starter module left side of G-Series system
Field Power Detection	About 14Vdc
General specification	
System Power	Supply voltage : 24Vdc nominal Supply voltage range : 15~32Vdc Protection : Output current limit (Min. 1.5A) Reverse polarity protection
Power Dissipation	70mA typical @ 24Vdc
Current for I/O Module	1.5A @ 5Vdc (When using in '60℃ ~ 70℃' temperature environment, the power dissipation is limited to 0.8A.)
Isolation	System power to internal logic : Non-isolation System power I/O driver : Isolation
Field Power	Supply voltage : 24Vdc typical (Max. 32Vdc) * Field Power Range is different depending on IO Module series. Refer to IO Module`s Specification.
Max. Current Field Power Contact	DC 10A Max

Weight	162g
Module Size	54mm x 99mm x 70mm
Environment Condition	**Refer to '1. Environment Specification'**

* When using Ethernet/IP only, tcp timeout connection time value should be '0'. '0' value means tcp connection time out is disabled. Refer to 'Adapter TCP/IP Special Register (0x1040, 4160)' at section '3.3.3'

** When using in '60℃ ~ 70℃' temperature environment, the power dissipation is limited to 0.8A.

2.2. GN-9289 Wiring Diagram



Pin No.	Signal Description	Signal Description	Pin No.
0	System Power, 24V	System Power, Ground	1
2	System Power, 24V	System Power, Ground	3
4	F.G	F.G	5
6	Field Power, Ground	Field Power, Ground	7
8	Field Power, 24V	Field Power, 24V	9

2.3. GN-9289 LED Indicator

2.3.1. LED Indicator

LED No.	LED Function / Description	LED Color
MOD	Module Status	Green/Red
LINK	Physical Connection	Green
ACTIVE	Exchange Data/Traffic Present	Green
IOS	Extension Module Status	Green/Red
System Power	System Power Enable	Green
Field Power	Field Power Enable	Green

2.3.2. MOD (Module Status LED)

Status	LED	To indicate
Not Powered	OFF	Not power is supplied to the unit.
Device Operational	Green	The unit is operating in normal condition.
Devicce in Standby	Flashing Green	The device needs commissioning due to configuration missing, incomplete or incorrect.
MODBUS Error	Green/Red Toggle	MODBUS error such as watchodg error, etc.
Minor Fault	Flashing Red	Recoverable Fault. - EEPROM checksum fault.
Unrecoverable Fault	Red	The device has an unrecoverable fault. - Memory error or CPU watchdog error.

2.3.3. LINK (Physical Connection LED)

Status	LED	To indicate
Not Powered or Not Linked	OFF	Device may not be powered
Adapter physical connected	Green	Adapter Ethernet Controller physically connected

2.3.4. ACTIVE (Exchange Data/Traffic Present LED)

Status	LED	To indicate
Not Powered	OFF	Device is idle or may not be powered.
Adapter exchange data	Flashing Green	Adapter(slave) exchange data/Traffic present. About 10msec flashing.

2.3.5. IOS LED (Extension Module Status LED)

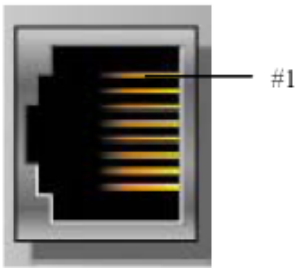
Status	LED	To indicate
Not Powered	OFF	Device may not be powered.
No Expansion Module	Flashing Red	Adapter has no expansion module
Internal Bus Connection, Run Exchanging I/O	Green	Exchanging I/O data.
Expansion Configuration Failed	Red	One or more expansion module occurred in fault state. - Detected invalid expansion module ID. - Overflowed Input/Output Size - Too many expansion module - Initialization failure - Communication failure. - Changed expansion module configuration. - Mismatch vendor code between adapter and expansion module.

2.3.6. Field Power, System Power LED (Field Power, System Power Status LED)

Status	LED	To indicate
No field, System power	OFF	Not supplied 24Vdc field power, 5Vdc system power.
Supplied field, System power	Green	Supplied 24Vdc field power, 5Vdc system power.

2.4. GN-9289 Electrical Interface

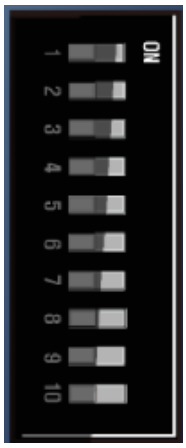
2.4.1. RJ-45 Socket



Shielded RJ-45 Socket

RJ-45	Signal Name	Description
1	TD+	Transmit +
2	TD-	Transmit -
3	RD+	Receive +
4	-	
5	-	
6	RD-	Receive -
7	-	
8	-	
Case	Shield	

2.4.2. Dip Switch (TBD)

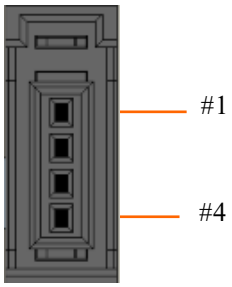


DIP Pole#	Description	
1	IP_DIP bit#0	Lowest IP Address when Pole#10=ON ex) XXX.XXX.XXX.IP_DIP
2	IP_DIP bit#1	
3	IP_DIP bit#2	
4	IP_DIP bit#3	
5	IP_DIP bit#4	
6	IP_DIP bit#5	
7	IP_DIP bit#6	
8	IP_DIP bit#7	
9	= ON : Enable DHCP/BOOTP *	
10	= ON : Use Lowest IP Address with IP_DIP value	

* DHCP/BOOTP have to be set in special register(default : BOOTP).

(0x1045, ref 3.3.3).

2.4.3. RS232 Port for MODBUS/RTU, Touch Pannel or IOGuide



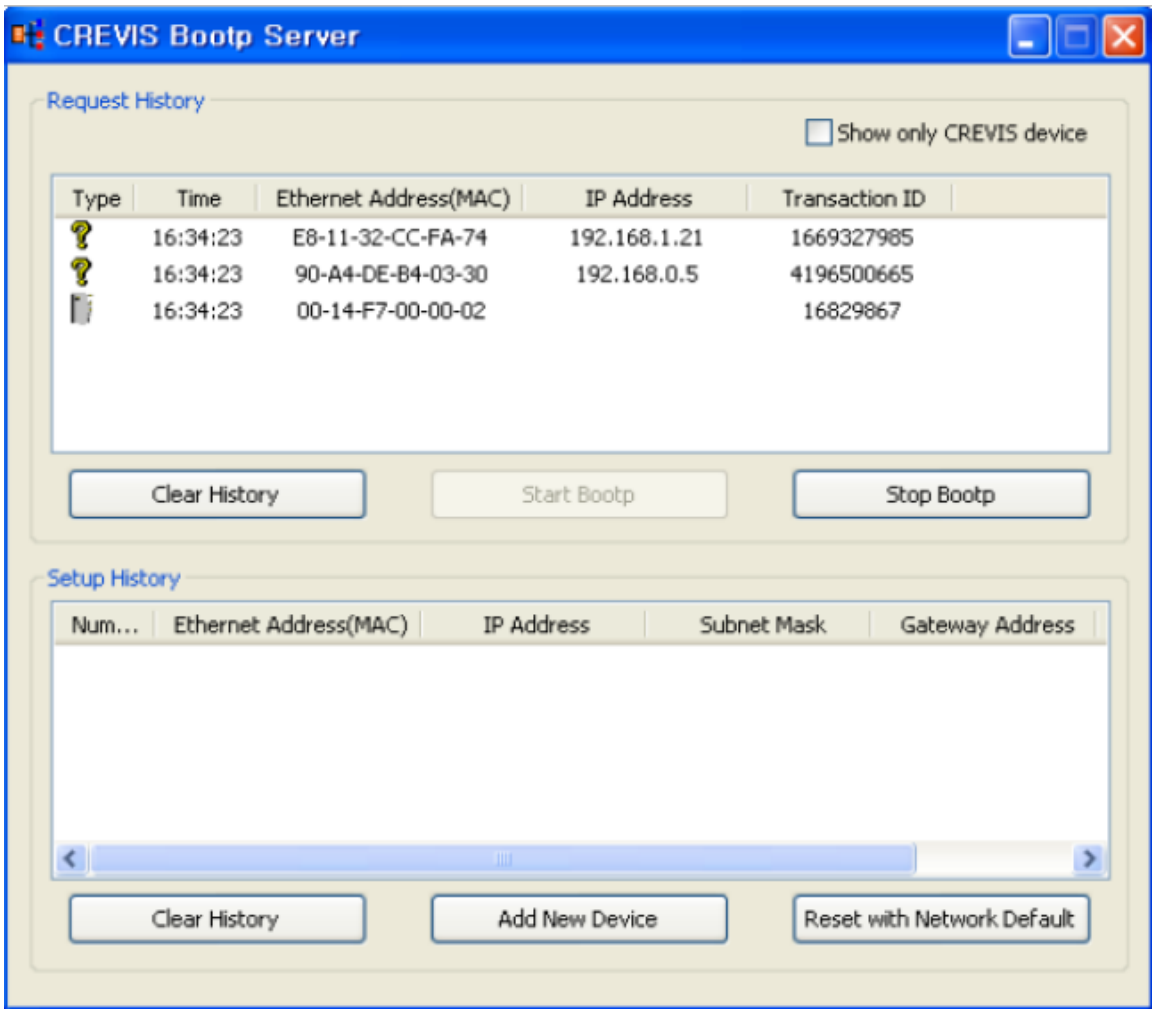
Pin#	Signal Name	Description
1	Reserved	----
2	TXD	RS232 TXD
3	RXD	RS232 RXD
4	GND	RS232 GND

2.5. MODBUS/TCP IP – Address Setup

2.5.1. IP-Address Setup using BOOTP/DHCP Sever

If the adapter BOOTP/DHCP enabled (DIP Pole#9 ON), the adapter sends BOOTP/DHCP request message of 20 times every 2sec. If BOOTP/DHCP sever does not response, the Adapter applies its IP Address with EEPROM (Latest saved IP Address).
The following is an example of adapter IP-Address setup that can be used with a third party BOOTP/DHCP server.

