HGP MCCB Communication Profile

RS-485 MODBUS-RTU

01 / 2019
Ed. 1

This document presents the architecture and the function of the Modbus communication option

The Modbus communication option makes it possible to remotely use all the functions of your HGP MCCB and may be used to interconnect the HGP ETU A/E types and a supervisor, a PLC or Modbus master equipment.
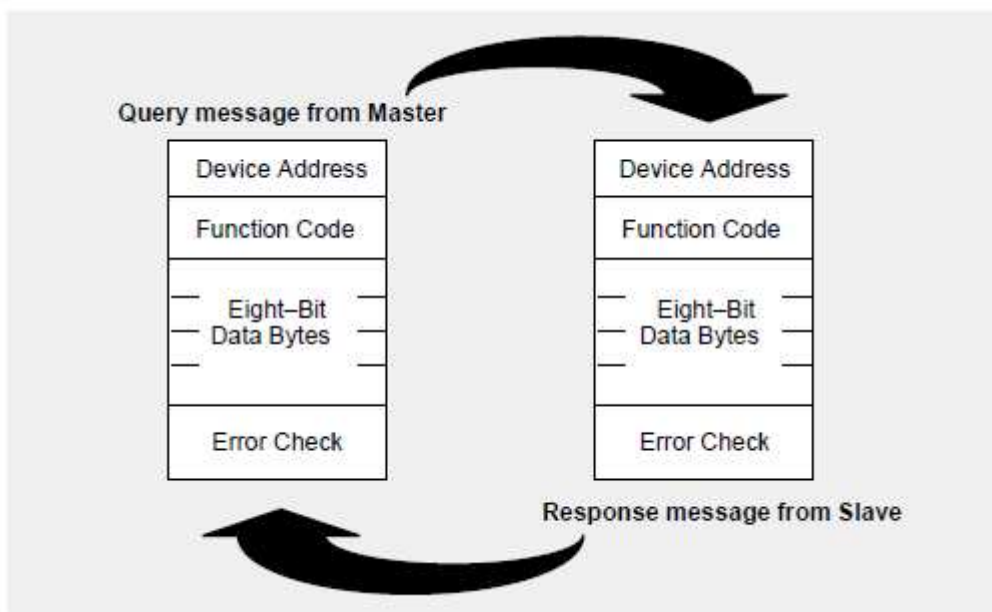
The connection implements an RS485 physical link and the Modbus-RTU protocol

Contents

1. Introduction

A. Protocol: Modbus-RTU

B. Start bit: 1 bit

C. Data bit: 8 bits

D. Parity: none

E. Stop bit: 1 bit

F. Error Check Field: Cyclical Redundancy Check(CRC)

G. Master – Client Method

H. Data Link Layer

I. The Query-Response Cycle

Ex)

03 Read Holding registers

The registers numbered 1-16 are addressed as 0-15. Our Example is requesting the information about "Long time protection current setting RMS".

Request

	Description		Example
Function code	1 byte	0x03	0x03
Starting Address	2 bytes	0x0000 to 0xFFFF	00 00
Quantity of Registers	2 bytes	1 to 125	00 01

Response

	Description		Example
Function code	1 byte	0x03	0x03
Byte count	1 bytes	2 x N*	0x02
Register value	N* x 2 bytes		0x07 0xD0 (decimal 2000)

* N = Quantity of Registers

Error

Error code	1 byte	0x83
Byte count	1 bytes	01 or 02 or 03 or 04

Exception code

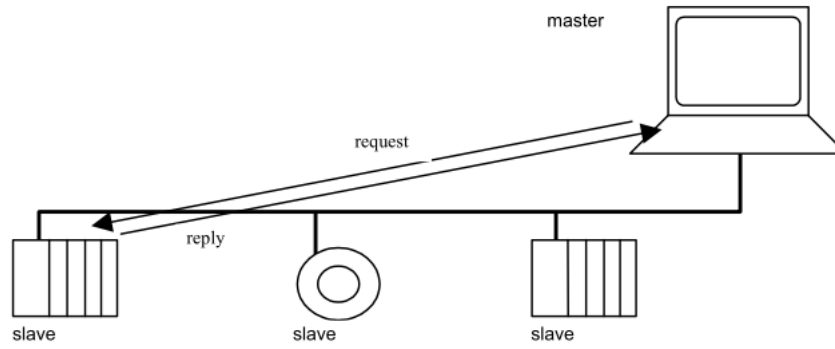| Exception Codes	Name	Description
01h	ILLEGAL FUNCTION	The function code received in the query is not an allowable action for the slave. If a Poll Program Complete command was issued, this code indicates that no program function preceded it.
02h	ILLEGAL DATA ADDRESS	The data address received in the query is not an allowable address for the slave.
03h	ILLEGAL DATA VALUE	A value contained in the query data field is not an allowable value for the slave.
04h	SLAVE DEVICE FAILURE	An unrecoverable error occurred while the slave was attempting to perform the requested action.
10h	ILLEGAL WAVE CAPTURE	Real time wave capture command is not requested.
11h	ILLEGAL WRITE CMD	Write function disabled because the Remote set is off. (exception remote set requests)

