KCU-70

Modbus TCP/IP Communication Module
Hardware Operation manual

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SECTION 1 : INTRODUCTION

Modbus TCP/IP also known as Modbus RTU communication protocol, the communication interface to the Ethernet.

KCU-70 Modbus TCP/IP network communication module can only be applied to Kutai's advanced control units (For example : ATS-XX type、GCU-100、GCU-3000、AMF-10、AMF-11 …etc).

- Support manual or automatic IP network configuration
- Number of connection allowed : 3
- Support 10/100Base-T network transmission
- IP Port : 502 (Factory pre-set)
- Communication Status Indicator

SECTION 2 : SPECIFICATION

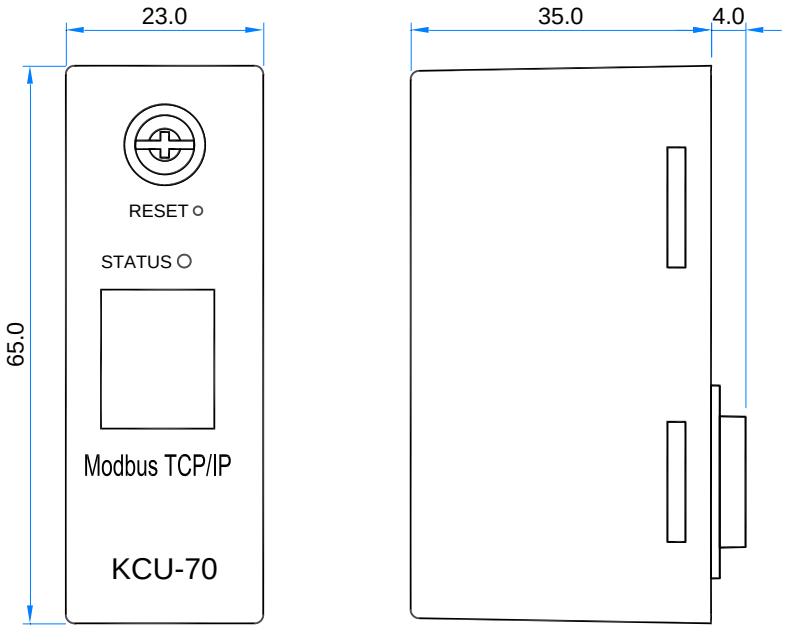
Power Input
5 Vdc

Static Consumption
< 1.0 watt

Environment
Operating Temperature -20 to +60 ˚C
Storage Temperature -35 to +85 ˚C
Relative Humidity 95% or Below
Vibration 3 Gs @ 100 – 2K Hz

Dimension
65.0 (L) x 23.0 (W) x 35.0 (H) mm

Weight
31 g +/- 2%
0.068 lb +/- 2%



Unit : mm

Fig 01 Dimention

Warning!!

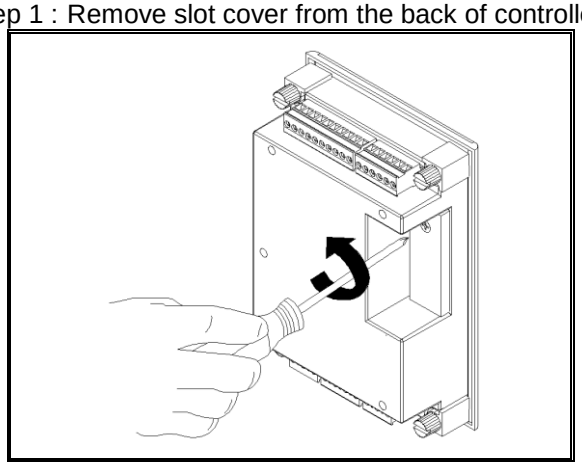
When using the KCU-70 module to remotely monitor the ATS system, it is recommended to use the DCtype controller ATS-245-DC to avoid communication to be interrupted and affect Remote monitoring function when both Utility and Standby power Failed at same time.

SECTION 3 : INSTALLATION PROCEDURE

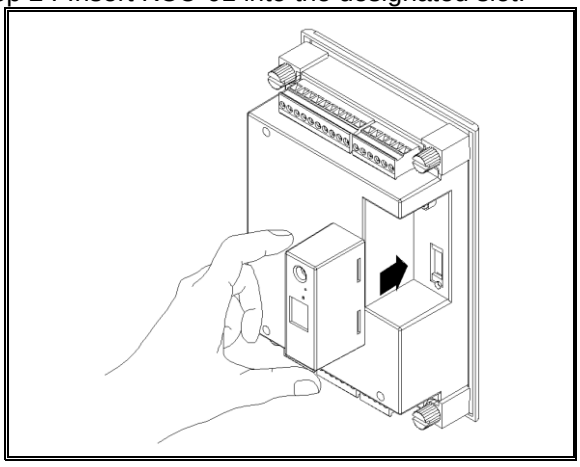
Always remove power input from control unit before installation. Refer to the following steps and connect KCU-70 to the control unit or onto the KCU-IF module.

3.1 ATS-245-DC Installation Example Description

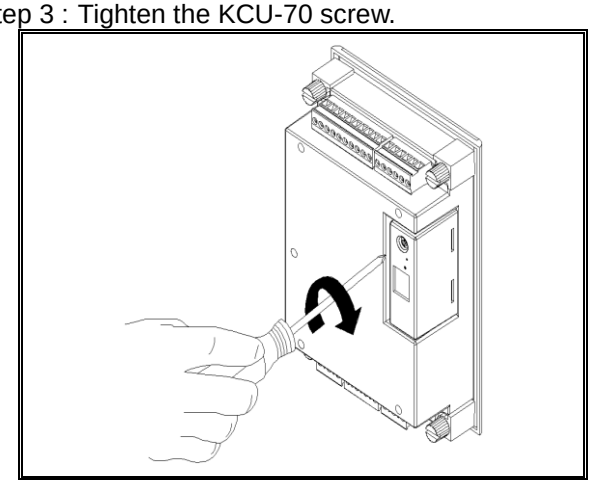
Step 1 : Remove slot cover from the back of controller.



Step 2 : Insert KCU-01 into the designated slot.



Step 3 : Tighten the KCU-70 screw.



Step 4 : Turn on the power of the controller, Operate according to the operation manual and perform the following two settings :

1. Setting KCU-70 Slave Address(1 – 99).

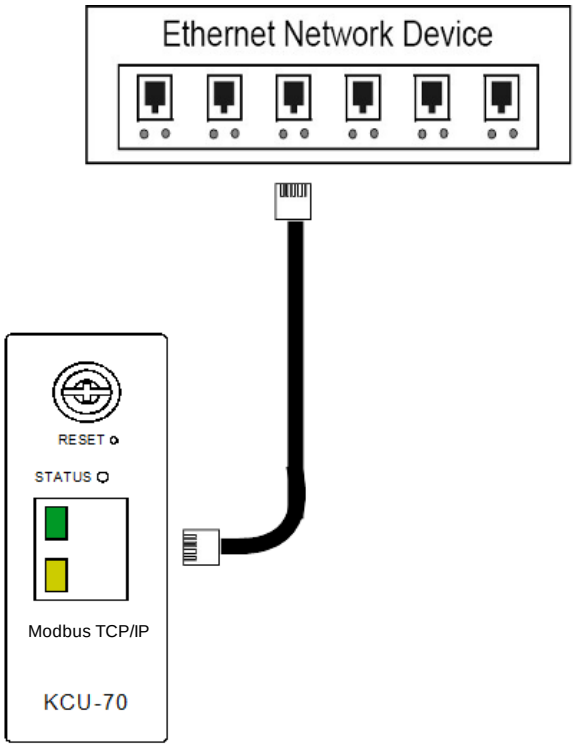
2. If you want to remotely operate the control unit, you need to enable the setting of “remote control by KCU-XX module”.

Warning!!

1. **When Remote control by KCU-XX module option is cancelled, the GenOnCall remote monitoring app can only provide monitoring function, all remote operation will be disabled.**

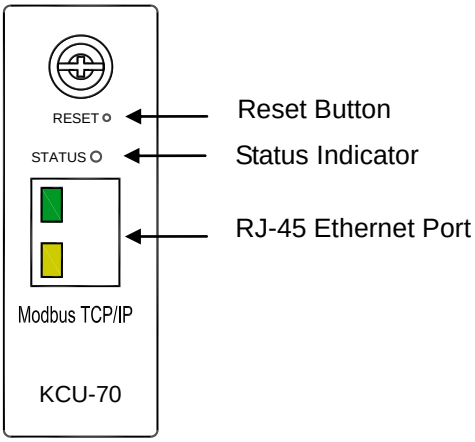
2. **Kutai Electronics reserves the right to modify the content and setting from current and newly developed control unit(s), prior or after modification will not be notified by Kutai Electronics. User is free to connect to the official website to obtain latest information and update.**

3.2 KCU-70 Connection Diagram



When KCU-70 is connected to network via ethernet network device Fig 02 (For example : HUB, IP Switch or IP Router). User must first enable the DHCP server function to allow KCU-70 to obtain valid connection IP provided by DHCP server.

SECTION 4 : STATUS AND NETWORK CONNECTION INDICATOR



Network Connection Port Indicator :

STATUS	Description
	Green On : Connection status normal Yellow Flash : Data is Transmitting

KCU-70 Status Indicator Description :

STATUS	Description
Flash	KCU-70 Connected and communicating to control unit
Flash	KCU-70 Network communication status : “Requesting IP from DHCP server” or “In communication with client (Master)”
Flash	Above two status operating simultaneously
Flash On	KCU-70 Communicating with control unit and pending connection (Green light entinguish when ready)
& Alternatel y lit	KCU-70 tries to establish a connection with the control unit and read all the information from the control unit ; or the control unit currently in use is not supported

KCU-70 Troubleshooting :

STATUS	Troubleshoot
Status Indicator does not flash or & Alternately lit	(1) Click control unit if faulty (2) If control unit is operating correctly, reinstall KCU-70 and check if returns to normal (3) If problem still exisit after following the above steps, replace KCU-70 or contact dealer.

SECTION 5 : KCU-70 PARAMETER CONFIGURATION

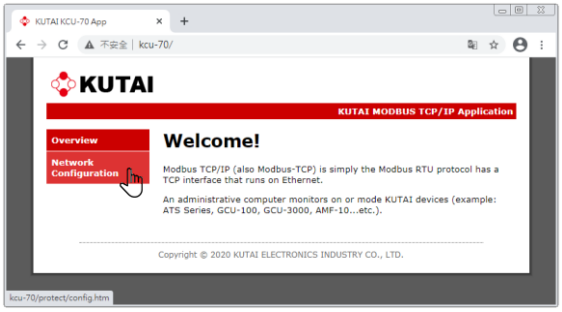
KCU-70 Factory parameter reset :
Use a pointy object (tip of a pen or tooth pick) to hold and press down RESET for 2 seconds. When GREEN light is illuminated, the system is in process of reseting, once the light turns RED, all settings are resume to factory preset.

Item	Description
Host Name	KCU-70
Admin Name	admin
Admin Password	ji394kutai
DHCP	Enable
IP Address	192.168.1.56
Gateway	192.168.1.1
Subnet Mask	255.255.0.0
Primary DNS	192.168.1.1
Secondary DNS	0.0.0.0
Modbus-TCP Port	502

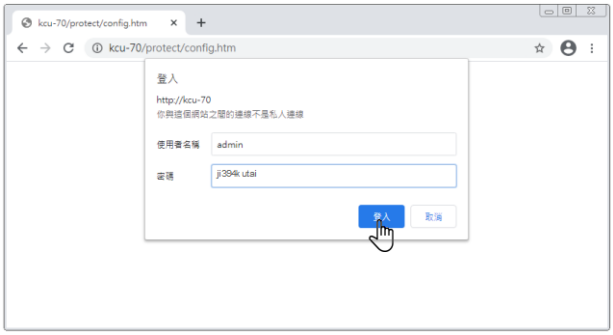
KCU-70 Configuration :
After installs the KCU-70 properly according to Section 3, follow the steps below to change the KCU-70 parameter configuration.

Step 1 : Open Web browser and enter keyword "kcu-70/"(or IPaddress)

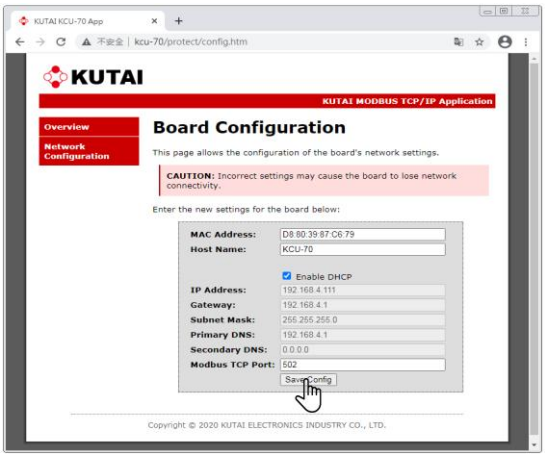
Step 2 : Click “Network Configuration”



Step 3 : Enter the correct user name "admin" and password "ji394kutai"before click “Sign in”.

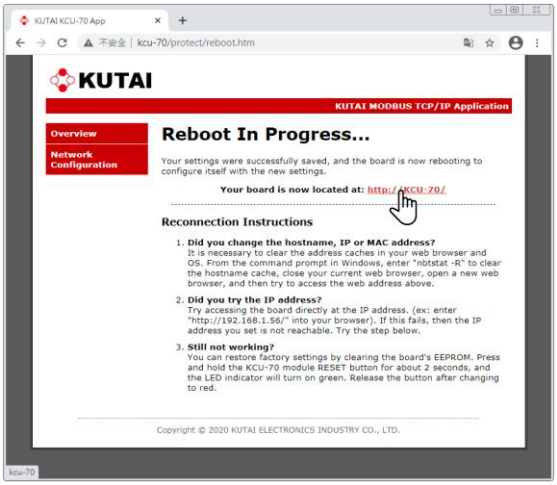


Step 4 : Enter the required parameter settings and click “Save Config”



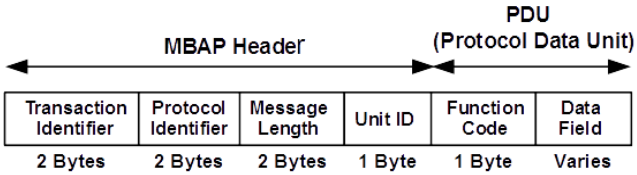
When multiple KCU-70 are connected in the same domain, different host Name (up to 15 characters) for each module is recommended.

Step 5 : End screen. Click on “http://KCU-70/” to return to configuration.



SECTION 6 : MODBUS-TCP/IP DATA PACKET FORMAT

Modbus-TCP/IP Data packet includes MBAP(ModBus Application Protocol) headers, Function Code and Data Field three sections. MBAP is divided into 4 field with total of 7 bytes.



Transaction Identifier : Used to identify the corresponding code for transmitting and receiving packet(s).

Protocol Identifier : Modbus fixed to 0.

Message Length : Unit ID to Data Field byte data length.

Unit ID : Remote Slave device identification code (Slave Address)

Function Code : execution code to request remote Slave device to carry out operation.

Data Field : Contains a message string that makes a request or response to a remote slave device.

SECTION 7 : MODBUS-TCP/IP FUNCTION CODE

KCU-70 is compatible with Modbus-TCP/IP protocol and provides access to related information through different function codes.

Function Code	Description
01 (01h)	Read Coil Status
02 (02h)	Read Input Status
03 (03h)	Read Holding Registers
04 (04h)	Read Input Registers
05 (05h)	Write Single Coil
06 (06h)	Write Single Register
16 (10h)	Write Multiple Registers
17 (11h)	Read Slave Device Information

The KCU-70 has a timeout of 1 second for each Modbus-TCP data packet. When the timeout occurs, all received data will be discarded; the network communication timeout time is 22 seconds.

7.1 Code 01 – Read Coil Status

This function code is to read 1 to 2000 consecutive Digital Output (DO) bit data (Single bit) from a remote control unit.

Each Coil Status from the data packet responded by KCU-70 occupies 1 bit. When status indicates 1 = ON, 0 = OFF. The reading of first Coil Status is stored in the least significant bit (lsb), and so on into each byte.

Request

Function Code	1 Byte	0x01
Start Address	2 Bytes	0x0000 – 0xFFFF
Quantity of Coils	2 Bytes	1 – 2000(0x7D0)

Response

Function Code	1 Byte	0x01
Byte Count	1 Byte	N*
Coil Status	n Byte	n = N or N+1

N = Quantity of Coils / 8. If the remainder is not 0, n = N+1

Error

Function Code	1 Byte	0x81
Exception code	1 Byte	Ref. section 7.9

Example : Reading from ATS-245-DC Digital Output (DO) bit data(Output Status 1 – 10)

Request

Field Name	HEX
Function Code	01
Starting Address Hi	00
Starting Address Lo	00
No. of Points Hi	00
No. of Points Lo	0A

Response

Field Name	HEX
Function Code	01
Byte Count	02
Output Status 8 – 1	04
Output Status 16 – 9	00

Description :

Appendix 01 <Reading Digital Output (DO) Data> Define only Output status 1 – 4. Output Status 5 – 16 are undefined, therefore the Output readings are OFF (0).Output Status 1 being the least significant bit (lsb) of the first data byte, and Output Status 8 is the most significant bit (msb) of the byte. The other coils status follows with low order to high order in subsequent bytes.

Output Status 8 – 1 displaying status value 0x04 (Hex) or Binary 0000 0100.

Output Status 3 is ON(1) : The control unit current setting is under OFF mode operation.

7.2 Code 02 – Read Input Status

This function code is to read 1 to 2000 consecutive Digital Input (DI) bit data (Single bit) from a remote control unit.

Each Input Status from the data packet responded by KCU-70 occupies 1 bit. When status indicates 1 = ON, 0 = OFF. The reading of first Input Status is stored in the least significant bit (lsb), and so on into each byte.

Request

Function Code	1 Byte	0x02
Start Address	2 Bytes	0x0000 – 0xFFFF
Quantity of Inputs	2 Bytes	1 – 2000(0x07D0)

Response

Function Code	1 Byte	0x02
Byte Count	1 Byte	N*
Input Status	n Byte	n = N or N+1

N = Quantity of Coils / 8. If the remainder is not 0, n = N+1

Error

Function Code	1 Byte	0x82
Exception code	1 Byte	Ref. section 7.9

Example : reading from ATS-245-DCDigital Input (DI)bit data(Input Status 1 – 10)

Request

Field Name	HEX
Function Code	02
Starting Address Hi	00
Starting Address Lo	00
No. of Points Hi	00
No. of Points Lo	0A

Response

Field Name	HEX
Function Code	02
Byte Count	02
Input Status 8 – 1	05
Input Status 16 – 9	00

Description :

Apendix 01 <Reading Digital Input (DI) Data> Define Input Status 1 – 31,Readings are all within the defined range.