- CREVIS IO Guide Pro’ s BOOTP server

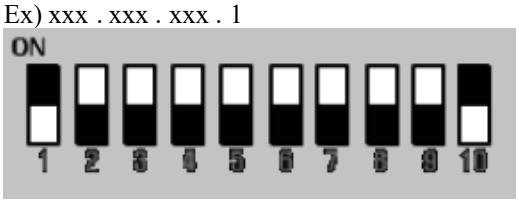


2.5.2. IP-Address Setup using Dip Switch(Manual Function)

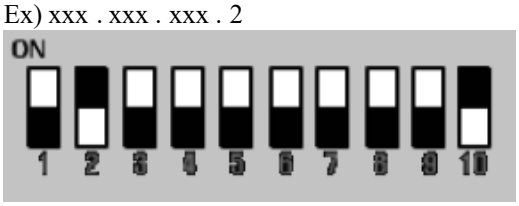
If the adapter DIP Pole#10 is ON, lowest IP address is set by DIP Pole#1~#8 manually. Refer to 2.4.2.

These are examples of adapter IP-Address setup by manual function.

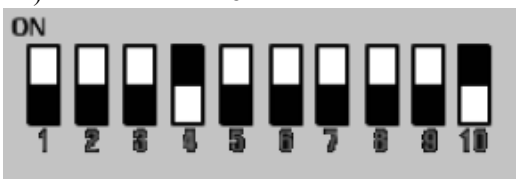
Ex) xxx . xxx . xxx . 1



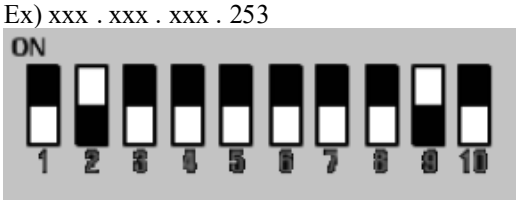
Ex) xxx . xxx . xxx . 2



Ex) xxx . xxx . xxx . 8

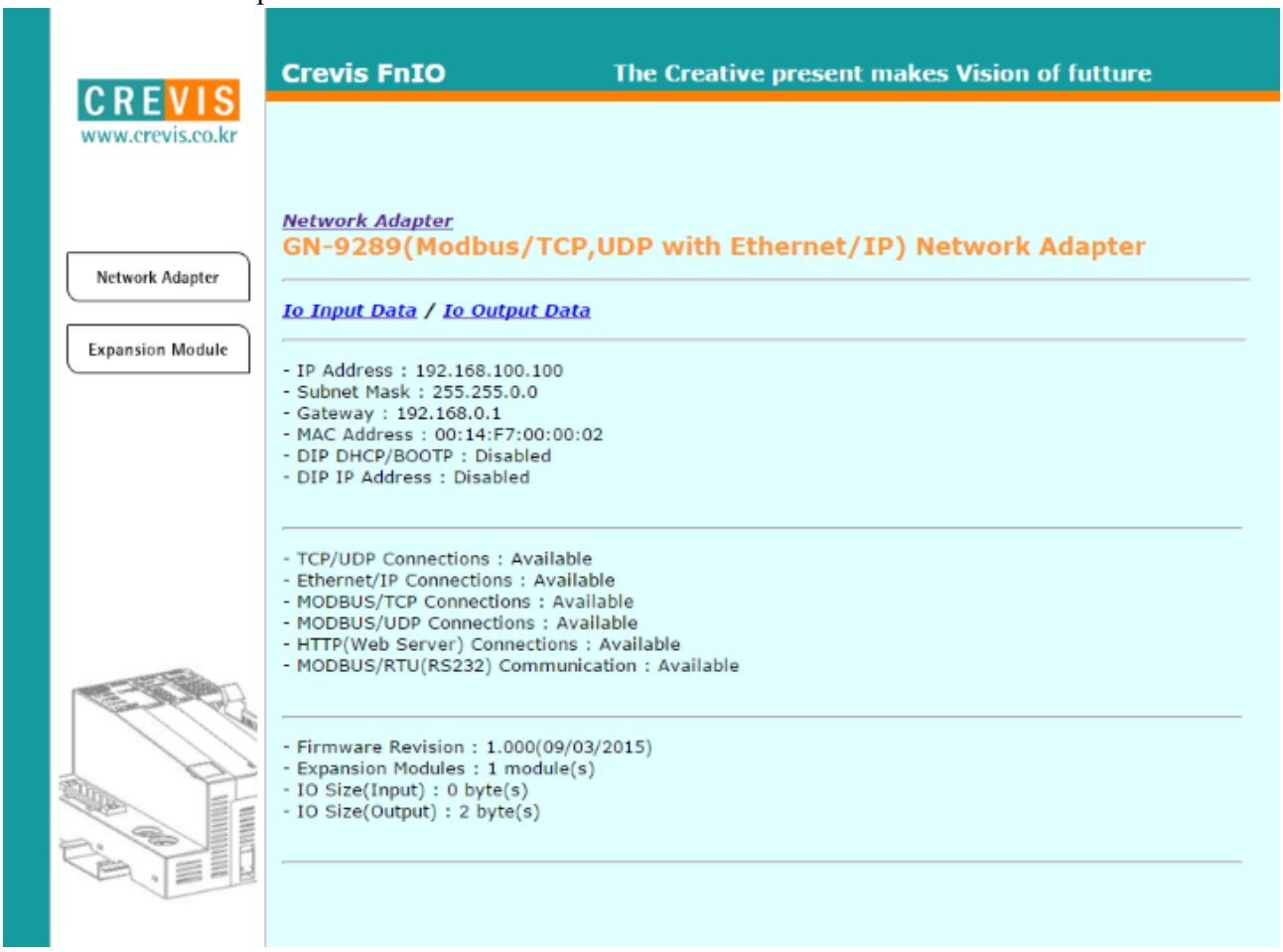


Ex) xxx . xxx . xxx . 253

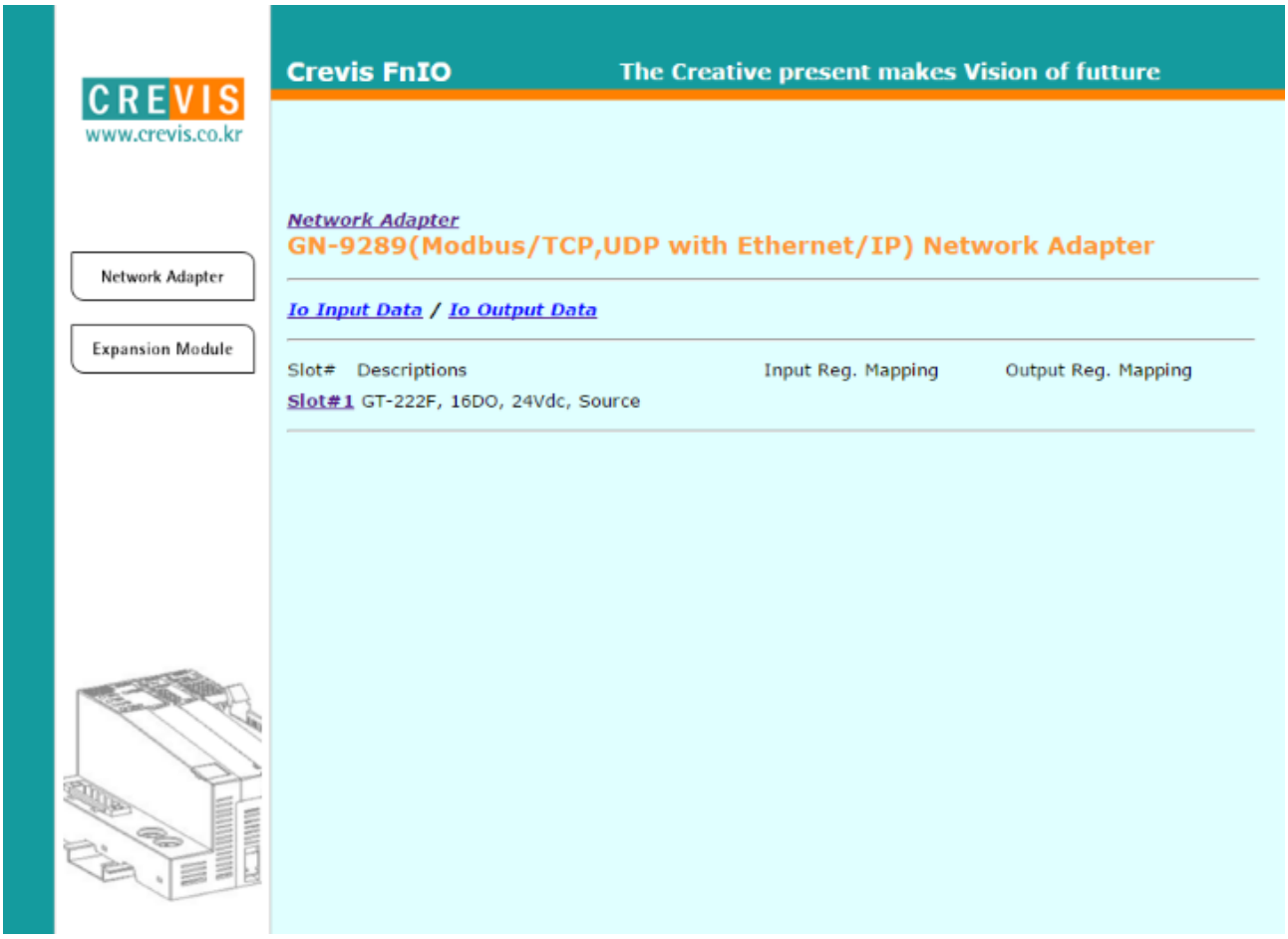


2.6. MODBUS/TCP IP – Web Server

- Network Adapter

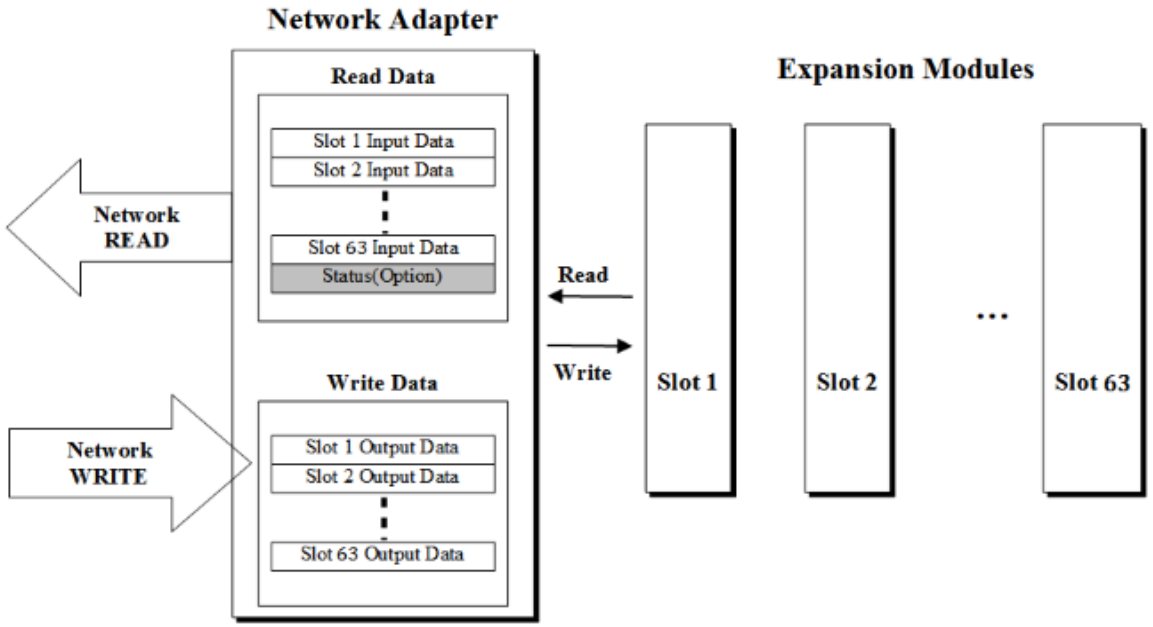


- Expansion Module



2.7. I/O Process Image Map

An expansion module may have 3 types of data as I/O data, configuration parameter and memory register.
The data exchange between network adapter and expansion modules is done via an I/O process image data by G-Series protocol. The following figure shows the data flow of process image between network adapter and expansion modules.



2.7.1. MODBUS Interface Register/Bit Map

- **Register Map**

Start Address	Read/Write	Description	Func. Code
0x0000 ~	Read	Process input image registers (Real Input Register)	3,4,23
0x0800 ~	Read/Write	Process output image registers (Real Output Register)	3,16,23
0x1000 *	Read	Adapter Identification special registers.	3,4,23
0x1020 *	Read/Write	Adapter Watchdog, other time special register.	3,4,6,16,23
0x1100 *	Read/Write	Adapter Information special registers.	3,4,6,16,23
0x2000 *	Read/Write	Expansion Slot Information special registers.	3,4,6,16,23

* The special register map must be accessed by read/write of every each address (one address).

- **Register Map**

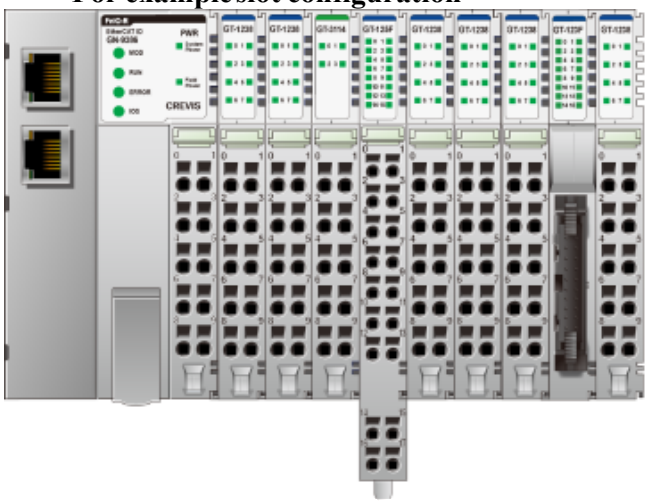
Start Address	Read/Write	Description	Func. Code
0x0000~	Read	Process input image bits All input registers area are addressable by bit address. Size of input image bit is size of input image register * 16.	2

0x1000~	Read/Write	Process output image bits All output registers area are addressable by bit address. Size of output image bit is size of output image register * 16.	1,5,15

2.7.2. Example of Input Process Image (Input Register) Map

Input image data depends on slot position and expansion slot data type. Input process image data is only ordered by expansion slot position

- **For example slot configuration**



Slot Address	Module Description
#0	EtherCAT Adapter
#1	8-discrete input
#2	8-discrete input
#3	4-analog input
#4	16-discrete input
#5	8-discrete input
#6	8-discrete input
#7	8-discrete input
#8	16-discrete input
#9	8-discrete input

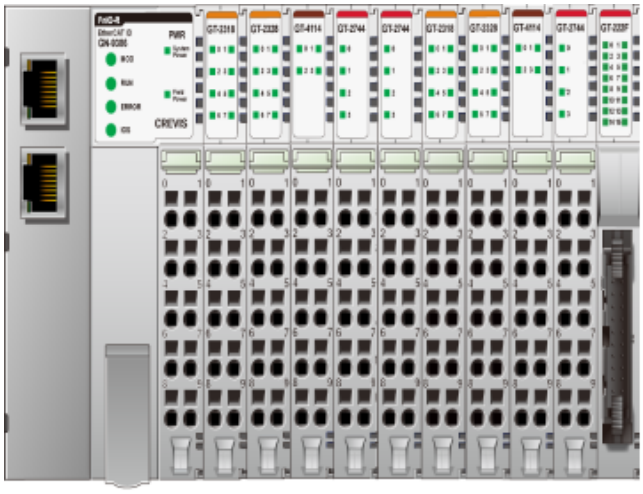
- **Input Process Image**

TXPDO	Entries	Byte	Bit 7	Bit 6	Bti 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0x1A01	0x6010	0	Discrete Input 8 pts (Slot#1)							
0x1A02	0x6020	1	Discrete Input 8 pts (Slot#2)							
0x1A03	0x6030	2	Analog Input Ch0 low byte (Slot#3)							