1.1. Master-Slave Communication modes

The Modbus protocol can exchange information using 2 communication mode:
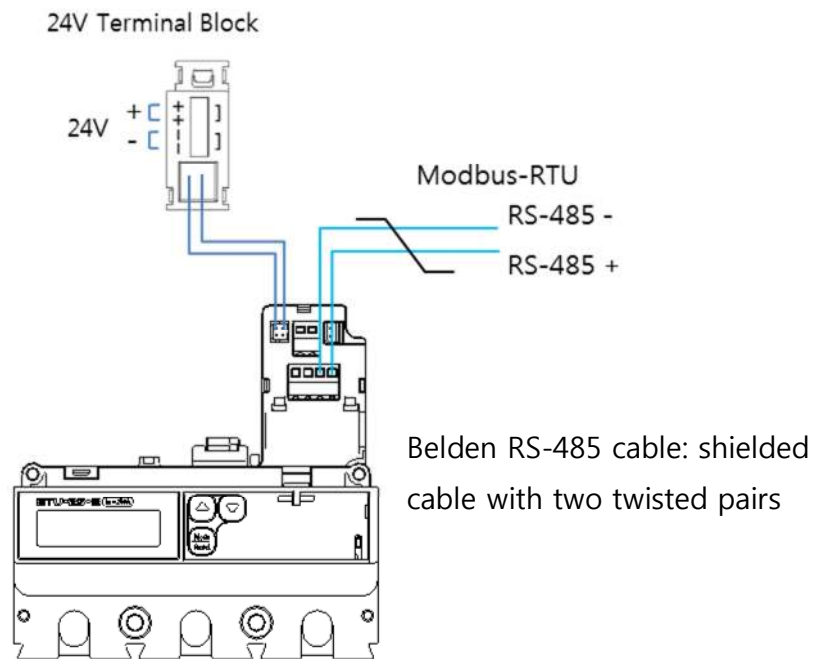
- unicast mode

Unicast mode

In unicast mode, the master addresses a slave using the specific address of the slave. The slave processes a request from the master, and replies to the master.
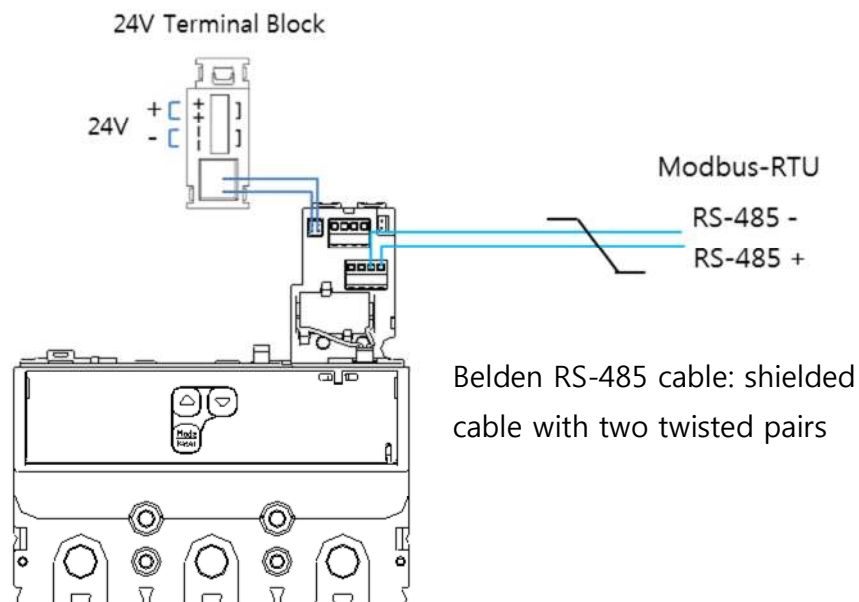
2. ETU Modbus configure

2.1. Communication wiring

    1) 250AF

Belden RS-485 cable: shielded
cable with two twisted pairs

    2) 630/800AF

Belden RS-485 cable: shielded
cable with two twisted pairs
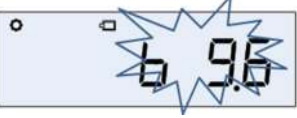
2.2. ETU Communication parameter configure

Only ETU A/E types are available to connect a communication network.

🕐 🔒 → ⚙ 🔒	Enter x 1	Metering mode to configure mode
A001	▲ x 9	address display
A001	Mode/Reset + Enter > 3 sec	Press and hold for 3 seconds at the same time to release the setting protection mode. Check the lock icon is deleted. 🔒
A001	Enter x 1 ▲or▼	The address segment is blinking. Press the up or down key to change the device address.
A001	Enter x 1	Press the enter key to save new address.
b 9.6	▲ x 1	next information display. move to the baud rate display.
b 9.6	Enter x 1 ▲or▼	Enter the setting mode of a baud rate. Press the up or down key to change the baud rate. b9.6: 9600 bps, b19.2: 19200bps, b38.4: 38400bps
b 9.6	Enter x 1	Press the enter key to save new baud rate.

3. Address Profile

3.1. Metering Information ETU

Function code is the 4.

