

RTP 300

High Accuracy Digital Integrated Protection Relay



Communication User Guide[Korean]

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위험

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1. INTRODUCTION

1.1 Serial Communication

RTP 300은 Master/Slave 간의 통신을 위하여 Multi-drop으로 동작하는 RS485 통신포트를 가진다. 상위 프로그램과의 통신을 위하여 RTP 300은 일반사용자를 위한 Modbus RTU Protocol을 지원한다. Modbus RTU 프로토콜은 일반 PC 및 PLC 등과 같은 자동화 장비와 연계하기 위한 프로토콜로서 Slave[RTP 300]와 Master[PC 또는 PLC 등]간의 계측 및 Setup에 대한 데이터 정보를 효율적으로 전송할 수 있는 산업용 일반프로토콜이다.

Master/Slave Multi-drop

- 네트워크상의 모든 통신은 Master/Slave의 방식으로 이루어진다.
- Master는 통신 루프상에서 모든 정보의 전달을 시작하고 제어한다.
- Slave 장치는 Master의 요청이 있을 때에만 응답동작을 한다.
- 모든 통신데이터는 Packet들로 이루어지고 한 Packet은 바이트들로 이루어진 조합으로 구성된다.
- Master에 의해서 전송된 모든 Packet은 Request가 되고 Slave에 의해 전송된 모든 Packet은 Response가 된다.
- Master/Slave 통신에서 Master로부터 하나의 Request가 오면 하위에 연결된 Slave중에 오직 하나만이 Response한다.

Modbus RTU Protocol

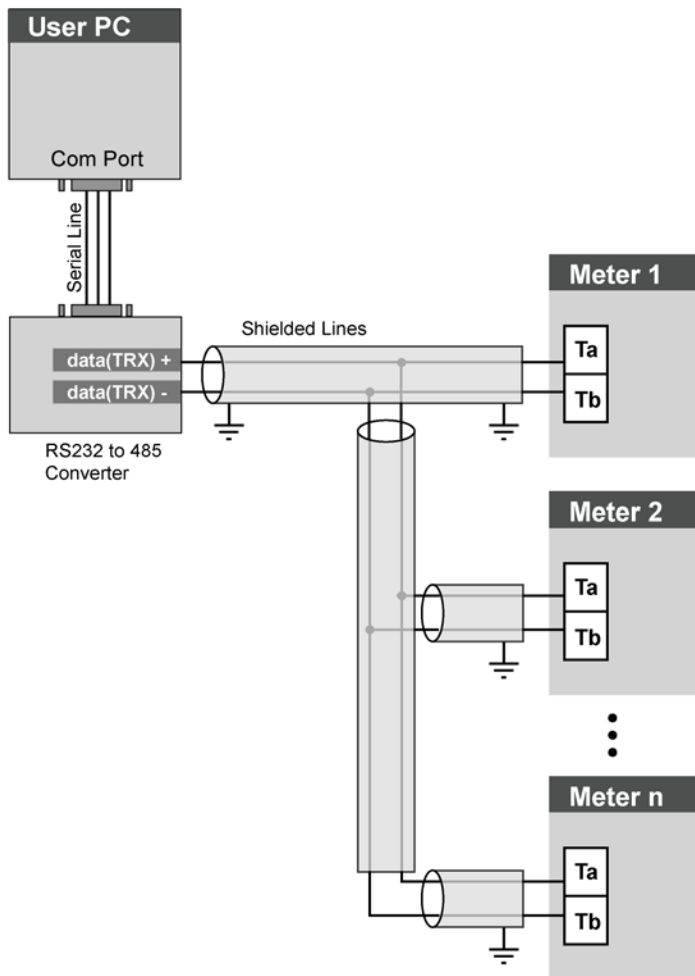
- 일반사용자를 위한 범용 프로토콜.
- 루텍 제품과의 통신은 Modbus RTU이용 권장.
- Modicon사의 Modbus RTU 프로토콜에 준해서 설계한다.
- 메터의 각 계측데이터 및 설정 파라미터에 대한 어드레스맵을 이용하여 각 데이터에 대한 선별적인 통신수행을 가능하게 한다.
- Modbus는 산업현장의 범용 프로토콜로서 PLC나 자동화프로그램 등에서는 통신드라이버를 기본적으로 지원한다.

1.2 Communication

RTP 300의 직렬통신설정은 8 data bits, even parity, 1 stop bit를 디폴트로 한다. 자세한 메터 통신설정 방법은 “RTP 300 Users Guide” 참조

RS485 통신은 다수의 메터를 연결하기 위하여 버스라인 결선을 한다. 기본적으로 32대까지 연결가능하고 리피터 이용하면 최대 247개까지의 메터를 연결할 수 있다. 모든 장치의 연결은 RS485 제한거리[1.2km]를 넘지 않도록 연결한다.

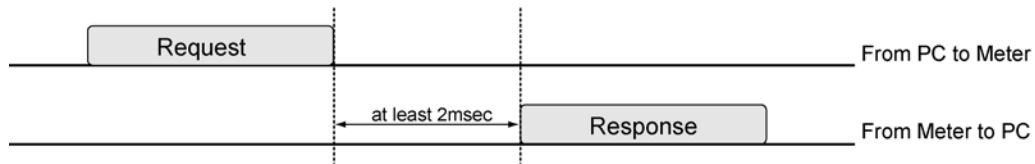
RS485 Multi-drop Connection Diagram



RS485 통신 라인과 PC-PC는 RS232 포트만 지원-를 연결하기 위해서는 RS485를 RS232로 바꿔주는 컨버터[RTS/CTS 자동 콘트롤이 되어야 함]를 사용한다. PC와 RTP 300의 통신은 RTP 300의 Ta, Tb 단자를 각각 컨버터의 RS485 Data(TRX) +, Data(TRX) -로 연결하고 컨버터의 RS232 포트는 사용자PC와 일대일로 연결한다. RS485 통신선은 AWG 22[0.33mm²]이상의 규격을 가지는 실드된 Twisted Pair선을 사용해야 한다.

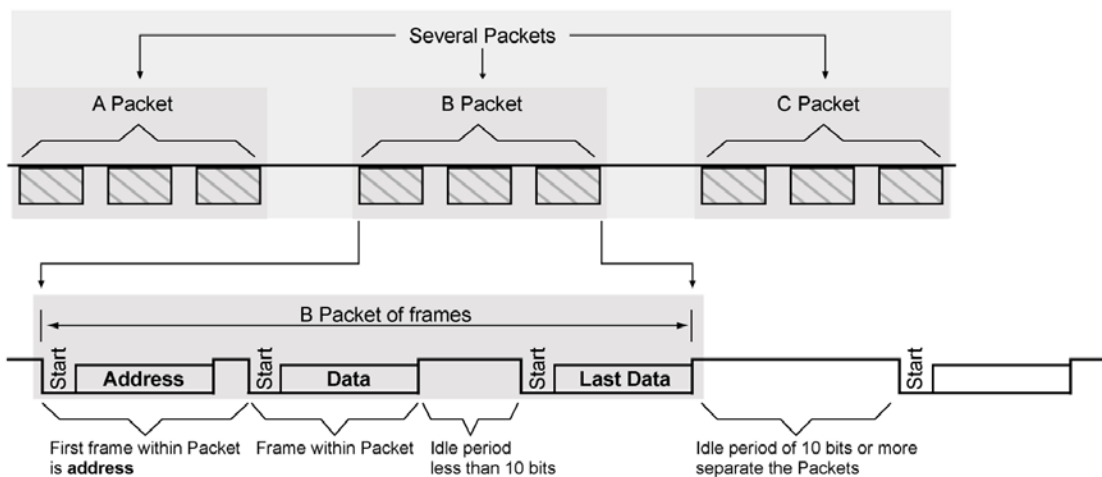
RS485 Communication Timing

Request Packet과 Response Packet 사이의 시간 지연 타이밍을 보인다.



Packet Recognition Time

상위프로그램과 로컬 메터사이에서 송수신되는 데이터 Packet은 아래의 포맷으로 구성된다. 하나의 Packet은 연속된 다수의 데이터 Frame으로 구성되며 Frame간의 거리가 10bits 이내가 되어야 같은 Packet의 Frame으로 인식된다. 한 Packet과 다음 Packet까지는 최소 10bit이상의 시간이 필요하다.



Holding Time before transmitting Request Packet

PC[Master]에서 Meter로부터 데이터를 받고난후 최소 1.2msec[9600bps인 경우]의 시간이 지난후에 다음 데이터를 위한 Request Packet을 재전송해야 한다. 고속데이터 Request를 하는 경우-Meter가 데이터를 수신하고 곧 바로 Request Packet을 전송하는 경우-에 특히 유의해야 한다.

2. MODBUS RTU PROTOCOL

2.1 Modbus RTU Protocol

RTP 300에서 지원하는 Modbus RTU에 대한 세부규격은 아래와 같다.

Packet Field of Modbus RTU

Modbus RTU는 4 가지 필드로 구성된다.

- Slave Address Field
- Function Field
- Data Field
- Error Check Field

Slave Address Field

Modbus RTU Packet의 slave address 필드는 한 바이트의 크기를 가지며 통신중에 slave device인 RTP 300을 지정하기 위한 ID로 이용된다. 유효한 메터 어드레스 ID는 1 ~ 247이다. 사용자는 프로그램에서 데이터를 수신하고자 하는 slave address[메터 ID]를 지정해서 Request해야 한다.

Function Field

Modbus RTU Packet의 function 필드는 한 바이트의 크기를 가지며 사용자가 보낸 Request의 명령내용을 나타낸다.

Function[Decimal]	Meaning	Description
03	Read Multiple register	하나 이상의 메터 계측데이터 읽기
06	Write Single register	한 개의 메터 데이터를 특정값으로 설정
16	Write Multiple registers	여러 개의 메터 데이터를 특정값들로 설정

Data Field

Modbus RTU Packet의 data 필드는 가변 크기를 가진다. 이 필드는 Request Packet에서 사용자가 메터에 명령하고자 하는 데이터를 포함하며 Response Packet에서는 메터에서 사용자에게 전달되는 데이터를 포함한다.

각 데이터는 2 Bytes[16 bits]의 크기를 가지며 그 순서는 상위 하위의 “Big Endian” 포맷을 가진다.

예]

2 Byte 데이터가 3A12 hex 라면 전송되는 순서는

상위 바이트 = 3A hex

하위 바이트 = 12 hex

Error Check Field

Modbus RTU Packet의 error check 필드는 CRC-16 알고리즘을 사용하여 통신중에 발생할 수 있는 전송오류를 체크한다. CRC-16은 2 Bytes[16 bits]의 크기를 가지며 그 순서는 상위 하위의 “Big Endian” 포맷을 가진다.

수신장치는 전송 받은 Packet에 CRC 바이트를 제외하고 계산한 값이 CRC 바이트와 같다면 통신오류가 발생하지 않은 것이고 같지 않다면 통신중 오류가 발생한 것이다. CRC-16 알고리즘에 대한 자세한 설명은 Appendix A&B를 참조.