		3	Analog Input Ch0 high byte (Slot#3)							
		4	Analog Input Ch1 low byte (Slot#3)							
		5	Analog Input Ch1 high byte (Slot#3)							
		6	Analog Input Ch2 low byte (Slot#3)							
		7	Analog Input Ch2 high byte (Slot#3)							
		8	Analog Input Ch3 low byte (Slot#3)							
		9	Analog Input Ch3 high byte (Slot#3)							
0x1A04	0x6040	10	Discrete Input 8 pts (Slot#4)							
		11	Discrete Input 8 pts (Slot#4)							
0x1A05	0x6050	12	Discrete Input 8 pts (Slot#5)							
0x1A06	0x6060	13	Discrete Input 8 pts (Slot#6)							
0x1A07	0x6070	14	Discrete Input 8 pts (Slot#7)							
0x1A08	0x6080	15	Discrete Input 8 pts (Slot#8)							
		16	Discrete Input 8 pts (Slot#8)							
0x1A09	0x6090	17	Discrete Input 8 pts (Slot#9)							

2.7.3. Example of Output Process Image (Output Register) Map

Output image data depends on slot position and expansion slot data type. Output process image data is only ordered by expansion slot position.

- **For example slot configuration**



Slot Address	Module Description
#0	EtherCAT Adapter
#1	8-discrete output
#2	8-discrete output
#3	4-analog output
#4	4- relay output
#5	4-relay output
#6	8-discrete output
#7	8-discrete output
#8	4-analog output
#9	4-relay output
#10	16-discrete output

- **Output Process Image**

RXPDO	Entries	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0x1601	0x7010	0	Discrete Output 8 pts (Slot#1)							
0x1602	0x7020	1	Discrete Output 8 pts (Slot#2)							
0x1603	0x7030	2	Analog Output Ch0 low byte (Slot#3)							
		3	Analog Output Ch0 high byte (Slot#3)							
		4	Analog Output Ch1 low byte (Slot#3)							
		5	Analog Output Ch1 high byte (Slot#3)							
		6	Analog Output Ch2 low byte (Slot#3)							
		7	Analog Output Ch2 high byte (Slot#3)							
		8	Analog Output Ch3 low byte (Slot#3)							
		9	Analog Output Ch3 high byte (Slot#3)							
0x1604	0x7040	10	Discrete Output low 4 pts (Slot#4)							
0x1605	0x7050	12	Discrete Output low 4 pts (Slot#5)							
0x1606	0x7060	13	Discrete Output low 8 pts (Slot#6)							
0x1607	0x7070	14	Discrete Output low 8 pts (Slot#7)							
0x1608	0x7080	15	Analog Output Ch0 low byte (Slot#8)							
		16	Analog Output Ch0 high byte (Slot#8)							
		17	Analog Output Ch1 low byte (Slot#8)							
		18	Analog Output Ch1 high byte (Slot#8)							
		19	Analog Output Ch2 low byte (Slot#8)							
		20	Analog Output Ch2 high byte (Slot#8)							
		21	Analog Output Ch3 low byte (Slot#8)							
		22	Analog Output Ch3 high byte (Slot#8)							
0x1609	0x7090	24	Discrete Output low 8 pts (Slot#9)							
0x160A	0x70A0	25	Discrete Output low 8 pts (Slot#10)							
		26	Discrete Output high 8 pts (Slot#10)							

3. MODBUS TCP/ UDP INTERFACE

3.1. MODBUS TCP/ UDP Protocol

The MODBUS messaging service provides a Client/Server communication between devices connected on an Ethernet TCP/IP network. All MODBUS/TCP messages are sent via TCP on registered port 502.
Refer to Modbus_Messaging_Implementation_Guide_V1_0a.pdf.