3.1.1. Current, Voltage

R/W	Register	ADDRESS	Description	range	Type	scale	unit	A/E
R	1	0	Status information		F001			A, E
R	3	2	Current on phase R	0 ~ 17 x In	UINT32		A	A, E
R	5	4	Current on phase S	0 ~ 17 x In	UINT32		A	A, E
R	7	6	Current on phase T	0 ~ 17 x In	UINT32		A	A, E
R	9	8	Current on the neutral	0 ~ 17 x In	UINT32		A	A, E
R	11	10	Ground curret	0 ~ 17 x In	UINT32		A	A, E
R	13	12	maximum current	0 ~ 17 x In	UINT32		A	A, E
R	15	14	minimum current	0 ~ 17 x In	UINT32		A	A, E
R	17	16	Average current	0 ~ 17 x In	INT32		A	A, E
R	19	18	TRIP COUNTER	0~65000회	UINT32			A, E
R	21	20	RUN TIME COUNTER		UINT32		HOUR	A, E
R	23	22	Load porfile In < 50		UINT32		HOUR	A, E
R	25	24	Load porfile 50 ≤ In < 80		UINT32		HOUR	A, E
R	27	26	Load porfile 80 ≤ In < 90		UINT32		HOUR	A, E
R	29	28	Load porfile 90 ≤		UINT32		HOUR	A, E
R	31	30	MCU temperature		INT32	*10		A, E
R	33	32	Phase to neutral voltage Van	0 ~ 1000	UINT32		V	E
R	35	34	Phase to neutral voltage Vbn	0 ~ 1000	UINT32		V	E
R	37	36	Phase to neutral voltage Vcn	0 ~ 1000	UINT32		V	E
R	39	38	Phase to phase voltage Vab	0 ~ 1000	UINT32		V	E
R	41	40	Phase to phase voltage Vbc	0 ~ 1000	UINT32		V	E
R	43	42	Phase to phase voltage Vca	0 ~ 1000	UINT32		V	E
R	45	44	MAX phase to phase voltage	0 ~ 1000	UINT32		V	E
R	47	46	Minimum phase to phase voltage	0 ~ 1000	UINT32		V	E
R	49	48	Average phase to phase voltage	0 ~ 1000	INT32		V	E
R	51	50	phase degree Van	-180 ~ +180	INT32		DEGREE	E
R	53	52	phase degree Vbn	-180 ~ +180	INT32		DEGREE	E
R	55	54	phase degree Vcn	-180 ~ +180	INT32		DEGREE	E
R	57	56	phase degree current on phase R	-180 ~ +180	INT32		DEGREE	E
R	59	58	phase degree current on phase S	-180 ~ +180	INT32		DEGREE	E
R	61	60	phase degree current on phase T	-180 ~ +180	INT32		DEGREE	E
R	63	62	unbalance current on phase R	-100 ~ +100	INT32		%	E
R	65	64	unbalance current on phase S	-100 ~ +100	INT32		%	E
R	67	66	unbalance current on phase T	-100 ~ +100	INT32		%	E
R	69	68	Maximum unbalance current	-100 ~ +100	UINT32		%	E
R	71	70	unbalance voltage on Van	-100 ~ +100	INT32		%	E
R	73	72	unbalance voltage on Vbn	-100 ~ +100	INT32		%	E
R	75	74	unbalance voltage on Vcn	-100 ~ +100	INT32		%	E
R	77	76	Maximum unbalance voltage	-100 ~ +100	UINT32		%	E
R	79	78	FREQUENCY	45 ~ 65	UINT32	*10	Hz	E