Packet Format

Slave Address	Function	Data	Error Check
1 byte	1 byte	N × 2 bytes	2 bytes

Exception Responses

Master에서 Slave[RTP 300]로 유효하지 않은 Command를 보내거나 유효하지 않은 Holding Register를 읽는 경우에는 Slave로부터 Exception Response가 발생이 된다. Exception Response에서 에러를 나타내기 위해서 Function code의 high order bit를 1로 한다.

Exception Response의 data field는 Exception error code를 포함한다.

Exception Response

Slave Address	Function	Exception Code	Error Check
1 byte	1 byte	1 bytes	2 bytes

Exception Code	Name	Description
01	Illegal Function	Request Packet에서 유효하지 못한 명령어
02	Illegal Address	Request Packet에서 유효하지 못한 Holding Address
03	Illegal Value	Holding Address에서 유효하지 못한 데이터값 전송

Broadcast Packets

Broadcast Request Packet은 Master로부터 하위에 연결된 많은 Slave[RTP 300]로 동시에 같은 명령을 전달하게 한다. Broadcast Request Packet은 Slave Address가 0인 것을 제외하면 일반적인 Request Packet과 동일하다.

모든 Slave 장치는 Broadcast Request 명령을 수신하고 실행한다. 그러나 Slave 장치가 응답은 하지 않는다.

2.2 Packet Communications

RTP 300의 Modbus function에 세부사항은 아래와 같다.

Function 03: Read Holding Registers

메터의 파라미터 값을 읽기 위해서 Master는 Slave 장치로 Read Holding Registers Request Packet을 송신한다. Read Holding Registers Request Packet은 수신대상인 Holding Register의 Starting Address[시작어드레스]와 Word Count[수신할 Register의 개수]를 명기한다.

Starting Address는 40000번지에서 상대적인 어드레스로 나타낸다[40001=0, 40002=1, 40101= 100, and etc.]. CRC 생성은 Appendix B 참조.

메터는 Request에서 요구된 Register의 값을 포함하는 Packet을 응답한다.

Request

Slave	Function	Starting Address	Word Count	Error Check
	03			
1 byte	1 byte	2 bytes	2 bytes	2 bytes

예]

메터 1에 R상 전압[주소 40101], S상 전압[주소 40102]을 Function 03 명령으로 Polling 하는 실제 전송 코드는 아래와 같다.

slave address = 1, starting address = 100, word count = 2, crc high = 85, crc low = D4

Slave	Function	Starting Address	Word Count	Error Check
01	03	00 64	00 02	85 D4

Response

Slave	Function	Byte Count	Data Word 1	---	Data Word N	Error Check
	03			---		
1 byte	1 byte	1 byte	2 bytes	---	2 bytes	2 bytes

Data Word 는 Request에서 요구한 데이터의 내용을 나타낸다.

예]

메터 1에서 R상 전압값= 1A1B, S상 전압값=223B 를 응답함.

slave address = 1, byte count = 4, crc high = D4, crc low = 5F

Slave	Function	Byte Count	Data Word 1		Data Word N		Error Check	
01	03	04	1A	1B	22	3B	D4	5F

Write Single Register to Meter

Function 06은 메터의 한 레지스터에 데이터를 쓰는 Request 포맷이다.

Request

Slave	Function	Starting Address	Data Word	Error Check
	06			
1 byte	1 byte	2 bytes	2 bytes	2 bytes

예]

메터 1의 PT Ratio[주소 40002]에 데이터[120=0x78]를 쓰기 명령

slave address = 1, starting address = 1, data word = 78, crc high = D8, crc low = 28

Slave	Function	Starting Address		Data Word		Error Check	
01	06	00	01	00	78	D8	28

Response

Function 06에 대한 메터의 응답은 Request를 Packet을 재전송한다.

예]

위 Request Packet에 대한 응답은 아래와 같다.

Slave	Function	Starting Address		Data Word		Error Check	
01	06	00	01	00	78	D8	28

Write Multiple Registers to Meter

Function 16[decimal]은 메터의 여러 레지스터에 데이터를 쓰는 Request/Response 포맷이다.[주의. 십진수 16은 16진수로 10이 된다.]

Request

Slave	Function	Starting Address	Word Count	Byte Count
	10			
1 byte	1 byte	2 bytes	2 bytes	1 byte

Data Word 1	---	---	---	Data Word N	Error Check
	---	---	---		
2 bytes	---	---	---	2 bytes	2 bytes

Starting Address는 설정할 데이터의 시작 어드레스를 나타내고 Word Count는 설정 데이터의 개수, Byte Count 는 Word Count의 두 배이다.

예]

메터 1의 PT Ratio[주소 40002], CT Ratio[주소 40003]에 데이터[120=0x78], 데이터 [10=0xA]를 쓰기 명령

slave address = 1, starting address = 1, word count = 2, byte count = 4, crc high = 32, crc low = 7D

Slave	Function	Starting Address		Word Count		Byte Count	Data Word1	
01	10	00	01	00	02	04	00	78

Data Word2		Error Check	
00	0A	32	7D

Response

Slave	Function	Starting Address	Word Count	Error Check
	10			
1 byte	1 byte	2 bytes	2 bytes	2 bytes

예]

메터 1의 PT Ratio, CT Ratio에 쓰기 명령에 대한 응답

Slave	Function	Starting Address		Word Count		Error Check	
01	10	00	01	00	02	10	08

2.3 Modbus RTU Address Overview

RTP 300에서 지원하는 전체 어드레스 맵은 아래와 같다.

Memory Map Overview

Memory Map Section	Address Range	Descriptions
Basic System Setup	40001 - 40022	Wiring mode, Communication, Version
Basic Measurement	40101 - 40250	Main metering data
Basic Digital In/Out	40501 - 40617	Digital Input, Output Status, Output Control
Basic Fault Status	40701 - 40709	Fault Phase, Fault and Pickup Status
Metering [Harmonics]	41001 - 41554	THD, Even THD, Odd THD, K-factor, Crest factor, Harmonic component [Vr, Vs, Vt, Ir, Is, It, Vg, Ig]
User Map Values	41601 - 41800	User Map Values
User Map Addresses	41801 - 41900	User Map Addresses
Metering [Current]	42001 - 42056	Current data
Metering [Voltage]	42061 - 42146	Voltage data
Metering [Power, PF, Energy, Freq., Demand]	42151 - 42256	Power, PF, Energy, Freq., Demand data
Metering [Temperature]	42301 - 42304	Temperature
Metering [Vector diagram]	42501 - 42532	Vector value of Vr, Vs, Vt, Vg, Ir, Is, It and Ig
Metering [Day, Time]	43001 - 43164	Day and time [Maximum, Minimum, Reset]
Metering[Waveform]	44001 - 44650	Waveform
Status	46001 - 46110	Maintenance data, Last trip data, Event record data
Capture	46201 - 46856	Event Waveform
Setup [General]	47001 - 47045	Clock, LCD, Event Recorder, Waveform Trace, Data Logger, Clear Data
Setup [System]	47101 - 47144	Power factor control, Demand Current, Demand Active Power, Demand Reactive Power, Demand Apparent Power, Maintenance
Setup [DIO]	47201 - 47265	Digital Input, Digital Output
Setup [OCR]	47301 - 47356	Time OCR1, Time OCR2, Inst OCR1, Inst OCR2, Time NSOCR, Inst NSOCR
Setup [OCGR]	47401 - 47456	Time OCGR1, Time OCGR2, Inst OCGR1, Inst OCGR2, Time NOCR, Inst NOCR
Setup [OVR]	47501 - 47555	Time OVR1, Time OVR2 , Inst OVR1, Inst OVR2, Inst NSOVR, POR

Setup [UVR]	47601 - 47635	Time UVR1, Time UVR2 , Inst UVR1, Inst UVR2
Setup [OVGR]	47701 - 47746	Time OVGR1, Time OVGR2 , Inst OVGR1, Inst OVGR2, SGR
Setup [DIR]	47801 - 47899	DOCR, DGR, Time APR, Inst APR, Time RPR, 32Q, 37
Setup [Others]	47901 - 47986	BF, Manual Close Blocking, CLP Blocking, 81R, 81O, 81U, 78
Setup [Motor]	48001 - 48072	THR, Stall/Lock, UCR, Overload

2.4 Modbus RTU Address Map

Basic System Setting Address

Address	Attribute	Value	Format	Descriptions
40001	R/W		UINT16	CT Wiring Mode
		0		None
		1		2 CT
		2		3 CT
40002	R/W	0 - 50,000 / 1	UINT16	Phase CT 1차측 값
40003	R/W	0 - 50,000 / 1	UINT16	Ground CT 1차측 값
40004	R/W		UINT16	PT Wiring Mode
		0		None
		1		Wye
		2		Open-Delta
40005	R/W	50.0 – 240.0 / 0.1	S1-UINT16	PT 2차측 전압
40006	R/W	1.0 – 999.9 / 0.1	S1-UINT16	PT Ratio
40007	R/W	50.0 – 240.0 / 0.1	S1-UINT16	GPT 2차측 전압
40008	R/W	1.0 – 999.9 / 0.1	S1-UINT16	GPT Ratio
40009	R/W	50 – 60 / 10	UINT 16	Nominal Frequency
40010	R/W	0 – 50,000 / 1	UINT 16	MOF CT Primary
40011	R/W		UINT16	Communication Baud Rate (RS485)
		0[1200bps]		
		1[2400bps]		
		2[4800bps]		

		3[9600bps]		
		4[19200bps]		Default
		5[38400bps]		
		6[57600bps]		
		7[115200bps]		
40012	R/W		UINT16	Communication Parity Bit (RS485)
		0[Non Parity]		
		1[Odd Parity]		
		2[Even Parity]		Default
40013			UINT16	Communication Stop Bit (RS485)
		0[1 bit]		Default
		1[1.5 bit]		
		2[2 bit]		
40014	R/W		UINT16	Communication Baud Rate (Front Optic port)
		0[1200bps]		
		1[2400bps]		
		2[4800bps]		
		3[9600bps]		
		4[19200bps]		Default
		5[38400bps]		
		6[57600bps]		
		7[115200bps]		
40015	R/W		UINT16	Communication Parity Bit (Front Optic Port)
		0[Non Parity]		
		1[Odd Parity]		
		2[Even Parity]		Default
40016			UINT16	Communication Stop Bit (Front Optic Port)
		0[1 bit]		Default
		1[1.5 bit]		
		2[2 bit]		

40017	R/W		UINT16	전력계량방법 선택
		0[1종]		
		1[3종-A]		
		2[3종-B]		
		3[1종 H]		
		4[3종-A H]		
		5[3종-B H]		
40018	R/W	T29	UINT16	Re-Setup System
40019	R/W	T29	UINT16	Clear Changed Setting Data
40020	R/W	T29	UINT16	Clear Energy
40021	R		UNIT 16	Product Name
		300[RTP300]		
		1300[RTP300T]		
		2300[RTM300]		
40022	R	xx.xx	S2 UNIT 16	Firmware Version
40023	R	0300xxxx	UINT32	Product Serial Number

[주의] 통신을 통하여 Setup Value를 수정하고자 할 때에는 수정 후 40018번지의 Re-Setup System을 수행하여야 변경된다.