Input Status 1 being the least significant bit (lsb) of the first data byte, and Input Status 8 is the most significant bit (msb) of the byte. The other input status follows with

low order to high order in subsequent bytes.
Input Status 8 – 1 displaying value 0x05 (Hex) or binary 0000 0101.

Input Status 1 is ON(1) : Allow remote connection to switch the operation mode of the control unit.
Input Status 3 is ON (1) : The control unit is at OFF mode operation.

7.3 Code 03 – Read Holding Registers

This function code is to read from 1 to 125 holding register data from a remotely operated control unit.

There are 2 bytes occupied, with high byte prioritized in each holding register responded data packet.

Request

Function Code	1 Byte	0x03
Start Address	2 Bytes	0x0000 – 0xFFFF
Quantity of Registers	2 Bytes	1 – 125(0x7D)

Response

Function Code	1 Byte	0x01
Byte Count	1 Byte	2 x N
Register Value	N x 2 Bytes	

N = Quantity of Registers

Error

Function Code	1 Byte	0x83
Exception code	1 Byte	Ref. section 7.9

Example : Reading ATS-245-DC holding register

Register 1 : Current operation mode of ATS

Register 2 : System Phase of ATS

Register 3 : Change over switch type of ATS

Request

Field Name	HEX
Function Code	03
Starting Address Hi	00
Starting Address Lo	00
No. of Registers Hi	00
No. of Registers Lo	03

Response

Field Name	HEX
Function Code	03
Byte Count	06
Register Value Hi (Register 1)	00
Register Value Lo (Register 1)	01
Register Value Hi (Register 2)	00
Register Value Lo (Register 2)	01
Register Value Hi (Register 3)	00
Register Value Lo (Register 3)	00

Description :
Appendix 01 <Read Holding Register Data> Definition table, each temporary storage occupies 2 bytes.

Register 1(Address 0)the value is 0x0001(Hex) or 1(Decimal) : The Control Unit is in OFF mode operation.

Register 2(Address 1) the value is 0x0001(Hex) or 1(Decimal) : The system phase of the ATS is configured as 3 Phase (3P).

Register 3(Address 2) the value is 0x0000(Hex) or 0(Decimal) : Change Over Switch type is MCCB Type (Single motor).

7.4 Code 04 – Read Input Registers

This Funcition code is to read from 1 to 125 Analog Input (AI) register from the remotely operated control unit.

There are 2 bytes occupied, with high byte prioritized in each holding register responded data packet.

Request

Function Code	1 Byte	0x04
Start Address	2 Bytes	0x0000 - 0xFFFF
Quantity of Registers	2 Bytes	1 – 125(0x7D)

Response

Function Code	1 Byte	0x04
Byte Count	1 Byte	2 x N
Register Value	N x 2 Bytes	

N = Quantity of Registers

Error

Function Code	1 Byte	0x84
Exception code	1 Byte	Ref. section 7.9

Example:Reading ATS-245-DC Analog Input (AI) Data

Register 1 : Normal power V_{12} voltage reading

Register 2 : Normal power V_{23} voltage reading

Register 3 : Normal power V_{31} voltage reading

Request

Field Name	HEX
Function Code	04
Starting Address Hi	00
Starting Address Lo	00
No. of Registers Hi	00
No. of Registers Lo	03

Response

Field Name	HEX
Function Code	04
Byte Count	06
Register Value Hi (Register 1)	08
Register Value Lo (Register 1)	9E
Register Value Hi (Register 2)	08
Register Value Lo (Register 2)	9C
Register Value Hi (Register 3)	08
Register Value Lo (Register 3)	9D

Description :
Refer to Appendix 01 < Reading Analog Input (AI) Data > table. To read the data < Normal power V12 voltage reading >, < Normal power V23 voltage reading > and < Normal power V31 voltage reading > from the control unit. The data type is U16 and accupying one register. Therefore total of 3 register values are readed.

(1) Register 1 (Normal power V12 voltage reading) :
Value 0x089E(Hex) or 2206(Decimal).
Because the ratio = 0.1V, so the value must devided by 10 : V_{12} Voltage = 2206 * 0.1 = 220.6 V.

(2) Register 2 (Normal power V23 voltage reading) :
Value 0x089C(Hex) or 2204(Decimal).
Because the Ratio = 0.1V, so the value must devided by 10 : V_{23} Voltage = 2204 * 0.1 = 220.4 V.

(3) Register 3 (Normal power V31 voltage reading) :
Value 0x089D(Hex) or 2205(Decimal).
Because the Ratio = 0.1 V, so the value must devided by 10 : V_{31} Voltage = 2205 * 0.1 = 220.5 V.

7.5 Code 05 – Write Single Coil

This Function Code is for Digital Output (DO) to estabilish ON or OFF status.

When enter value to 0xFF00 status to **ON**, 0x0000 status to **OFF**, other value becomes invalid but does not affect the output status.

Warning!!
When changing operation mode AUTO, OFF or TEST function on the remote-control unit, system can only accept entering value 0xFF00 (ON). Because once the operation mode is changed, it automatically disengages (OFF) and other operation functions.

To change operation mode to OFF, user need only enter value 0xFF00 to Coil Number 3 (Address 2).

Request

Function Code	1 Byte	0x05
Start Address	2 Bytes	0x0000 – 0xFFFF
Output Value	2 Bytes	0x0000 or 0xFF00

Response

Function Code	1 Byte	0x05
Start Address	2 Byte	0x0000 - 0xFFFF
Output Value	2 Bytes	0x0000 or 0xFF00

Error

Function Code	1 Byte	0x85
Exception code	1 Byte	Ref. section 7.9

Example : Write ATS-245-DCDigital Output (DO) Data. Set the ATS-245-DC to AUTOoperation mode.

Request

Field Name	HEX
Function Code	05
Start Address Hi	00
Start Address Lo	01
Output Value Hi	FF
Output Value Lo	00

Respons

Field Name	HEX
Function Code	05
Start Address Hi	00
Start Address Lo	01
Output Value Hi	FF
Output Value Lo	00

Description :

Refer to Appendix 01 <Write Digital Output (DO) Data >Table, To set the ATS-245-DC to AUTOoperation mode, enter value 0xFF00 (ON) to Coil Number 2 (Address 1).

7.6 Code 06 – Write Single Register

This function cord is for writing a data to the rigister of the control unit. The entered value must be a valid address and defined register value otherwise an exception code will be responded.

Warning!!

When changing operation mode AUTO, OFF, or TEST function on the remote-control unit. Simply enter value 0x0000 (AUTO) or 0x0001 (OFF) or 0x0002(TEST) to Register Number 1 (Address 0).

After switching the operating mode of the control unit, other operating options are automatically cancelled.

Request

Function Code	1 Byte	0x06
Start Address	2 Bytes	0x0000 – 0xFFFF
Register Value	2 Bytes	0x0000 – 0xFFFF

Response

Function Code	1 Byte	0x06
Start Address	2 Byte	0x0000 – 0xFFFF
Register Value	2 Bytes	0x0000 – 0xFFFF

Error

Function Code	1 Byte	0x86
Exception code	1 Byte	Ref. section 7.9

Example : Write ATS-245-DC holding register data
Change the ATS-245-DC to OFF mode.

Request

Field Name	HEX
Function Code	06
Start Address Hi	00
Start Address Lo	00
Register Value Hi	00
Register Value Lo	01

Response

Field Name	HEX
Function Code	06
Start Address Hi	00
Start Address Lo	00
Register Value Hi	00
Register Value Lo	01

Description :
Refer to Appendix 02 < Write Holding Register Data (System paraments) > table. To change the ATS-245-Dcto OFF mode, Write 0x0001(Hex) to address 0register.

7.7 Code 16 – Write Multiple Registers

This Function Code is for writing multiple 1 to 20 register(s) to a remote-control unit. When write a single or multiple register(s) value, the entered value(s) must be a valid address and defined register value otherwise an exception code will be responded.

Warning!!

Strongly Suggest : Not to enter other register settings while changing the operation mode on the remote-control unit in the sametime.

Request

Function Code	1 Byte	0x10
Start Address	2 Bytes	0x0000 – 0xFFFF
Quantity of Registers	2 Bytes	1 – 20(0x14)
Byte Count	1 Byte	2 x N
Registers Value	N x 2 Bytes	Value

N = Quantity of Registers

Response

Function Code	1 Byte	0x10
Start Address	1 Byte	0x0000 – 0xFFFF
Quantity of Registers	2 Bytes	1 – 20(0x14)

Error

Function Code	1 Byte	0x90
Exception code	1 Byte	Ref. section 7.9

Example : Write ATS-245-DC Holding Register Data

Register 4 : Time delay from Emergency to Normal (TDEN)

Register 5 : Time delay from Normal to Emergency (TDNE)

Request

Field Name	HEX
Function Code	10
Start Address Hi	00
Start Address Lo	03
No. of Register Hi	00
No. of Register Lo	02
Byte Count	04
Register Value Hi (Register 4)	00
Register Value Lo (Register 4)	09
Register Value Hi (Register 5)	00
Register Value Lo (Register 5)	0E

Response

Field Name	HEX
Function Code	10
Start Address Hi	00
Start Address Lo	03
No. of Register Hi	00
No. of Register Lo	02

Description :

Refer to appendix 02 Write Holding Register Data (System paraments)> table. To write the setting < Time delay from Emergency to Normal (TDEN)> and < Time delay from Normal to Emergency (TDNE)> into control unit

(1) Register 4 : Enter the value 0x0009(Hex).
TDEN setting = 9 seconds

(2) Register 5 : Enter the valure 0x000E(Hex).
TDENsetting = 14seconds

7.8 Code 17 – Read Slave Device Information

This Function Code is for retrieve general information from the control unit, included Control unit mode, Serial number and Firmware version…etc.

Request

Function Code	0x11

Respond

Function Code	0x11
Byte of Count	0x01 – 0xFA
Fixed Code	0x5A
Run Indicator	0x00 = OFF 0xFF = Running
Device Type	0x0001 – 0xFFFF
Device Number	0x0001 – 0xFFFF
Manufacture Name	String Type
Device Product Name	String Type
Device Serial Number	String Type
Device Firmware Version	String Typr
KCU-70 Serial Number	String Type
KCU-70 Firmware Version	String Type

Error

Error Code	0x91
Exception Code	Ref. section 7.9

Example : Read ATS245-DC general information

Request

Field Name	HEX
Function Code	11

Respond

Field Name	HEX
Function Code	11
Byte of Count	49
Fixed Code	5A
Indicator Status	FF
Device Type Hi Value	00
Device Type Lo Value	0A
Device Number Hi Value	00
Device Number Lo Value	18
Manufacture Name	String Type
(End of Code = 0x00)	KUTAI Electronics
Device Product Name	String Type
(End of Code = 0x00)	ATS-245-DC
Device Serial Number	String Type
(End of Code = 0x00)	**********
Device Firmware Version	String Type
(End of Code = 0x00)	xx.xx
KCU-70 Serial Number	String Type
(End of Code = 0x00)	123456789012
KCU-70 Firmware Version	String Type
(End of Code = 0x00)	01.01

Notice :
"**********" and "xx.xx",Indicates that there is no such information

7.9 Modbus Exception Respond

When User (Master) Send request to a remote Slavedevice (KCU-70), one of the follow 4 scenarios may occur.

- When KCU-70 receives request, with no communication error occurring during transmission and data packet validated, the system resume to normal message response.
- If KCU-70 fails to receive command due to communication error, no responding message will be issued.
- If KCU-70 receives request then communication error occurs, no responding message will be issued.
- When KCU-70 receives request with no communication error occurring, but unable to process the request; An Exception Code will be issued, notifying Master to take appropriate action.

Exception Codes Table

Code (Hex)	Name	Description
01	ILLEGAL Function	Function Code received in the query is not an allowable action for the server.
02	ILLEGAL Data Address	The data address received in the query is not an allowable address for the server.
03	ILLEGAL Data Value	A value contained in the query data field is not an allowable value for server.
51	Control Unit and KCU-70 Connection Lost	Control Unit and KCU-70 communication failure. This failure code is generated when Master issue a Read / Write request command and control unit and KCU-70 fails to estabilish connection.
52	Control Unit not ready	KCU-70 didn't receive all necessary information from control unit. This failure code is generated when Master issue a Read / Write request command and KCU-70 fails to obtain all necessary information from control unit.
53	Data buffer overflow	This failure code is generated when Master issue a Read / Write request command and discovers data buffer overflow.
54	Controller not supported by KCU-70	This failure code is generated when Master issue a Read / Write request command but KCU-70 does not currently support the current control unit.
55	Operation mode change failure	This failure code is generated when Master issued operation mode change (AUTO / OFF / MANU / TEST) but fails. **Note : If the ATS-245-DC is the operating control unit, <Register 32 of Appendix 02 (Remote control by KCU-XX module)> must be set at "1" to enable user to change the operation mode remotely.** **(For detailed information, refer to the operation manual of each control unit).**
56	Write Failure	The failure code is generated when Master issue write holding register data request and received a request denial by Slave device. **Note : If the ATS-245-DC is the operating control unit, <Register 32 of Appendix 02 (Remote control by KCU-XX module)> must be set at "1" to enable user to write the system paraments remotely, and control unit must in OFF operating mode (change operating mode in addition), allowable write request.** **(For detailed information, refer to the operation manual of each control unit).**
57	Over Quantity of Registers	The failure code is generated when Master issue multiple Read / Write Register and exceed the maximum number (or Zero) allowed.
58	Prohibition of switching control unit operation mode (Function lock)	The control unit is in function lock mode, When the Master send out a request to change the operation mode of the control unit or modify the system paraments to control unit, it will respond with this error code. **(For detailed information, refer to the operation manual of each control unit).**

SECTION 8 : COMPATIBLE CONTROL UNIT LIST

Control Unit	Firmware Version Request	Reference Appendix
ATS-245	Vr 29.04 or above	Appendix 01
		Appendix 02
ATS-385	Vr 23.04 or above	Appendix 01
		Appendix 02
ATS-465	Vr 26.03 or above	Appendix 01
		Appendix 02
ATS-245-DC	Vr 18.04 or above	Appendix 01
		Appendix 02
ATS-22A-DC	Vr 32.04 or above	Appendix 01
		Appendix 02
ATS-245AG	Vr 20.05 or above	Appendix 01
		Appendix 03
ATS-PLC	Vr 07.03 or above	Appendix 04
		Appendix 05
ATS-332	Vr 01.05 or above	Appendix 06
		Appendix 07
ATS-342	Vr 01.04 or above	Appendix 06
		Appendix 08
AMF-10	Vr 01.03 or above	Appendix 09
		Appendix 10
AMF-11	Vr 01.03 or above	Appendix 11
		Appendix 12
GCU-100	Vr 01.05 or above	Appendix 13
		Appendix 14
GCU-3000	Vr 01.07 or above	Appendix 15
		Appendix 16

APPENDIX 01

Compatible Control Unitv : ATS-22A-DC / ATS-245-DC / ATS-245 / ATS-385 / ATS-465 / ATS-245AG		
Reading Digital Input (DI) Data : Function Code 02		
Address (Decimal)	**Description**	**Note**
0	Remote Operation	1 : Remote app operation granted
1	ATS panel operation button : AUTO	1 : ATS panel operation button in AUTO mode
2	ATS panel operation button : OFF	1 : ATS panel operation button in OFF mode
3	ATS panel operation button : TEST	1 : ATS panel operation button in TEST mode
4	**ATS-22A-DC :** panel button locked	1 : LOCK (All operation mode selection disabled)
	ATS-245AG : panel button locked	1 : LOCK (All operation mode selection disabled)
	Other models : Not used	0
5	Utility (Grid) Power Status	1 : Utility (Grid) Power OFF
6	Utility (Grid) Over Voltage	1 : Utility (Grid) Over Voltage Warning
7	Utility (Grid) Under Voltage	1 : Utility (Grid) Under Voltage Warning
8	Utility (Grid) Over Frequency	1 : Utility (Grid) Over Frequency Warning
9	Utility (Grid) Under Frequency	1 : Utility (Grid) Under Frequency Warning
10	Utility (Grid) Transfer Failure	1 : Utility (Grid) Transfer Failure Warning
11	Standby (Genset) Power Status	1 : Standby (Genset) Power OFF
12	Standby (Genset) Over Voltage	1 : Standby (Genset) Over Voltage Warning
13	Standby (Genset) Under Voltage	1 : Standby (Genset) Under Voltage Warning
14	Standby (Genset) Over Frequency	1 : Standby (Genset) Over Frequency Warning
15	Standby (Genset) Under Frequency	1 : Standby (Genset) Under Frequency Warning
16	Standby (Genset) Transfer Failure	1 : Standby (Genset) Transfer Failure Warning
17	Utility (Grid) ON/OFF Status	1 : Utility (Grid) Power Connect with Load
18	Standby (Genset) ON/OFF Status	1 : Standby (Genset) Power Connect with Load
19	TDEN Countdown Status	1 : TDEN Executing Countdown
20	TDNE Countdown Status	1 : TDNE Executing Countdown
21	TDES Countdown Status	1 : TDES Executing Countdown
22	TDEC Countdown Status	1 : TDEC Executing Countdown
23	Utility (Grid) Power Supply Status	1 : Utility (Grid) Power Connect with Load
24	Standby Power Establishment Status	1 : Waiting for Standby Power to be Established
25	Standby (Genset) Supply Status	1 : Standby (Genset) Power Connect with Load
26	TDEN Countdown Status(EXER)	1 : TDEN Executing Countdown(Exerciser)
27	TDES Countdown Status(EXER)	1 : TDES Executing Countdown(Exerciser)
28	Standby Power Establishment Status (EXER)	1 : Waiting for Standby Power to be Established(Exerciser)
29	Standby (Genset) Supply Status (EXER)	1 : Standby (Genset) Power Connect with Load(Exerciser)
30	Test Without load Supply Status (EXER)	1 : Perform Test Without load (Exerciser)