3.1.2. 전력, 전력량

R/W	Register	ADDRESS	Description	range	Type	scale	unit	A/E
R	200	199	TOTAL active power	- 99999999 ~ + 999999999	INT32		kW	E
R	202	201	TOTAL reactive power	- 99999999 ~ + 999999999	INT32		kVAR	E
R	204	203	TOTAL apparent power	- 99999999 ~ + 999999999	INT32		kVA	E
R	206	205	TOTAL power factor	-100 ~ 101	INT32	* 100		E
R	208	207	Active power on phase R	- 99999999 ~ + 999999999	INT32		kW	E
R	210	209	Active power on phase S	- 99999999 ~ + 999999999	INT32		kW	E
R	212	211	Active power on phase T	- 99999999 ~ + 999999999	INT32		kW	E
R	214	213	Reactive power on phase R	- 99999999 ~ + 999999999	INT32		kVAR	E
R	216	215	Reactive power on phase S	- 99999999 ~ + 999999999	INT32		kVAR	E
R	218	217	Reactive power on phase T	- 99999999 ~ + 999999999	INT32		kVAR	E
R	220	219	Apparent power on phase R	- 99999999 ~ + 999999999	INT32		kVA	E
R	222	221	Apparent power on phase S	- 99999999 ~ + 999999999	INT32		kVA	E
R	224	223	Apparent power on phase T	- 99999999 ~ + 999999999	INT32		kVA	E
R	226	225	Power factor on phase R	-100 ~ 100	INT32	*100		E
R	228	227	Power factor on phase S	-100 ~ 100	INT32	*100		E
R	230	229	Power factor on phase T	-100 ~ 100	INT32	*100		E
R	232	231	TOTAL active energy	0 ~ + 999999999	INT32		kWh	E
R	234	233	TOTAL reactive energy	0 ~ + 999999999	INT32		kVARh	E
R	236	235	TOTAL apparent energy	0 ~ + 999999999	INT32		kVAh	E
R	238	237	Active energy on phase R	0 ~ + 999999999	INT32		kWh	E
R	240	239	Active energy on phase S	0 ~ + 999999999	INT32		kWh	E
R	242	241	Active energy on phase T	0 ~ + 999999999	INT32		kWh	E
R	244	243	Reactive energy on phase R	0 ~ + 999999999	INT32		kVARh	E
R	246	245	Reactive energy on phase S	0 ~ + 999999999	INT32		kVARh	E
R	248	247	Reactive energy on phase T	0 ~ + 999999999	INT32		kVARh	E
R	250	249	Reverse active energy on phase R	0 ~ + 999999999	INT32		rkWh	E
R	252	251	Reverse active energy on phase S	0 ~ + 999999999	INT32		rkWh	E
R	254	253	Reverse active energy on phase T	0 ~ + 999999999	INT32		rkWh	E
R	256	255	Reverse reactive energy on phase R	0 ~ + 999999999	INT32		rkVARh	E
R	258	257	Reverse reactive energy on phase S	0 ~ + 999999999	INT32		rkVARh	E
R	260	259	Reverse reactive energy on phase T	0 ~ + 999999999	INT32		rkVARh	E
R	262	261	Reverse apparent energy on phase R	0 ~ + 999999999	INT32		kVAh	E
R	264	263	Reverse apparent energy on phase S	0 ~ + 999999999	INT32		kVAh	E
R	266	265	Reverse apparent energy on phase S	0 ~ + 999999999	INT32		kVAh	E
R	268	267	Demand on phase R	0.2 x In ~ 17 x In	UINT32		A	E
R	270	269	Demand on phase S	0.2 x In ~ 17 x In	UINT32		A	E
R	272	271	Demand on phase T	0.2 x In ~ 17 x In	UINT32		A	E
R	274	273	Demand on the neutural	0.2 x In ~ 17 x In	UINT32		A	E
R	276	275	Demand total active power	- 99999999 ~ + 999999999	INT32		kW	E
R	278	277	Demand total reactive power	- 99999999 ~ + 999999999	INT32		kVAR	E
R	280	279	Demand total apparent power	- 99999999 ~ + 999999999	INT32		kVA	E

3.1.3. 고조파

The Harmonics describes two cases below

- 3P : phase to phase

- 4P: phase to neutral

R/W	Register	ADDRESS	Description	range	Type	scale	unit	A/E
R	4000	3999	Total harmonic current on R 1~15		UINT16	*10	A	E
R	4015	4014	Total harmonic current on S 1~15		UINT16	*10	A	E
R	4030	4029	Total Harmonic current on T 1~15		UINT16	*10	A	E
R	4045	4044	Total harmonic current on the neutral 1~15		UINT16	*10	A	E
R	4060	4059	Total harmonic voltage on VR/VRS 1 ~15		UINT16	*10	V	E
R	4075	4074	Total harmonic voltage VS/VST 1 ~15		UINT16	*10	V	E
R	4090	4089	Total harmonic voltage VT/VTR 1 ~15		UINT16	*10	V	E

3.1.4. THD (Total harmonic distortion)

R/W	Register	ADDRESS	Description	range	Type	scale	unit	A/E
R	4500	4499	IR THD		UINT16		%	E
R	4501	4500	IS THD		UINT16		%	E
R	4502	4501	IT THD		UINT16		%	E
R	4503	4502	IN THD		UINT16		%	E
R	4504	4503	VR/VRS THD		UINT16		%	E
R	4505	4504	VS/VST THD		UINT16		%	E
R	4506	4505	VT/VTR THD		UINT16		%	E

3.2. Setting Information

Function code is the 3 (4xxxxx).