Basic Measurement Address

Address	Attribute	Value	Format	Descriptions
40101	R	0 – 999.99k	FLOAT	R Phase Voltage
40103	R	0 – 999.99k	FLOAT	S Phase Voltage
40105	R	0 – 999.99k	FLOAT	T Phase Voltage
40107	R		FLOAT	Reserved
40109	R	0 – 999.99k	FLOAT	RS Line Voltage
40111	R	0 – 999.99k	FLOAT	ST Line Voltage
40113	R	0 – 999.99k	FLOAT	TR Line Voltage
40115	R		FLOAT	Reserved
40117	R	0 – 999.99k	FLOAT	R Phase Current
40119	R	0 – 999.99k	FLOAT	S Phase Current
40121	R	0 – 999.99k	FLOAT	T Phase Current
40123	R		FLOAT	Reserved
40125	R	0 – 999.99M	FLOAT	R Phase W

40127	R	0 – 999.99M	FLOAT	S Phase W
40129	R	0 – 999.99M	FLOAT	T Phase W
40131	R	0 – 999.99M	FLOAT	Total W
40133	R		FLOAT	Reserved
40135	R	0 – 999.99M	FLOAT	R Phase Var
40137	R	0 – 999.99M	FLOAT	S Phase Var
40139	R	0 – 999.99M	FLOAT	T Phase Var
40141	R	0 – 999.99M	FLOAT	Total Var
40143	R		FLOAT	Reserved
40145	R	-1.00 – 1.00	FLOAT	R Phase PF
40147	R	-1.00 – 1.00	FLOAT	S Phase PF
40149	R	-1.00 – 1.00	FLOAT	T Phase PF
40151	R	-1.00 – 1.00	FLOAT	Total PF
40153	R		FLOAT	Reserved
40155	R	45.0 – 65.0	FLOAT	Frequency Hz
40157	R		FLOAT	Reserved
40159	R	-99,999G – 99,999G	FLOAT	Wh(WhP + WhN)
40161	R		FLOAT	Reserved
40163	R	-99,999G – 99,999G	FLOAT	Varh(QhP + QhN)
40165	R		FLOAT	Reserved
40167	R	0 – 999.99k	FLOAT	Max R Phase Voltage
40169	R	0 – 999.99k	FLOAT	Max S Phase Voltage
40171	R	0 – 999.99k	FLOAT	Max T Phase Voltage
40173	R	0 – 999.99k	FLOAT	Max RS Line Voltage
40175	R	0 – 999.99k	FLOAT	Max ST Line Voltage
40177	R	0 – 999.99k	FLOAT	Max TR Line Voltage
40179	R	0 – 999.99k	FLOAT	Min R Phase Voltage
40181	R	0 – 999.99k	FLOAT	Min S Phase Voltage
40183	R	0 – 999.99k	FLOAT	Min T Phase Voltage
40185	R	0 – 999.99k	FLOAT	Min RS Line Voltage
40187	R	0 – 999.99k	FLOAT	Min ST Line Voltage
40189	R	0 – 999.99k	FLOAT	Min TR Line Voltage
40191	R	0 – 999.99k	FLOAT	Max R Phase Current
40193	R	0 – 999.99k	FLOAT	Max S Phase Current

40195	R	0 – 999.99k	FLOAT	Max T Phase Current
40197	R		FLOAT	Reserved
40199	R	0 – 999.99M	FLOAT	Max R Phase W
40201	R	0 – 999.99M	FLOAT	Max S Phase W
40203	R	0 – 999.99M	FLOAT	Max T Phase W
40205	R	0 – 999.99M	FLOAT	Total Max W
40207	R	0 – 999.99M	FLOAT	Max R Phase Var
40209	R	0 – 999.99M	FLOAT	Max S Phase Var
40211	R	0 – 999.99M	FLOAT	Max T Phase Var
40213	R	0 – 999.99M	FLOAT	Total Max Var
40215	R		UINT32	Reserved
40217	R	0 – 999.99k	FLOAT	Demand R Phase Current
40219	R	0 – 999.99k	FLOAT	Demand S Phase Current
40221	R	0 – 999.99k	FLOAT	Demand T Phase Current
40223	R			Reserved
40225	R	0 – 999.99M	FLOAT	Demand W
40227	R	0 – 999.99M	FLOAT	Demand Var
40229	R	0 – 999.99k	FLOAT	Max Demand R Phase Current
40231	R	0 – 999.99k	FLOAT	Max Demand S Phase Current
40233	R	0 – 999.99k	FLOAT	Max Demand T Phase Current
40235	R	0 – 999.99M	FLOAT	Max Demand W
40237	R	0 – 999.99M	FLOAT	Max Demand Var
40239	R	0 – 3600	UINT32	Inst' Demand Time[sec]
40241	R	0 – 999.99k	FLOAT	Inst' Demand R Current
40243	R	0 – 999.99k	FLOAT	Inst' Demand S Current
40245	R	0 – 999.99k	FLOAT	Inst' Demand T Current
40247	R	0 – 999.99M	FLOAT	Inst' Demand W
40249	R	0 – 999.99M	FLOAT	Inst' Demand Var
40251	R	0 – 999.99M	FLOAT	Night Energy[심야]
40253	R	0 – 999.99M	FLOAT	Daytime Energy[주간]
40255	R	0 – 999.99M	FLOAT	Evening Energy[저녁]
40257	R	0 – 999.99M	FLOAT	Light Energy[경부하]
40259	R	0 – 999.99M	FLOAT	Medium Energy[중간부하]
40261	R	0 – 999.99M	FLOAT	Maximum Energy[최대부하]
40262	R			Reserved

Basic Digital In/Out Address

Address	Attribute	Value	Format	Descriptions
40501	R	T3	UINT16	Digital Input Status 1
40502	R	T4-1	UINT16	Digital Output Status 1
40601	R/W	T4	UINT16	CB ON Relay
40602	R/W	T4	UINT16	CB OFF Relay
40603	R/W	T4	UINT16	CB Trip Relay
40604	R/W	T4	UINT16	Digital Output 1
40605	R/W	T4	UINT16	Digital Output 2
40606	R/W	T4	UINT16	Digital Output 3
40607	R/W	T4	UINT16	Digital Output 4
40608	R/W	T4	UINT16	Digital Output 5
40609	R/W	T4	UINT16	Digital Output 6
40610	R/W	T29	UINT16	Fault Reset
40611	R/W	T28	UINT16	Demand Period Restart
40612	R	T4	UINT16	Digital Output 1 Status
40613	R	T4	UINT16	Digital Output 2 Status
40614	R	T4	UINT16	Digital Output 3 Status
40615	R	T4	UINT16	Digital Output 4 Status
40616	R	T4	UINT16	Digital Output 5 Status
40617	R	T4	UINT16	Digital Output 6 Status

Basic Fault Status Address

Address	Attribute	Value	Format	Descriptions
40701	R	T5	UINT16	FAULT PHASE
40702	R	T6	UINT16	FAULT STATUS 1
40703	R	T7	UINT16	FAULT STATUS 2
40704	R	T8	UINT16	FAULT STATUS 3
40705	R	T8-1	UINT16	FAULT STATUS 4
40706	R	T5	UINT16	PICKUP PHASE
40707	R	T6	UINT16	PICKUP STATUS 1
40708	R	T7	UINT16	PICKUP STATUS 2
40709	R	T8	UINT16	PICKUP STATUS 3
40710	R	T8-1	UINT16	PICKUP STATUS 4

Metering [Harmonics] Address

Address	Attribute	Value	Format	Descriptions
THD, K-Factor, Crest Factor				
41001	R	0.0 – 100.0 %	S1-UINT16	R Phase Voltage THD
41002	R	0.0 – 100.0 %	S1-UINT16	R Phase Voltage EVEN THD
41003	R	0.0 – 100.0 %	S1-UINT16	R Phase Voltage ODD THD
41004	R	0.0 – 100.0 %	S1-UINT16	S Phase Voltage THD
41005	R	0.0 – 100.0 %	S1-UINT16	S Phase Voltage EVEN THD
41006	R	0.0 – 100.0 %	S1-UINT16	S Phase Voltage ODD THD
41007	R	0.0 – 100.0 %	S1-UINT16	T Phase Voltage THD
41008	R	0.0 – 100.0 %	S1-UINT16	T Phase Voltage EVEN THD
41009	R	0.0 – 100.0 %	S1-UINT16	T Phase Voltage ODD THD
41010	R	0.0 – 100.0 %	S1-UINT16	R Phase Current THD
41011	R	0.0 – 100.0 %	S1-UINT16	R Phase Current EVEN THD
41012	R	0.0 – 100.0 %	S1-UINT16	R Phase Current ODD THD
41013	R	0.0 – 100.0	S1-UINT16	R Phase Current K-Factor
41014	R	0.0 – 100.0	S1-UINT16	R Phase Current Crest Factor
41015	R	0.0 – 100.0 %	S1-UINT16	S Phase Current THD
41016	R	0.0 – 100.0 %	S1-UINT16	S Phase Current EVEN THD
41017	R	0.0 – 100.0 %	S1-UINT16	S Phase Current ODD THD
41018	R	0.0 – 100.0	S1-UINT16	S Phase Current K-Factor
41019	R	0.0 – 100.0	S1-UINT16	S Phase Current Crest Factor
41020	R	0.0 – 100.0 %	S1-UINT16	T Phase Current THD
41021	R	0.0 – 100.0 %	S1-UINT16	T Phase Current EVEN THD
41022	R	0.0 – 100.0 %	S1-UINT16	T Phase Current ODD THD
41023	R	0.0 – 100.0	S1-UINT16	T Phase Current K-Factor
41024	R	0.0 – 100.0	S1-UINT16	T Phase Current Crest Factor
41025	R	0.0 – 100.0 %	S1-UINT16	N Phase Voltage THD
41026	R	0.0 – 100.0 %	S1-UINT16	N Phase Voltage EVEN THD
41027	R	0.0 – 100.0 %	S1-UINT16	N Phase Voltage ODD THD
41028	R	0.0 – 100.0 %	S1-UINT16	N Phase Current THD
41029	R	0.0 – 100.0 %	S1-UINT16	N Phase Current EVEN THD
41030	R	0.0 – 100.0 %	S1-UINT16	N Phase Current ODD THD
41031	R	0.0 – 100.0	S1-UINT16	N Phase Current K-Factor