Compatible Control Unit : ATS-22A-DC / ATS-245-DC / ATS-245 / ATS-385 / ATS-465 / ATS-245AG			
Read Digital Output (DO) Data : Function Code 01 **Write Digital Output (DO) Data : Function Code 05**			
Address (Decimal)	**Description**	**R/W**	**Note**
0	ATS Remote Start Signal	R	1 : Remote start signal action
1	ATS Operation Mode : AUTO	R / W	1 : ATS In AUTO Mode
2	ATS Operation Mode : OFF	R / W	1 : ATS In OFF Mode
3	ATS Operation Mode : TEST	R / W	1 : ATS In TEST Mode

Compatible Control Unit : ATS-22A-DC / ATS-245-DC / ATS-245 / ATS-385 / ATS-465 / ATS-245AG				
Read Digital Input (AI) Data : Function Code 04				
Address (Decimal)	**Description**	**Data Type**	**Ratio**	**Note**
0	Utility (Grid) Phase V_{12} voltage	U16	0.1 Volt	Example : (1) V_{12} Value = 0x089B(Hex) = 2203(Decimal) V_{12} = 2203 / 10 = 220.3 Volt (2) Frequency Value = 0x0257(Hex) = 599(Decimal) Frequency = 599 / 10 = 59.9 Hz **Note :** **If system is <Single Phase>, Ignore Reading from V_{23} and V_{31}**
1	Utility (Grid) Phase V_{23} voltage	U16	0.1 Volt	
2	Utility (Grid) Phase V_{31} voltage	U16	0.1 Volt	
3	Utility (Grid) Frequency	U16	0.1 Hz	
4	Standby (Genset) Phase V_{12} voltage	U16	0.1 Volt	Example : (1) V_{12} Value = 0x089B(Hex) = 2203(Decimal) V_{12} = 2203 / 10 = 220.3 Volt (2) Frequency Value = 0x0257(Hex) = 599(Decimal) Frequency = 599 / 10 = 59.9 Hz **Note :** **If system is <Single Phase>, Ignore Reading from V_{23} and V_{31}**
5	Standby (Genset) Phase V_{23} voltage	U16	0.1 Volt	
6	Standby (Genset) Phase V_{31} voltage	U16	0.1 Volt	
7	Standby (Genset) Frequency	U16	0.1 Hz	

APPENDIX 02

Compatible Control Unitv : ATS-22A-DC / ATS-245-DC / ATS-245 / ATS-385 / ATS-465					
Read Holding Register Data : Function Code 03 Write Holding Register Data : Function Code 06 or 16					
Address (Decimal)	**Description**	**R/W**	**Data Type**	**Note**	**Fty Preset**
0	ATS Operation Mode	R / W	U16	0x0000 = AUTO Mode 0x0001 = OFF Mode 0x0002 = TEST Mode	0x0000
1	ATS System Phase	R / W	U16	0x0000 = Single phase 0x0001 = 3 Phase	0x0001
2	Change Over Switch Type	R / W	U16	0x0000 = MCCB BTS type (1 motor) 0x0001 = Mot type (2 motors) 0x0002 = Air circuit breaker type (ACB) 0x0003 = Double throw type (Without OFF position) 0x0004 = Double throw type (With OFF position) 0x0005 = Kutai TS-XXX type ATS 0x0006 = Magnetic contactor type (MC)	0x0000
3	TDEN Time Delay Emergency to Normal	R / W	U16	**According to the data of <function code 17>, the value of [Device Number] defines the time unit of the TDEN.** (1) [Device Number] = 0x0036 Adjustment : 0 – 999 Minute (2) [Device Number] = Other Adjustment : 0 – 999 Second	0x000A
4	TDNE : Time Delay Normal to Emergency	R / W	U16	Adjustment : 0 – 250 Second	0x000A
5	TDES Time Delay Engine Start	R / W	U16	Adjustment : 0 – 30 Second	0x0005
6	TDEC : Time Delay Engine Cool-down	R / W	U16	Adjustment : 0 – 250 Second	0x001E
7	Time Delay in the OFF Position	R / W	U16	Adjustment : 0 – 99 Second	0x0005
8	Utility Over Voltage Protection Setting **(Voltage = Set Value * 10V)**	R / W	U16	**ATS-22A-DC :** Adjustment 11 – 53	0x0019
				ATS-245-DC : Adjustment 11 – 53	0x0019
				ATS-245 : Adjustment 21 – 29	0x0019
				ATS-385 : Adjustment 39 – 49	0x002A
				ATS-465 : Adjustment 45 – 53	0x0030

Compatible Control Unitv：ATS-22A-DC / ATS-245-DC / ATS-245 / ATS-385 / ATS-465					
Read Holding Register Data : Function Code 03 Write Holding Register Data : Function Code 06 or 16					
Address (Decimal)	**Description**	**R/W**	**Data Type**	**Note**	**Fty Preset**
9	Utility Under Voltage Protection Setting **(Voltage = Set Value * 10V)**	R / W	U16	**ATS-22A-DC**：Adjustment 8 – 47	0x0012
				ATS-245-DC：Adjustment 8 – 47	0x0012
				ATS-245：Adjustment 16 – 23	0x0013
				ATS-385：Adjustment 30 – 41	0x0022
				ATS-465：Adjustment 35 – 47	0x0028
10	Time delay if there is a problem with the Utility voltage	R / W	U16	Adjustment：0 – 99 Second (0 = Disable voltage monitoring)	0x0001
11	Utility over frequency protection setting	R / W	U16	**According to the data of <function code 17>, the value of [Device Number] defines the Utility over frequency setting.** (1) [Device Number] = 0x0039 Adjustment : 41 – 50 **Frequency = Set Value * 10Hz** (2) [Device Number] = Other Adjustment : 51 – 75 Hz	(1) 0x002B (2) 0x0041
12	Utility under frequency protection setting	R / W	U16	**According to the data of <function code 17>, the value of [Device Number] defines the Utility under frequency setting.** (1) [Device Number] = 0x0039 Adjustment : 30 – 39 **Frequency = Set Value * 10Hz** (2) [Device Number] = Other Adjustment : 40 – 59 Hz	(1) 0x0025 (2) 0x0037
13	Time delay if there is a problem with the Utility frequency	R / W	U16	Adjustment : 0 – 99 Second (0 = Disabled Hz monitoring)	0x0001
14	Standby over voltage protection setting **(Voltage = Set Value * 10V)**	R / W	U16	**ATS-22A-DC :** Adjustment 11 – 53	0x0019
				ATS-245-DC : Adjustment 11 – 53	0x0019
				ATS-245 : Adjustment 21 – 29	0x0019
				ATS-385 : Adjustment 39 – 49	0x002A
				ATS-465 : Adjustment 45 – 53	0x0030

Compatible Control Unit : ATS-22A-DC / ATS-245-DC / ATS-245 / ATS-385 / ATS-465					
Read Holding Register Data : Function Code 03 Write Holding Register Data : Function Code 06 or 16					
Address (Decimal)	**Description**	**R/W**	**Data Type**	**Note**	**Fty Preset**
15	Standby under voltage protection setting **(Voltage = Set Value * 10V)**	R / W	U16	**ATS-22A-DC :** Adjustment 8 – 47	0x0012
				ATS-245-DC : Adjustment 8 – 47	0x0012
				ATS-245 : Adjustment 16 – 23	0x0013
				ATS-385 : Adjustment 30 – 41	0x0022
				ATS-465 : Adjustment 35 – 47	0x0028
16	Time delay if there is a problem with Standby voltage output	R / W	U16	Adjustment : 0 – 99 second (0 = Disabled voltage monitoring)	0x0001
17	Standby over frequency protection setting	R / W	U16	**According to the data of <function code 17>, the value of [Device Number] defines the Standby over frequency setting.** (1) [Device Number] = 0x0039 Adjustment : 41 – 50 **Frequency = Set Value * 10Hz** (2) [Device Number] = Other Adjustment : 51 – 75 Hz	(1) 0x002B (2) 0x0041
18	Standby under frequency setting	R / W	U16	**According to the data of <function code 17>, the value of [Device Number] defines the Standby under frequency setting.** (1) [Device Number] = 0x0039 Adjustment : 30 – 39 **Frequency = Set Value * 10Hz** (2) [Device Number] = Other Adjustment : 40 – 59 Hz	(1) 0x0025 (2) 0x0037
19	Time delay if there is a problem with Standby frequency output	R / W	U16	Adjustment : 0 – 99 Second (0 = Disabled Hz monitoring)	0x0001
20	Set today's day of the week– Day	R / W	U16	Adjustment : 1 – 7 (Monday to Sunday)	Current
21	Set today's hour – Hour	R / W	U16	Adjustment : 0 – 23 Hour	Current
22	Set today's minutes - Minute	R / W	U16	Adjustment : 0 – 59 Minute	Current
23	Set day of week to do the engine exercise	R / W	U16	Adjustment : 1 – 7(Monday to Sunday)	0x0006
24	Set the time to start the exercise	R / W	U16	Adjustment : 0 – 23 Hour	0x000C
25	Set generator automatic exercise cycle	R / W	U16	0x0001 = 1 week 0x0002 = 2 weeks 0x0003 = 3 weeks 0x0004 = 4 weeks	0x0001
26	Exercising duration	R / W	U16	Adjustment : 0 – 60 Minute (0 = Do not exercise)	0x0000

Compatible Control Unit : ATS-22A-DC / ATS-245-DC / ATS-245 / ATS-385 / ATS-465 Read Holding Register Data : Function Code 03 Write Holding Register Data : Function Code 06 or 16						
Address (Decimal)	**Description**	**R/W**	**Data Type**	**Note**		**Fty Preset**
27	Exercise with load or without load	R / W	U16	0x0000 = Without load 0x0001 = With load		0x0000
28	Test with load or without load	R / W	U16	0x0000 = Without load 0x0001 = With load		0x0001
29	Display setting	R / W	U16	0x0000 = Cyclic Mode 0x0001 = Fix Mode		0x0000
30	Program the auxiliary contact output (User can only select a single warning signal to be programmed for the auxiliary output)	R / W	U16	0x0000 = Transfer failure 0x0001 = Pre-transfer 0x0002 = Pre-exerciser 0x0003 = When the ATS is in Standby position **Only the ATS-22A-DC has following two parameters.** 0x0004 = When the ATS is in AUTO operation mode 0x0005 = When the ATS is in OFF operation mode		0x0001
31	Pre-transfer / Pre-exercising time delay	R / W	U16	Adjustment : 0 – 99 Second		0x000A
32	Remote control by KCU-XX module	R	U16	0x0000 = Disable 0x0001 = Enable		0x0000
33	KCU-XX module address	R	U16	Adjustment : 0x0000 – 0x0063 (0 = Disable KCU-XX module)		0x0000
34	KCU-XX module transmission Baud rate	R	U16	0x0001 = 115200	0x0006 = 9600	0x0003
				0x0002 = 57600	0x0007 = 4800	
				0x0003 = 38400	0x0008 = 2400	
				0x0004 = 19200	0x0009 = 1200	
				0x0005 = 14400		

APPENDIX 03

Compatible Control Unit : ATS-245AG Read Holding Register Data : Function Code 03 Write Holding Register Data : Function Code 06 or 16					
Address (Decimal)	**Description**	**R/W**	**Data Type**	**Note**	**Fty Preset**
0	ATS Operation Mode	R / W	U16	0x0000 = AUTOMode 0x0001 = OFFMode 0x0002 = TESTMode	0x0000
1	TDEN Time Delay Emergency to Normal	R / W	U16	Adjustment : 0 – 999 Second	0x000A
2	TDNE Time Delay Normal to Emergency	R / W	U16	Adjustment : 0 – 250 Second	0x000A
3	TDES Time Delay Engine Start	R / W	U16	Adjustment : 0 – 30 Second	0x0005
4	TDEC Time Delay Engine Cool-down	R / W	U16	Adjustment : 0 – 999 Second	0x0000
5	Time Delay in the OFF Position	R / W	U16	Adjustment : 0 – 25 Second	0x0002
6	Utility Over Voltage Protection Setting **(Voltage = Set Value * 10V)**	R / W	U16	Adjustment : 21 – 30	0x001B
7	Utility Under Voltage Protection Setting **(Voltage = Set Value * 10V)**	R / W	U16	Adjustment : 16 – 24	0x0012
8	Standby Over Voltage Protection Setting **(Voltage = Set Value * 10V)**	R / W	U16	Adjustment : 21 – 30	0x001B
9	Standby Under Voltage Protection Setting **(Voltage = Set Value * 10V)**	R / W	U16	Adjustment : 16 – 24	0x0012
10	Set today's day of the week– Day	R / W	U16	Adjustment : 1 – 7 (Monday to Sunday)	Current
11	Set today's hour – Hour	R / W	U16	Adjustment : 0 – 23 Hour	Current
12	Set today's minutes - Minute	R / W	U16	Adjustment : 0 – 59 Minute	Current
13	Set day of week to do the engine exercise	R / W	U16	Adjustment : 1 – 7 (Monday to Sunday)	0x0006
14	Set the time to start the exercise	R / W	U16	Adjustment : 0 – 23 Hour	0x000C
15	Exercising duration	R / W	U16	Adjustment : 0 – 99Minute (0 = Do not exercise)	0x0000
16	Exercise with load or without load	R / W	U16	0x0000 = Without load 0x0001 = With load	0x0001
17	Remote control by KCU-XX module	R	U16	0x0000 = Disable 0x0001 = Enable	0x0001

APPENDIX 04

Compatible Control Unit：ATS-PLC		
Reading Digital Input (DI) Data : Function Code 02		
Address (Decimal)	**Description**	**Note**
0	Remote Operation	1 : Remote app operation granted
1	ATS panel operation button : AUTO	1 : ATS panel operation button in AUTO mode
2	ATS panel operation button : OFF	1 : ATS panel operation button in OFF mode
3	ATS panel operation button : MANU	1 : ATS panel operation button in MANU mode
4	ATS panel operation button : TEST	1 : ATS panel operation button in TEST mode
5	ATS panel operation button : PROG	1 : ATS panel operation button in PROG mode
6	Password setting status	1 : The control unit password has been set (forbidden to write system parameters)
Operation button status in MANU operation mode		
7	Utility power on button status	1 : Utility power connectted to load
8	Standby power on button status	1 : Standby power connectted to load
9	Engine start button status	1 : Engine Start
Operation button status in TEST operation mode		
10	Whether the panel displays With load / Without load selection screen	1 : Yes
11	Test with load button status	1 : Test with load
12	Test without load button status	1 : Test without load
13	Utility (Grid) Power Status	1 : Warning action
14	Utility (Grid) Over Voltage	
15	Utility (Grid) Under Voltage	
16	Utility (Grid) Over Frequency	
17	Utility (Grid) Under Frequency	
18	Utility (Grid) Transfer Failure	
19	Utility (Grid) TRIP	
20	Utility (Grid) Power reverse phase sequence	
21	Standby (Genset) Power Status	1 : Warning action
22	Standby (Genset) Over Voltage	
23	Standby (Genset) Under Voltage	
24	Standby (Genset) Over Frequency	
25	Standby (Genset) Under Frequency	
26	Standby (Genset) Transfer Failure	
27	Standby (Genset) TRIP	
28	Standby (Genset) power reverse phase sequency	
29	ATS transferring status	1 : ransferring from standby to Utility
30	Utility transfer failure status	1 : Utility transfer failure

Compatible Control Unit：ATS-PLC		
Reading Digital Input (DI) Data : Function Code 02		
Address (Decimal)	**Description**	**Note**
31	ATS transferring status	1 : Transferring from Utility to standby
32	Standby transfer failure status	1 : Standby transfer failure
33	TDEN Countdown Status	1 : TDEN Executing Countdown
34	TDEC Countdown Status	1 : TDEC Executing Countdown
35	Test with load status	1 : Action
AUTO Operation Mode		
36	Utility Power ON	1 : Action
37	Utility Power connected to load	
38	Standby Power ON	
39	Standby Power connected to load	
40	Standby Power Establishment Status	
41	TDNE Countdown Status	
42	TDES Countdown Status	
MANU Operation Mode		
43	Utility Power ON	1 : Action
44	Standby Power ON	
TEST Operation Mode		
45	Utility Power connected to load	1 : Action
46	Standby Power ON	
47	Standby Power connected to load	
48	Standby Power Establishment Status	
49	TDNE Countdown Status	
50	TDES Countdown Status	
Auto Exerciser Mode		
51	Standby Power ON	1 : Action
52	Standby Power connected to load	
53	Standby Power Establishment Status	
54	TDNE Countdown Status	
55	TDES Countdown Status	
56	Utility Power connected to load (Test without load)	

Compatible Control Unit : ATS-PLC			
Read Digital Output (DO) Data : Function Code 01 **Write Digital Output (DO) Data : Function Code 05**			
Address (Decimal)	**Description**	**R/W**	**Note**
0	Not used	R	0
1	Buzzer status	R	1 : Buzzer energized
2	ATS Operation Mode : AUTO	R / W	1 : ATS in AUTO Mode
3	ATS Operation Mode : OFF	R / W	1 : ATS in OFF Mode
4	ATS Operation Mode : MANU	R / W	1 : ATS in MANUMode
5	ATS Operation Mode : TEST	R / W	1 : ATS in TEST Mode
Operate only in MANU mode			
6	Utility power ON button status	R / W	1 : Manually force Utility power ON
7	Standby power ON button status	R / W	1 : Manually force Standby power ON
8	Generator Start button status	R / W	1 : Manually force the generator start
9	Generator shutdown button status	W	1 : Manually force the generator shutdown(Read:0)
Operate only in TEST mode			
10	Test With load button status	R / W	1 : Test with load action
11	Test without load button status	R / W	1 : Test without load action