3.2.1. Protection and alarm

R/W	Register	ADDRESS	Description	range	Type	scale	uint	A/E
R	1	0	Current scale factor for wave		UINT16	*1000		A, E
R	2	1	Voltage scale factor for wave		UINT16	*1000		A, E
R/W	3	2	Long time Ir pick-up	0.4*In ~ rotary setting	UINT16		A	A, E
R/W	4	3	Long time tr time delay		UINT16		msec	A, E
R	5	4	Short time Isd pick-up		UINT16		A	A, E
R/W	6	5	Short time tsd time delay		UINT16		msec	A, E
R/W	7	6	Ground fault Ig pick-up		UINT16		A	A, E
R/W	8	7	Ground fault tg time delay		UINT16		msec	A, E
R/W	9	8	Instantaneous Ii pick-up		UINT16		A	A, E
R	10	9	The neutral pick-up		UINT16		A	A, E
R/W	11	10	Thermal on/off		F004			A, E
R/W	12	11	Remote set on/off		F004			A, E
R/W	13	12	Serial com. swap set		F004			A, E
R/W	14	13	Serial com. BAUERATE		F007			A, E
R/W	15	14	Serial com. ADDRESS	1 ~249	UINT16			A, E
R/W	16	15	ENCT set		F004			A, E
R/W	17	16	ENVT set		F004			E
R/W	18	17	Demand current time	5 ~60	UINT16			E
R/W	19	18	Demand power time	5~ 60	UINT16			E
R/W	20	19	Power factor sign		F008			E
R/W	21	20	Power flow sign	forward/reverse	F009			E
R/W	22	21	UVR status	OFF.ALARM	F004			E
R/W	23	22	UVR pick up value	100 to OVR pick up value	UINT16		V	E
R/W	24	23	UVR drop out value	UVR pick up value to OVR pick up value	UINT16		V	E
R/W	25	24	UVR pick up time delay	1 to 1500	UINT16		sec	E
R/W	26	25	UVR drop out time delay	1 to 1500	UINT16		sec	E
R/W	27	26	OVR status	OFF.ALARM	F004			E
R/W	28	27	OVR pick up value	UVR pick-up to 1100	UINT16		V	E
R/W	29	28	OVR drop out value	100 to OVR pick up value	UINT16		V	E
R/W	30	29	OVR pick up time delay	1 to 1500	UINT16		sec	E
R/W	31	30	OVR drop out time delay	1 to 1500	UINT16		sec	E
R/W	32	31	U-unbal status	OFF.ALARM	F004			E
R/W	33	32	U-unbal pick up value	2 to 30	UINT16		%	E
R/W	34	33	U-unbal drop out value	2 to U-unbal pick up value	UINT16		%	E
R/W	35	34	U-unbal pick up time delay	1 to 1500	UINT16		sec	E
R/W	36	35	U-unbal drop out time delay	1 to 1500	UINT16		sec	E
R/W	37	36	I-unbal status	OFF.ALARM	F004			E
R/W	38	37	I-unbal pick up value	5 to 60	UINT16		%	E
R/W	39	38	I-unbal drop out value	5 to I-unbal pick up value	UINT16		%	E
R/W	40	39	I-unbal pick up time delay	1 to 1500	UINT16		sec	E
R/W	41	40	I-unbal drop out time delay	1 to 1500	UINT16		sec	E
R/W	42	41	UFR status	OFF.ALARM	F004			E
R/W	43	42	UFR pick up value	45 to OFR pick up value	UINT16	*10	Hz	E
R/W	44	43	UFR drop out value	UFR pick up value to OFR pick up value	UINT16	*10	Hz	E
R/W	45	44	UFR pick up time delay	1 to 1500	UINT16		sec	E
R/W	46	45	UFR drop out time delay	1 to 1500	UINT16		sec	E
R/W	47	46	OFR status	OFF.ALARM	F004			E
R/W	48	47	OFR pick up value	UFR pick up value to 65	UINT16	*10	Hz	E
R/W	49	48	OFR drop out value	45 to OFR pick up value	UINT16	*10	Hz	E
R/W	50	49	OFR pick up time delay	1 to 1500	UINT16		sec	E
R/W	51	50	OFR drop out time delay	1 to 1500	UINT16		sec	E

3.2.2. Time set

R/W	Register	ADDRESS	Description	range	Type	scale	unit	A/E
R/W	190	189	RCT Time	2000 to 2099 year	F011			A, E

3.3. Write Command

3.3.1. Reset Write

The function code is the 5.

R/W	Register	ADDRESS	Description	Range	Type	scale	unit	A/E
W	1	0	FAULT RESET		F013			A, E
W	2	1	TRIP COUNTER reset		F013			A, E
W	3	2	RUN COUNTER reset		F013			A, E
W	4	3	MAX RESET		F013			A, E
W	5	4	Load profile reset		F013			A, E
W	6	5	demand I reset		F013			E
W	7	6	demand P reset		F013			E
W	8	7	ENERGY RESET		F013			E

3.3.2. Protection Setting

The function code is the 6.

3.3.2.1. Long time Ir Pick up and tr time delay

The long time pick up value can be adjusted to step 1A

R/W	Register	ADDRESS	Description	range	Type	scale	unit	A/E
W	3	2	Long time pick up value	0.4*In ~ rotary setting	UINT16			A, E
W	4	3	Long time tr delay	[0 ~ 6]	F017			A, E

3.3.2.2. Short time tsd time delay

R/W	Register	ADDRESS	Description	range	Type	scale	unit	A/E
W	6	5	Short time tsd delay	[0 ~ 7]	F016			A, E

3.3.2.3. Ground fault Ig pick up and tg time delay

R/W	Register	ADDRESS	Description	range	Type	scale	unit	A/E
W	7	6	Ground fault Ig pick up value	[0 ~ 8]	F015			A, E
W	8	7	Ground fault tg time delay	[0 ~ 7]	F018			A, E

3.3.2.4. Instantaneous pick up value

R/W	Register	ADDRESS	Description	range	Type	scale	unit	A/E
W	9	8	Instantaneous Ii pick up value	[0 ~ 6]	F014			A, E

3.3.3. Demand current, voltage time

A default demand time is 15 min and It can be adjusted in 1V increments

R/W	Register	ADDRESS	Description	range	Type	scale	unit	A/E
W	6	5	demand I reset		F013			E
W	7	6	demand P reset		F013			E

3.3.4. Alarm set

3.3.4.1. Under voltage

The pick-up value and dropout value: step 5V,

The pick-up time delay and dropout time delay : step 1sec

The information indicates that:

For 3P circuit breaker: Phase to phase voltage.

For 4P circuit breaker: Phase to neutral voltage.