3.1.1. Comparison of MODBUS TCP/ UDP And MODUB/RTU

This header provides some differences compared to the MODBUS RTU application data unit used on serial line:
• The MODBUS 'slave address' field usually used on MODBUS Serial Line is replaced by a single byte 'Unit Identifier' within the MBAP Header. The 'Unit Identifier' is used to communicate via devices such as bridges, routers and gateways that use a single IP address to support multiple independent MODBUS end units.
• All MODBUS requests and responses are designed in such a way that the recipient can verify that a message is finished. For function codes where the MODBUS PDU has a fixed length, the function code alone is sufficient. For function codes carrying a variable amount of data in the request or response, the data field includes a byte count.
• When MODBUS is carried over TCP, additional length information is carried in the MBAP header to allow the recipient to recognize message boundaries even if the message has been split into multiple packets for transmission. The existence of explicit and implicit length rules, and use of a CRC-32 error check code (on Ethernet) results in an infinitesimal chance of undetected corruption to a request or response message.

MODBUS TCP/ UDP

MBAP Header	Function	Data
7 chars	1 char	Up to 252 chars

MODBUS/ RTU

Start	Address	Function	Data	CRC Check	End
≥ 3.5 char	1 char	1 char	Up to 252 chars	2 chars	≥ 3.5 char

Function and data field of MODBUS/TCP are identical to function and data field of MODBUS/RTU.

3.1.2. MODBUS TCP/ UDP MBAP Header

The MBAP (MODBUS Application Protocol) header contains the following fields.

Fields	Length	Description	Client	Server
Transaction Identifier	2byes	Identification of a MODBUS Request /Response transaction.	Initialized by the client	Recopied by the server from the received
Protocol Identifier	2bytes	0 = MODBUS protocol	Initialized by the client	Recopied by the server from the received
Length	2bytes	Number of following bytes	Initialized by the client (Request)	Initialized by the server (Response)
Unit Identifier	1byte	Identification of a remote slave connected on a serial line or on other buses.	Initialized by the client	Recopied by the server from the received

• Transaction Identifier - It is used for transaction pairing, the MODBUS server copies in the response the transaction identifier of the request.
• Protocol Identifier – It is used for intra-system multiplexing. The MODBUS protocol is identified by the value 0.
• Length - The length field is a byte count of the following fields, including the Unit Identifier and data fields.
• Unit Identifier – This field is used for intra-system routing purpose. Typically MODBUS server must be returned with the same value set by MODBUS client.

3.2. Supported MODBUS Function Codes

Function Code	Function	Description
1(0x01)	Read Coils	Read output bit
2(0x02)	Read Discrete Inputs	Read input bit
3(0x03)	Read Holding Registers	Read output word
4(0x04)	Read Input Registers	Read input word
5(0x05)	Write Single Coil	Write one bit output
6(0x06)	Write Single Register	Write one word output
8(0x08)	Diagnostics	Read diagnostic register
15(0x0F)	Write Multiple Coils	Write a number of output bits
16(0x10)	Write Multiple registers	Write a number of output words
23(0x17)	Read/Write Multiple registers	Read a number of input words /Write a number of output words

- Refer to MODBUS APPLICATION PROTOCOL SPECIFICATION V1.1a

3.2.1. 1 (0x01) Read Coils

This function code is used to read from 1 to 2000 contiguous status of coils in a remote device. The Request PDU specifies the starting address, i.e. the address of the first coil specified, and the number of coils. In the PDU Coils are addressed starting at zero. Therefore coils numbered 1-16 are addressed as 0-15. The coils in the response message are packed as one coil per bit of the data field. Status is indicated as 1= ON and 0= OFF.

- **Request**

Field name	Example
Function Code	0x01
Starting Address Hi	0x10
Starting Address Lo	0x00
Quantity of Outputs Hi	0x00
Quantity of Outputs Lo	0x0A

- **Response**

Field name	Example
Function Code	0x01
Byte Count	0x02
Output Status	0x55
Output Status	0x02

- In case of address 0x1015~0x1000 output bit value: 10101010_01010101.

3.2.2. 2 (0x02) Read Discrete Inputs

This function code is used to read from 1 to 2000 contiguous status of discrete inputs in a remote device. The Request PDU specifies the starting address, i.e. the address of the first input specified, and the number of inputs. In the PDU Discrete Inputs are addressed starting at zero. Therefore Discrete inputs numbered 1-16 are addressed as 0-15.
The discrete inputs in the response message are packed as one input per bit of the data field.
Status is indicated as 1= ON; 0= OFF.

- **Request**

Field name	Example
Function Code	0x02
Starting Address Hi	0x00
Starting Address Lo	0x00
Quantity of Inputs Hi	0x00
Quantity of Inputs Lo	0x0A

- **Response**

Field name	Example
Function Code	0x02
Byte Count	0x02
Input Status	0x80
Input Status	0x00

- In case of address 0x0015~0x0000 input bit value: 00000000_10000000.

3.2.3. 3 (0x03) Read Holding Resgisters

This function code is used to read the contents of a contiguous block of holding registers in a remote device. The Request PDU specifies the starting register address and the number of registers.
The register data in the response message are packed as two bytes per register, with the binary contents right justified within each byte. For each register, the first byte contains the high order bits and the second contains the low order bits.

- **Request**

Field name	Example
Function Code	0x03
Starting Address Hi	0x08
Starting Address Lo	0x00
Quantity of Register Hi	0x00
Quantity of Register Lo	0x02

- **Response**

Field name	Example
Function Code	0x03
Byte Count	0x04
Output Register#0 Hi	0x11
Output Register#0 Lo	0x22
Output Register#1 Hi	0x33
Output Register#1 Lo	0x44

- In case of address 0x0800, 0x0801 output register value: 0x1122, 0x3344.

3.2.4. 4 (0x04) Read Input Resgisters

This function code is used to read from 1 to approx. 125 contiguous input registers in a remote device. The Request PDU specifies the starting register address and the number of registers. The register data in the response message are packed as two bytes per register, with the binary contents right justified within each byte. For each register, the first byte contains the high order bits and the second contains the low order bits.

- **Request**

Field name	Example
Function Code	0x04
Starting Address Hi	0x00
Starting Address Lo	0x00
Quantity of Register Hi	0x00
Quantity of Register Lo	0x02

- **Response**

Field name	Example
Function Code	0x03
Byte Count	0x04
Input Register#0 Hi	0x00
Input Register#0 Lo	0x80
Input Register#1 Hi	0x00
Input Register#1 Lo	0x00

- In case of address 0x0000, 0x0001 input register value: 0x0080, 0x0000.

3.2.5. 5 (0x05) Write Single Coil

This function code is used to write a single output to either ON or OFF in a remote device. The requested ON/OFF state is specified by a constant in the request data field. A value of FF 00 hex requests the output to be ON. A value of 00 00 requests it to be OFF. All other values are illegal and will not affect the output.

- **Request**

Field name	Example
Function Code	0x05
Output Address Hi	0x10
Output Address Lo	0x01
Output Value Hi	0xFF
Output Value Lo	0x00

- **Response**

Field name	Example
Function Code	0x05
Output Address Hi	0x10
Output Address Lo	0x01
Output Value Hi	0xFF
Output Value Lo	0x00

- Output bit of address 0x1001 turns ON.

3.2.6. 6 (0x06) Write Single Register

This function code is used to write a single holding register in a remote device. Therefore register numbered 1 is addressed as 0. The normal response is an echo of the request, returned after the register contents have been written.

- **Request**

Field name	Example
Function Code	0x06
Register Address Hi	0x08
Register Address Lo	0x00
Register Value Hi	0x11
Register Value Lo	0x22

- **Response**

Field name	Example
Function Code	0x06
Register Address Hi	0x08
Register Address Lo	0x00
Register Value Hi	0x11
Register Value Lo	0x22

- In case of address 0x0800 output register value: 0x0000 changes to 0x1122.

3.2.7. 8 (0x08) Diagnostics

MODBUS function code 08 provides a series of tests for checking the communication system between a client (Master) device and a server (Slave), or for checking various internal error conditions within a server.
The function uses a two–byte sub-function code field in the query to define the type of test to be performed. The server echoes both the function code and sub-function code in a normal response. Some of the diagnostics cause data to be returned from the remote device in the data field of a normal response.

- **Request**

Field name	Example
Function Code	0x08
Sub-Function Hi	0x00
Sub-Function Lo	0x00
Data Hi	0x11
Data Lo	0x22

- **Response**

Field name	Example
Function Code	0x08
Sub-Function Hi	0x00
Sub-Function Lo	0x00
Data Hi	0x11
Data Lo	0x22

Sub-function 0x0000(0) Return Query Data
The data passed in the request data field is to be returned (looped back) in the response.
The entire response message should be identical to the request.

Sub-function	Data Field (Request)	Data Field (Response)	Description
0x0000(0)	Any	Echo Request Data	

Sub-function 0x0001(1) Restart Communications Option
The remote device could be initialized and restarted, and all of its communications event counters are cleared.
Especially, data field 0x55AA make the remote device to restart with factory default setup of EEPROM.