Compatible Control Unit : ATS-PLC				
Read Digital Input (AI) Data : Function Code 04				
Address (Decimal)	**Description**	**Data Type**	**Ratio**	**Note**
0	Utility (Grid) Phase L_{12} voltage	U16	0.1 V	Example : (1) L_{12} Value = 0x089B(Hex) = 2203(Decimal) V_{12} = 2203 / 10 = 220.3 Volt (2) L_1 Value = 0x04D2(Hex) = 1234(Decimal) L_1 = 1234 / 10 = 123.4 A (3) Hz Value = 0x0257(Hex) = 599(Decimal) Frequency = 599 / 10 = 59.9 Hz **Note :** **If system is <Single Phase>, Ignore Reading from L_{23},L_{31},L_{1N}, L_{2N}, L_{3N}, L_2 and L_3**
1	Utility (Grid) Phase L_{23} voltage			
2	Utility (Grid) Phase L_{31} voltage			
3	Utility (Grid) Phase L_{1N} voltage			
4	Utility (Grid) Phase L_{2N} voltage			
5	Utility (Grid) Phase L_{3N} voltage			
6	Utility (Grid) Frequency		0.1 Hz	
7	Standby (Genset) Phase L_{12} voltage		0.1 V	
8	Standby (Genset) Phase L_{23} voltage			
9	Standby (Genset) Phase L_{31} voltage			
10	Standby (Genset) Phase L_{1N} voltage			
11	Standby (Genset) Phase L_{2N} voltage			
12	Standby (Genset) Phase L_{3N} voltage			
13	Standby (Genset) Frequency		0.1 Hz	
14	L_1 Current		0.1 A	
15	L_2 Current			
16	L_3 Current			
17	KVA Power	U16	0.1 KVA	KVA reading value

APPENDIX 05

<table>
<tr><th colspan="6">Compatible Control Unit : ATS-PLC
Read Holding Register Data : Function Code 03
Write Holding Register Data : Function Code 06 or 16</th></tr>
<tr><th>Address (Decimal)</th><th>Description</th><th>R/W</th><th>Data Type</th><th>Note</th><th>Fty Preset</th></tr>
<tr><td>0</td><td>Language</td><td>R</td><td>U16</td><td>0x0001 = Traditional Chinese
0x0003 = English
0x0005 = Spanish</td><td>0x0003</td></tr>
<tr><td>1</td><td>Brightness Adjustment</td><td>R</td><td>U16</td><td>Adjustment : 0 – 7 (Dark to Light)</td><td>0x005</td></tr>
<tr><td>2</td><td>Screen Saver : 2 - 11</td><td>R</td><td>U16</td><td>Adjustment : 2 – 10 Minute
(Value 11 = Do not screen saver)</td><td>0x0003</td></tr>
<tr><td>3</td><td>System Phase</td><td>R / W</td><td>U16</td><td>0x0001 = 3 Phase 4 Wires (3P4W)
0x0002 = 3 Phase 3 Wires (3P3W)
0x0003 = Single Phase (1P)</td><td>0x0002</td></tr>
<tr><td>4</td><td>Current Transformer (CT)
: 0 – 20</td><td>R / W</td><td>U16</td><td>
<table>
<tr><th>Setting</th><th>CT Ratio</th><th>Setting</th><th>CT Ratio</th></tr>
<tr><td>0</td><td>None</td><td>11</td><td>1000/5</td></tr>
<tr><td>1</td><td>50/5</td><td>12</td><td>1200/5</td></tr>
<tr><td>2</td><td>100/5</td><td>13</td><td>1500/5</td></tr>
<tr><td>3</td><td>150/5</td><td>14</td><td>1600/5</td></tr>
<tr><td>4</td><td>200/5</td><td>15</td><td>2000/5</td></tr>
<tr><td>5</td><td>250/5</td><td>16</td><td>2500/5</td></tr>
<tr><td>6</td><td>300/5</td><td>17</td><td>3000/5</td></tr>
<tr><td>7</td><td>400/5</td><td>18</td><td>4000/5</td></tr>
<tr><td>8</td><td>500/5</td><td>19</td><td>5000/5</td></tr>
<tr><td>9</td><td>600/6</td><td>20</td><td>6000/5</td></tr>
<tr><td>10</td><td>800/5</td><td></td><td></td></tr>
</table>
Note :
The default value is 11, which means that the ratio of 1000A/5A is selected. (When the external CT ratio does not match the setting, it will cause the current display value error)</td><td>0x000B</td></tr>
<tr><td>5</td><td>TDEN Time Delay Emergency to Normal</td><td>R / W</td><td>U16</td><td>Adjustment : 0 – 900
(Time Delay = Set Value * 2 sec)</td><td>0x0005</td></tr>
<tr><td>6</td><td>TDNE Time Delay Normal to Emergency</td><td>R / W</td><td>U16</td><td>Adjustment : 0 – 900
(Time Delay = Set Value * 2 sec)</td><td>0x0005</td></tr>
<tr><td>7</td><td>TDES Timer Delay Engine Start
(1) 0 – 300 Minute
(2) 0 – 300 Second</td><td>R / W</td><td>U16</td><td>According to the data of <function code 17>, the value of [Device Number] defines the time delay TDES setting.
(1) [Device Number] = 0x0008/0x0004
Adjustment : 0 – 150
(Time Delay = Set Value * 2 minute)
(2) [Device Number] = Other
Adjustment : 0 – 150
(Time Delay = Set Value * 2 sec)</td><td>0x0005</td></tr>
</table>

Compatible Control Unit : ATS-PLC					
Read Holding Register Data : Function Code 03 Write Holding Register Data : Function Code 06 or 16					
Address (Decimal)	**Description**	**R/W**	**Data Type**	**Note**	**Fty Preset**
8	TDEC Timer Delay Engine Cooling Down	R / W	U16	Adjustment : 0 – 900 **(Time Delay = Set Value * 2 sec)**	0x000F
9	Time Delay in the OFF Position	R / W	U16	Adjustment : 0 – 150 **(Time Delay = Set Value * 2 sec)**	0x0002
10	Change Over Switch Type	R / W	U16	0x0001 = MCCB type (1 motor) 0x0002 = MOT type (2 motors) 0x0003 = ACB type 0x0004 = Kutai TS-XXX type 0x0005 = Double throw (1 coil) 0x0006 = Double throw (2 coils)	0x0001
11	Auto Exercise	R / W	U16	0x0000 = Enable 0x0001 = Disable	0x0001
12	Exercise with load or without load	R / W	U16	0x0000 = Without load 0x0001 = With load	0x0000
13	Set generator automatic exercise cycle	R / W	U16	0x0001 = 1 week 0x0002 = 2 weeks 0x0003 = 3 weeks 0x0004 = 4 weeks	0x0001
14	Set day of week to do the engine exercise	R / W	U16	Adjustment : 1 – 7 (Monday to Sunday)	0x0006
15	Set the hour to start the exercise	R / W	U16	Adjustment : 0 – 23 Hour	0x000C
16	Set the minute to start the exercise	R / W	U16	Adjustment : 0 – 59 Minute	0x0000
17	Exercise duration	R / W	U16	Adjustment : 1 – 120 Minute	0x0005
18	Utility Over Voltage Protection Setting : 110 – 530 V	R / W	U16	Adjustment : 11 – 53 **(Voltage = Set Value * 10V)**	0x0019
19	Utility Over Voltage Reset Value	R / W	INT16	Adjustment : -20 – 0 V	-5
20	Utility Under Voltage Protection Setting : 80 – 470 V	R / W	U16	Adjustment : 8 – 47 **(Voltage = Set Value * 10V)**	0x0012
21	Utility Under Voltage Reset Value	R / W	INT16	Adjustment : 0 – 20 V	5
22	Time delay if there is a problem with the Utility voltage	R / W	U16	Adjustment : 0 – 99 Second **(**0 = Disable voltage monitoring)	0x000A
23	Utility over frequency protection setting	R / W	U16	Adjustment : 51 – 75 Hz	0x0041
24	Utility over frequency Reset Value	R / W	INT16	Adjustment : -10 – 0 Hz	-1
25	Utility under frequency protection setting	R / W	U16	Adjustment : 40 – 59 Hz	0x0037
26	Utility over frequency Reset Value	R / W	INT16	Adjustment : 0 – 10 Hz	1
27	Time delay if there is a problem with the Utility frequency	R / W	U16	Adjustment : 0 – 99 Second (0 = Disabled Hz monitoring)	0x000A

Compatible Control Unit : ATS-PLC					
Read Holding Register Data : Function Code 03 Write Holding Register Data : Function Code 06 or 16					
Address (Decimal)	**Description**	**R/W**	**Data Type**	**Note**	**Fty Preset**
28	Standby over voltage protection setting : 110 – 530 V	R / W	U16	Adjustment : 11 – 53 **(Voltage = Set Value * 10V)**	0x0019
29	Standby Over Voltage Reset Value	R / W	INT16	Adjustment : -20 – 0 V	-5
30	Standby under voltage protection setting : 80 – 470 V	R / W	U16	Adjustment : 8 – 47 **(Voltage = Set Value * 10V)**	0x0012
31	Standby Under Voltage Reset Value	R / W	INT16	Adjustment : 0 – 20 V	5
32	Time delay if there is a problem with Standby voltage output	R / W	U16	Adjustment : 0 – 99 Second (0 = Disable voltage monitoring)	0x000A
33	Standby over frequency protection setting	R / W	U16	Adjustment : 51 – 75 Hz	0x0041
34	Standby over frequency Reset Value	R / W	INT16	Adjustment : -10 – 0 Hz	-1
35	Standby under frequency setting	R / W	U16	Adjustment : 40 – 59 Hz	0x0037
36	Standby under frequency Reset Value	R / W	INT16	Adjustment : 0 – 10 Hz	1
37	Time delay if there is a problem with Standby frequency output	R / W	U16	Adjustment : 0 – 99 Second (0 = Disabled Hz monitoring)	0x000A
38	Reverse Phase Sequency Protection	R / W	U16	0x0000 = Enable 0x0001 = Disable	0x0001
39	Set Today's Year – Year	R / W	U16	Adjustment : 2000 – 2099	Current
40	Set Today's Month – Month	R / W	U16	Adjustment : 1 – 12	Current
41	Set Today's Day – Day	R / W	U16	Adjustment : 1 – 31	Current
42	Set Today's day of the week	R / W	U16	Adjustment : 1 – 7 (Monday to Sunday)	Current
43	Set Today's hour – Hour	R / W	U16	Adjustment : 0 – 23 Hour	Current
44	Set Today's minutes - Minute	R / W	U16	Adjustment : 0 – 59 Minute	Current
45	Remote Control by KCU-XX Module	R	U16	0x0000 = Disable 0x0001 = Enable	0x0000
46	KCU-XX module transmission Baud rate	R	U16	0x0002 = 57600 / 0x0007 = 4800 0x0003 = 38400 / 0x0008 = 2400 0x0004 = 19200 / 0x0009 = 1200 0x0006 = 9600	0x0003
47	KCU-XX module address	R	U16	Adjustment : 0x0000 – 0x0063 (0 = Disable KCU-XX module)	0x0000

APPENDIX 06

Compatible Control Unit : ATS-332 / ATS-342		
Reading Digital Input (DI) Data : Function Code 02		
Address (Decimal)	**Description**	**Note**
0	Remote Operation	1 : Remote app operation granted
1	ATS panel operation button : AUTO	1 : ATS panel operation button in AUTO mode
2	ATS panel operation button : OFF	1 : ATS panel operation button in OFF mode
3	ATS panel operation button : Bypass	1 : In AUTO mode, Bypass button action
4	**ATS-332 :** Not used	0
	ATS-342 : panel button locked	1 : LOCK (All operation mode selection disabled)
5	Genset-1(G1)Power Status	1 : G1 Power OFF
6	Genset-1(G1)Over Voltage	1 : G1 Over Voltage Warning
7	Genset-1(G1)Under Voltage	1 : G1 Under Voltage Warning
8	Genset-1(G1)Over Frequency	1 : G1 Over Frequency Warning
9	Genset-1(G1)Under Frequency	1 : G1 Under Frequency Warning
10	Genset-1(G1)Start Failure	1 : G1 Start Failure Warning
11	Genset-1(G1)Transfer Failure	1 : G1 Transfer Failure Warning
12	Genset-1(G1)Power Quality Abnormal	1 : G1 Power Quality Abnormal Warning
13	Genset-2(G2)Power Status	1 : G2 Power OFF
14	Genset-2(G2)Over Voltage	1 : G2 Over Voltage Warning
15	Genset-2(G2)Under Voltage	1 : G2 Under Voltage Warning
16	Genset-2(G2)Over Frequency	1 : G2 Over Frequency Warning
17	Genset-2(G2)Under Frequency	1 : G2 Under Frequency Warning
18	Genset-2(G2)start Failure	1 : G2 Start Failure Warning
19	Genset-2(G2)Transfer Failure	1 : G2 Transfer Failure Warning
20	Genset-2(G2)Power Quality Abnormal	1 : G2 Power Quality Abnormal Warning
21	G1 and G2 Power Failure	1 : G1 and G2 Power Failure Warning
22	Genset-1(G1)ON/OFF Status	1 : G1 Power Connected to Load
23	Genset-2(G2)ON/OFF Status	1 : G2 Power Connected to Load
24	G1 Strat / G2 Shutdown Status	1 : G1 Strat / G2 Shutdown
25	G1 Start / G2 Abnormal Shutdown Status	1 : G1 Start / G2 Abnormal Shutdown
26	G1 Start / G2 Running Status	1 : G1 Start / G2 Running
27	G1 Transfer Delay / G2 Running Status	1 : G1 Transfer Delay Count Down / G2 Running
28	G1 Transferring Status	1 : Transferring from G2 to G1
29	G1 Engine Cooling Down Status	1 : G1 Engine Cooling Down
30	G1 Power Connected to Load Staus	1 : G1 Power Connected to Load
31	G2 Strat / G1 Shutdown Status	1 : G2 Strat / G1 Shutdown

Compatible Control Unit：ATS-332 / ATS-342		
Reading Digital Input (DI) Data : Function Code 02		
Address (Decimal)	**Description**	**Note**
32	G2 Start / G1 Abnormal Shutdown Status	1 : G2 Start / G1 Abnormal Shutdown
33	G2 Start / G1 Running Status	1 : G2 Start / G1 Running
34	G2 Transfer Delay / G1 Running Status	1 : G2 Transfer Delay Count Down / G1 Running
35	G2 Transferring Status	1 : Transferring from G1 to G2
36	G2 Engine Cooling Down Status	1 : G2 Engine Cooling Down
37	G2 Power Connected to Load Staus	1 : G2 Power Connected to Load

Compatible Control Unit：ATS-332 / ATS-342			
Read Digital Output (DO) Data : Function Code 01 **Write Digital Output (DO) Data : Function Code 05**			
Address (Decimal)	**Description**	**R/W**	**Note**
0	ATS Remote Start Signal	R	1 : Remote start signal action
1	ATS Operation Mode : AUTO	R / W	1 : ATS In AUTO Mode
2	ATS Operation Mode : OFF	R / W	1 : ATS In OFF Mode
3	ATS Operation Mode : Bypass	R / W	1 : In AUTO mode, Bypass button action

Compatible Control Unit：ATS-332 / ATS-342				
Read Digital Input (AI) Data : Function Code 04				
Address (Decimal)	**Description**	**Data Type**	**Ratio**	**Note**
0	G1 Phase V_{12} voltage	U16	0.1 Volt	Example : (1) V_{12} Value = 0x089B(Hex) = 2203(Decimal) V_{12} = 2203 / 10 = 220.3 Volt (2) Frequency Value = 0x0257(Hex) = 599(Decimal) Frequency = 599 / 10 = 59.9 Hz **Note :** **If system is <Single Phase>, Ignore Reading from V_{23} and V_{31}**
1	G1 Phase V_{23} voltage	U16	0.1 Volt	
2	G1 Phase V_{31} voltage	U16	0.1 Volt	
3	G1 Frequency	U16	0.1 Hz	
4	G2 Phase V_{12} voltage	U16	0.1 Volt	Example : (1) V_{12} Value = 0x089B(Hex) = 2203(Decimal) V_{12} = 2203 / 10 = 220.3 Volt (2) Frequency Value = 0x0257(Hex) = 599(Decimal) Frequency = 599 / 10 = 59.9 Hz **Note :** **If system is <Single Phase>, Ignore Reading from V_{23} and V_{31}**
5	G2 Phase V_{23} voltage	U16	0.1 Volt	
6	G2 Phase V_{31} voltage	U16	0.1 Volt	
7	G2 Frequency	U16	0.1 Hz	
8	Remaining running minutes	U16	1 Minute	G1 or G2 remaining running minutes. Example : Value = 0x0012(Hex) = 18(Decimal) remaining running minutes = 18 Minute **Note :** **When the operating time of the unit in operation reaches the set number of hours, the standby unit is started to alternately operate.**

APPENDIX 07

Compatible Control Unit : ATS-332 Read Holding Register Data : Function Code 03 Write Holding Register Data : Function Code 06 or 16					
Address (Decimal)	**Description**	**R/W**	**Data Type**	**Note**	**Fty Preset**
0	ATS Operation Mode	R / W	U16	0x0000 = AUTO Mode 0x0001 = OFF Mode	0x0000
1	ATS System Phase	R / W	U16	0x0000 = Single phase 0x0001 = 3 Phase	0x0001
2	Change Over Switch Type	R / W	U16	0x0000 = MCCB BTS type ATS (Single motor) 0x0001 = Mot type (MCCB with separate motor) 0x0002 = Air circuit breaker type (ACB) 0x0003 = Double throw type (Without OFF position) 0x0004 = Double throw type (With OFF position) 0x0005 = Kutai TS-XXX type ATS 0x0006 = Magnetic contactor type ATS (MC)	0x0000
3	G1 duty time - Hour	R / W	U16	Adjustment : 1 – 999 Hour	0x000C
4	G2 duty time - Hour	R / W	U16	Adjustment : 1 – 999 Hour	0x000C
5	Time delay G1 to G2	R / W	U16	Adjustment : 0 – 250 Second	0x000A
6	Time delay G2 to G1	R / W	U16	Adjustment : 0 – 250 Second	0x000A
7	TDEC Time delay engine cool-down	R / W	U16	Adjustment : 0 – 250 Second	0x001E
8	Time delay in OFF position	R / W	U16	Adjustment : 0 – 99 Second	0x0005
9	G1 Over Voltage Protection Setting : 110 – 510 V	R / W	U16	Adjustment : 11 – 51 **(Voltage = Set Value * 10V)**	0x0019
10	G1 Under Voltage Protection Setting : 80 – 470 V	R / W	U16	Adjustment : 8 – 47 **(Voltage = Set Value * 10V)**	0x0012
11	Time delay if there is a problem with the G1 voltage	R / W	U16	Adjustment : 0 – 99 Second (0 = Disable voltage monitoring)	0x000A
12	G1 Over Frequency Protection Setting	R / W	U16	Adjustment : 51 – 75 Hz	0x0041
13	G1 Under Frequency Protection Setting	R / W	U16	Adjustment : 40 – 59 Hz	0x0037
14	Time delay if there is a problem with the G1 Frequency	R / W	U16	Adjustment : 0 – 99 Second (0 = Disabled Hz monitoring)	0x000A
15	G2 Over Voltage Protection Setting : 110 – 510 V	R / W	U16	Adjustment : 11 – 51 **(Voltage = Set Value * 10V)**	0x0019
16	G2 Under Voltage Protection Setting : 80 – 470 V	R / W	U16	Adjustment : 8 – 47 **(Voltage = Set Value * 10V)**	0x0012