R/W	Register	ADDRESS	Description	range	Type	scale	unit	A/E
W	22	21	UVR status	OFF.ALARM	F004			E
W	23	22	UVR pick up value	100 to OVR pick up value	UINT16		V	E
W	24	23	UVR dropout value	UVR pick up value to OVR pick up value	UINT16		V	E
W	25	24	UVR pick up time delay	1 to 1500	UINT16		SEC	E
W	26	25	UVR dropout time delay	1 to 1500	UINT16		SEC	E

3.3.4.2. Over voltage

The pick-up value and dropout value: step 5V,

The pick-up time delay and dropout time delay : step 1sec

The information indicates that:

For 3P circuit breaker: Phase to phase voltage.

For 4P circuit breaker: Phase to neutral voltage.

R/W	Register	ADDRESS	Description	range	Type	scale	unit	A/E
W	27	26	OVR status	OFF.ALARM	F004			E
W	28	27	OVR pick up value	UVR pick up value to 1100	UINT16		V	E
W	29	28	OVR dropout value	100 to OVR pick up value	UINT16		V	E
W	30	29	OVR pick up time delay	1 to 1500	UINT16		SEC	E
W	31	30	OVR dropout time delay	1 to 1500	UINT16		SEC	E

3.3.4.3. Unbalance phase to phase voltage

The information indicates an unbalance of phase to phase voltage.

The pick-up value and dropout value: step 1%

The pick-up time delay and dropout time delay : step 1sec

R/W	Register	ADDRESS	Description	range	Type	scale	unit	A/E
W	32	31	U-unbal status	OFF.ALARM	F004			E
W	33	32	U-unbal pick up value	2 to 30	UINT16		%	E
W	34	33	U-unbal dropout value	2 to U-unbal pick up value	UINT16		%	E
W	35	34	U-unbal pick up time delay	1 to 1500	UINT16		SEC	E
W	36	35	U-unbal dropout time delay	1 to 1500	UINT16		SEC	E

3.3.4.4. Unbalance phase current

The pick-up value and dropout value: step 1%

The pick-up time delay and dropout time delay : step 1sec

R/W	Register	ADDRESS	Description	range	Type	scale	unit	A/E
W	37	36	I-unbal status	OFF.ALARM	F004			E
W	38	37	I-unbal pick up value	5 to 60	UINT16		%	E
W	39	38	I-unbal dropout value	5 to I-unbal pick up value	UINT16		%	E
W	40	39	I-unbal pick up time delay	1 to 1500	UINT16		SEC	E
W	41	40	I-unbal dropout time delay	1 to 1500	UINT16		SEC	E

3.3.4.5. Under Frequency

The pick-up value and dropout value: step 0.5Hz

The pick-up time delay and dropout time delay : step 1sec

R/W	Register	ADDRESS	Description	range	Type	scale	unit	A/E
W	42	41	UFR status	OFF.ALARM	F004			E
W	43	42	UFR pick up value	45 to OFR pick up value	UINT16	*10	Hz	E
W	44	43	UFR dropout value	UFR pick up value to OFR pick up value	UINT16	*10	Hz	E
W	45	44	UFR pick up time delay	1 to 1500	UINT16		SEC	E
W	46	45	UFR dropout time delay	1 to 1500	UINT16		SEC	E

3.3.4.6. Over Frequency

The pick-up value and dropout value: step 0.5Hz

The pick-up time delay and dropout time delay : step 1sec

R/W	Register	ADDRESS	Description	range	Type	scale	unit	A/E
W	47	46	OFR status	OFF.ALARM	F004			E
W	48	47	OFR pick up value	UFR pick up value to 65	UINT16	*10	Hz	E
W	49	48	OFR dropout value	45 to OFR pick up value	UINT16	*10	Hz	E
W	50	49	OFR pick up time delay	1 to 1500	UINT16		SEC	E
W	51	50	OFR dropout time delay	1 to 1500	UINT16		SEC	E

3.3.5. 시간 동기화

Function code is the 16.

R/W	Register	ADDRESS	Description	Range	Type	scale	unit	A/E
W	190	189	Time SYNC		F011			A, E

3.3.6. ETU configuration.

R/W	Register	ADDRESS	Description	range	Type	scale	unit	A/E
W	11	10	thermal on/off		F004			A, E
W	12	11	REMOTE SET ON/OFF		F004			A, E
W	13	12	Communication swap		F004			A, E
W	14	13	Communication baud rate		F007			A, E
W	15	14	Communication address	1 ~249	UINT16			A, E
W	16	15	Reserved					A, E
W	17	16	Reserved					E

3.4. Events

The function code is 4.

3.4.1. System events

The ETU can save 32 status information of ETU. The master can request up to max 5 register of slave.