41032	R	0.0 – 100.0	S1-UINT16	N Phase Current Crest Factor
HARMONICS OF VOLTAGE, CURRENT				
41033	R		FLOAT	R Phase Voltage 1 st Value
41035	R	0.0 – 999.9 %	S1-UINT16	R Phase Voltage DC Component
41036	R	0.0 – 999.9 %	S1-UINT16	R Phase Voltage 2 nd Harmonic
:	:	:	:	:
41097	R	0.0 – 999.9 %	S1-UINT16	R Phase Voltage 63 rd Harmonic
41098	R	0 – 999.99k	FLOAT	S Phase Voltage 1 st Value
41100	R	0.0 – 999.9 %	S1-UINT16	S Phase Voltage DC Component
41101	R	0.0 – 999.9 %	S1-UINT16	S Phase Voltage 2 nd Harmonic
:	:	:	:	:
41162	R	0.0 – 999.9 %	S1-UINT16	S Phase Voltage 63 rd Harmonic
41163	R	0 – 999.99k	FLOAT	T Phase Voltage 1 st Value
41165	R	0.0 – 999.9 %	S1-UINT16	T Phase Voltage DC Component
41166	R	0.0 – 999.9 %	S1-UINT16	T Phase Voltage 2 nd Harmonic
:	:	:	:	:
41227	R	0.0 – 999.9 %	S1-UINT16	T Phase Voltage 63 rd Harmonic
41228	R		UINT16	Reserved
41229	R	0 – 999.99k	FLOAT	R Phase Current 1 st Value
41231	R	0.0 – 999.9 %	S1-UINT16	R Phase Current DC Component
41232	R	0.0 – 999.9 %	S1-UINT16	R Phase Current 2 nd Harmonic
:	:	:	:	:
41293	R	0.0 – 999.9 %	S1-UINT16	R Phase Current 63 rd Harmonic
41294	R	0 – 999.99k	FLOAT	S Phase Current 1 st Value
41296	R	0.0 – 999.9 %	S1-UINT16	S Phase Current DC Component
41297	R	0.0 – 999.9 %	S1-UINT16	S Phase Current 2 nd Harmonic
:	:	:	:	:
41358	R	0.0 – 999.9 %	S1-UINT16	S Phase Current 63 rd Harmonic
41359	R	0 – 999.99k	FLOAT	T Phase Current 1 st Value
41361	R	0.0 – 999.9 %	S1-UINT16	T Phase Current DC Component
41362	R	0.0 – 999.9 %	S1-UINT16	T Phase Current 2 nd Harmonic
:	:	:	:	:
41423	R	0.0 – 999.9 %	S1-UINT16	T Phase Current 63 rd Harmonic
41424	R	0 – 999.99k	FLOAT	N Phase Voltage 1 st Value

41426	R	0.0 – 999.9 %	S1-UINT16	N Phase Voltage DC Component
41427	R	0.0 – 999.9 %	S1-UINT16	N Phase Voltage 2 nd Harmonic
:	:	:	:	:
41488	R	0.0 – 999.9 %	S1-UINT16	N Phase Voltage 63 rd Harmonic
41489	R	0 – 999.99k	FLOAT	N Phase Current 1 st Value
41491	R	0.0 – 999.9 %	S1-UINT16	N Phase Current DC Component
41492	R	0.0 – 999.9 %	S1-UINT16	N Phase Current 2 nd Harmonic
:	:	:	:	:
41553	R	0.0 – 999.9 %	S1-UINT16	N Phase Current 63 rd Harmonic

User Map Values

Address	Attribute	Value	Format	Descriptions
41601	R/W	User Map Value #1	FLOAT, UINT32	User Map Value #1
41603	R/W	User Map Value #2	FLOAT, UNIT32	User Map Value #2
:	:	:	:	:
41799	R/W	User Map Value #100	FLOAT, UINT32	User Map Value #100

User Map Address

Address	Attribute	Value	Format	Descriptions
41801	R/W	User Map Value #1	UINT16	User Map #1
41802	R/W	User Map Value #2	UINT16	User Map #2
:	:	:	:	:
41900	R/W	User Map Value #100	UINT16	User Map #100

Metering [Current] Address

Address	Attribute	Value	Format	Descriptions
42001	R	0 – 999.99k	FLOAT	I _r
42003	R	0 – 999.99k	FLOAT	I _s
42005	R	0 – 999.99k	FLOAT	I _t
42007	R	0 – 999.99k	FLOAT	I _{avg}
42009	R	0 – 999.99k	FLOAT	Unbalanced Ratio = (I _{max} - I _{min}) / I _{average}
42011	R	0 – 999.99k	FLOAT	I _g
42013	R	0 – 999.99k	FLOAT	I _n (Neutral Current)= I _r + I _s + I _t

42015	R	0 – 999.99k	FLOAT	I1(Positive Sequence)
42017	R	0 – 999.99k	FLOAT	I2(Negative Sequence)
42019	R	0 – 999.99k	FLOAT	I0(Zero Sequence)
42021	R	0 – 359.9	FLOAT	Ir Phase
42023	R	0 – 359.9	FLOAT	Is Phase
42025	R	0 – 359.9	FLOAT	It Phase
42027	R	0 – 359.9	FLOAT	Ig Phase
42029	R	0 – 359.9	FLOAT	In Phase
42031	R	0 – 359.9	FLOAT	I1 Phase
42033	R	0 – 359.9	FLOAT	I2 Phase
42035	R	0 – 359.9	FLOAT	I0 Phase
42037	R	0 – 999.99k	FLOAT	Irf
42039	R	0 – 999.99k	FLOAT	Isf
42041	R	0 – 999.99k	FLOAT	Irf
42043	R	0 – 999.99k	FLOAT	Igf
42045	R	0 – 999.99k	FLOAT	Irf % of L/T
42047	R	0 – 999.99k	FLOAT	Isf % of L/T
42049	R	0 – 999.99k	FLOAT	Irf % of L/T
42051	R	0 – 999.99k	FLOAT	Peak of Ir
42053	R	0 – 999.99k	FLOAT	Peak of Is
42055	R	0 – 999.99k	FLOAT	Peak of It
42057	R		FLOAT	Reserved
42059	R		FLOAT	Reserved

Metering [Voltage] Address

Address	Attribute	Value	Format	Descriptions
42061	R	0 – 999.99k	FLOAT	Vrs
42063	R	0 – 999.99k	FLOAT	Vst
42065	R	0 – 999.99k	FLOAT	Vtr
42067	R	0 – 999.99k	FLOAT	Average of Line Voltage
42069	R	0 – 999.99k	FLOAT	Unbalance Ratio of Vline = (Vmax – Vmin) / Vaverage
42071	R	0 – 359.9	FLOAT	Phase of Vrs
42073	R	0 – 359.9	FLOAT	Phase of Vst
42075	R	0 – 359.9	FLOAT	Phase of Vtr

42077	R	0 – 999.99k	FLOAT	Vr
42079	R	0 – 999.99k	FLOAT	Vs
42081	R	0 – 999.99k	FLOAT	Vt
42083	R	0 – 999.99k	FLOAT	Average of Phase Voltage
42085	R	0 – 999.99k	FLOAT	Unbalance Ratio of Vphase = (Vmax – Vmin) / Vaverage
42087	R	0 – 359.9	FLOAT	Phase of Vr
42089	R	0 – 359.9	FLOAT	Phase of Vs
42091	R	0 – 359.9	FLOAT	Phase of Vt
42093	R	0 – 999.99k	FLOAT	Vg
42095	R	0 – 359.9	FLOAT	Phase of Vg
42097	R	0 – 999.99k	FLOAT	Vn(Neutral Voltage) = Va+Vb+Vc
42099	R	0 – 999.99k	FLOAT	V1(Positive Sequence)
42101	R	0 – 999.99k	FLOAT	V2(Negative Sequence)
42103	R	0 – 999.99k	FLOAT	V0(Zero Sequence)
42105	R	0 – 359.9	FLOAT	Phase of Vn
42107	R	0 – 359.9	FLOAT	Phase of V1
42109	R	0 – 359.9	FLOAT	Phase of V2
42111	R	0 – 359.9	FLOAT	Phase of V0
42113	R	0 – 999.99k	FLOAT	Vrsf
42115	R	0 – 999.99k	FLOAT	Vstf
42117	R	0 – 999.99k	FLOAT	Vtrf
42119	R	0 – 999.99k	FLOAT	Vrf
42121	R	0 – 999.99k	FLOAT	Vsf
42123	R	0 – 999.99k	FLOAT	Vtf
42125	R	0 – 999.99k	FLOAT	Vgf
42127	R	0 – 999.99k	FLOAT	Peak of Vline
42129	R	0 – 999.99k	FLOAT	Peak of Vrs
42131	R	0 – 999.99k	FLOAT	Peak of Vst
42133	R	0 – 999.99k	FLOAT	Peak of Vtr
42135	R	0 – 999.99k	FLOAT	Peak of Vr
42137	R	0 – 999.99k	FLOAT	Peak of Vs
42139	R	0 – 999.99k	FLOAT	Peak of Vt
42141	R	0 – 999.99k	FLOAT	Peak of Vg
42143	R	0 – 999.99k	FLOAT	Min. of Vline

42145	R	0 – 999.99k	FLOAT	Min. of Vphase
42147	R		FLOAT	Reserved
42149	R		FLOAT	Reserved

Metering [Power, PF, Energy] Address

Address	Attribute	Value	Format	Descriptions
42151	R	0 – 999.99M	FLOAT	3Phase Real Power
42153	R	0 – 999.99M	FLOAT	3Phase Reactive Power
42155	R	0 – 999.99M	FLOAT	3Phase Apparent Power
42157	R	0 – 999.99M	FLOAT	3Phase Power Factor
42159	R	0 – 999.99M	FLOAT	Peak of 3Phase Real Power
42161	R	0 – 999.99M	FLOAT	Peak of 3Phase Reactive Power
42163	R	0 – 999.99M	FLOAT	Peak of 3Phase Apparent Power
42165	R	0 – 999.99M	FLOAT	Phase R Real Power
42167	R	0 – 999.99M	FLOAT	Phase R Reactive Power
42169	R	0 – 999.99M	FLOAT	Phase R Apparent Power
42171	R	0 – 999.99M	FLOAT	Phase R Power Factor
42173	R	0 – 999.99M	FLOAT	Peak of Phase R Real Power
42175	R	0 – 999.99M	FLOAT	Peak of Phase R Reactive Power
42177	R	0 – 999.99M	FLOAT	Peak of Phase R Apparent Power
42179	R	0 – 999.99M	FLOAT	Phase S Real Power
42181	R	0 – 999.99M	FLOAT	Phase S Reactive Power
42183	R	0 – 999.99M	FLOAT	Phase S Apparent Power
42185	R	0 – 999.99M	FLOAT	Phase S Power Factor
42187	R	0 – 999.99M	FLOAT	Peak of Phase S Real Power
42189	R	0 – 999.99M	FLOAT	Peak of Phase S Reactive Power
42191	R	0 – 999.99M	FLOAT	Peak of Phase S Apparent Power
42193	R	0 – 999.99M	FLOAT	Phase T Real Power
42195	R	0 – 999.99M	FLOAT	Phase T Reactive Power
42197	R	0 – 999.99M	FLOAT	Phase T Apparent Power
42199	R	0 – 999.99M	FLOAT	Phase T Power Factor
42201	R	0 – 999.99M	FLOAT	Peak of Phase T Real Power
42203	R	0 – 999.99M	FLOAT	Peak of Phase T Reactive Power
42205	R	0 – 999.99M	FLOAT	Peak of Phase T Apparent Power
42207	R	0 – 999.99G	FLOAT	Positive Watthours