Compatible Control Unit : ATS-332					
Read Holding Register Data : Function Code 03 Write Holding Register Data : Function Code 06 or 16					
Address (Decimal)	**Description**	**R/W**	**Data Type**	**Note**	**Fty Preset**
17	Time delay if there is a problem with the G2 voltage	R / W	U16	Adjustment : 0 – 99 Second (0 = Disable voltage monitoring)	0x000A
18	G2 Over Frequency Protection Setting	R / W	U16	Adjustment : 51 – 75 Hz	0x0041
19	G2 Under Frequency Protection Setting	R / W	U16	Adjustment : 40 – 59 Hz	0x0037
20	Time delay if there is a problem with the G2 Frequency	R / W	U16	Adjustment : 0 – 99 Second (0 = Disabled Hz monitoring)	0x000A
21	Display setting	R / W	U16	0x0000 = Cyclic Mode 0x0001 = Fix Mode	0x0000
22	Remote control by KCU-XX module	R	U16	0x0000 = Disable 0x0001 = Enable	0x0000
23	KCU-XX module address	R	U16	Adjustment : 0x0000 – 0x0063 (0 = Disable KCU-XX module)	0x0000
24	KCU-XX module transmission Baud rate	R	U16	0x0001=115200 / 0x0006 = 9600 0x0002 = 57600 / 0x0007 = 4800 0x0003 = 38400 / 0x0008 = 2400 0x0004 = 19200 / 0x0009 = 1200 0x0005 = 14400	0x0003

APPENDIX 08

Compatible Control Unit : ATS-342 Read Holding Register Data : Function Code 03 Write Holding Register Data : Function Code 06 or 16					
Address (Decimal)	**Description**	**R/W**	**Data Type**	**Note**	**Fty Preset**
0	ATS Operation Mode	R / W	U16	0x0000 = AUTO Mode 0x0001 = OFF Mode	0x0000
1	ATS System Phase	R / W	U16	0x0000 = Single phase 0x0001 = 3 Phase	0x0001
2	Change Over Switch Type	R / W	U16	0x0000 = MCCB BTS type ATS (Single motor) 0x0001 = Mot type (MCCB with separate motor) 0x0002 = Air circuit breaker type (ACB) 0x0003 = Double throw type (Without OFF position) 0x0004 = Double throw type (With OFF position) 0x0005 = Kutai TS-XXX type ATS 0x0006 = Magnetic contactor type ATS (MC)	0x0000
3	Select the lead generator	R / W	U16	0x0000 = G1 Leading 0x0001 = G2 Leading 0x0002 = Alternate lead Generator by run time hours 0x0003 = Alternate lead Generator by starts & run attempts	0x0002
4	Change lead generator by run time on duty cycle-	R / W	U16	Adjustment : 0 – 250Hour (0 = Do not alternate generators)	0x0008
5	Change lead by the number of starts & run	R / W	U16	Adjustment : 1 – 10 Starts	0x0001
6	Time delay load transfer	R / W	U16	Adjustment : 0 – 250 Second	0x000A
7	TDEC Time delay engine cool-down	R / W	U16	Adjustment : 0 – 250 Second	0x001E
8	Time delay in OFF Position	R / W	U16	Adjustment : 0 – 99 Second	0x0005
9	G1 Over Voltage Protection Setting : 110 – 510 V	R / W	U16	Adjustment : 11 – 51 **(Voltage = Set Value * 10V)**	0x0019
10	G1 Under Voltage Protection Setting : 80 – 470 V	R / W	U16	Adjustment : 8 – 47 **(Voltage = Set Value * 10V)**	0x0012
11	Time delay if there is a problem with the G1 voltage	R / W	U16	Adjustment : 0 – 99 Second (0 = Disable voltage monitoring)	0x000A
12	G1 Over Frequency Protection Setting	R / W	U16	Adjustment : 51 – 75 Hz	0x0041

Compatible Control Unit : ATS-342					
Read Holding Register Data : Function Code 03 Write Holding Register Data : Function Code 06 or 16					
Address (Decimal)	**Description**	**R/W**	**Data Type**	**Note**	**Fty Preset**
13	G1 Under Frequency Protection Setting	R / W	U16	Adjustment : 40 – 59 Hz	0x0037
14	Time delay if there is a problem with the G1 Frequency	R / W	U16	Adjustment : 0 – 99 Second (0 = Disable Hz monitoring)	0x000A
15	G2 Over Voltage Protection Setting : 110 – 510 V	R / W	U16	Adjustment :11 – 51 **(Voltage = Set Value * 10V)**	0x0019
16	G2 Under Voltage Protection Setting : 80 – 470 V	R / W	U16	Adjustment : 8 – 47 **(Voltage = Set Value * 10V)**	0x0012
17	Time delay if there is a problem with the G2 voltage (1) 0 – 198 Second (2) 0 – 99 Second (0 = Disable voltage monitoring)	R / W	U16	**According to the data of <function code 17>, the value of [Device Number] defines the time delay setting.** **(1)** [Device Number] = 0x0002 Adjustment : 0 – 99 **(Time Delay = Set Value * 2 sec)** **(2)** [Device Number] = Other Adjustment : 0 – 99 Second	0x000A
18	G2 Over Frequency Protection Setting	R / W	U16	Adjustment : 51 – 75 Hz	0x0041
19	G2 Underr Frequency Protection Setting	R / W	U16	Adjustment : 40 – 59 Hz	0x0037
20	Time delay if there is a problem with the G2 Frequency (1) 0 – 198 Second (2) 0 – 99 Second (0 = Disable Hz monitoring)	R / W	U16	**According to the data of <function code 17>, the value of [Device Number] defines the time delay TDES setting.** (1) [Device Number] = 0x0002 Adjustment : 0 – 99 **(Time Delay = Set Value * 2 sec)** (2) [Device Number] = Other Adjustment : 0 – 99 Second	0x000A
21	Display setting	R / W	U16	0x0000 = Cyclic Mode 0x0001 = Fix Mode	0x0000
22	Remote control by KCU-XX module	R	U16	0x0000 = Disable 0x0001 = Enable	0x0000
23	KCU-XX module address	R	U16	Adjustment : 0x0000 – 0x0063 (0 = Disable KCU-XX module)	0x0000
24	KCU-XX module transmission Baud rate	R	U16	0x0001 =115200 / 0x0006 = 9600 0x0002 = 57600 / 0x0007 = 4800 0x0003 = 38400 / 0x0008 = 2400 0x0004 = 19200 / 0x0009 = 1200 0x0005 = 14400	0x0003

APPENDIX 09

Compatible Control Unit : AMF-10		
Reading Digital Input (DI) Data : Function Code 02		
Address (Decimal)	**Description**	**Note**
0	Remote Operation	1 : Remote app operation granted
1	Remote Start Signal	1 : Remote start signal action
2	Panel operation button : AUTO	1 : Panel operation button in AUTO mode
3	Panel operation button : OFF	1 : Panel operation button in OFF mode
4	Panel operation button : MANU	1 : Panel operation button in MANU mode
5	Panel operation button : TEST	1 : Panel operation button in TEST mode
6	Utility (Grid) Power OFF	1 : Action
7	Utility (Grid) Over Voltage Warning	
8	Utility (Grid) Under Voltage Warning	
9	Utility (Grid) Transfer Failure Warning	
10	Standby (Genset) Power OFF	1 : Action
11	Standby (Genset) Over Voltage Shutdown	
12	Standby (Genset) Under Voltage Shutdown	
13	Standby (Genset) Over Voltage Warning	
14	Standby (Genset) Under Voltage Warning	
15	Standby (Genset) Transfer Failure Warning	
16	Alarm1 Failure Shutdown	1 : Shutdown Action
17	Alarm2 Failure Shutdown	
18	High Coolant Temperature Shutdown	
19	Low oil Pressure Shutdown	
20	Low Fuel Level Shutdown	
21	Engine Over Speed Shutdown	
22	Engine Under Speed Shutdown	
23	Emergency Shutdown	
24	Engine Start Failure Shutdown	
25	Generator Over Load Shutdown	
26	Alarm1 Failure Warning	1 : Warning Action
27	Alarm2 Failure Warning	
28	Low Fuel Level Warning	
29	Engine Under Speed Warning	
30	Generator Over Load Warning	
31	Battery Voltage Status	1 : Battery Voltage Abnormal
32	Service & Maintenance Status	1 : Service & Maintenance Warning

Compatible Control Unit : AMF-10		
Reading Digital Input (DI) Data : Function Code 02		
Address (Decimal)	**Description**	**Note**
33	ATS transferring status	1 : Transferring from standby to Utility
34	Utility Power connected to load Status	1 : Utility Power connected to load
35	ATS transferring status	1 : Transferring from Utility to Standby
36	Standby Power connected to load Status	1 : Standby Power connected to load
37	Pre-Heat Timer Countdown Status	1 : Pre-Heat Timer Executing Countdown
38	Engine Cranking Timer Countdown Status	1 : Engine Cranking Timer Executing Countdown
39	Time Delay From Emergency to Normal status	1 : TDEN Executing Countdown
40	Time Delay From Normal to Emergency status	1 : TDNE Executing Countdown
41	Time Delay Engine Cooling Down Status	1 : TDEC Executing Countdown
42	Idel Timer Countdown Status	1 : Idel Timer Executing Countdown
43	Engine Shutdown Timer Countdown Status	1 : Engine Shutdown Timer Executing Countdown
44	Failure Shutdown Timer Countdown Status	1 : Failure Shutdown Timer Executing Countdown
45	External Remote Test Without Load Operating Status	1 : External Remote Test Without Load Operating
46	TEST Mode Without Load Operating Status	1 : TEST Mode Without Load Operating
Operation Status in MANU Mode		
47	Transferring from Standby to Utility	1 : Action
48	Utility Transfer Failure	
49	Transferring from Utility to Standby	
50	Standby Transfer Failure	
51	Utility Connect to Load and Engine is running	
52	Utility Connect to Load and Engine Shutdown	
53	Standby Connect to Load and Engine is running	
54	Standby Connect to Load and Engine Shutdown	
55	Engine Cranking Timer Executing Countdown	
56	Engine Shutdown Timer Executing Countdown	
57	Failure Shutdown Timer Executing Countdown	

Compatible Control Unit : AMF-10			
Read Digital Output (DO) Data : Function Code 01 **Write Digital Output (DO) Data : Function Code 05**			
Address (Decimal)	**Description**	**R/W**	**Note**
0	Not Used	R	0
1	Operation Mode : AUTO	R / W	1 : Control Unit In AUTO Mode
2	Operation Mode : OFF	R / W	1 : Control Unit In OFF Mode
3	Operation Mode : MANU	R / W	1 : Control Unit In MANU Mode
4	Operation Mode : TEST	R / W	1 : Control Unit In TEST Mode
5	Emergency Stop Switch Status	R / W	1 : Emergency Stop Action
Operation in MANU Mode			
6	Generator Start button status (START)	W	1 : Manually force the generator start (Read : 0)
7	Generator Shutdown button status (STOP)	W	1 : Manually force the generator shutdown (Read : 0)
8	Utility power ON button status (MAIN)	W	1 : Manually force Utility power ON (Read : 0)
9	Standby power ON button (GEN)	W	1 : Manually force Standby power ON (Read : 0)

Compatible Control Unit : AMF-10				
Read Digital Input (AI) Data : Function Code 04				
Address (Decimal)	**Description**	**Data Type**	**Ratio**	**Note**
0	Utility (Grid) Phase L_{12} voltage	U16	0.1 V	Example : (1) L_{12} Value = 0x089B(Hex) = 2203(Decimal) V_{12} = 2203 / 10 = 220.3 Volt (2) L_1 Value = 0x04D2(Hex) = 1234(Decimal) L_1 = 1234 / 10 = 123.4 A (3) Hz Value = 0x0257(Hex) = 599(Decimal) Frequency = 599 / 10 = 59.9 Hz **Note :** **If system is <Single Phase>, Ignore Reading from L_{23},L_{31},$L_2$and L_3.**
1	Utility (Grid) Phase L_{23} voltage			
2	Utility (Grid) Phase L_{31} voltage			
3	Utility (Grid) Frequency		0.1 Hz	
4	Standby (Genset) Phase L_{12} voltage		0.1 V	
5	Standby (Genset) Phase L_{23} voltage			
6	Standby (Genset) Phase L_{31} voltage			
7	Standby (Genset) Frequency		0.1 Hz	
8	L_1 Current		0.1 A	
9	L_2 Current			
10	L_3 Current			
11	Engine Running Hours – Hour	U16	1 Hr	Range : 0 – 9999 Hour
12	Engine Running Hours – Minute	U16	1 Minute	Range : 0 – 59 Minute
13	Battery Voltage	U16	0.1 VDC	
14	Engine Service & Maintenance Hours	U16	1 Minute	Service & Maintenance Hours (0 – 15000 Minute)

APPENDIX 10

Compatible Control Unit : AMF-10 Read Holding Register Data : Function Code 03 Write Holding Register Data : Function Code 06 or 16					
Address (Decimal)	**Description**	**R/W**	**Data Type**	**Note**	**Fty Preset**
0	System Phase	R / W	U16	0x0000 = 3 Phase 3 Wires (3P3W) 0x0001 = Single Phase 3 Wires (1P3W) 0x0002 = Single Phase (1P)	0x0000
1	TDEN Time Delay Emergency to Normal	R / W	U16	Adjustment : 0 – 60 **(Time Delay = Set Value * 5 sec)**	0x0002
2	TDNE Time Delay Normal to Emergency	R / W	U16		0x0002
3	TDEC Time Delay Engine Cooling Down	R / W	U16		0x000C
4	Engine Idle Time Delay	R / W	U16		0x0000
5	Utility Voltage Reading Calibration Up or Down	R / W	U16	0x0000 = Tune Up 0x0001 = Tune Down	0x0000
6	Utility Voltage Reading Calibration Setting	R / W	U16	Adjustment : 0 – 99 V	0x0000
7	Utility Over Voltage Protection Setting : 110 – 500 V	R / W	U16	Adjustment : 11 – 50 **(Voltage = Set Value * 10V)**	0x0019
8	Utility Under Voltage Protection Setting : 80 – 470 V	R / W	U16	Adjustment : 8 – 47 **(Voltage = Set Value * 10V)**	0x0012
9	Time delay if there is a problem with the Utility voltage	R / W	U16	Adjustment : 2 – 99 Second	0x000A
10	Standby Voltage Reading Calibration Up or Down	R / W	U16	0x0000 = Tune Up 0x0001 = Tune Down	0x0000
11	Standby Voltage Reading Calibration Setting	R / W	U16	Adjustment : 0 – 99 V	0x0000
12	Standby Over Voltage Protection Setting : 110 – 500 V	R / W	U16	Adjustment : 11 – 50 **(Voltage = Set Value * 10V)**	0x0019
13	Standby Under Voltage Protection Setting : 80 – 470 V	R / W	U16	Adjustment : 8 – 47 **(Voltage = Set Value * 10V)**	0x0012
14	Time delay if there is a problem with the Standby voltage	R / W	U16	Adjustment : 0 – 99 Second (0 = Disable voltage monitoring)	0x000A
15	Standby voltage abnormity execution	R / W	U16	0x0000 = Warning 0x0001 = Shutdown	0x0001
16	Engine over speed	R / W	U16	Adjustment : 51 – 75 Hz	0x0041
17	Time delay with the Engine Over Speed	R / W	U16	Adjustment : 0 – 99 Second (0 = Disabled OF monitoring)	0x0005
18	Engine Under Speed	R / W	U16	Adjustment : 40 – 59 Hz	0x0037
19	Time delay with the Engine Under Speed	R / W	U16	Adjustment : 0 – 99 Second (0 = Disabled UF monitoring)	0x0005

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<tr><th colspan="6">Read Holding Register Data : Function Code 03
Write Holding Register Data : Function Code 06 or 16</th></tr>
<tr><th>Address (Decimal)</th><th>Description</th><th>R/W</th><th>Data Type</th><th>Note</th><th>Fty Preset</th></tr>
<tr><td>20</td><td>Engine Under Speed Execution</td><td>R / W</td><td>U16</td><td>0x0000 = Warning
0x0001 = Shutdown</td><td>0x0001</td></tr>
<tr><td>21</td><td>Installation location of CT</td><td>R / W</td><td>U16</td><td>0x0000 = Load Side
0x0001 = Utility Side
0x0002 = Standby Side</td><td>0x0000</td></tr>
<tr><td>22</td><td>Current Reading Calibration Up or Down</td><td>R / W</td><td>U16</td><td>0x0000 = Turn Up
0x0001 = Turn Down</td><td>0x0000</td></tr>
<tr><td>23</td><td>Current Reading Calibration Setting</td><td>R / W</td><td>U16</td><td>Adjustment : 0 – 99 A</td><td>0x0000</td></tr>
<tr><td>24</td><td>Current Transformer (CT)
: 1 – 20</td><td>R / W</td><td>U16</td><td>
<table>
<tr><th>Setting</th><th>CT Ratio</th><th>Setting</th><th>CT Ratio</th></tr>
<tr><td>1</td><td>25/5</td><td>11</td><td>500/5</td></tr>
<tr><td>2</td><td>50/5</td><td>12</td><td>600/5</td></tr>
<tr><td>3</td><td>60/5</td><td>13</td><td>750/5</td></tr>
<tr><td>4</td><td>75/5</td><td>14</td><td>800/5</td></tr>
<tr><td>5</td><td>100/5</td><td>15</td><td>1000/5</td></tr>
<tr><td>6</td><td>150/5</td><td>16</td><td>1200/5</td></tr>
<tr><td>7</td><td>200/5</td><td>17</td><td>1500/5</td></tr>
<tr><td>8</td><td>250/5</td><td>18</td><td>1600/5</td></tr>
<tr><td>9</td><td>300/5</td><td>19</td><td>2000/5</td></tr>
<tr><td>10</td><td>400/5</td><td>20</td><td>3000/5</td></tr>
</table>
Note:
The default value is 5, which means that the ratio of 100A/5A is selected. (When the external CT ratio does not match the setting, it will cause the current display value error)
</td><td>0x0005</td></tr>
<tr><td>25</td><td>Overload protection setting
: 50 – 3000 A</td><td>R / W</td><td>U16</td><td>Adjustment : 1 – 60
(Current = Set Value * 50A)</td><td>0x0002</td></tr>
<tr><td>26</td><td>Overload activation delay time</td><td>R / W</td><td>U16</td><td>Adjustment : 0 – 99 Second
(0 = Disable overload warning)</td><td>0x0000</td></tr>
<tr><td>27</td><td>Engine Overload Execution</td><td>R / W</td><td>U16</td><td>0x0000 = Warning
0x0001 = Shutdown</td><td>0x0000</td></tr>
<tr><td>28</td><td>Oil pressure switch type NO or NC</td><td>R / W</td><td>U16</td><td>0x0000 = Normally Open(NO)
0x0001 = Normally Close(NC)</td><td>0x0001</td></tr>
<tr><td>29</td><td>Time delay with the Engine Low Oil Pressure</td><td>R / W</td><td>U16</td><td>Adjustment : 2 – 99 Second</td><td>0x0005</td></tr>
<tr><td>30</td><td>Coolant Temperature switch type NO or NC</td><td>R / W</td><td>U16</td><td>0x0000 = NO
0x0001 = NC</td><td>0x0000</td></tr>
<tr><td>31</td><td>Time delay with the Engine High Temperature</td><td>R / W</td><td>U16</td><td>Adjustment : 2 – 99 Second</td><td>0x0005</td></tr>
</table>