Sub-function	Data Field (Request)	Data Field (Response)	Description
0x0001(1)	0x0000 or 0xFF00	Echo Request Data	Reset
0x0001(1)	0x55AA+0xAB7B+Sumcheck	Echo Request Data	Reset with Factory default [1)]
0x0001(1)	0x55AA+0xAA55+Sumcheck	Echo Request Data	Reset with Factory default [2)]

1),2) IP Address, Subnet Mask Address, Gateway Address will be the factory defaults value.
2) Mac Address will be the factory default value.

Sub-function 0x000A(10) Clear Counters and Diagnostic Register
The goal is to clear all counters and the diagnostic register. Counters are also cleared upon power–up.

Sub-function	Data Field (Request)	Data Field (Response)	Description
0x000A(10)	0x0000	Echo Request Data	

Sub-function 0x000B(11) Return Bus Message Count
The response data field returns the quantity of messages that the remote device has detected on the communications system since its last restart, clear counters operation, or power–up.

Sub-function	Data Field (Request)	Data Field (Response)	Description
0x000B(11)	0x0000	Total Message Count	

Sub-function 0x000C(12) Return Bus Communication Error Count
The response data field returns the quantity of CRC errors encountered by the remote device since its last restart, clear counters operation, or power–up.

Sub-function	Data Field (Request)	Data Field (Response)	Description
0x000C(12)	0x0000	CRC Error Count	

Sub-function 0x000D(13) Return Bus Exception Error Count
The response data field returns the quantity of MODBUS exception responses returned by the remote device since its last restart, clear counters operation, or power–up.
Exception responses are described and listed in section 3.2.11.

Sub-function	Data Field (Request)	Data Field (Response)	Description
0x000D(13)	0x0000	Exception Error Count	

Sub-function 0x000E(14) Return Slave Message Count
The response data field returns the quantity of messages addressed to the remote device, or broadcast, that the remote device has processed since its last restart, clear counters operation, or power–up.

Sub-function	Data Field (Request)	Data Field (Response)	Description
0x000E(14)	0x0000	Slave Message Count	

Sub-function 0x000F(15) Return Slave No Response Count
The response data field returns the quantity of messages addressed to the remote device for which it has returned no response (neither a normal response nor an exception response), since its last restart, clear counters operation, or power–up.

Sub-function	Data Field (Request)	Data Field (Response)	Description
0x000F(15)	0x0000	Slave No Response Count	

Sub-function 0x0064(100) Return Slave ModBus, Internal Bus Status
The response data field returns the status of ModBus and Internal Bus addressed to the remote device.
This status values are identical with status 1word of input process image.

Sub-function	Data Field (Request)	Data Field (Response)	Description
0x0064(100)	0x0000	ModBus, Internal Bus Status	Same as status 1word

Sub-function 0x0065(101) Return Slave Watchdog Error Count

The response data field returns the quantity of watchdog error addressed to the remote device since its last restart, clear counters operation, or power–up.

Sub-function	Data Field (Request)	Data Field (Response)	Description
0x0065(101)	0x0000	Watchdog Error Count	

3.2.8. 15 (0x0F) Write Multiple Coils

This function code is used to force each coil in a sequence of coils to either ON or OFF in a remote device. The Request PDU specifies the coil references to be forced. Coils are addressed starting at zero. A logical '1' in a bit position of the field requests the corresponding output to be ON. A logical '0' requests it to be OFF.
The normal response returns the function code, starting address, and quantity of coils forced.

- **Request**

Field name	Example
Function Code	0x0F
Starting Address Hi	0x10
Starting Address Lo	0x00
Quantity of Outputs Hi	0x00
Quantity of Outputs Lo	0x0A
Byte Count	0x02
Output Value#0	0x55
Output Value#1	0x01

- **Response**

Field name	Example
Function Code	0x0F
Starting Address Hi	0x10
Starting Address Lo	0x00
Quantity of Outputs Hi	0x00
Quantity of Outputs Lo	0x0A

- In case of address 0x1015~0x1000 output bit value: 00000000_00000000 changes to 00000001_01010101.

3.2.9. 16 (0x10) Write Multiple Resgisters

This function code is used to write a block of contiguous registers (1 to approx. 120 registers) in a remote device.
The requested written values are specified in the request data field. Data is packed as two bytes per register.
The normal response returns the function code, starting address, and quantity of registers written.

- **Request**

Field name	Example
Function Code	0x0F
Starting Address Hi	0x10
Starting Address Lo	0x08
Quantity of Registers Hi	0x00
Quantity of Registers Lo	0x02
Byte Count	0x04
Register Value#0 Hi	0x11
Register Value#0 Lo	0x22
Register Value#1 Hi	0x33
Register Value#1 Lo	0x44

- **Response**

Field name	Example
Function Code	0x0F
Starting Address Hi	0x10
Starting Address Lo	0x08
Quantity of Registers Hi	0x00
Quantity of Registers Lo	0x02

.- In case of address 0x0800, 0x0801 output register value: 0x0000, 0x0000 changes to 0x1122, 0x3344.

3.2.10. 23 (0x17) Read/Write Multiple Resgisters

This function code performs a combination of one read operation and one write operation in a single MODBUS transaction. The write operation is performed before the read. The request specifies the starting address and number of holding registers to be read as well as the starting address, number of holding registers, and the data to be written. The byte count specifies the number of bytes to follow in the write data field.
The normal response contains the data from the group of registers that were read. The byte count field specifies the quantity of bytes to follow in the read data field.

- **Request**

Field name	Example
Function Code	0x17
Read Starting Address Hi	0x08
Read Starting Address Lo	0x00
Quantity of Read Hi	0x00
Quantity of Read Lo	0x02
Write Starting Address Hi	0x08
Write Starting Address Lo	0x00
Quantity of Write Hi	0x00
Quantity of Write Lo	0x02
Byte Count	0x04
Write Reg. Value#0 Hi	0x11
Write Reg. Value#0 Lo	0x22
Write Reg. Value#1 Hi	0x33
Write Reg. Value#1 Lo	0x44

- **Response**

Field name	Example
Function Code	0x17
Byte Count	0x04
Read Reg. Value#0 Hi	0x11
Read Reg. Value#0 Lo	0x22
Read Reg. Value#1 Hi	0x33
Read Reg. Value#1 Lo	0x44

- In case of address 0x0800, 0x0801 output register value: 0x0000, 0x0000 changes to 0x1122, 0x3344.

3.2.11. Error Response

In an exception response, the server sets the MSB of the function code to 1. This makes the function code value in an exception response exactly 80 hexadecimal higher than the value would be for a normal response.

- **Exception Response Example**

Field name	Example
Function Code	0x81
Exception Code	0x02

- **Exception Codes**

Exception Code	Name	Description
01	Illegal Function	The function code received in the query is not an allowable action for the server (or slave).
02	Illegal Data Address	The data address received in the query is not an allowable address for the server (or slave).
03	Illegal Data Value	A value contained in the query data field is not an allowable value for server (or slave).
04	Slave Device Failure	An unrecoverable error occurred while the server (or slave) was attempting to perform the requested action.
05	Acknowledge	The server (or slave) has accepted the request and is processing it, but a long duration of time will be required to do so.
06	Slave Device Busy	Specialized use in conjunction with programming commands. The server (or slave) is engaged in processing a long–duration program command. The client (or master) should retransmit the message later when the server (or slave) is free.
08	Memory Parity Error	The server (or slave) attempted to read record file, but detected a parity error in the memory. The client (or master) can retry the request, but service may be required on the server (or slave) device.
0A	Gateway Path Unavailable	Specialized use in conjunction with gateways, indicates that the gateway was unable to allocate an internal communication path from the input port to the output port for processing the request.

- GN-9289 response exception code 01, 02, 03, 04 and 06.

3.3. MODBUS Special Register Map

The special register map can be accessed by function code 3, 4, 6 and 16. Also the special register map must be accessed by read/write of every each address (one address).

3.3.1. Adapter Identification Special Resgister (0x1000, 4096)

Address	Access	Type, Size	Description
0x1000(4096)	Read	1word	Vendor ID = 0x02E5(741), Crevis. Co., Ltd.
0x1001(4097)	Read	1word	Device type = 0x000C, Network Adapter
0x1002(4098)	Read	1word	Product Code = 0x9000
0x1003(4099)	Read	1word	Firmware revision, if 0x0101, revision 1.01
0x1004(4100)	Read	2word	Product unique serial number
0x1005(4101)	Read	String upto 34byte	Product name string (ASCII) “GN-9289,Modbus/TCP Adapter,GBUS”
0x1006(4102)	Read	1word	Sum check of EEPROM
0x1010(4112)	Read	2word	Firmware release date
0x1011(4113)	Read	2word	Product manufacturing inspection date
0x101E(4126)	Read	 7word - 1word - 1word - 1word - 1word - 1word - 2word 15word - 2word - 2word - 2word - 3word - 1word - 1word - 1word - 1word - 2word	Composite Id of following address * RTU mode 0x1100(4352), Modbus RS232 Node. (Fixed 0x0001) 0x1000(4096), Vendor ID 0x1001(4097), Device type 0x1002(4098), Product code 0x1003(4099), Firmware revision 0x1004(4100), Product serial number *TCP mode 0x1050(4176), IP address 0x1051(4177), Subnet mask 0x1052(4178), Gateway 0x1053(4179), Ethernet physical address (MAC ID) 0x1000(4096), Vendor ID 0x1001(4097), Device type 0x1002(4098), Product code 0x1003(4099), Firmware revision 0x1004(4100), Product serial number

- String Type consists of valid string length (first 1word) and array of characters

3.3.2. Adapter Watchdog Time, other Time Special Register (0x1020, 4128)

A watchdog timer can be configured for timeout periods up to 65535(1unit=100msec). The Watchdog timer will timeout (timer decreased, reached 0) if ModBus operation to the slave node does not occur over the configured watchdog value, then the slave adapter forces that slot output value is automatically set to user-configured fault actions and values.