42209	R	0 – 999.99G	FLOAT	Negative Watthours
42211	R	0 – 999.99G	FLOAT	Net Watthours(WhP + WhN)
42213	R	0 – 999.99G	FLOAT	Total Watthours(WhP+abs(WhN))
42215	R	0 – 999.99G	FLOAT	Positive Varhours
42217	R	0 – 999.99G	FLOAT	Negative Varhours
42219	R	0 – 999.99G	FLOAT	Net Varhours(QhP + QhN)
42221	R	0 – 999.99G	FLOAT	Total Varhours(QhP+abs(QhN))
42223	R	0 – 999.99G	FLOAT	VAhours
42225	R	45.000 – 65.000	FLOAT	Frequency
42227	R	45.000 – 65.000	FLOAT	Maximum Frequency
42229	R	45.000 – 65.000	FLOAT	Minimum Frequency
42231	R		FLOAT	Reserved
42233	R	0 – 999.99M	FLOAT	Real Power Demand
42235	R	0 – 999.99M	FLOAT	Peak of Real Power Demand
42237	R	0 – 999.99M	FLOAT	Reactive Power Demand
42239	R	0 – 999.99M	FLOAT	Peak of Reactive Power Demand
42241	R	0 – 999.99M	FLOAT	Apparent Power Demand
42243	R	0 – 999.99M	FLOAT	Peak of Apparent Power Demand
42245	R	0 – 999.99k	FLOAT	Phase R Current Demand
42247	R	0 – 999.99k	FLOAT	Peak of Ir Demand
42249	R	0 – 999.99k	FLOAT	Phase S Current Demand
42251	R	0 – 999.99k	FLOAT	Peak of Is Demand
42253	R	0 – 999.99k	FLOAT	Phase T Current Demand
42255	R	0 – 999.99k	FLOAT	Peak of It Demand

Metering [Temperature] Address

Address	Attribute	Value	Format	Descriptions
42301	R	-999.99k – 999.99k	FLOAT	Temperature 1
42303	R	-999.99k – 999.99k	FLOAT	Temperature 2

Metering [Vector Diagram] Address

Address	Attribute	Value	Format	Descriptions
42501	R	-999.99k – 999.99k	FLOAT	Vrx
42503	R	-999.99k – 999.99k	FLOAT	Vry
42505	R	-999.99k – 999.99k	FLOAT	Vsx

42507	R	-999.99k – 999.99k	FLOAT	Vsy
42509	R	-999.99k – 999.99k	FLOAT	Vtx
42511	R	-999.99k – 999.99k	FLOAT	Vty
42513	R		FLOAT	Reserved
42515	R		FLOAT	Reserved
42517	R	-999.99k – 999.99k	FLOAT	Irx
42519	R	-999.99k – 999.99k	FLOAT	Iry
42521	R	-999.99k – 999.99k	FLOAT	Isx
42523	R	-999.99k – 999.99k	FLOAT	Isy
42525	R	-999.99k – 999.99k	FLOAT	Itx
42527	R	-999.99k – 999.99k	FLOAT	Ity
42529	R		FLOAT	Reserved
42531	R		FLOAT	Reserved

Metering [Day, Time] Address

Address	Attribute	Value	Format	Descriptions
TIME OF CURRENT PEAK				
43001	R	T2	UINT 32	Day of Ir Peak
43003	R	T1	UINT 32	Time of Ir Peak
43005	R	T2	UINT 32	Day of Is Peak
43007	R	T1	UINT 32	Time of Is Peak
43009	R	T2	UINT 32	Day of It Peak
43011	R	T1	UINT 32	Time of It Peak
43013	R	T2	UINT 32	Day of I Peak Reset
43015	R	T1	UINT 32	Time of I Peak Reset
TIME OF VOLTAGE PEAK				
43017	R	T2	UINT 32	Day of Vline Peak
43019	R	T1	UINT 32	Time of Vline Peak
43021	R	T2	UINT 32	Day of Vrs Peak
43023	R	T1	UINT 32	Time of Vrs Peak
43025	R	T2	UINT 32	Day of Vst Peak
43027	R	T1	UINT 32	Time of Vst Peak
43029	R	T2	UINT 32	Day of Vtr Peak
43031	R	T1	UINT 32	Time of Vtr Peak
43033	R	T2	UINT 32	Day of Vr Peak

45035	R	T1	UINT 32	Time of Vr Peak
43037	R	T2	UINT 32	Day of Vs Peak
43039	R	T1	UINT 32	Time of Vs Peak
43041	R	T2	UINT 32	Day of Vt Peak
43043	R	T1	UINT 32	Time of Vt Peak
43045	R	T2	UINT 32	Day of Vg Peak
43047	R	T1	UINT 32	Time of Vg Peak
43049	R	T2	UINT 32	Day of V Peak Reset
43051	R	T1	UINT 32	Time of V Peak Reset
TIME OF VOLTAGE MIN.				
43053	R	T2	UINT 32	Day of Vline Min.
43055	R	T1	UINT 32	Time of Vline Min.
43057	R	T2	UINT 32	Day of Vphase Min.
43059	R	T1	UINT 32	Time of Vphase Min.
43061	R	T2	UINT 32	Day of I Min. Reset
43063	R	T1	UINT 32	Time of I Min. Reset
TIME OF POWER PEAK				
43065	R	T2	UINT 32	Day of 3P P Peak
43067	R	T1	UINT 32	Time of 3P P Peak
43069	R	T2	UINT 32	Day of 3P Q Peak
43071	R	T1	UINT 32	Time of 3P Q Peak
43073	R	T2	UINT 32	Day of 3P VA Peak
43075	R	T1	UINT 32	Time of 3P VA Peak
43077	R	T2	UINT 32	Day of Phase R P Peak
43079	R	T1	UINT 32	Time of Phase R P Peak
43081	R	T2	UINT 32	Day of Phase R Q Peak
43083	R	T1	UINT 32	Time of Phase R Q Peak
43085	R	T2	UINT 32	Day of Phase R VA Peak
43087	R	T1	UINT 32	Time of Phase R VA Peak
43089	R	T2	UINT 32	Day of Phase S P Peak
43091	R	T1	UINT 32	Time of Phase S P Peak
43093	R	T2	UINT 32	Day of Phase S Q Peak
43095	R	T1	UINT 32	Time of Phase S Q Peak
43097	R	T2	UINT 32	Day of Phase S VA Peak

43099	R	T1	UINT 32	Time of Phase S VA Peak
43101	R	T2	UINT 32	Day of Phase T P Peak
43103	R	T1	UINT 32	Time of Phase T P Peak
43105	R	T2	UINT 32	Day of Phase T Q Peak
43107	R	T1	UINT 32	Time of Phase T Q Peak
43109	R	T2	UINT 32	Day of Phase T VA Peak
43111	R	T1	UINT 32	Time of Phase T VA Peak
43113	R	T2	UINT 32	Day of Power Peak Reset
43115	R	T1	UINT 32	Time of Power Peak Reset
TIME OF ENERGY RESET				
43117	R	T2	UINT 32	Day of Energy Reset
43119	R	T1	UINT 32	Time of Energy Reset
FREQUENCY PEAK, MIN.				
43121	R	T2	UINT 32	Day of Frequency Peak
43123	R	T1	UINT 32	Time of Frequency Peak
43125	R	T2	UINT 32	Day of Frequency Min.
43127	R	T1	UINT 32	Time of Frequency Min.
43129	R	T2	UINT 32	Day of Freq. Peak Reset
43131	R	T1	UINT 32	Time of Freq. Peak Reset
DEMAND PEAK				
43133	R	T2	UINT 32	Day of W Demand Peak
43135	R	T1	UINT 32	Time of W Demand Peak
43137	R	T2	UINT 32	Day of Q Demand Peak
43139	R	T1	UINT 32	Time of Q Demand Peak
43141	R	T2	UINT 32	Day of VA Demand Peak
43143	R	T1	UINT 32	Time of VA Demand Peak
43145	R	T2	UINT 32	Day of P Demand Reset
43147	R	T1	UINT 32	Time of P Demand Reset
43149	R	T2	UINT 32	Day of Ir Demand Peak
43151	R	T1	UINT 32	Time of Ir Demand Peak
43153	R	T2	UINT 32	Day of Is Demand Peak
43155	R	T1	UINT 32	Time of Is Demand Peak
43157	R	T2	UINT 32	Day of It Demand Peak
43159	R	T1	UINT 32	Time of It Demand Peak

43161	R	T2	UINT 32	Day of I Demand Reset
43163	R	T1	UINT 32	Time of I Demand Reset

Metering [Waveform] Address

Address	Attribute	Value	Format	Descriptions
EVENT NUMBER SELECTOR				
44001	R/W	T30	UNIT 16	Select Channel
44002	R/W	T31	UNIT 16	Select Cycle
44003	R/W	T29	UINT 16	Request Waveform Data
44004			UINT 16	Reserved
:			:	:
44010			UINT 16	Reserved
WAVEFORM DATA				
44011	R		FLOAT	1 st Data of Selected Waveform
44013	R		FLOAT	2 nd Data of Selected Waveform
:			:	:
:			:	:
44647	R		FLOAT	319 th Data of Selected Waveform
44649	R		FLOAT	320 th Data of Selected Waveform

Status Address

Address	Attribute	Value	Format	Descriptions
MAINTENANCE				
46001	R		UINT 32	Total Trip Counter
46003	R		UINT 32	Fault Trip Counter
46005	R		UINT 32	Sag Event Counter
46007	R		UINT 32	Swell Event Counter
46009	R		UINT 32	Reserved
46011	R	T2	UINT 32	Date of Maintenance Counter Reset
46013	R	T1	UINT 32	Time of Maintenance Counter Reset
46015	R		UINT 32	Reserved
46017	R		UINT 32	Reserved
46019	R		UINT 32	Reserved
LAST TRIP DATA				
46021	R	T2	UINT 32	Record Date of Trip