Compatible Control Unit : AMF-10					
Read Holding Register Data : Function Code 03 Write Holding Register Data : Function Code 06 or 16					
Address (Decimal)	**Description**	**R/W**	**Data Type**	**Note**	**Fty Preset**
32	Fuel Level switch type NO or NC	R / W	U16	0x0000 = No fuel level switch install 0x0001 = Normally Open(NO) 0x0002 = Normally Close(NC)	0x0000
33	Time delay with the Engine Low Fuel Level	R / W	U16	Adjustment : 2 – 99 Second	0x000A
34	Engine Low Fuel Level Execution	R / W	U16	0x0000 = Warning 0x0001 = Shutdown	0x0000
35	Battery under voltage setting	R / W	U16	Adjustment : 8 – 23 VDC	0x0008
36	Battery over voltage setting	R / W	U16	Adjustment : 13 – 35 VDC	0x0020
37	Engine preheat time setting	R / W	U16	Adjustment : 0 – 99 Second	0x0006
38	Attempts permitted to restart engine	R / W	U16	Adjustment : 1 – 9 Attempt	0x0003
39	Engine Cranking time setting	R / W	U16	Adjustment : 2 – 30 Second	0x0006
40	Oil pressure switch used to check and permit engine start	R / W	U16	0x0000 = NO 0x0001 = Yes	0x0001
41	Engine Shutdown time setting	R / W	U16	Adjustment : 2 – 99 Second	0x000A
42	Engine Shutdown Mode	R / W	U16	0x0000 = Energized to Shutdown 0x0001 = Energized to Start	0x0000
43	User Defined the Alarm1 input signal as NO or NC type	R / W	U16	0x0000 = No Alarm1 input 0x0001 = Normally Open(NO) 0x0002 = Normally Close(NC)	0x0000
44	Time delay with the Alarm1 Failure	R / W	U16	Adjustment : 2 – 99 Second	0x000A
45	Alarm1 Failure Execution	R / W	U16	0x0000 = Warning 0x0001 = Shutdown	0x0000
46	User Defined the Alarm2 input signal as NO or NC type	R / W	U16	0x0000 = No Alarm2 input 0x0001 = Normally Open(NO) 0x0002 = Normally Close(NC)	0x0000
47	Time delay with the Alarm2 Failure	R / W	U16	Adjustment : 2 – 99 Second	0x000A
48	Alarm2 Failure Execution	R / W	U16	0x0000 = Warning 0x0001 = Shutdown	0x0000
49	External remote testing is With load or Without load	R / W	U16	0x0000 = With load 0x0001 = Without load	0x0001
50	Display setting	R / W	U16	0x0000 = Fix Mode 0x0001 = Cyclic Mode	0x0001
51	Engine Service & Maintenance Hour : 0 – 250 Hour	R	U16	Adjustment : 0 – 25 (0 = Disable maintenance warning) **(Time Setting = Set Value * 10Hr)**	0x0000

Compatible Control Unit : AMF-10						
Read Holding Register Data : Function Code 03 Write Holding Register Data : Function Code 06 or 16						
Address (Decimal)	**Description**	**R/W**	**Data Type**	**Note**		**Fty Preset**
52	Remote control by KCU-XX module	R	U16	0x0000 = Disable 0x0001 = Enable		0x0000
53	KCU-XX module address	R	U16	Adjustment : 0x0000 – 0x0063 (0 = Disable KCU-XX module)		0x0000
54	KCU-XX module transmission Baud rate	R	U16	0x0001 = 115200	0x0006 = 9600	0x0003
				0x0002 = 57600	0x0007 = 4800	
				0x0003 = 38400	0x0008 = 2400	
				0x0004 = 19200	0x0009 = 1200	
				0x0005 = 14400		

APPENDIX 11

Compatible Control Unit : AMF-11		
Reading Digital Input (DI) Data : Function Code 02		
Address (Decimal)	**Description**	**Note**
0	Remote Operation	1 : Remote app operation granted
1	Remote Start Signal	1 : Remote start signal action
2	Panel operation button : AUTO	1 : Panel operation button in AUTO mode
3	Panel operation button : OFF	1 : Panel operation button in OFF mode
4	Panel operation button : MANU	1 : Panel operation button in MANU mode
5	Panel operation button : TEST	1 : Panel operation button in TEST mode
6	Utility (Grid) Power OFF	1 : Action
7	Utility (Grid) Over Voltage Warning	
8	Utility (Grid) Under Voltage Warning	
9	Utility (Grid) Transfer Failure Warning	
10	Standby (Genset) Power OFF	1 : Action
11	Standby (Genset) Over Voltage Shutdown	
12	Standby (Genset) Under Voltage Shutdown	
13	Standby (Genset) Over Voltage Warning	
14	Standby (Genset) Under Voltage Warning	
15	Standby (Genset) Transfer Failure Warning	
16	Fire Alarm Shutdown	1 : Shutdown Action
17	Alarm2 Failure Shutdown	
18	High Coolant Temperature Shutdown	
19	Low oil Pressure Shutdown	
20	Low Fuel Level Shutdown	
21	Engine Over Speed Shutdown	
22	Engine Under Speed Shutdown	
23	Emergency Shutdown	
24	Engine Start Failure Shutdown	
25	Generator Over Load Shutdown	
26	Fire Alarm Warning	1 : Warning Action
27	Alarm2 Failure Warning	
28	Low Fuel Level Warning	
29	Engine Under Speed Warning	
30	Engine fail to Shutdown Warning	
31	Generator Over Load Warning	
32	Battery Voltage Status	1 : Battery Voltage Abnormal

Compatible Control Unit : AMF-11		
Reading Digital Input (DI) Data : Function Code 02		
Address (Decimal)	**Description**	**Note**
33	Service & Maintenance Status	1 : Service & Maintenance Warning
34	ATS transferring status	1 : Transferring from standby to Utility
35	Utility Power connected to load Status	1 : Utility Power connected to load
36	ATS transferring status	1 : Transferring from Utility to Standby
37	Standby Power connected to load Status	1：Standby Power connected to load
38	Pre-Heat Timer Countdown Status	1：Pre-Heat Timer Executing Countdown
39	Engine Cranking Timer Countdown Status	1：Engine Cranking Timer Executing Countdown
40	Time Delay From Emergency to Normal status	1：TDEN Executing Countdown
41	Time Delay From Normal to Emergency status	1：TDNE Executing Countdown
42	Time Delay Engine Cooling Down Status	1：TDEC Executing Countdown
43	Idel Timer Countdown Status	1：Idel Timer Executing Countdown
44	Engine Shutdown Timer Countdown Status	1：Engine Shutdown Timer Executing Countdown
45	Failure Shutdown Timer Countdown Status	1：Failure Shutdown Timer Executing Countdown
46	TEST Mode Without Load Operating Status	1：TEST Mode Without Load Operating
Operation Status in MANU Mode		
47	Transferring from Standby to Utility	1：Action
48	Transferring from Utility to Standby	
49	Utility Transfer Failure	
50	Standby Transfer Failure	
51	Utility Connect to Load and Engine is running	
52	Utility Connect to Load and Engine Shutdown	
53	Standby Connect to Load and Engine is running	
54	Standby Connect to Load and Engine Shutdown	
55	Engine Cranking Timer Executing Countdown	
56	Engine Shutdown Timer Executing Countdown	
57	Failure Shutdown Timer Executing Countdown	

Compatible Control Unit : AMF-11			
Read Digital Output (DO) Data : Function Code 01 **Write Digital Output (DO) Data : Function Code 05**			
Address (Decimal)	**Description**	**R/W**	**Note**
0	Not Used	R	0
1	Operation Mode : AUTO	R / W	1 : Control Unit In AUTO Mode
2	Operation Mode : OFF	R / W	1 : Control Unit In OFF Mode
3	Operation Mode : MANU	R / W	1 : Control Unit In MANU Mode
4	Operation Mode : TEST	R / W	1 : Control Unit In TEST Mode
5	Emergency Stop Switch Status	R / W	1 : Emergency Stop Action
Operation in MANU Mode			
6	Generator Start button status (START)	W	1 : Manually force the generator start (Read : 0)
7	Generator Shutdown button status (STOP)	W	1 : Manually force the generator shutdown (Read : 0)
8	Utility power ON button status (MAIN)	W	1 : Manually force Utility power ON (Read : 0)
9	Standby power ON button (GEN)	W	1 : Manually force Standby power ON (Read : 0)

Compatible Control Unit : AMF-11				
Read Digital Input (AI) Data : Function Code 04				
Address (Decimal)	**Description**	**Data Type**	**Ratio**	**Note**
0	Utility (Grid) Phase L_{12} voltage	U16	0.1 V	Example : (1) L_{12} Value = 0x089B(Hex) = 2203(Decimal) V_{12} = 2203 / 10 = 220.3 Volt (2) L_1 Value = 0x04D2(Hex) = 1234(Decimal) L_1 = 1234 / 10 = 123.4 A (3) Hz Value = 0x0257(Hex) = 599(Decimal) Frequency = 599 / 10 = 59.9 Hz **Note :** **If system is <Single Phase>, Ignore Reading from L_{23},L_{31},L_2 and L_3.**
1	Utility (Grid) Phase L_{23} voltage			
2	Utility (Grid) Phase L_{31} voltage			
3	Utility (Grid) Frequency		0.1 Hz	
4	Standby (Genset) Phase L_{12} voltage		0.1 V	
5	Standby (Genset) Phase L_{23} voltage			
6	Standby (Genset) Phase L_{31} voltage			
7	Standby (Genset) Frequency		0.1 Hz	
8	L_1 Current		0.1 A	
9	L_2 Current			
10	L_3 Current			
11	Engine Running Hours – Hour	U16	1 Hr	Range : 0 – 9999 Hour
12	Engine Running Hours – Minute	U16	1 Minute	Range : 0 – 59 Minute
13	Battery Voltage	U16	0.1 VDC	
14	Engine Service & Maintenance Hours	U16	1 Minute	Service & Maintenance Hours (0 – 15000 Minute)

APPENDIX 12

Compatible Control Unit : AMF-11 Read Holding Register Data : Function Code 03 Write Holding Register Data : Function Code 06 or 16					
Address (Decimal)	**Description**	**R/W**	**Data Type**	**Note**	**Fty Preset**
0	System Phase	R / W	U16	0x0000 = 3 Phase 3 Wires (3P3W) 0x0001 = Single Phase 3 Wires (1P3W) 0x0002 = Single Phase (1P)	0x0000
1	TDEN Time Delay Emergency to Normal	R / W	U16	Adjustment : 0 – 60 **(Time Delay = Set Value * 5 sec)**	0x0002
2	TDNE Time Delay Normal to Emergency	R / W	U16		0x0002
3	TDEC Time Delay Engine Cooling Down	R / W	U16		0x000C
4	Engine Idle Time Delay	R / W	U16		0x0000
5	Utility Voltage Reading Calibration Up or Down	R / W	U16	0x0000 = Tune Up 0x0001 = Tune Down	0x0000
6	Utility Voltage Reading Calibration Setting	R / W	U16	Adjustment : 0 – 99 V	0x0000
7	Utility Over Voltage Protection Setting : 110 – 500 V	R / W	U16	Adjustment : 11 – 50 **(Voltage = Set Value * 10V)**	0x0019
8	Utility Under Voltage Protection Setting : 80 – 470 V	R / W	U16	Adjustment : 8 – 47 **(Voltage = Set Value * 10V)**	0x0012
9	Time delay if there is a problem with the Utility voltage	R / W	U16	Adjustment : 2 – 99 Second	0x000A
10	Standby Voltage Reading Calibration Up or Down	R / W	U16	0x0000 = Tune Up 0x0001 = Tune Down	0x0000
11	Standby Voltage Reading Calibration Setting	R / W	U16	Adjustment : 0 – 99 V	0x0000
12	Standby Over Voltage Protection Setting : 110 – 500 V	R / W	U16	Adjustment : 11 – 50 **(Voltage = Set Value * 10V)**	0x0019
13	Standby Under Voltage Protection Setting : 80 – 470 V	R / W	U16	Adjustment : 8 – 47 **(Voltage = Set Value * 10V)**	0x0012
14	Time delay if there is a problem with the Standby voltage	R / W	U16	Adjustment : 0 – 99 Second (0 = Disable voltage monitoring)	0x000A
15	Standby voltage abnormity execution	R / W	U16	0x0000 = Warning 0x0001 = Shutdown	0x0001
16	Engine over speed	R / W	U16	Adjustment : 51 – 75 Hz	0x0041
17	Time delay with the Engine Over Speed	R / W	U16	Adjustment : 0 – 99 Second (0 = Disabled OF monitoring)	0x0005
18	Engine Under Speed	R / W	U16	Adjustment : 40 – 59 Hz	0x0037
19	Time delay with the Engine Under Speed	R / W	U16	Adjustment : 0 – 99 Second (0 = Disabled UF monitoring)	0x0005

<table>
<tr><th colspan="6">Compatible Control Unit : AMF-11</th></tr>
<tr><th colspan="6">Read Holding Register Data : Function Code 03
Write Holding Register Data : Function Code 06 or 16</th></tr>
<tr><th>Address (Decimal)</th><th>Description</th><th>R/W</th><th>Data Type</th><th>Note</th><th>Fty Preset</th></tr>
<tr><td>20</td><td>Engine Under Speed Execution</td><td>R / W</td><td>U16</td><td>0x0000 = Warning
0x0001 = Shutdown</td><td>0x0001</td></tr>
<tr><td>21</td><td>Installation location of CT</td><td>R / W</td><td>U16</td><td>0x0000 = Load Side
0x0001 = Utility Side
0x0002 = Standby Side</td><td>0x0000</td></tr>
<tr><td>22</td><td>Current Reading Calibration Up or Down</td><td>R / W</td><td>U16</td><td>0x0000 = Turn Up
0x0001 = Turn Down</td><td>0x0000</td></tr>
<tr><td>23</td><td>Current Reading Calibration Setting</td><td>R / W</td><td>U16</td><td>Adjustment : 0 – 99 A</td><td>0x0000</td></tr>
<tr><td>24</td><td>Current Transformer (CT)
: 1 – 15</td><td>R / W</td><td>U16</td><td>
<table>
<tr><th>Setting</th><th>CT Ratio</th><th>Setting</th><th>CT Ratio</th></tr>
<tr><td>1</td><td>25/5</td><td>9</td><td>300/5</td></tr>
<tr><td>2</td><td>50/5</td><td>10</td><td>500/5</td></tr>
<tr><td>3</td><td>60/5</td><td>11</td><td>500/5</td></tr>
<tr><td>4</td><td>75/5</td><td>12</td><td>600/5</td></tr>
<tr><td>5</td><td>100/5</td><td>13</td><td>750/5</td></tr>
<tr><td>6</td><td>150/5</td><td>14</td><td>800/5</td></tr>
<tr><td>7</td><td>200/5</td><td>15</td><td>1000/5</td></tr>
<tr><td>8</td><td>250/5</td><td></td><td></td></tr>
</table>
Note:
The default value is 5, which means that the ratio of 100A/5A is selected. (When the external CT ratio does not match the setting, it will cause the current display value error)
</td><td>0x0005</td></tr>
<tr><td>25</td><td>Overload protection setting
: 10 – 990 A</td><td>R / W</td><td>U16</td><td>Adjustment : 1 – 99
(Current = Set Value * 10A)</td><td>0x000A</td></tr>
<tr><td>26</td><td>Overload activation delay time</td><td>R / W</td><td>U16</td><td>Adjustment : 0 – 99 Second
(0 = Disa ble overload warning)</td><td>0x0000</td></tr>
<tr><td>27</td><td>Engine Overload Execution</td><td>R / W</td><td>U16</td><td>0x0000 = Warning
0x0001 = Shutdown</td><td>0x0000</td></tr>
<tr><td>28</td><td>Oil pressure switch type NO or NC</td><td>R / W</td><td>U16</td><td>0x0000 = Normally Open(NO)
0x0001 = Normally Close(NC)</td><td>0x0001</td></tr>
<tr><td>29</td><td>Time delay with the Engine Low Oil Pressure</td><td>R / W</td><td>U16</td><td>Adjustment : 2 – 99 Second</td><td>0x0005</td></tr>
<tr><td>30</td><td>Coolant Temperature switch type NO or NC</td><td>R / W</td><td>U16</td><td>0x0000 = Normally Open(NO)
0x0001 = Normally Close(NC)</td><td>0x0000</td></tr>
<tr><td>31</td><td>Time delay with the Engine High Temperature</td><td>R / W</td><td>U16</td><td>Adjustment : 2 – 99 Second</td><td>0x0005</td></tr>
<tr><td>32</td><td>Fuel Level switch type NO or NC</td><td>R / W</td><td>U16</td><td>0x0000 = No fuel level switch install
0x0001 = Normally Open(NO)
0x0002 = Normally Close(NC)</td><td>0x0000</td></tr>
</table>