Address	Access	Type, Size	Description

0x1020(4128)	Read/Write	1word	Watchdog time value 16bit unsigned. The time value is represented by multiples of 100msec. The 0 (watchdog timeout disabled) is default value. A changing of watchdog time value resets watchdog error and counter.
0x1021(4129)	Read	1word	Watchdog timer remain value This value is decreased every 100msec
0x1022(4130)	Read	1word	Watchdog error counter, it is cleared by writing address 0x1020
0x1023(4131)	Read/Write	1word	Enable/disable auto recovery Watchdog error when receiving new frame. 0:Disable, 1:Enable(default). Its value is stored in EEPROM.
0x1028(4136)	Read	1word	IO update time, main loop time. (1usec unit)

3.3.3. Adapter TCP/IP Special Register (0x1040, 4160)

Address	Access	Type, Size	Description
0x1040(4160)	Read	1word	Reserved
0x1041(4161)	Read/Write	1word	MODBUS/TCP connection timeout time. (0.5sec unit) Maximum time of ModBus connection to stay to be opened without receiving a ModBus request. 0~3600 The 120 (60sec) is default value. The value 0 disables connection time out specially. *Notice : When using Ethernet/IP only, this value should be '0' (disable).
0x1042(4162)	Read	1word	Number of ModBus/TCP connected
0x1043(4163)	Read	1word	ModBus/TCP port, fixed 502
0x1044(4164)	Read	1word	Ethernet Interface Speed, 10(10Mbps) or 100(100Mbps)
0x1045(4165)*	Read/Write	1word	IP Setting Method. 0: BOOTP, 1:DHCP
0x1046(4166)	---	---	Reserved.
0x1047(4167)	Read	1word	Status of DIP SW#9 DHCP/BOOTP(Enable/Disable). 0 : OFF, 1 : ON
0x1048(4168)	Read	1word	Enable/disable Lowest IP address via DIP Switch, 1:Enabled
0x1050(4176)	Read/Write	2word	IP address. If 192.168.123.1, then 0xA8C0, 0x017B. After update this value, IP address, Subnet mask and Gateway are applied as new one.
0x1051(4177)	Read/Write	2word	Subnet mask. If 255.255.255.0, then 0xFFFF, 0x00FF.
0x1052(4178)	Read/Write	2word	Gateway. If 192.168.123.254, then 0xA8C0, 0xFE7B.
0x1053(4179)	Read	3word	Ethernet physical address (MAC-ID). If 11-22-33-44-55-66, then 0x2211, 0x4433, 0x6655.

* Power off and then power on, this value is applied.

3.3.4. Adapter Information Special Register (0x1100, 4352)

Address	Access	Type, Size	Description
0x1100(4352)*	Read/Write	1word	Master fault action option. (Disable : 0x0000, Enable : 0x0001) This option can enable Master fault action option. With master fault action, fault action can be activated with master communication failure. Default is disable.
0x1102(4354)	Read	1word	Start address of input image word register. =0x0000
0x1103(4355)	Read	1word	Start address of output image word register. =0x0800
0x1104(4356)	Read	1word	Size of input image word register.
0x1105(4357)	Read	1word	Size of output image word register.
0x1106(4358)	Read	1word	Start address of input image bit. = 0x0000
0x1107(4359)	Read	1word	Start address of output image bit. =0x1000
0x1108(4360)	Read	1word	Size of input image bit.
0x1109(4361)	Read	1word	Size of output image bit.
0x110A(4362)	Read	1word	Update time for cyclic data change (same as 0x1028)
0x110D(4365)	Read	1word	Current Dip Switch State and Field Power Status (MSB) ex) DHCP/Booth enable, Dip SW(0x01), Field Power On = 0x8101
0x110E(4366)	Read	upto 33word	Expansion slot's GT-number including GN First 1word is adapter's number, if GN-9289, then 0x9289
0x1110(4368)	Read	1word	Number of expansion slot
0x1113(4371)	Read	upto 33word	Expansion slot Module Id. First 1word is adapter's module id.
0x1119(4377)	Read	1word	Hi byte is ModBus status, low byte is internal status. Zero value means 'no error'.
0x111D(4381)	Read	1word	Adapter G-Series Revision.

* After the system is reset, the new "Set Value" action is applied.
** If the slot location is changed, set default value automatically (all expansion slot are live).

3.3.5. Expasion Slot Information Special Resister (0x2000, 8192)

Each expansion slot has 0x20(32) address offset and same information structure.

Slot#1 0x2000(8192)~0x201F(8223) Slot#2 0x2020(8224)~0x203F(8255)
Slot#3 0x2040(8256)~0x205F(8287) Slot#4 0x2060(8288)~0x207F(8319)
Slot#5 0x2080(8320)~0x209F(8351) Slot#6 0x20A0(8352)~0x20BF(8383)
Slot#7 0x20C0(8384)~0x20DF(8415) Slot#8 0x20E0(8416)~0x20FF(8447)
Slot#9 0x2100(8448)~0x211F(8479) Slot#10 0x2120(8480)~0x213F(8511)
Slot#11 0x2140(8512)~0x215F(8543) Slot#12 0x2160(8544)~0x217F(8575)
Slot#13 0x2180(8576)~0x219F(8607) Slot#14 0x21A0(8608)~0x21BF(8639)
Slot#15 0x21C0(8640)~0x21DF(8671) Slot#16 0x21E0(8672)~0x21FF(8703)
Slot#17 0x2200(8704)~0x221F(8735) Slot#18 0x2220(8736)~0x223F(8767)
Slot#19 0x2240(8768)~0x225F(8799) Slot#20 0x2260(8800)~0x227F(8831)
Slot#21 0x2280(8832)~0x229F(8863) Slot#22 0x22A0(8864)~0x22BF(8895)
Slot#23 0x22C0(8896)~0x22DF(8927) Slot#24 0x22E0(8928)~0x22FF(8959)
Slot#25 0x2300(8960)~0x231F(8991) Slot#26 0x2320(8992)~0x233F(9023)
Slot#27 0x2340(9024)~0x235F(9055) Slot#28 0x2360(9056)~0x237F(9087)
Slot#29 0x2380(9088)~0x239F(9119) Slot#30 0x23A0(9120)~0x23BF(9151)
Slot#31 0x23C0(9152)~0x23DF(9183) Slot#32 0x23E0(9184)~0x23FF(9215)
Slot#33 0x2400(9216)~0x241F(9247) Slot#34 0x2420(9248)~0x243F(9279)
…..
Slot#63 0x27C0(10176)~0x27DF(10207)

Address Offset	Expansion Slot#1	Expansion Slot#2	Expansion Slot#3	Expansion Slot#4	……..	Expansion Slot#63
+ 0x00(+0)	0x2000(8192)	0x2020(8224)	0x2040(8256)	0x2060(8288)	…….	0x27C0(10176)
+ 0x01(+1)	0x2001(8193)	0x2021(8225)	0x2041(8257)	0x2061(8289)	…….	0x27C1(10177)
+ 0x02(+2)	0x2002(8194)	0x2022(8226)	0x2042(8258)	0x2062(8290)	…….	0x27C2(10178)
+ 0x03(+3)	0x2003(8195)	0x2023(8227)	0x2043(8259)	0x2063(8291)	…….	0x27C3(10179)
+ 0x04(+4)	0x2004(8196)	0x2024(8228)	0x2044(8260)	0x2064(8292)	…….	0x27C4(10180)
+ 0x05(+5)	0x2005(8197)	0x2025(8229)	0x2045(8261)	0x2065(8293)	…….	0x27C5(10181)
+ 0x06(+6)	0x2006(8198)	0x2026(8230)	0x2046(8262)	0x2066(8294)	…….	0x27C6(10182)
+ 0x07(+7)	0x2007(8199)	0x2027(8231)	0x2047(8263)	0x2067(8295)	…….	0x27C7(10183)
+ 0x08(+8)	0x2008(8200)	0x2028(8232)	0x2048(8264)	0x2068(8296)	…….	0x27C8(10184)
+ 0x09(+9)	0x2009(8201)	0x2029(8233)	0x2049(8265)	0x2069(8297)	…….	0x27C9(10185)
+ 0x0A(+10)	0x200A(8202)	0x202A(8234)	0x204A(8266)	0x206A(8298)	…….	0x27CA(10186)
+ 0x0B(+11)	0x200B(8203)	0x202B(8235)	0x204B(8267)	0x206B(8299)	…….	0x27CB(10187)
+ 0x0C(+12)	0x200C(8204)	0x202C(8236)	0x204C(8268)	0x206C(8300)	…….	0x27CC(10188)
+ 0x0D(+13)	0x200D(8205)	0x202D(8237)	0x204D(8269)	0x206D(8301)	…….	0x27CD(10189)
+ 0x0E(+14)	0x200E(8206)	0x202E(8238)	0x204E(8270)	0x206E(8302)	…….	0x27CE(10190)
+ 0x0F(+15)	0x200F(8207)	0x202F(8239)	0x204F(8271)	0x206F(8303)	…….	0x27CF(10191)
+ 0x10(+16)	0x2010(8208)	0x2030(8240)	0x2050(8272)	0x2070(8304)	…….	0x27D0(10192)
+ 0x11(+17)	0x2011(8209)	0x2031(8241)	0x2051(8273)	0x2071(8305)	…….	0x27D1(10193)
+ 0x12(+18)	0x2012(8210)	0x2032(8242)	0x2052(8274)	0x2072(8306)	…….	0x27D2(10194)
+ 0x13(+19)	0x2013(8211)	0x2033(8243)	0x2053(8275)	0x2073(8307)	…….	0x27D3(10195)
+ 0x14(+20)	0x2014(8212)	0x2034(8244)	0x2054(8276)	0x2074(8308)	…….	0x27D4(10196)
+ 0x15(+21)	0x2015(8213)	0x2035(8245)	0x2055(8277)	0x2075(8309)	…….	0x27D5(10197)
+ 0x16(+22)	0x2016(8214)	0x2036(8246)	0x2056(8278)	0x2076(8310)	…….	0x27D6(10198)
+ 0x17(+23)	0x2017(8215)	0x2037(8247)	0x2057(8279)	0x2077(8311)	…….	0x27D7(10199)
+ 0x18(+24)	0x2018(8216)	0x2038(8248)	0x2058(8280)	0x2078(8312)	…….	0x27D8(10200)
+ 0x19(+25)	0x2018(8217)	0x2038(8249)	0x2058(8281)	0x2078(8313)	…….	0x27D9(10201)
+ 0x1A(+26)	0x201A(8218)	0x203A(8250)	0x205A(8282)	0x207A(8314)	…….	0x27DA(10202)
+ 0x1B(+27)	0x201B(8219)	0x203B(8251)	0x205B(8283)	0x207B(8315)	…….	0x27DB(10203)
+ 0x1C(+28)	0x201C(8220)	0x203C(8252)	0x205C(8284)	0x207C(8316)	…….	0x27DC(10204)
+ 0x1D(+29)	0x201D(8221)	0x203D(8253)	0x205D(8285)	0x207D(8317)	…….	0x27DD(10205)
+ 0x1E(+30)	0x201E(8222)	0x203E(8254)	0x205E(8286)	0x207E(8318)	…….	0x27DE(10206)
+ 0x1F(+31)	0x201F(8223)	0x203F(8255)	0x205F(8287)	0x207F(8319)	…….	0x27DF(10207)