46023	R	T1	UINT 32	Record Time of Trip
46025	R	T14	UINT 32	Record Cause of Trip
46027	R		FLOAT	Record Ir Magnitude
46029	R		FLOAT	Record Is Magnitude
46031	R		FLOAT	Record It Magnitude
46033	R		FLOAT	Record Ig Magnitude
46035	R		FLOAT	Record In Magnitude
46037	R		FLOAT	Record I0 Magnitude
46039	R		FLOAT	Record I1 Magnitude
46041	R		FLOAT	Record I2 Magnitude
46043	R		FLOAT	Record Vr(Vrs) Magnitude
46045	R		FLOAT	Record Vs(Vst) Magnitude
46047	R		FLOAT	Record Vt(Vtr) Magnitude
46049	R		FLOAT	Record Vg Magnitude
46051	R		FLOAT	Record V0 Magnitude
46053	R		FLOAT	Record V1 Magnitude
46055	R		FLOAT	Record V2 Magnitude
46057	R		FLOAT	Record Frequency
46059	R		FLOAT	Reserved
EVENT RECORD INFORMATION				
46061	R		UINT 32	Number of Event Since Clear
46063	R		UINT 32	Last Recorder Number
46065	R	T2	UINT 32	Day of Event Record Clear
46067	R	T1	UINT 32	Time of Event Record Clear
46069	R		UINT 32	Reserved
EVENT NUMBER SELECTOR				
46071	R/W	0 – 799	UINT 16	Selected Event Number
46072	R/W	T29	UINT 16	Request Event Data
EVENT RECORD DATA				
46073	R	T2	UINT 32	Record #N Date of Event
46075	R	T1	UINT 32	Record #N Time of Event
46077	R	T14	UINT 16	Record #N Cause of Event
46078	R		FLOAT	Record #N Ir Magnitude
46080	R		FLOAT	Record #N Is Magnitude
46082	R		FLOAT	Record #N It Magnitude

46084	R		FLOAT	Record #N Ig Magnitude
46086	R		FLOAT	Record #N In Magnitude
46088	R		FLOAT	Record #N I0 Magnitude
46090	R		FLOAT	Record #N I2 Magnitude
46092	R		FLOAT	Record #N Vr(Vrs) Magnitude
46094	R		FLOAT	Record #N Vs(Vst) Magnitude
46096	R		FLOAT	Record #N Vt(Vtr) Magnitude
46098	R		FLOAT	Record #N Vg Magnitude
46100	R		FLOAT	Record #N V2 Magnitude
46102	R		FLOAT	Record #N Frequency

Capture [Event Waveform] Address

Address	Attribute	Value	Format	Descriptions
CAPTURED WAVEFORM INFORMATION				
46201	R	T32	UINT 16	Last Captured Event Number
46202	R	T37	UINT 16	Updated Status of Captured Event
46203	R	T15	UINT 16	Buffer Organization for Captured Waveform
46204	R		UINT 16	Reserved
EVENT NUMBER SELECTOR				
46205	R/W	T32	UINT 16	Selected Event Number
46206	R/W	T30	UNIT 16	Selected Channel
46207	R/W	T33	UNIT 16	Selected Cycle
46208	R/W	T29	UINT 16	Request Capture Data
46209			UINT 16	Reserved
46210			UINT 16	Reserved
CAPTURED WAVEFORM DATA OF EVENT				
46211	R	T2	UINT 32	Date of Selected Event
46213	R	T1	UINT 32	Time of Selected Event
46215	R	T34	UINT 16	Cause of Selected Event
46216			UINT 16	Reserved
46217	R		FLOAT	1 st Data of Selected Cycle
46219	R		FLOAT	2 nd Data of Selected Cycle
:			:	:
:			:	:
46853	R		FLOAT	319 th Data of Selected Cycle
46855	R		FLOAT	320 th Data of Selected Cycle

[주의] Last Captured Event Number가 3이면 Selected Event Number를 3-2-1-8-7-6-5-4 순으로 바꾸면 최근 순으로 Captured Waveform을 받을 수 있다.

Setup [General] Address

Address	Attribute	Value	Format	Descriptions
CLOCK				
47001	R/W	T2	UINT 32	New DATE
47003	R/W	T1	UINT 32	New TIME

47005	R/W	T36	UINT 16	Set New Day, Date and Time
LCD				
47006	R/W	1 – 60 / 1 min	UINT 16	LCD Idle Start Time
47007	R/W	20 – 220 / 1	UINT 16	LCD Contrast
47008	R/W	1 – 10 / 1	UINT 16	Data Display Interval
47009	R/W	0 : Positive, 1 : Negative	UINT 16	Display Format
47010	R/W	0 – 200 / 1	UINT 16	Brightness Control
SET EVENT RECORDER				
47011	R/W	T13	UINT 16	Event Recorder Function
47012	R/W	T13	UINT 16	Record Pickup Events
47013	R/W	T13	UINT 16	Record Dropout Events
47014	R/W	T13	UINT 16	Record Trip Events
47015	R/W	T13	UINT 16	Record Alarm Events
47016	R/W	T13	UINT 16	Record Control Events
47017	R/W	T13	UINT 16	Record Logic Input Events
47018	R/W	T13	UINT 16	Record DATE/TIME Events
WAVEFORM TRACE				
47019	R/W	T15	UINT 16	Buffer Organization
47020	R/W	0 – 100 / 1	UINT 16	Trigger Position
47021	R/W	T13	UINT 16	Trigger on Pickup
47022	R/W	T13	UINT 16	Trigger on Dropout
47023	R/W	T13	UINT 16	Trigger on Trip
47024	R/W	T13	UINT 16	Trigger on Alarm or Control
47025	R/W		UNIT16	Reserved
:				
47025	R/W		UINT 16	Reserved
CLEAR DATA				
47035	R/W	T19	UINT 16	Clear Current Peak
47036	R/W	T19	UINT 16	Clear Voltage Peak
47037	R/W	T19	UINT 16	Clear Voltage Min.
47038	R/W	T19	UINT 16	Clear Frequency Min., Max.
47039	R/W	T19	UINT 16	Clear Power Peak
47040	R/W	T19	UINT 16	Clear Energy
47041	R/W	T19	UINT 16	Clear Current Demand Peak

47042	R/W	T19	UINT 16	Clear Power Demand Peak
47043	R/W	T19	UINT 16	Clear Event Recorder Data
47044	R/W	T19	UINT 16	Clear Maintenance Value
47045	R/W	T19	UINT 16	Clear All Data and Value
47046				Reserved
Sag, Swell				
47051	R/W	T13	UINT 16	Enable Record Sag Events
47052	R/W	T13	UINT 16	Enable Record Swell Events
47053	R/W	0 – 99 / 1	UINT 16	Trigger Level on Sag
47054	R/W	0 – 99 / 1	UINT 16	Dropout Level on Sag
47055	R/W	0 – 200 / 1	UINT 16	Trigger Level on Swell
47056	R/W	0 – 200 / 1	UINT 16	Dropout Level on Swell

Setup [System] Address

Address	Attribute	Value	Format	Descriptions
Power Factor Control				
47101	R/W	T41	UINT 16	Function
47102	R/W	T10	UINT 16	No. 1 Aux. Relay
47103	R/W	T10	UINT 16	No. 2 Aux. Relay
47104	R/W	T10	UINT 16	No. 3 Aux. Relay
47105	R/W	T10	UINT 16	No. 4 Aux. Relay
47106	R/W	T10	UINT 16	No. 5 Aux. Relay
47107	R/W	T10	UINT 16	No. 6 Aux. Relay
47108	R/W	0 – 1.00 / 0.01	S2 INT 16	Pickup Value
47109	R/W	0 – 1.00 / 0.01	S2 INT 16	Dropout Value
47110	R/W	0 – 60,000 / 1 sec	UINT 16	Control Period
DEMAND ACTIVE POWER				
47111	R/W	T26	UINT 16	Function
47112	R/W	T20	UINT 16	Measurement Type
47113	R/W	5 – 60 / 5 min	UINT 16	Demand Period
47114	R/W	1 – 65,535 kW / 1 kW	UINT 16	Reference Power
47115	R/W	1 – 60 / 1 sec	UINT 16	Control Period
47116	R/W	T27	UINT 16	Control Method
47117	R/W	0 – 300 / 1 sec	UINT 16	Min. All Close Time
47118	R/W	0 – 300 / 1 sec	UINT 16	Close Block Time

47119	R/W	0 – 300 / 1 sec	UINT 16	Min. ON Period
47120	R/W	0 – 300 / 1 sec	UINT 16	Min. OFF Period
47121	R/W	0 – 1000 / 1	UINT 16	Pulse / wh
47122	R/W	T10-1	UINT 16	No1. Aux. Relay
47123	R/W	T10-1	UINT 16	No2. Aux. Relay
47124	R/W	T10-1	UINT 16	No3. Aux. Relay
47125	R/W	T10-1	UINT 16	No4. Aux. Relay
47126	R/W	T10-1	UINT 16	No5. Aux. Relay
47127	R/W	T10-1	UINT 16	No6. Aux. Relay
47128	R/W	T10-1	UINT 16	No7. Aux. Relay
47129	R/W	T10-1	UINT 16	No8. Aux. Relay
47130	R/W	T10-1	UINT 16	No9. Aux. Relay
47131	R/W		UINT 16	Reserved
47132	R/W	T13	UINT 16	Demand Alarm Output
47133	R/W	0 – 100 / 1	UINT 16	Control Minimum %
Bank Capacity for PF Control				
47134	R/W	0.1 – 999.9 / 0.1[kVar]	S1 UINT 16	1 Bank capacity
Maintenance				
47135	R/W	T42	UINT 16	Trip Counter Function
47136	R/W	T10	UINT 16	Aux. Relay
47137	R/W	1 - 10,000 / 1	UINT 16	Trip Counter Limit
47138	R/W	T42	UINT 16	PT Failure Function
47139	R/W	T10	UINT 16	Aux. Relay
47140	R/W	1 – 100 / 1 sec	UINT 16	Time Delay
47141	R/W	T13	UINT 16	UVR Blocking
47142	R/W	T13	UNIT 16	Alarm Function of System Error
47143	R/W	T10	UNIT 16	Aux. Relay
47144	R/W	T43	UNIT 16	Phase Rotation
Temperature Setup				
47145	R/W	-6,000 – 6,000 / 1	INT 16	T1 Max. Temperature
47146	R/W	-6,000 – 6,000 / 1	INT 16	T1 Min. Temperature
47147	R/W	-6,000 – 6,000 / 1	INT 16	T2 Max. Temperature
47148	R/W	-6,000 – 6,000 / 1	INT 16	T2 Min. Temperature
47149				Reserved
47150				Reserved

Holiday Setup				
47151	R/W	0 - 31	UNIT 16	This Month 1 st Holiday
47152	R/W	0 - 31	UNIT 16	This Month 2 nd Holiday
47153	R/W	0 - 31	UNIT 16	This Month 3 rd Holiday
47154	R/W	0 - 31	UNIT 16	This Month 4 th Holiday
47155	R/W	0 - 31	UNIT 16	This Month 5 th Holiday
47156	R/W	0 - 31	UNIT 16	Next Month 1 st Holiday
47157	R/W	0 - 31	UNIT 16	Next Month 2 nd Holiday
47158	R/W	0 - 31	UNIT 16	Next Month 3 rd Holiday
47159	R/W	0 - 31	UNIT 16	Next Month 4 th Holiday
47160	R/W	0 - 31	UNIT 16	Next Month 5 th Holiday