Compatible Control Unit : AMF-11					
Read Holding Register Data : Function Code 03 Write Holding Register Data : Function Code 06 or 16					
Address (Decimal)	**Description**	**R/W**	**Data Type**	**Note**	**Fty Preset**
33	Time delay with the Engine Low Fuel Level	R / W	U16	Adjustment : 2 – 99 Second	0x000A
34	Engine Low Fuel Level Execution	R / W	U16	0x0000 = Warning 0x0001 = Shutdown	0x0000
35	Battery under voltage setting	R / W	U16	Adjustment : 8 – 23 VDC	0x0008
36	Battery over voltage setting	R / W	U16	Adjustment : 13 – 35 VDC	0x0020
37	Engine preheat time setting	R / W	U16	Adjustment : 0 – 99 Second	0x0006
38	Attempts permitted to restart engine	R / W	U16	Adjustment :1 – 9 Attempt	0x0003
39	Engine Cranking time setting	R / W	U16	Adjustment : 2 – 30 Second	0x0006
40	Oil pressure switch used to check and permit engine start	R / W	U16	0x0000 = NO 0x0001 = Yes	0x0001
41	Engine Shutdown time setting	R / W	U16	Adjustment : 2 – 99 Second	0x000A
42	Engine Shutdown Mode	R / W	U16	0x0000 = Energized to Shutdown 0x0001 = Energized to Start	0x0000
43	Fire Alarm input signal as NO or NC type	R / W	U16	0x0000 = No Fire Alarm Input 0x0001 = Normally Open(NO) 0x0002 = Normally Close(NC)	0x0000
44	Time delay with the Fire Alarm Failure	R / W	U16	Adjustment : 2 – 99 Second	0x000A
45	Change Over Switch Type	R / W	U16	0x0000 = MCCB BTS type (1 Motor) 0x0001 = Kutai TS-XXX type ATS 0x0002 = Magnetic contactor type (MC)	0x0001
46	User Defined the Alarm2 input signal as NO or NC type	R / W	U16	0x0000 = No Alarm2 input 0x0001 = Normally Open(NO) 0x0002 = Normally Close(NC)	0x0000
47	Time delay with the Alarm2 Failure	R / W	U16	Adjustment : 2 – 99 Second	0x000A
48	Alarm2 Failure Execution	R / W	U16	0x0000 = Warning 0x0001 = Shutdown	0x0000
49	Display setting	R / W	U16	0x0000 = Fix Mode 0x0001 = Cyclic Mode	0x0001
50	How to start the engine in AUTO mode	R / W	U16	0x0000 = Delay Start mode (when the Utility power is abnormal, wait for the TDES delay before engine cranking) 0x0001 = Remote Strat mode (Start the engine when the remote start signal is ON)	0x0000
51	TDES Time Delay Engine Start	R	U16	Adjustment : 0 – 60Minute	0x0000

Compatible Control Unit : AMF-11						
Read Holding Register Data : Function Code 03 Write Holding Register Data : Function Code 06 or 16						
Address (Decimal)	**Description**	**R/W**	**Data Type**	**Note**		**Fty Preset**
52	Engine Service & Maintenance Hour : 0 – 990 Hour	R	U16	Adjustment : 0 – 99 (0 = Disable maintenance warning) (Time Setting = Set Value * 10Hr)		0x0000
53	Remote control by KCU-XX module	R	U16	0x0000 = Disable 0x0001 = Enable		0x0000
54	KCU-XX module address	R	U16	Adjustment : 0x0000 – 0x0063 (0 = Disable KCU-XX module)		0x0000
55	KCU-XX module transmission Baud rate	R	U16	0x0001 = 115200	0x0006 = 9600	0x0003
				0x0002 = 57600	0x0007 = 4800	
				0x0003 = 38400	0x0008 = 2400	
				0x0004 = 19200	0x0009 = 1200	
				0x0005 = 14400		

APPENDIX 13

Compatible Control Unit : GCU-100		
Reading Digital Input (DI) Data : Function Code 02		
Address (Decimal)	**Description**	**Note**
0	Remote Operation	1 : Remote app operation granted
1	Remote Start Signal	1 : Remote start signal action
2	Panel operation button : AUTO	1 : Panel operation button in AUTO mode
3	Panel operation button : OFF	1 : Panel operation button in OFF mode
4	Panel operation button : MANU	1 : Panel operation button in MANU mode
5	AUTO standby mode	1 : Control unit in AUTO Standby mode
6	AC Over Voltage Shutdown	1 : Shutdown Action
7	AC Under Voltage Shutdown	
8	Engine Over Speed Shutdown	
9	Engine Under Speed Shutdown	
10	Generator Over Load Shutdown	
11	High Coolant Temperature Shutdown	
12	Low oil Pressure Shutdown	
13	Low Fuel Level Shutdown	
14	Alarm1 Failure Shutdown	
15	Alarm2 Failure Shutdown	
16	MPU Failure Shutdown	
17	Charge Alternator Failure Shutdown	
18	Engine Fail to Start Shutdown	
19	Emergency Shutdown	
20	AC Over Voltage Warning	1 : Warning Action
21	AC Under Voltage Warning	
22	Engine Under Speed Warning	
23	Generator Over Load Warning	
24	Low Fuel Level Warning	
25	Alarm1 Failure Warning	
26	Alarm2 Failure Warning	
27	MPU Failure Warning	
28	Charge Alternator Failure Warning	
29	Service & Maintenance Status	1 : Service & Maintenance Warning
30	Battery Voltage Status	1 : Battery Voltage Abnormal
31	Pre-Heat Timer Countdown Status	1 : Pre-Heat Timer Executing Countdown
32	Engine Cranking Timer Countdown Status	1 : Engine Cranking Timer Executing Countdown

Compatible Control Unit : GCU-100		
Reading Digital Input (DI) Data : Function Code 02		
Address (Decimal)	**Description**	**Note**
33	Engine Cooling Down Timer Countdown Status	1 : Engine Cooling Down Timer Executing Countdown
34	Idel Timer Countdown Status	1 : Idel Timer Executing Countdown
35	Engine Shutdown Timer Countdown Status	1 : Engine Shutdown Timer Executing Countdown
36	Failure Shutdown Timer Countdown Status	1 : Failure Shutdown Timer Executing Countdown
37	Engine Running Hours Timing Status	1 : Engine Running Hours Executing Timing
Use KCU-04 module (CANbus J1939)		
38	Engine Over Speed Shutdown	1 : Shutdown Action
39	Engine Under Speed Shutdown	
20	Engine Over Speed Warning	1 : Warning Action
41	Engine Under Speed Warning	
42	High Coolant Temperature Warning	
43	Low oil Pressure Warning	

Compatible Control Unit : GCU-100			
Read Digital Output (DO) Data : Function Code 01 **Write Digital Output (DO) Data : Function Code 05**			
Address (Decimal)	**Description**	**R/W**	**Note**
0	Not Used	R	0
1	Operation Mode : AUTO	R / W	1 : Control Unit In AUTO Mode
2	Operation Mode : OFF	R / W	1 : Control Unit In OFF Mode
3	Operation Mode : MANU	R / W	1 : Control Unit In MANU Mode
4	Emergency Stop Switch Status	R / W	1 : Emergency Stop Action

Compatible Control Unit : GCU-100				
Read Digital Input (AI) Data : Function Code 04				
Address (Decimal)	**Description**	**Data Type**	**Ratio**	**Note**
0	Generator Phase L_{12} voltage	U16	0.1 V	Example : (1) L_{12} Value = 0x089B(Hex) = 2203(Decimal) V_{12} = 2203 / 10 = 220.3 Volt (2) L_1 Value = 0x04D2(Hex) = 1234(Decimal) L_1 = 1234 / 10 = 123.4 A (3) Hz Value = 0x0257(Hex) = 599(Decimal) Frequency = 599 / 10 = 59.9 Hz **Note :** **If system is <Single Phase>, Ignore Reading from L_{23},L_{31},L_2 and L_3**
1	Generator Phase L_{23} voltage			
2	Generator Phase L_{31} voltage			
3	Generator L_1 Current		0.1 A	
4	Generator L_2 Current			
5	Generator L_3 Current			
6	Generator Frequency		0.1 Hz	
7	Engine Oil Pressure Reading	U16	0.1 Psi	Engine oil pressure reading The value 0xFFFF (Hex), which means there is no such information. **Note : Ignored the oil pressure reading when the KCU-04 module is not used.**
8	Coolant Temperature Reading	INT16	0.1 ℃	Water Coolant Temperature Reading The value -32768(-3276.8℃),which means there is no such information. **Note : Ignored the Temperature reading when the KCU-04 module is not used.**
9	Engine Running Hours – Hour	U16	1 Hr	Range : 0 – 9999 Hour
10	Engine Running Hours– Minute	U16	1 Minute	Range : 0 – 59 Minute
11	Battery Voltage	U16	0.1 VDC	
12	Engine Service& Maintenance Hours	U16	1 Minute	Service & Maintenance Hours (0 – 15000 Minute)

APPENDIX 14

<table>
<tr><th colspan="6">Compatible Control Unit : GCU-100</th></tr>
<tr><th colspan="6">Read Holding Register Data : Function Code 03
Write Holding Register Data : Function Code 06 or 16</th></tr>
<tr><th>Address (Decimal)</th><th>Description</th><th>R/W</th><th>Data Type</th><th>Note</th><th>Fty Preset</th></tr>
<tr><td>0</td><td>System Phase</td><td>R / W</td><td>U16</td><td>0x0000 = 3 Phase 3 Wires (3P3W)
0x0001 = Single Phase 3 Wires (1P3W)
0x0002 = Single Phase (1P)</td><td>0x0000</td></tr>
<tr><td>1</td><td>Ac Frequency</td><td>R / W</td><td>U16</td><td>0x0000 = 60 Hz
0x0001 = 50 Hz</td><td>0x0000</td></tr>
<tr><td>2</td><td>AC Voltage Reading Calibration Up or Down</td><td>R / W</td><td>U16</td><td>0x0000 = Not needed
0x0001 = Tune Up
0x0002 = Tune Down</td><td>0x0000</td></tr>
<tr><td>3</td><td>AC Voltage Reading Calibration Setting</td><td>R / W</td><td>U16</td><td>Adjustment : 0 – 99 V</td><td>0x0000</td></tr>
<tr><td>4</td><td>Time delay if there is a problem with the AC voltage</td><td>R / W</td><td>U16</td><td>Adjustment : 0 – 99 Second
(0 = Disable voltage monitoring)</td><td>0x000F</td></tr>
<tr><td>5</td><td>AC Power Under Voltage Protection Setting : 80 – 470 V</td><td>R / W</td><td>U16</td><td>Adjustment : 8 – 47
(Voltage = Set Value * 10V)</td><td>0x0012</td></tr>
<tr><td>6</td><td>AC Power Under Voltage Execution</td><td>R / W</td><td>U16</td><td>0x0000 = Warning
0x0001 = Shutdown</td><td>0x0001</td></tr>
<tr><td>7</td><td>AC Power Over Voltage Protection Setting : 110 – 500 V</td><td>R / W</td><td>U16</td><td>Adjustment : 11 – 50
(Voltage = Set Value * 10V)</td><td>0x0019</td></tr>
<tr><td>8</td><td>AC Power Over Voltage Execution</td><td>R / W</td><td>U16</td><td>0x0000 = Warning
0x0001 = Shutdown</td><td>0x0001</td></tr>
<tr><td>9</td><td>Current Reading Calibration Up or Down</td><td>R / W</td><td>U16</td><td>0x0000 = Not needed
0x0001 = Tune Up
0x0002 = Tune Down</td><td>0x0000</td></tr>
<tr><td>10</td><td>Current Reading Calibration Setting</td><td>R / W</td><td>U16</td><td>Adjustment : 0 – 99 A</td><td>0x0000</td></tr>
<tr><td>11</td><td>Current Transformer (CT)
: 1 - 17</td><td>R / W</td><td>U16</td><td>
<table>
<tr><th>Setting</th><th>CT Ratio</th><th>Setting</th><th>CT Ratio</th></tr>
<tr><td>1</td><td>50/5</td><td>10</td><td>750/5</td></tr>
<tr><td>2</td><td>100/5</td><td>11</td><td>800/5</td></tr>
<tr><td>3</td><td>150/5</td><td>12</td><td>1000/5</td></tr>
<tr><td>4</td><td>200/5</td><td>13</td><td>1200/5</td></tr>
<tr><td>5</td><td>250/5</td><td>14</td><td>1500/5</td></tr>
<tr><td>6</td><td>300/5</td><td>15</td><td>1600/5</td></tr>
<tr><td>7</td><td>400/5</td><td>16</td><td>2000/5</td></tr>
<tr><td>8</td><td>500/5</td><td>17</td><td>3000/5</td></tr>
<tr><td>9</td><td>600/5</td><td></td><td></td></tr>
</table>
Note :
The default value is 5, which means that the ratio of 100A/5A is selected. (When the external CT ratio does not match the setting, it will cause the current display value error)
</td><td>0x000C</td></tr>
</table>

Compatible Control Unit : GCU-100					
Read Holding Register Data : Function Code 03 Write Holding Register Data : Function Code 06 or 16					
Address (Decimal)	**Description**	**R/W**	**Data Type**	**Note**	**Fty Preset**
12	Overload activation delay time	R / W	U16	Adjustment : 0 – 99 Second (0 = Disable overload warning)	0x0000
13	Overload protection setting : 30 – 99 %	R / W	U16	Percentage of CT primary current Adjustment : 30 – 99 Example: CT=1000/5A and overload protection setting value 80%, overcurrent action value = 1000A * 80% = 800A	0x0050
14	Engine Overload Execution	R / W	U16	0x0000 = Warning 0x0001 = Shutdown	0x0001
15	Engine over speed	R / W	U16	Adjustment : 51 – 75 Hz	0x0041
16	Time delay with the Engine Over Speed	R / W	U16	Adjustment : 0 – 99 Second (0 = Disabled OF monitoring)	0x0005
17	Engine Under speed	R / W	U16	Adjustment : 40 – 59 Hz	0x0037
18	Time delay with the Engine Under Speed	R / W	U16	Adjustment : 0 – 99 Second (0 = Disabled UF monitoring)	0x000A
19	Engine Under speed Execution	R / W	U16	0x0000 = Warning 0x0001 = Shutdown	0x0001
20	Magnetic Pick-up (MPU) installation	R / W	U16	0x0000 = NO 0x0001 = Yes	0x0000
21	Magnetic Pick-up (MPU) used to monitor engine over speed	R / W	U16	0x0000 = NO 0x0001 = Yes	0x0000
22	MPU Failure Execution	R / W	U16	0x0000 = Warning 0x0001 = Shutdown	0x0000
23	Oil pressure switch type NO or NC, or get info from J1939 (KCU-04) transducer	R / W	U16	0x0000 = Normally Open(NO) 0x0001 = Normally Close(NC) 0x0002 = KCU-04 installation	0x0001
24	Time delay with the Engine Low Oil Pressure	R / W	U16	Adjustment : 2 – 99 Second	0x0005
25	Coolant Temperature switch type NO or NC	R / W	U16	0x0000 = Normally Open(NO) 0x0001 = Normally Close(NC)	0x0000
26	Time delay with the Engine High Temperature	R / W	U16	Adjustment : 2 – 99 Second	0x0005
27	Engine preheat time setting	R / W	U16	Adjustment : 2 – 99 Second	0x0006
28	Attempts permitted to restart engine	R / W	U16	Adjustment : 1 – 9 Attempt	0x0003
29	Engine Cranking time setting	R / W	U16	Adjustment : 2 – 30 Second	0x0006
30	Oil pressure switch used to check and permit engine start	R / W	U16	0x0000 = NO 0x0001 = Yes	0x0001

Compatible Control Unit : GCU-100					
Read Holding Register Data : Function Code 03 Write Holding Register Data : Function Code 06 or 16					
Address (Decimal)	**Description**	**R/W**	**Data Type**	**Note**	**Fty Preset**
31	MPU used to check and permit engine start	R / W	U16	0x0000 = NO 0x0001 = Yes	0x0000
32	Engine Idel time setting	R / W	U16	Adjustment : 2 – 99 Second	0x0000
33	Engine Shutdown time setting	R / W	U16	Adjustment : 2 – 99 Second	0x000A
34	Engine Shutdown Mode	R / W	U16	0x0000 = Energized to Shutdown 0x0001 = Energized to Start	0x0000
35	Engine Cooling Down time setting	R / W	U16	Adjustment : 0 – 60 Minute	0x0000
36	Battery Under Voltage	R / W	U16	Adjustment : 8 – 23 VDC	0x0008
37	Battery Over Voltage	R / W	U16	Adjustment : 13 – 35 VDC	0x0020
38	Time Delay with Charge Alternator Failure	R / W	U16	Adjustment : 0 – 99 Second (0 = Disable Charge Alternator monitor)	0x0000
39	Charge alternator D+ terminal minimum voltage Setting	R / W	U16	Adjustment : 8 – 25 VDC	0x0008
40	Charge Alternator Failure Execution	R / W	U16	0x0000 = Warning 0x0001 = Shutdown	0x0000
41	Fuel Level switch type NO or NC	R / W	U16	0x0000 = No fuel level switch install 0x0001 = Normally Open(NO) 0x0002 = Normally Close(NC)	0x0000
42	Time delay with the Engine Low Fuel Level	R / W	U16	Adjustment : 2 – 99 Second	0x000A
43	Engine Low Fuel Level Execution	R / W	U16	0x0000 = Warning 0x0001 = Shutdown	0x0000
44	User Defined the Alarm1 input signal as NO or NC type	R / W	U16	0x0000 = No Alarm1 input 0x0001 = Normally Open(NO) 0x0002 = Normally Close(NC)	0x0000
45	Time delay with the Alarm1 Failure	R / W	U16	Adjustment : 2 – 99 Second	0x000A
46	Alarm1 Failure Execution	R / W	U16	0x0000 = Warning 0x0001 = Shutdown	0x0000
47	User Defined the Alarm2 input signal as NO or NC type	R / W	U16	0x0000 = No Alarm2 input 0x0001 = Normally Open(NO) 0x0002 = Normally Close(NC)	0x0000
48	Time delay with the Alarm2 Failure	R / W	U16	Adjustment : 2 – 99 Second	0x000A
49	Alarm2 Failure Execution	R / W	U16	0x0000 = Warning 0x0001 = Shutdown	0x0000
50	Engine Service & Maintenance Hour : 0 – 250 Hour	R	U16	Adjustment : 0 – 25 (0 = Disable maintenance warning) **(Time Setting = Set Value * 10Hr)**	0x0000