R/W	Register	ADDRESS	Description	range	Type	scale	unit	A/E
R	1001	1000	System event #1		F020			A, E
R	1005	1004	System event #2		F020			A, E
R	1009	1008	System event #3		F020			A, E
R	1013	1012	System event #4		F020			A, E
R	1017	1016	System event #5		F020			A, E
R	1021	1020	System event #6		F020			A, E
R	1025	1024	System event #7		F020			A, E
R	1029	1028	System event #8		F020			A, E
R	1033	1032	System event #9		F020			A, E
R	1037	1036	System event #10		F020			A, E
R	1041	1040	System event #11		F020			A, E
R	1045	1044	System event #12		F020			A, E
R	1049	1048	System event #13		F020			A, E
R	1053	1052	System event #14		F020			A, E
R	1057	1056	System event #15		F020			A, E
R	1061	1060	System event #16		F020			A, E
R	1065	1064	System event #17		F020			A, E
R	1069	1068	System event #18		F020			A, E
R	1073	1072	System event #19		F020			A, E
R	1077	1076	System event #20		F020			A, E
R	1081	1080	System event #21		F020			A, E
R	1085	1084	System event #22		F020			A, E
R	1089	1088	System event #23		F020			A, E
R	1093	1092	System event #24		F020			A, E
R	1097	1096	System event #25		F020			A, E
R	1101	1100	System event #26		F020			A, E
R	1105	1104	System event #27		F020			A, E
R	1109	1108	System event #28		F020			A, E
R	1113	1112	System event #29		F020			A, E
R	1117	1116	System event #30		F020			A, E
R	1121	1120	System event #31		F020			A, E
R	1125	1124	System event #32		F020			A, E

3.4.2. Fault events

The ETU can save 20 events of fault, long time, short time, Instantaneous and the latest fault event is saved on event No. 1.

The master can request a register of slave one by one.

R/W	Register	ADDRESS	Description	Range	Type	Scale	Unit	A/E
R	1131	1130	Fault event #1		F019			A, E
R	1147	1146	Fault event #2		F019			A, E
R	1163	1162	Fault event #3		F019			A, E
R	1179	1178	Fault event #4		F019			A, E
R	1195	1194	Fault event #5		F019			A, E
R	1211	1210	Fault event #6		F019			A, E
R	1227	1226	Fault event #7		F019			A, E
R	1243	1242	Fault event #8		F019			A, E
R	1259	1258	Fault event #9		F019			A, E
R	1275	1274	Fault event #10		F019			A, E
R	1291	1290	Fault event #11		F019			A, E
R	1307	1306	Fault event #12		F019			A, E
R	1323	1322	Fault event #13		F019			A, E
R	1339	1338	Fault event #14		F019			A, E
R	1355	1354	Fault event #15		F019			A, E
R	1371	1370	Fault event #16		F019			A, E
R	1387	1386	Fault event #17		F019			A, E
R	1403	1402	Fault event #18		F019			A, E
R	1419	1418	Fault event #19		F019			A, E
R	1435	1434	Fault event #20		F019			A, E

3.5. ETU identification.

R/W	Register	ADDRESS	Description	Range	Type	Scale	Unit	A/E
R	9000	8999	FW version		UINT16	*100		A, E
R	9001	9000	Product Type		F021			A, E
R	9002	9001	ETU Type		F022			A, E
R	9003	9002	Production date		F023			A, E
R	9004	9003	Production number	1 ~ 99999	UINT16			A, E

4. Type Information

4.1. F001

BIT	DATA	DESCRIPTION
[0:3]	0 = 100A, 1 = 160A, 2 = 250A, 3 = 400A, 4 = 630A	In(A)
	5 = 800A	
4	0 : 50Hz , 1 : 60Hz	FREQUENCY
5	0 : 4POLE , 1 : 3POLE	POLE
6	REV.	
7	OVR ALARM 0 : OFF, 1 : ON	OVR ALARM
8	UVR ALARM 0 : OFF, 1 : ON	UVR ALARM
9	U-unbalance ALARM 0 : OFF , 1 : ON	U-unbalance ALARM
10	I-unbalance ALARM 0 : OFF , 1 : ON	I-unbalance ALARM
11	REV.	
12	OFR ALARM 0 : OFF, 1 : ON	OFR ALARM
13	UFR ALARM 0 : OFF, 1 : ON	UFR ALARM
[14:15]	REV.	
[16:19]	0 : NONE 1 : OVERRIDE TRIP 2 : INST 3 : LONG-TIME PROTECTION Ir 4 : SHORT-TIME PROTECTION Isd 5 : GROUND-FAULT PROTECTION Ig	CAUSE OF TRIPPING
[20:22]	REV.	
23	0 : OFF , 1 : I2t ON	SHORT FAULT TIME CURVE
24	0 : OFF , 1 : Ig2t ON	GROUND FAULT TIME CURVE
25	0 : NOT EMPTY , 1 : EMPTY or NOT CONNECTED	BATTERY STATUS
26	ENCT 0 : OFF , 1: ON	ENCT
27	ENVT 0 : OFF , 1: ON	ENVT
[28:31]	ETU error status	0: normal 1 : MHT error (Err1) 2 : In setting error(Err2)

4.2. F002

Reg	Description	Type
1	YEAR	UINT16
2	month	UINT16
3	day	UINT8
	hour (24h)	UINT8
4	minute	UINT8
	sec	UINT8
5 .. 68	2 cycle wave	INT16

4.3. F003

Neutral protection setting 0: off, 1: 0.5, 2: 1.0, 3: 1.6

4.4. F004

0 = off, 1 = on

4.5. F007

0 = 9600 bps, 1 = 19200 bps, 2 = 38400 bps

4.6. F008

Power factor convention sign 0= IEC, 1= IEEE

4.7. F009

Power direction 0= forward, 1= reverse

4.8. F011

Register	DESCRIPTION	Type
1	YEAR	UINT16
2	MONTH	UINT16
3	DAY	UINT16
4	HOUR(24h)	UINT16
5	MINUTE	UINT16
6	SEC	UINT16

4.9. F013

0x0000 = OFF, 0xFF00 = ON

4.10. F014

The instantaneous protection pick up value for the phase and neutral. It is expressed in multiples of In.