Address Offset	Access	Type, Size	Description
+ 0x02(+2) **	Read	1word	Input start register address of input image word this slot.
+ 0x03(+3) **	Read	1word	Input word's bit offset of input image word this slot.
+ 0x04(+4) **	Read	1word	Output start register address of output image word this slot.
+ 0x05(+5) **	Read	1word	Output word's bit offset of output image word this slot.
+ 0x06(+6) **	Read	1word	Input bit start address of input image bit this slot.
+ 0x07(+7) **	Read	1word	Output bit start address of output image bit this slot.
+ 0x08(+8) **	Read	1word	Size of input bit this slot
+ 0x09(+9) **	Read	1word	Size of output bit this slot
+ 0x0A(+10)**	Read	n word	Read input data this slot
+ 0x0B(+11)**	Read/Write	n word	Read/write output data this slot
+ 0x0E(+14)	Read	1word	GT-number, if GT-1238, returns 0x1238
+ 0x0F(+15)	Read	String upto 72byte	First 1word is length of valid character string. If GT-1238, returns "00 1E 52 54 2D 31 32 33 38 2C 20 38 44 49 2C 20 32 34 56 64 63 2C 20 55 6E 69 76 65 72 73 61 6C 00 00" Valid character size = 0x001E =30 characters, "GT-1238, 8DI, 24Vdc, Universal"
+ 0x10(+16)	Read	1word	Size of configuration parameter byte
+ 0x11(+17)**	Read/Write	n word	Read/write Configuration parameter data, up to 8byte. Refer to A.2 ***
+ 0x17(+23)	Read	2word	Firmware Revision ex) 0x00010010 (Major revision 1 /Minor revision 1, Rev 1.001)
+ 0x19(+25)	Read	2word	Firmware release date.

* After the system is reset, the new "Set Value" action is applied.
** Nothing of output, input, memory or configuration parameter corresponding slot returns Exception 02.

3.4. Supported MODBUS Function Codes

MODBUS Reference Documents
http://www.modbus.org
MODBUS Tools
http://www.modbustools.com, modbus poll
http://www.win-tech.com, modscan32

4. OBJECT MODELS

EtherNet/IP was developed from a very widely implemented standard used for transferring data between two devices in DeviceNet and ControlNet, called the Common Industrial Protocol (CIP). Every CIP node is modeled as a collection of objects. An object provides an abstract representation of a particular component within a device. Anything not described in object form is not visible through the CIP protocol. CIP objects are structured into classes, instances, and attributes.

A class of objects represents the same kind of system component. An object instance is the actual representation of a particular object within a class. Each instance of a class has the same attributes, but it has its own particular set of attribute values.

The objects and their components are addressed by uniform addressing scheme consisting of:

- Media Access Control Identifier (MAC ID), an integer identification value assigned to each node on a CIP network
- Class Identifier (Class ID), an integer identification value assigned to each Object Class accessible from the network
- Instance Identifier (Instance ID), an integer identification value assigned to an Object Instance that identifies it among all instances of the same class.
- Attribute Identifier (Attribute ID), an integer identification value assigned to a class and/or instance attribute.
- Service code, an integer identification value which denotes a particular object instance and/or object class function.

4.1. Supported Objects

■ **Supported Object**

Name of Object	Type	Number of Instances	Class Code
Identity	Required	1	01_{HEX}
Message Router	Required	1	02_{HEX}
Assembly	Required	2	04_{HEX}
Connection Manager	Required	1	06_{HEX}
Port	Required	1	$F4_{HEX}$
TCP/IP Interface	Required	1	$F5_{HEX}$
Ethernet Link	Required	1	$F6_{HEX}$
FnBus Manager	Vendor-specific	1	70_{HEX}
Expansion Slot	Vendor-specific	1~63	71_{HEX}

4.2. Identity Object

Class Code: 01_{HEX}

4.2.1. Common Services

Service Code	Implemented for		Service Name	Value
	Class	Instance		
0x01	Yes	Yes	Get_Attribute_All	
0x05	No	Yes	Reset	0: Reset Only 1: Reset and Factory Default
0x0E	No	Yes	Get_Attribute_Single	

4.2.2. Class Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
0	1	Get	Revision	UINT	0001_{HEX}
	2	Get	Max Instance	UINT	0001_{HEX}
	6	Get	Maximum ID Number Class Attributes	UINT	0000_{HEX}
	7	Get	Maximum ID Number Instance Attributes	UINT	0000_{HEX}

4.2.3. Instance Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
1	1	Get	Vendor ID	UINT	741_{DEC} (Crevis Co., Ltd)
	2	Get	Device Type	UINT	$0C_{HEX}$ (Communications Adapter)
	3	Get	Product Code	UINT	9000_{HEX} (GN-9289)
	4	Get	Revision - Major - Minor	Structure of: USINT USINT	 1 ~ 9 1 ~ 255
	5	Get	Status	WORD	Device status. Defined in standard.
	6	Get	Serial Number	UDINT	Unique Number
	7	Get	Product Name - String Length - ASCII String	Short_String USINT STRING	 34_{DEC} “9289,Modbus/TCP Adapter,GBUS”
	Vendor-specific				
	100	Get	Device Fault Code	USINT	00_{HEX} : Normal Operation Bit 0: No expansion slot Bit 1: Too many expansion slot Bit 2: Overflow I/O size Bit 3: I/O Configuration failure Bit 4: EEPROM Checksum fault Bit 6: Invalid Module ID Bit 7: Firmware fault
	104	Get	Firmware Release Date	UDINT	$YYYYMMDD_{HEX}$

4.3. Message Router Object

Class Code: 02_{HEX}

4.3.1. Common Services

Service Code	Implemented for		Service Name
	Class	Instance	
0x01	Yes	No	Get_Attribute_All
0x0E	No	Yes	Get_Attribute_Single

4.3.2. Class Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
0	1	Get	Revision	UINT	0001_{HEX}
	4	Get	Number of Attribute	UINT	0000_{HEX}
	5		Number of Service	UINT	0000_{HEX}
	6	Get	Maximum ID Number Class Attributes	UINT	0000_{HEX}
	7	Get	Maximum ID Number Instance Attributes	UINT	0000_{HEX}

4.3.3. Instance Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
1	1	Get	Object Class List	STRUCT of UINT Array of UINT	 10_{DEC} 09 00 01 00 02 00 04 00 06 00 F4 00 F5 00 F6 00 70 00 71 00
	2	Get	Number Available	UINT	16_{DEC} Maximum number of connections supported

4.4. Assembly Object

Class Code: 04 $_{HEX}$

4.4.1. Common Services

Service Code	Implemented for		Service Name
	Class	Instance	
0x0E	Yes	Yes	Get Attribute Single
0x10	No	Yes	Set Attribute Single

4.4.2. Class Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
0	1	Get	Revision	UINT	0002_{HEX}

4.4.3. Class Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
1	3	Get	Input (Produced) Process Image Data	Array n BYTE	Input process image data
2	3	Set/Get	Output (Consumed) Process Image Data	Array n BYTE	Output process image data

4.5. Connection Manager Object

Class Code: 06_{HEX}

4.5.1. Class Attributes, Instance Attribute

None

4.6. Port Object

Class Code: $F4_{HEX}$

4.6.1. Common Services

Service Code	Implemented for		Service Name
	Class	Instance	
0x01	Yes	Yes	Get_Attribute_All
0x0E	Yes	Yes	Get_Attribute_Single

4.6.2. Class Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
0	1	Get	Revision	UINT	0001_{HEX}
	2	Get	Max Instance	UINT	0001_{HEX}
	3	Get	Num Instances	UINT	0001_{HEX}
	8	Get	Entry Port	UINT	0001_{HEX}
	9	Get	All Ports	ARRAY of STRUCT UINT UINT	0000_{HEX} 0000_{HEX} 0004_{HEX} 0002_{HEX}

4.6.3. Instance Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
1	1	Get	Port Type	UINT	0004_{HEX} , TCP/IP Port
	2	Get	Port Number	UINT	0002_{HEX}, CIP port number associate with port
	3	Get	Port Object	UINT Padded EPATH	
	4	Get	Port Name	Short_String	=0
	7	Get	Node Address	Padded EPATH	

4.7. TCP/IP Object

Class Code: $F5_{HEX}$

4.7.1. Common Services

Service Code	Implemented for		Service Name
	Class	Instance	
0x01	Yes	Yes	Get_Attribute_All
0x0E	Yes	Yes	Get_Attribute_Single
0x02	No	Yes	Set_Attribute_All
0x10	No	Yes	Set_Attribute_Single

4.7.2. Class Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
0	1	Get	Revision	UINT	0001_{HEX}
	2	Get	Max Instance	UINT	0001_{HEX}
	3	Get	Num Instances	UINT	

4.7.3. Instance Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
1	1	Get	Status	DWORD	See section 4.7.3.1.
	2	Get	Configuration Capability	DWORD	00000006_{HEX}
	3	Get/Set	Configuration Control	DWORD	See section 4.7.3.2.
	4	Get	Physical Link Path Size of Path Path	STRUCT of: UINT Padded-PATH	 0002_{HEX} 00 00 20 F6 24 01
	5	Get/Set	Interface Configuration	STRUCT of: UDINT UDINT UDINT UDINT UDINT STRING	 IP address Network Mask Gateway Address Name Server Name Server 2 Domain Name

4.7.3.1. Status Instance Attributes

This attribute indicates the status of the TCP/IP network interface.