Setup [DIO] Address

Address	Attribute	Value	Format	Descriptions
INPUT Setup				
47201	R/W	T9	UINT 16	DI 1 Function
47202	R/W	T10	UINT 16	DI 1 Combination DOUT
47203	R/W	0 – 600 / 0.01 sec	S2 UINT16	DI 1 Delay Time
47204	R/W	T9	UINT 16	DI 2 Function
47205	R/W	T10	UINT 16	DI 2 Combination DOUT
47206	R/W	0 – 600 / 0.01 sec	S2 UINT16	DI 2 Delay Time
47207	R/W	T9	UINT 16	DI 3 Function
47208	R/W	T10	UINT 16	DI 3 Combination DOUT
47209	R/W	0 – 600 / 0.01 sec	S2 UINT16	DI 3 Delay Time
47210	R/W	T9	UINT 16	DI 4 Function
47211	R/W	T10	UINT 16	DI 4 Combination DOUT
47212	R/W	0 – 600 / 0.01 sec	S2 UINT16	DI 4 Delay Time
47213	R/W	T9	UINT 16	DI 5 Function
47214	R/W	T10	UINT 16	DI 5 Combination DOUT
47215	R/W	0 – 600 / 0.01 sec	S2 UINT16	DI 5 Delay Time
47216	R/W	T9	UINT 16	DI 6 Function
47217	R/W	T10	UINT 16	DI 6 Combination DOUT
47218	R/W	0 – 600 / 0.01 sec	S2 UINT16	DI 6 Delay Time
47219	R/W	T9	UINT 16	DI 7 Function
47220	R/W	T10	UINT 16	DI 7 Combination DOUT

47221	R/W	0 – 600 / 0.01 sec	S2 UINT16	DI 7 Delay Time
47222	R/W	T9	UINT 16	DI 8 Function
47223	R/W	T10	UINT 16	DI 8 Combination DOUT
47224	R/W	0 – 600 / 0.01 sec	S2 UINT16	DI 8 Delay Time
47225	R/W	T9	UINT 16	DI 9 Function
47226	R/W	T10	UINT 16	DI 9 Combination DOUT
47227	R/W	0 – 600 / 0.01 sec	S2 UINT16	DI 9 Delay Time
47228	R/W	T9	UINT 16	DI 10 Function
47229	R/W	T10	UINT 16	DI 10 Combination DOUT
47230	R/W	0 – 600 / 0.01 sec	S2 UINT16	DI 10 Delay Time
BREAKER FUNCTION				
47231	R/W	0 – 60.00 / 0.01 sec	S2 UINT16	52a Input Delay Time
47232	R/W	T21	UINT 16	52b Input Channel
INPUT CONTROL				
47233	R/W	T21	UINT 16	Local Mode
47234	R/W	T21	UINT 16	Fault Reset
47235	R/W	T21	UINT 16	Remote Open
47236	R/W	T21	UINT 16	Remote Close
47237	R/W	T21	UINT 16	Cold Load Pickup
47238	R/W	T21	UINT 16	Start Demand
47239	R/W	T21	UINT16	Energy Pulse
47240	R/W	T21	UINT 16	Alarm Reset
47241	R/W	T21	UINT 16	UVR Restoration Control
INPUT BLOCK				
47242	R/W	T21	UINT 16	Block CB Trip
47243	R/W	T21	UINT 16	Block CB Open
47244	R/W	T21	UINT 16	Block CB Close
47245	R/W	T21	UINT 16	Block L/R Change
47246	R/W	T21	UINT 16	Block Fault Reset
SET CB OPERATION				
47247	R/W	1.00 – 10 / 0.01 sec	S2 UINT16	CB Operation Delay
47248	R/W	0 – 600.00 / 0.01 sec	S2 UINT16	TRIP Operation Delay
47249	R/W	0 – 10.00 / 0.01 sec	S2 UINT16	OPEN, CLOSE Seal In Time
SET Aux. DOUT				

47250	R/W	T19	UINT 16	Reset Latched Aux. DOUT
47251	R/W	T22	UINT 16	Aux. DO1 Relay Type
47252	R/W	0 – 600 / 0.01 sec	S2 UINT16	Aux. DO1 Dwell Time
47253	R/W	T22	UINT 16	Aux. DO2 Relay Type
47254	R/W	0 – 600 / 0.01 sec	S2 UINT16	Aux. DO2 Dwell Time
47255	R/W	T22	UINT 16	Aux. DO3 Relay Type
47256	R/W	0 – 600 / 0.01 sec	S2 UINT16	Aux. DO3 Dwell Time
47257	R/W	T22	UINT 16	Aux. DO4 Relay Type
47258	R/W	0 – 600 / 0.01 sec	S2 UINT16	Aux. DO4 Dwell Time
47259	R/W	T22	UINT 16	Aux. DO5 Relay Type
47260	R/W	0 – 600 / 0.01 sec	S2 UINT16	Aux. DO5 Dwell Time
47261	R/W	T22	UINT 16	Aux. DO6 Relay Type
47262	R/W	0 – 600 / 0.01 sec	S2 UINT16	Aux. DO6 Dwell Time
47263	R/W	T10	UINT 16	Alarm Output Aux. DOUT
47264	R/W	T10	UINT 16	Local/Remote Aux. DOUT
47265	R/W	T10	UINT 16	CB Status Aux. DO CB ON -> Aux. DO ON CB OFF -> Aux. DO OFF

Setup [OCR] Address

Address	Attribute	Value	Format	Descriptions
TIME OCR 1				
47301	R/W	T9	UINT 16	Function
47302	R/W	T10	UINT 16	Aux. Relay
47303	R/W	0.1 – 2.4 / 0.01 x CT	S2 UINT16	Pickup value
47304	R/W	T24	UINT 16	Selected Curve
47305	R/W	0.05 – 10 / 0.01	S2 UINT16	Multiplier
47306	R/W	T11	UINT 16	Reset Method
47307	R/W	T12	UINT 16	Direction
				Reserved
TIME OCR 2				
47311	R/W	T9	UINT 16	Function
47312	R/W	T10	UINT 16	Aux. Relay
47313	R/W	0.1 – 2.4 / 0.01 x CT	S2 UINT16	Pickup value

47314	R/W	T24	UINT 16	Selected Curve
47315	R/W	0.05 – 10 / 0.01	S2 UINT16	Multiplier
47316	R/W	T11	UINT 16	Reset Method
47317	R/W	T12	UINT 16	Direction
	R/W			Reserved
Inst. OCR 1				
47321	R/W	T9	UINT 16	Function
47322	R/W	T10	UINT 16	Aux. Relay
47323	R/W	0.1 – 20 / 0.01 x CT	S2 UINT16	Pickup value
47324	R/W	0.03 – 600 / 0.01 sec	S2 UINT16	Delay
47325	R/W	0 – 600 / 0.01 sec	S2 UINT16	Reset Delay
47326	R/W	T12	UINT 16	Direction
	R/W			Reserved
Inst. OCR 2				
47331	R/W	T9	UINT 16	Function
47332	R/W	T10	UINT 16	Aux. Relay
47333	R/W	0.1 – 20 / 0.01 x CT	S2 UINT16	Pickup value
47334	R/W	0.03 – 600 / 0.01 sec	S2 UINT16	Delay
47335	R/W	0 – 600 / 0.01 sec	S2 UINT16	Reset Delay
47336	R/W	T12	UINT 16	Direction
	R/W			Reserved
TIME NSOCR				
47341	R/W	T9	UINT 16	Function
47342	R/W	T10	UINT 16	Aux. Relay
47343	R/W	0.1 – 0.8 / 0.01 x CT	S2 UINT16	Pickup value
47344	R/W	T25	UINT 16	Selected Curve
47345	R/W	0.05 – 10 / 0.01	S2 UINT16	Multiplier
47346	R/W	T11	UINT 16	Reset Method
	R/W			Reserved
Inst. NSOCR				
47351	R/W	T9	UINT 16	Function
47352	R/W	T10	UINT 16	Aux. Relay
47353	R/W	0.1 – 10 / 0.01 x CT	S2 UINT16	Pickup value
47354	R/W	0.03 – 600 / 0.01 sec	S2 UINT16	Delay

47355	R/W	0 – 600 / 0.01 sec	S2 UINT16	Reset Delay
	R/W			Reserved

Setup [OCGR] Address

Address	Attribute	Value	Format	Descriptions
TIME OCGR 1				
47401	R/W	T9	UINT 16	Function
47402	R/W	T10	UINT 16	Aux. Relay
47403	R/W	0.02 – 2.4 / 0.01 x CT	S2 UINT16	Pickup value
47404	R/W	T24	UINT 16	Selected Curve
47405	R/W	0.05 – 10 / 0.01	S2 UINT16	Multiplier
47406	R/W	T11	UINT 16	Reset Method
47407	R/W	T12	UINT 16	Direction
	R/W			Reserved
TIME OCGR 2				
47411	R/W	T9	UINT 16	Function
47412	R/W	T10	UINT 16	Aux. Relay
47413	R/W	0.02 – 2.4 / 0.01 x CT	S2 UINT16	Pickup value
47414	R/W	T24	UINT 16	Selected Curve
47415	R/W	0.05 – 10 / 0.01	S2 UINT16	Multiplier
47416	R/W	T11	UINT 16	Reset Method
47417	R/W	T12	UINT 16	Direction
	R/W			Reserved
Inst. OCGR 1				
47421	R/W	T9	UINT 16	Function
47422	R/W	T10	UINT 16	Aux. Relay
47423	R/W	0.1 – 20 / 0.01 x CT	S2 UINT16	Pickup value
47424	R/W	0.03 – 600 / 0.01 sec	S2 UINT16	Delay
47425	R/W	0 – 600 / 0.01 sec	S2 UINT16	Reset Delay
47426	R/W	T12	UINT 16	Direction
	R/W			Reserved
Inst. OCGR 2				
47431	R/W	T9	UINT 16	Function
47432	R/W	T10	UINT 16	Aux. Relay

47433	R/W	0.1 – 20 / 0.01 x CT	S2 UINT16	Pickup value
47434	R/W	0.03 – 600 / 0.01 sec	S2 UINT16	Delay
47435	R/W	0 – 600 / 0.01 sec	S2 UINT16	Reset Delay
47436	R/W	T12	UINT 16	Direction
	R/W			Reserved
TIME NOCR				
47441	R/W	T9	UINT 16	Function
47442	R/W	T10	UINT 16	Aux. Relay
47443	R/W	0.1 – 2.4 / 0.01 x CT	S2 UINT16	Pickup value
47444	R/W	T25	UINT 16	Selected Curve
47445	R/W	0.05 – 10 / 0.01	S2 UINT16	Multiplier
47446	R/W	T11	UINT 16	Reset Method
	R/W			Reserved
Inst. NOCR				
47451	R/W	T9	UINT 16	Function
47452	R/W	T10	UINT 16	Aux. Relay
47453	R/W	0.1 – 20 / 0.01 x CT	S2 UINT16	Pickup value
47454	R/W	0.03 – 600 / 0.01 sec	S2 UINT16	Delay
47455	R/W	0 – 600 / 0.01 sec	S2 UINT16	Reset Delay
	R/W			Reserved