Compatible Control Unit : GCU-100						
Read Holding Register Data : Function Code 03 Write Holding Register Data : Function Code 06 or 16						
Address (Decimal)	**Description**	**R/W**	**Data Type**	**Note**		**Fty Preset**
51	Remote control by KCU-XX module	R	U16	0x0000 = Disable 0x0001 = Enable		0x0000
52	KCU-XX module address	R	U16	Adjustment : 0x0000 – 0x0063 (0 = Disable KCU-XX module)		0x0000
53	KCU-XX module transmission Baud rate	R	U16	0x0001 = 115200	0x0006 = 9600	0x0003
				0x0002 = 57600	0x0007 = 4800	
				0x0003 = 38400	0x0008 = 2400	
				0x0004 = 19200	0x0009 = 1200	
				0x0005 = 14400		

APPENDIX15

Compatible Control Unit : GCU-3000		
Reading Digital Input (DI) Data : Function Code 02		
Address (Decimal)	**Description**	**Note**
0	Remote Operation	1 : Remote app operation granted
1	Remote Start Signal	1 : Remote start signal action
2	Panel operation button : AUTO	1 : Panel operation button in AUTO mode
3	Panel operation button : OFF	1 : Panel operation button in OFF mode
4	Panel operation button : MANU	1 : Panel operation button in MANU mode
5	AC Over Voltage Shutdown	1 : Shutdown Action
6	AC Under Voltage Shutdown	
7	Engine Over Speed Shutdown	
8	Engine Under Speed Shutdown	
9	Generator Over Load Shutdown	
10	High Coolant Temperature Shutdown	
11	Low oil Pressure Shutdown	
12	Low Fuel Level Shutdown	
13	Alarm1 Failure Shutdown	
14	Alarm2 Failure Shutdown	
15	MPU Failure Shutdown	
16	Temperature Sensor Failure Shutdown	
17	Oil Pressure Sensor Failure Shutdown	
18	Engine Fail to Start Shutdown	
19	Emergency Shutdown	
20	AC Over Voltage Warning	1 : Warning Action
21	AC Under Voltage Warning	
22	Generator Over Load Warning	
23	High Coolant Temperature Warning	
24	Low oil Pressure Warning	
25	Low Fuel Level Warning	
26	Alarm1 Failure Warning	
27	Alarm2 Failure Warning	
28	Temperature Sensor Failure Warning	
29	Oil Pressure Sensor Failure Warning	
30	Service & Maintenance Status	1 : Service & Maintenance Warning
31	Battery Voltage Status	1 : Battery Voltage Abnormal
32	Block Heater Status	1 : Block Heater in Operation

Compatible Control Unit : GCU-3000		
Reading Digital Input (DI) Data : Function Code 02		
Address (Decimal)	**Description**	**Note**
33	Pre-Heat Timer Countdown Status	1 : Pre-Heat Timer Executing Countdown
34	Engine Cranking Timer Countdown Status	1 : Engine Cranking Timer Executing Countdown
35	Engine Cooling Down Timer Countdown Status	1 : Cooling Down Timer Executing Countdown
36	Idel Timer Countdown Status	1 : Idel Timer Executing Countdown
37	Engine Shutdown Timer Countdown Status	1 : Engine Shutdown Timer Executing Countdown
38	Failure Shutdown Timer Countdown Status	1 : Failure Shutdown Timer Executing Countdown
39	Engine Running Hours Timing Status	1 : Engine Running Hours Executing Timing

Compatible Control Unit : GCU-3000			
Read Digital Output (DO) Data : Function Code 01 **Write Digital Output (DO) Data : Function Code 05**			
Address (Decimal)	**Description**	**R/W**	**Note**
0	Not Used	R	0
1	Operation Mode : AUTO	R / W	1 : Control Unit In AUTO Mode
2	Operation Mode : OFF	R / W	1 : Control Unit In OFF Mode
3	Operation Mode : MANU	R / W	1 : Control Unit In MANU Mode

Compatible Control Unit : GCU-3000				
Read Digital Input (AI) Data : Function Code 04				
Address (Decimal)	**Description**	**Data Type**	**Ratio**	**Note**
0	Generator Phase L_{12} voltage	U16	0.1 V	Example : (1) L_{12} Value = 0x089B(Hex) = 2203(Decimal) V_{12} = 2203 / 10 = 220.3 Volt (2) L_1 Value = 0x04D2(Hex) = 1234(Decimal) L_1 = 1234 / 10 = 123.4 A (3) Hz Value = 0x0257(Hex) = 599(Decimal) Frequency = 599 / 10 = 59.9 Hz **Note :** **If system is <Single Phase>, Ignore Reading from L_{23},L_{31},L_{1N},L_{2N},L_{3N},L_2 and L_3**
1	Generator Phase L_{23} voltage			
2	Generator Phase L_{31} voltage			
3	Generator Phase L_{1N} voltage			
4	Generator Phase L_{2N} voltage			
5	Generator Phase L_{3N} voltage			
6	Generator L_1 Current		0.1 A	
7	Generator L_2 Current			
8	Generator L_3 Current			
9	Generator Frequency		0.1 Hz	
10	Engine Oil Pressure Reading	U16	0.1 Psi	Engine oil pressure reading
11	Engine Oil Pressure Reading	INT16	0.1 ℃	Water Coolant Temperature Reading
12	Engine Running Hours – Hour	U16	1 Hr	Range : 0 – 9999 Hr
13	Engine Running Hours – Minute	U16	1 Minute	Range : 0 – 59 Minute
14	Battery Voltage	U16	0.1 VDC	
15	KVA Power	U16	0.1 KVA	KVA reading value
16	Engine Service& Maintenance Hours	U16	1 Minute	Service & Maintenance Hours (59400 – 0 Minute)

APPENDIX 16

<table>
<tr><th colspan="6">Compatible Control Unit : GCU-3000
Read Holding Register Data : Function Code 03
Write Holding Register Data : Function Code 06 or 16</th></tr>
<tr><th>Address (Decimal)</th><th>Description</th><th>R/W</th><th>Data Type</th><th>Note</th><th>Fty Preset</th></tr>
<tr><td>0</td><td>Ac Frequency</td><td>R / W</td><td>U16</td><td>0x0000 = 60 Hz 0x0001 = 50 Hz</td><td>0x0000</td></tr>
<tr><td>1</td><td>System Phase</td><td>R / W</td><td>U16</td><td>0x0000 = 3 Phase 4 Wires (3P4W)
0x0001 = 3 Phase 3 Wires (3P3W)
0x0002 = Single Phase 3 Wires (1P3W)
0x0003 = Single Phase (1P)</td><td>0x0000</td></tr>
<tr><td>2</td><td>AC Voltage Reading Calibration Up or Down</td><td>R / W</td><td>U16</td><td>0x0000 = Not needed
0x0001 = Tune Up
0x0002 = Tune Down</td><td>0x0000</td></tr>
<tr><td>3</td><td>AC Voltage Reading Calibration Setting</td><td>R / W</td><td>U16</td><td>Adjustment : 1 – 99 V</td><td>0x0005</td></tr>
<tr><td>4</td><td>Time delay if there is a problem with the AC voltage</td><td>R / W</td><td>U16</td><td>Adjustment : 0 – 99 Second
(0 = Disable voltage monitoring)</td><td>0x000F</td></tr>
<tr><td>5</td><td>AC Power Under Voltage Protection Setting : 80 – 470 V</td><td>R / W</td><td>U16</td><td>Adjustment : 8 – 47
(Voltage = Set Value * 10V)</td><td>0x0012</td></tr>
<tr><td>6</td><td>AC Power Under Voltage Execution</td><td>R / W</td><td>U16</td><td>0x0000 = Warning
0x0001 = Shutdown</td><td>0x0001</td></tr>
<tr><td>7</td><td>AC Power Over Voltage Protection Setting : 110 – 500 V</td><td>R / W</td><td>U16</td><td>Adjustment : 11 – 50
(Voltage = Set Value * 10V)</td><td>0x0019</td></tr>
<tr><td>8</td><td>AC Power Over Voltage Execution</td><td>R / W</td><td>U16</td><td>0x0000 = Warning
0x0001 = Shutdown</td><td>0x0001</td></tr>
<tr><td>9</td><td>Current Reading Calibration Up or Down</td><td>R / W</td><td>U16</td><td>0x0000 = Not needed
0x0001 = Tune Up
0x0002 = Tune Down</td><td>0x0000</td></tr>
<tr><td>10</td><td>Current Reading Calibration Setting</td><td>R / W</td><td>U16</td><td>Adjustment : 0 – 99 A</td><td>0x0005</td></tr>
<tr><td>11</td><td>Current Transformer (CT) : 1 – 20</td><td>R / W</td><td>U16</td><td>
<table>
<tr><th>Setting</th><th>CT Ratio</th><th>Setting</th><th>CT Ratio</th></tr>
<tr><td>1</td><td>25/5</td><td>11</td><td>500/5</td></tr>
<tr><td>2</td><td>50/5</td><td>12</td><td>600/5</td></tr>
<tr><td>3</td><td>60/5</td><td>13</td><td>750/5</td></tr>
<tr><td>4</td><td>75/5</td><td>14</td><td>800/5</td></tr>
<tr><td>5</td><td>100/5</td><td>15</td><td>1000/5</td></tr>
<tr><td>6</td><td>150/5</td><td>16</td><td>1200/5</td></tr>
<tr><td>7</td><td>200/5</td><td>17</td><td>1500/5</td></tr>
<tr><td>8</td><td>250/5</td><td>18</td><td>1600/5</td></tr>
<tr><td>9</td><td>300/5</td><td>19</td><td>2000/5</td></tr>
<tr><td>10</td><td>400/5</td><td>20</td><td>3000/5</td></tr>
</table>
Note:
The default value is 5, which means that the ratio of 100A/5A is selected. (When the external CT ratio does not match the setting, it will cause the current display value error)
</td><td>0x0005</td></tr>
</table>

Compatible Control Unit : GCU-3000					
Read Holding Register Data : Function Code 03 Write Holding Register Data : Function Code 06 or 16					
Address (Decimal)	**Description**	**R/W**	**Data Type**	**Note**	**Fty Preset**
12	Overload activation delay time	R / W	U16	Adjustment : 0 – 99 Second (0 = Disable overload warning)	0x0000
13	Overload protection setting : 50 – 3000 A	R / W	U16	Adjustment : 1 – 60 **(Current = Set Value * 50A)**	0x0002
14	Engine Overload Execution	R / W	U16	0x0000 = Warning 0x0001 = Shutdown	0x0000
15	Time delay if there is a problem with the Engine Speed	R / W	U16	Adjustment : 0 – 99 Second (0 = Disable Engine Speed Protection)	0x0005
16	Magnetic Pick-up (MPU) installation	R / W	U16	0x0000 = NO 0x0001 = Yes	0x0037
17	AC Frequency or MPU used to monitor engine over speed	R / W	U16	0x0000 = AC Frequency 0x0001 = MPU	0x000A
18	Engine over speed	R / W	U16	Adjustment : 51 – 75 Hz	0x0041
19	Engine Under speed	R / W	U16	Adjustment : 40 – 59 Hz	0x0037
20	Oil pressure Sensor or J1939 (KCU-04) transducer installation	R / W	U16	0x0000 = No Oil pressure Sensor 0x0001 = Oil pressure Sensor Installation 0x0002 = KCU-04) transducer Installation	0x0001
21	Oil pressure reading in Psi or Bar	R / W	U16	0x0000 = Psi 0x0001 = Bar	0x0003
22	Oil pressure Sensor Failure Execution	R / W	U16	0x0000 = Warning 0x0001 = Shutdown	0x0000
23	Time delay with the Engine Low Oil Pressure	R / W	U16	Adjustment : 0 – 99 Second	0x000A
24	Oil pressure Sensor used to detect Low Oil Pressure Failure	R / W	U16	0x0000 = NO 0x0001 = Yes	0x0000
25	Low oil pressure warning setting (LOW)	R / W	U16	Adjustment : 0 – 99 Psi	0x002D
26	Low oil pressure Shutdown setting (LOW/LOW)	R / W	U16	Adjustment : 0 – 99 Psi	0x000F
27	Oil pressure switch type NO or NC	R / W	U16	0x0000 = No Oil pressure switch 0x0001 = Normally Open(NO) 0x0002 = Normally Close(NC)	0x0002
28	Temperature Sensor Installation	R / W	U16	0x0000 = NO 0x0001 = Yes	0x0001
29	Temperature Reading in ℃ or ℉	R / W	U16	0x0000 = ℃ 0x0001 = ℉	0x0000
30	Temperature Sensor Failure Execution	R / W	U16	0x0000 = Warning 0x0001 = Shutdown	0x0001

Compatible Control Unit : GCU-3000					
Read Holding Register Data : Function Code 03 Write Holding Register Data : Function Code 06 or 16					
Address (Decimal)	**Description**	**R/W**	**Data Type**	**Note**	**Fty Preset**
31	Time delay with the Engine High Coolant Temperature	R / W	U16	Adjustment : 2 – 99 Second	0x0005
32	Temperature Sensor used to detect High Coolant Temperature Failure	R / W	U16	0x0000 = NO 0x0001 = Yes	0x0001
33	High Coolant Temperature Warning (HIGH)	R / W	U16	Adjustment : 10 – 20 (Temperature = Set Value * 5℃)	0x0012
34	High Coolant Temperature Shutdown (HIGH/HIGH)	R / W	U16	Adjustment : 10 – 24 (Temperature = Set Value * 5℃)	0x0015
35	Temperature Sensor used to control the block heater 0	R / W	U16	0x0000 = NO 0x0001 = Yes	0x0000
36	Block heater max temp OFF setting	R / W	U16	Adjustment : 0 – 50 ℃	0x0019
37	Temperature switch type NO or NC	R / W	U16	0x0000 = No Temperature switch 0x0001 = Normally Open(NO) 0x0002 = Normally Close(NC)	0x0001
38	Battery Under Voltage	R / W	U16	Adjustment : 8 – 23 VDC	0x0008
39	Battery Over Voltage	R / W	U16	Adjustment : 13 – 35 VDC	0x0020
40	Engine preheat time setting	R / W	U16	Adjustment : 0 – 99 Second	0x0006
41	Attempts permitted to restart engine	R / W	U16	Adjustment : 1 – 9 Attempt	0x0003
42	Engine Cranking time setting	R / W	U16	Adjustment : 2 – 30 Second	0x0006
43	MPU used to check and permit engine start	R / W	U16	0x0000 = NO 0x0001 = Yes	0x0000
44	Oil pressure Sensor used to check and permit engine start	R / W	U16	0x0000 = NO 0x0001 = Yes	0x0000
45	Oil pressure switch used to check and permit engine start	R / W	U16	0x0000 = NO 0x0001 = Yes	0x0001
46	Engine Shutdown time setting	R / W	U16	Adjustment : 2 – 99 Second	0x000A
47	Engine Shutdown Mode	R / W	U16	0x0000 = Energized to Shutdown 0x0001 = Energized to Start	0x0000
48	Engine Cooling Down time setting	R / W	U16	Adjustment : 0 – 60 Minute	0x0000
47	Engine Shutdown Mode	R / W	U16	0x0000 = Energized to Shutdown 0x0001 = Energized to Start	0x0000
48	Engine Cooling Down time setting	R / W	U16	Adjustment : 0 – 60 Minute	0x0000
49	Engine Idel time setting	R / W	U16	Adjustment : 0 – 60 Minute	0x0000
50	Time in Warm up before connecting load contactors	R / W	U16	Adjustment : 0 – 99 Second	0x000A
51	Activate the warning buzzer	R / W	U16	0x0000 = NO 0x0001 = Yes	0x0001

Compatible Control Unit : GCU-3000					
Read Holding Register Data : Function Code 03 Write Holding Register Data : Function Code 06 or 16					
Address (Decimal)	**Description**	**R/W**	**Data Type**	**Note**	**Fty Preset**
52	Fuel Level switch type NO or NC	R / W	U16	0x0000 = No fuel level switch install 0x0001 = Normally Open(NO) 0x0002 = Normally Close(NC)	0x0000
53	Time delay with the Engine Low Fuel Level	R / W	U16	Adjustment : 0 – 99 Second	0x000A
54	Engine Low Fuel Level Execution	R / W	U16	0x0000 = Warning 0x0001 = Shutdown	0x0000
55	User Defined the Alarm1 input signal as NO or NC type	R / W	U16	0x0000 = No Alarm1 input 0x0001 = Normally Open(NO) 0x0002 = Normally Close(NC)	0x0000
56	Time delay with the Alarm1 Failure	R / W	U16	Adjustment : 2 – 99 Second	0x000A
57	Alarm1 Failure Execution	R / W	U16	0x0000 = Warning 0x0001 = Shutdown	0x0000
58	User Defined the Alarm2 input signal as NO or NC type	R / W	U16	0x0000 = No Alarm2 input 0x0001 = Normally Open(NO) 0x0002 = Normally Close(NC)	0x0000
59	Time delay with the Alarm2 Failure	R / W	U16	Adjustment : 2 – 99 Second	0x000A
60	Alarm2 Failure Execution	R / W	U16	0x0000 = Warning 0x0001 = Shutdown	0x0000
61	AC Voltage and Current Display Mode	R / W	U16	0x0000 = Fix Mode 0x0001 = Cyclic Mode	0x0001
62	If the system is 3P4W, whether to display voltage (L1-N, L2-N, L2-N)	R / W	U16	0x0000 = NO 0x0001 = Yes	0x0001
63	Hr,V or Hz Display Mode	R / W	U16	0x0001 = Hour Meter 0x0002 = Hertz Meter 0x0003 = Cyclic Mode	0x0002
64	Engine Service & Maintenance Hour : 0 – 990 Hour	R	U16	Adjustment : 0 – 99 (0 = Disable maintenance warning) **(Time Setting = Set Value * 10Hr)**	0x0000
65	Remote control by KCU-XX module	R	U16	0x0000 = Disable 0x0001 = Enable	0x0000
66	KCU-XX module address	R	U16	Adjustment : 0x0000 – 0x0063 (0 = Disable KCU-XX module)	0x0000
67	KCU-XX module transmission Baud rate	R	U16	0x0001 = 115200 / 0x0006 = 9600 0x0002 = 57600 / 0x0007 = 4800 0x0003 = 38400 / 0x0008 = 2400 0x0004 = 19200 / 0x0009 = 1200 0x0005 = 14400	0x0003