1) In = 100/160 A

Data	0	1	2	3	4	5	6	7	8	9	10
Ii (x In) [A]	1.5	2	4	6	8	10	11	12	13	14	15

2) In = 250/400/630/800 A

Data	0	1	2	3	4	5	6
Ii (x In) [A]	1.5	2	4	6	8	10	11

4.11. F015

The Ground fault protection pick up is expressed in multiples of In

Data	0	1	2	3	4	5	6	7	8
Ig (x In) [A]	NON	0.2	0.3	0.4	0.5	0.6	0.7	0.8	1

4.12. F016

The Short time protection time delay

tsd (sec)	
I2t off	0 = 0.1, 1 = 0.2, 2 = 0.3, 3 = 0.4
I2t on	4 = 0.1, 5 = 0.2, 6 = 0.3, 7 = 0.4

4.13. F017

The Long time protection time delay

Data	0	1	2	3	4	5	6
tr [sec]	0.5	1	2	4	6	8	16

4.14. F018

The Ground fault protection time delay

tg (sec)

I2t off	0 = 0.1, 1 = 0.2, 2 = 0.3, 3 = 0.4
I2t on	4 = 0.1, 5 = 0.2, 6 = 0.3, 7 = 0.4

4.15. F019 (32 bytes)

register	description	byte
1	year	2
2	month	1
	day	1
3	hour	1
	min	1
4	sec	1
	trip type & freq 0x8- = 60Hz, 0x0- = 50Hz 0x01 = LTD, 0x02 = STD, 0x03 = INST, 0x04 = GFT, 0x05 = override	1
5	Trip phase: 1 = R, 2 = S, 3 = T, 4 = N	1
	Isd setting position	1
6	Ii setting position 0 = 1.5, 1 = 2, 2	1
	Ig setting position	1
7	Ir pick up value	2
8	Ia current	2
9	Ib current	2
10	Ic current	2
11	IN current	2
12	Ig current	2
13	Va/Vab voltage	2
14	Vb/Vbc voltage	2
15	Vc/Vca voltage	2
16	reserved	2

4.16. F020 (8 bytes)

Register	Description	Unit	bytes
1	year	UINT16	2
2	month	UINT8	1
	day	UINT9	1
3	hour	UINT10	1
	min	UINT11	1
4	sec	UINT12	1
	event data MSB 0 = local, 1 = remote	F020-1	1

4.16.1. F020-1

The data of information is expressed two modes that be masked with the upper bit to 1.

Event Information 0x80 = Remote, 0x00 = Local

Data	Description	remote	local
1	External power on		0
2	ENCT setting change	0	0
3	Communication setting change	0	0
4	ENVT setting change	0	0
5	RTC setting change	0	0
6	Demand time setting change	0	
7	UVR/OVR setting change	0	
8	V unbalance setting change	0	
9	Over frequency/ under frequency setting change	0	
10	I unbalance setting change	0	
11	Power Factor sign setting change	0	
12	POWER SIGN setting change	0	
13	remote set setting change	0	
14	The neutral protection(IN) setting change		0
15	fault reset	0	0
16	trip counter reset	0	
17	RUN counter reset	0	
18	max min reset	0	
19	Load profile reset	0	
20	demand I reset	0	
21	demand P reset	0	
22	ENERGY RESET	0	0
23	UVR ALARM operation on phase R		0
24	UVR ALARM operation on phase S		0
25	UVR ALARM operation on phase T		0
26	OVR ALARM operation on phase R		0
27	OVR ALARM operation on phase S		0
28	OVR ALARM operation on phase T		0
29	U-unbal ALARM operation		0
30	I-unbal ALARM operation		0
31	UFR ALARM operation		0
32	OFR ALARM operation		0
33	Ir protection setting change	0	0
34	Isd protection setting change		0
35	Ii protection setting change	0	0
36	Ig protection setting change	0	0

37	Tr time delay setting change	0	0
38	Tsd time delay setting change	0	0
39	Tg time delay setting change	0	0
40	Thermal setting change	0	0
41	PRU CONNECT	0	
42	PRU DISCONNECT	0	
43	ETU MHT ERROR		0
44	ETU In setting ERROR		0

4.17. F021

2 = MCCB.

4.18. F022

HGP AF and ETU type information.

1 = 250AF N type, 2 = 250AF A type, 3 = 250AF E type
4 = 630AF N type, 5 = 630AF A type, 6 = 630AF E type
7 = 800AF N type, 8 = 800AF A type, 9 = 800AF E type
10 = 250AF D type, 11 = 630AF D type, 12 = 800AF D type

4.19. F023

Product identification: Rated current (In), Production date.

15	14	13	12	11	10	9	8
In value				Production Month (1 ~12)			
7	6	5	4	3	2	1	0
Prodution Year (0 ~ 99)							

Rated current (In) value : 0 = 100A, 1 = 160A, 2 = 250A, 3 = 400A, 4 = 630A, 5 = 800A

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