Table4.7.1. Status Attribute

Bit	Description
0-3	0 – The Interface Configuration attribute has not been configured. 1 – The Interface Configuration attribute contains valid configuration from BOOTP, DHCP, or non-volatile storage. 2 – The Interface Configuration attribute contains valid configuration, obtained from DIP switch. 3-15 – Reserved.
4	Indicates pending configuration change in TTL and/or Mcast config.
5-31	Reserved

4.7.3.2. Configuration Control Instance Attributes

This attribute is a bitmap to control network configuration.

Table4.7.1. ConfigurationControlAttribute

Bit	Description
0-3	Determine how the device shall obtain its initial configuration at startup. 0 – The device shall use the interface configuration values previously stored in EEPROM. 1 – The device shall use the interface configuration values via BOOTP. 2 – The device shall use the interface configuration values via DHCP upon start-up. 3-15 – Reserved.
4	If TRUE, the device shall resolve host names by querying a DNS server.
5-31	Reserved

4.8. Ethernet Link Object

Class Code: $F6_{HEX}$

4.8.1. Common Services

Service Code	Implemented for		Service Name
	Class	Instance	
0x01	Yes	Yes	Get_Attribute_All
0x0E	Yes	Yes	Get_Attribute_Single

4.8.2. Class Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
0	1	Get	Revision	UINT	0002_{HEX}
	2	Get	Max Instance	UINT	0001_{HEX}
	3	Get	Num Instances	UINT	0001_{HEX}

4.8.3. Instance Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
1	1	Get	Interface Speed	UDINT	10_{DEC}, 100_{DEC}
	2	Get	Interface Flags	DWORD	Bit 0 : Link Active Bit 1 : Full Duplex Bit 2~4 : Auto negotiation Bit 5 : Manual Setting required Reset Bit 6 : Local Hardware Fault Others : 0
	3	Get	Physical Address	ARRAY of 6 USINTs	Same as MAC address

4.9. Fn-Bus Manager Object

Class Code: 70_{HEX}

4.9.1. Common Services

Service Code	Implemented for		Service Name
	Class	Instance	
0x0E	No	Yes	Get Attribute Single
0x10	No	Yes	Set Attribute Single

4.9.2. Class Attributes

None

4.9.3. Instance Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
1	1	Get	Number of I/O Slot	USINT	(include deactivated slot)
	2	Get	Num of Activated Slot	USINT	
	3	Get	Num of Deactivated Slot	USINT	
	4	Get	External IDs	Array of 64 WORD	See Table 4.9.6. See Appendix A.1.
	5	Get/Set*	Selection of Input (Produced) Process Image Mode	USINT	(default 2) Fixed
	6	Get/Set*	Selection of Output (Consumed) Process Image Mode	USINT	(default 0) Fixed
	10	Get	Fn-Bus Status	USINT	0: Normal Operation 1: FnBus Standby 2: FnBus Connection Fault 3: Expansion Configuration Fault 4: No expansion module
	11	Get	Input (Produced) Byte Size	UINT	IO input byte size
	12	Get	Output (Consumed) Byte Size	UINT	IO output byte size
	13	Get/Set*	Enable Input Run/Idle Header	BOOL	0:Disabled Input Run/Idle Header (default) Fixed
	14	Get/Set*	Enable Output Run/Idle Header	BOOL	1:Enabled Output Run/Idle Header (default) Fixed
	15	Get/Set*	Output Reset at stop	BOOL	0:Disable(default) 1:Enable

*After the system is reset, the new "Set Value" action is applied. If slot location is changed, default value is set automatically.

Table4.9.6. External IDs (=Expansion Module ID)

Word	Description
0	Network Adapter Module External ID = 0x00
1	External ID for slot position #1
2	External ID for slot position #2
.	.
.	.
.	.
62	External ID for slot position #62
63	External ID for slot position #63

4.10. Expansion Slot Object

Class Code: 71_{HEX}

4.10.1. Common Services

Service Code	Implemented for		Service Name
	Class	Instance	
0x0E	No	Yes	Get_Attribute_Single
0x10	No	Yes	Set_Attribute_Single

4.10.2. Class Attributes

None

4.10.3. Instance Attributes

Instance ID	Attribute ID	Access Rule	Name	Data Type	Value
1~63 (Slot Address)	1	Get	Module External ID	USINT	Crevis Module ID
	2	Get	I/O Data Code - Input Data Code - Output Data Code	Structure of: USINT USINT	See Table 4.10.1
	3	Get	Input Offset Table - Byte Offset - Bit Offset	Structure of: USINT USINT	Byte offset in the Input Assembly Corresponding bit offset in the byte (If Input data length is zero, then return Empty.)
	4	Get	Output Offset Table - Byte Offset - Bit Offset	Structure of: USINT USINT	Byte offset in the Output Assembly Corresponding bit offset in the byte (If Output data length is zero, then return Empty.)
	5	Get	Input Data	Array of BYTE	Read Input data size defined by attribute 2. If Input data length is zero, then return Empty.
	6	Get/Set	Output Data	Array of BYTE	Read/Write Output data size defined by attribute 2. If Output data length is zero, then return Empty.
	7	Get/Set*	Active Flag	BOOL	0: This slot is activated 1: This slot is deactivated
	8	Get	Configuration Parameter Data length	USINT	FnBUS I/O Parameter
	9	Get/Set	R/W Configuration Data	n Byte	Data array size defined by attribute 8.
	100	Get	Product Code	4 Byte	See Table 4.10.2
	101	Get	Catalog Number	4 Byte	
	102	Get	Firmware Revision	Structure of: USINT USINT	Expansion Module Firmware Revision

*After the system is reset, the new "Set Value" action is applied. If slot location is changed, default value is set automatically.

Table4.10.1. I/O Data Code Format

Byte#	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
+0	Input Data Type		Input Data Length					
+1	Output Data Type		Output Data Length					

Input/outputType:
0 0: No I/O Data
0 1: Byte Data
1 0: Word Data
1 1: Bit Data

Input/outputData Length:
0 0 0 0 0 0: 0 Bit/Byte/Word
0 0 0 0 0 1: 1 Bit/Byte/Word
0 0 0 0 1 0: 2 Bit/Byte/Word
0 0 0 0 1 1: 3 Bit/Byte/Word
…
1 1 1 1 1 1: 63 Bit/Byte/Word

Table4.10.2. ProductCode Format

Byte#	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

+0	Connection Type
+1	Assembly Type
+2	Output Information
+3	Input Information

**** Connection Type***

Byte#	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
+0	Reserved						**Mem**	**IO**

IO (Input/output Connection)
IO = 0: does not support Input/output Connection
IO = 1: support Input/output Connection

MEM (Memory Register Service)
MEM = 0: does not support Memory Register Service Connection
MEM = 1: support Memory Register Service Connection

** Assembly Type*

Byte#	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
+1	**Unit_Type**		**Priority**		**S**	Reserved		

Unit_Type
0 0: Not Used
0 1: Input Module
1 0: Output Module
1 1: I/O Both Modules

Priority (Input/output Data Priority for assembly)
0 0: Priority 0 (low) - usually it is used by Byte/Bit Type Discrete module.
0 1: Priority 1
1 0: Priority 2 - usually it is used by Analog I/O module.
1 1: Priority 3 (high)

S (Status for Profibus Slot Diagnostic)
0: No Status
1: Support Word Input Diagnostic(0x8000 = -32678)

for example: ST-3234(current analog input 4~20mA, 14bit)

Status	Input Data
Normal	0x0000 (4mA) ~ 0x3FFF (20mA)
Open Wire or Underrange (0~3mA)	0x8000 (-32678)

**** Input/Output Information***

Byte#	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
+2	**Data_Type**		**Data_Length**						Output Information
+3	**Data_Type**		**Data_Length**						Input Information

Input/output Type:
0 0: Byte Data
0 1: Word Data
1 0: Bit Data
1 1: have no Input or Output Data

Input/output Data Length:
0 0 0 0 0 0: 0 Bit/Byte/Word
0 0 0 0 0 1: 1 Bit/Byte/Word
0 0 0 0 1 0: 2 Bit/Byte/Word
0 0 0 0 1 1: 3 Bit/Byte/Word
…
1 1 1 1 1 1: 63 Bit/Byte/Word

4.11. Ethernet/IP Reference

Ethernet/IP Reference Documents
http://www.odva.org
http://www.ethernet-ip.org
Ethernet/IP Tools
http://www.pyramid-solutions.com