Setup [OVR] Address

Address	Attribute	Value	Format	Descriptions
TIME OVR 1				
47501	R/W	T9	UINT 16	Function
47502	R/W	T10	UINT 16	Aux. Relay
47503	R/W	0.8 – 1.6 / 0.01 x PT	S2 UINT16	Pickup value
47504	R/W	0: IEC A, 1: IEC B	UINT 16	Selected Curve
47505	R/W	0.05 – 10 / 0.01	S2 UINT16	Multiplier
47506	R/W	T11	UINT 16	Reset Method
	R/W			Reserved
TIME OVR 2				
47511	R/W	T9	UINT 16	Function
47512	R/W	T10	UINT 16	Aux. Relay
47513	R/W	0.8 – 1.6 / 0.01 x PT	S2 UINT16	Pickup value

47514	R/W	0: IEC A, 1: IEC B	UINT 16	Selected Curve
47515	R/W	0.05 – 10 / 0.01	S2 UINT16	Multiplier
47516	R/W	T11	UINT 16	Reset Method
	R/W			Reserved
Inst. OVR 1				
47521	R/W	T9	UINT 16	Function
47522	R/W	T10	UINT 16	Aux. Relay
47523	R/W	0.8 – 2.5 / 0.01 x PT	S2 UINT16	Pickup value
47524	R/W	0.03 – 600 / 0.01 sec	S2 UINT16	Delay
47525	R/W	0 – 600 / 0.01 sec	S2 UINT16	Reset Delay
	R/W			Reserved
Inst. OVR 2				
47531	R/W	T9	UINT 16	Function
47532	R/W	T10	UINT 16	Aux. Relay
47533	R/W	0.8 – 2.5 / 0.01 x PT	S2 UINT16	Pickup value
47534	R/W	0.03 – 600 / 0.01 sec	S2 UINT16	Delay
47535	R/W	0 – 600 / 0.01 sec	S2 UINT16	Reset Delay
	R/W			Reserved
Inst. NSOVR				
47541	R/W	T9	UINT 16	Function
47542	R/W	T10	UINT 16	Aux. Relay
47543	R/W	0.05 – 1.0 / 0.01 x PT	S2 UINT16	Pickup value
47544	R/W	0.03 – 600 / 0.01 sec	S2 UINT16	Delay
47545	R/W	0 – 600 / 0.01 sec	S2 UINT16	Reset Delay
	R/W			Reserved
POR				
47551	R/W	T9	UINT 16	Function
47552	R/W	T10	UINT 16	Aux. Relay
47553	R/W	5 – 100 / 1 %	UINT 16	Pickup value
47554	R/W	0.05 – 600 / 0.01 sec	S2 UINT16	Delay
47555	R/W	0 – 600 / 0.01 sec	S2 UINT16	Reset Delay
	R/W			Reserved

Setup [UVR] Address

Address	Attribute	Value	Format	Descriptions
TIME UVR 1				
47601	R/W	T9	UINT 16	Function
47602	R/W	T10	UINT 16	Aux. Relay
47603	R/W	0.2 – 1.0 / 0.01 x PT	S2 UINT16	Pickup value
47604	R/W	IEC Curve B(Only)	UINT 16	Selected Curve
47605	R/W	0.05 – 10 / 0.01	S2 UINT16	Multiplier
47606	R/W	0 – 1 / 0.01 x PT	S2 UINT16	Minimum Voltage
47607	R/W	T35	UINT16	CB Status
47608	R/W	0 – 600 / 0.01 [sec]	S2 UINT16	Reset Time Delay
47609	R/W	T38	UINT16	Operation Condition
	R/W			Reserved
TIME UVR 2				
47611	R/W	T9	UINT 16	Function
47612	R/W	T10	UINT 16	Aux. Relay
47613	R/W	0.2 – 1.0 / 0.01 x PT	S2 UINT16	Pickup value
47614	R/W	IEC Curve B(Only)	UINT 16	Selected Curve
47615	R/W	0.05 – 10 / 0.01	S2 UINT16	Multiplier
47616	R/W	0 – 1.0 / 0.01 x PT	S2 UINT16	Minimum Voltage
47617	R/W	T35	UINT16	CB Status
47618	R/W	0 – 600 / 0.01 [sec]	S2 UINT16	Reset Time Delay
47619	R/W	T38	UINT16	Operation Condition
	R/W			Reserved
Inst. UVR 1				
47621	R/W	T9	UINT 16	Function
47622	R/W	T10	UINT 16	Aux. Relay
47623	R/W	0.2 – 1.0 / 0.01 x PT	S2 UINT16	Pickup value
47624	R/W	0.03 – 600 / 0.01 sec	S2 UINT16	Delay
47625	R/W	0 – 1.0 / 0.01 x PT	S2 UINT16	Minimum Voltage
47626	R/W	T35	UINT16	CB Status
47627	R/W	0 – 600 / 0.01 [sec]	S2 UINT16	Reset Time Delay
47628	R/W	T38	UINT16	Operation Condition
	R/W			Reserved
Inst. UVR 2				
47631	R/W	T9	UINT 16	Function

47632	R/W	T10	UINT 16	Aux. Relay
47633	R/W	0.2 – 1.0 / 0.01 x PT	S2 UINT16	Pickup value
47634	R/W	0.03 – 600 / 0.01 sec	S2 UINT16	Delay
47635	R/W	0 – 1.0 / 0.01 x PT	S2 UINT16	Minimum Voltage
47636	R/W	T35	UINT16	CB Status
47637	R/W	0 – 600 / 0.01 [sec]	S2 UINT16	Reset Time Delay
47638	R/W	T38	UINT16	Operation Condition
	R/W			Reserved

Setup [OVGR] Address

Address	Attribute	Value	Format	Descriptions
TIME OVGR 1				
47701	R/W	T9	UINT 16	Function
47702	R/W	T10	UINT 16	Aux. Relay
47703	R/W	0.05 – 1.00 / 0.01 x GPT	S2 UINT16	Pickup value
47704	R/W	T25	UINT 16	Selected Curve
47705	R/W	0.05 – 10 / 0.01	S2 UINT16	Multiplier
47706	R/W	T11	UINT 16	Reset Method
	R/W			Reserved
TIME OVGR 2				
47711	R/W	T9	UINT 16	Function
47712	R/W	T10	UINT 16	Aux. Relay
47713	R/W	0.05 – 1.00 / 0.01 x GPT	S2 UINT16	Pickup value
47714	R/W	T25	UINT 16	Selected Curve
47715	R/W	0.05 – 10 / 0.01	S2 UINT16	Multiplier
47716	R/W	T11	UINT 16	Reset Method
	R/W			Reserved
Inst. OVGR 1				
47721	R/W	T9	UINT 16	Function
47722	R/W	T10	UINT 16	Aux. Relay
47723	R/W	0.05 – 1.0 / 0.01 x GPT	S2 UINT16	Pickup value
47724	R/W	0.03 – 600 / 0.01 sec	S2 UINT16	Delay
47725	R/W	0 – 600 / 0.01 sec	S2 UINT16	Reset Delay
	R/W			Reserved
Inst. OVGR 2				

47731	R/W	T9	UINT 16	Function
47732	R/W	T10	UINT 16	Aux. Relay
47733	R/W	0.05 – 1.0 / 0.01 x GPT	S2 UINT16	Pickup value
47734	R/W	0.03 – 600 / 0.01 sec	S2 UINT16	Delay
47735	R/W	0 – 600 / 0.01 sec	S2 UINT16	Reset Delay
	R/W			Reserved
SGR				
47741	R/W	T9	UINT 16	Function
47742	R/W	T10	UINT 16	Aux. Relay
47743	R/W	0.9 – 10.0 / 0.1 mA	S2 UINT16	Pickup Io
47744	R/W	0° - 359° / 1°	UINT16	MTA
47745	R/W	0.1 – 1.2 / 0.01 x GPT	S2 UINT16	Minimum Voltage
47746	R/W	0.03 – 600 / 0.01 sec	S2 UINT16	Delay

Setup [DIR] Address

Address	Attribute	Value	Format	Descriptions
DOCR [Time]				
47801	R/W			Reserved
47802	R/W			Reserved
47803	R/W	0° - 359° / 1°	UINT16	MTA 1
47804	R/W	0.01 – 2.0 / 0.01 x PT	S2 UINT16	Minimum Voltage 1
47805	R/W	0° - 359° / 1°	UINT16	MTA 2
47806	R/W	0.01 – 2.0 / 0.01 x PT	S2 UINT16	Minimum Voltage 2
	R/W			Reserved
DOCR [Inst.]				
47811	R/W			Reserved
47812	R/W			Reserved
47813	R/W	0° - 359° / 1°	UINT16	MTA 1
47814	R/W	0.01 – 2.0 / 0.01 x PT	S2 UINT16	Minimum Voltage 1
47815	R/W	0° - 359° / 1°	UINT16	MTA 2
47816	R/W	0.01 – 2.0 / 0.01 x PT	S2 UINT16	Minimum Voltage 2
	R/W			Reserved
DGR [Time]				
47821	R/W			Reserved
47822	R/W			Reserved

47823	R/W	0° - 359° / 1°	UINT16	MTA 1
47824	R/W	0.1 – 1.2 / 0.01 x GPT	S2 UINT16	Minimum Voltage 1
47825	R/W	0° - 359° / 1°	UINT16	MTA 2
47826	R/W	0.1 – 1.2 / 0.01 x GPT	S2 UINT16	Minimum Voltage 2
	R/W			Reserved
DGR [Inst.]				
47831	R/W			Reserved
47832	R/W			Reserved
47833	R/W	0° - 359° / 1°	UINT16	MTA 1
47834	R/W	0.1 – 1.2 / 0.01 x GPT	S2 UINT16	Minimum Voltage 1
47835	R/W	0° - 359° / 1°	UINT16	MTA 2
47836	R/W	0.1 – 1.2 / 0.01 x GPT	S2 UINT16	Minimum Voltage 2
47837	R/W	T39	UNIT16	Reference Voltage
	R/W			Reserved
TIME APR				
47841	R/W	T9	UINT 16	Function
47842	R/W	T10	UINT 16	Aux. Relay
47843	R/W	0.01 – 2.4 / 0.01 x CT x PT	S2 UINT16	Pickup value
47844	R/W	IEC Curve B(Only)	UINT 16	Selected Curve
47845	R/W	0.05 – 10.0 / 0.01	S2 UINT16	Multiplier
47846	R/W	T11	UINT 16	Reset Method
47847	R/W	T44	UINT 16	Direction
47848	R/W	T40	UNIT 16	Pickup Condition
	R/W			Reserved
Inst. APR				
47851	R/W	T9	UINT 16	Function
47852	R/W	T10	UINT 16	Aux. Relay
47853	R/W	0.01 – 20.0 / 0.01 x CT x PT	S2 UINT16	Pickup value
47854	R/W	0.03 – 600.0 / 0.01 sec	S2 UINT16	Delay
47855	R/W	0.0 – 600.0 / 0.01 sec	S2 UINT16	Reset Delay
47856	R/W	T44	UINT 16	Direction
47857	R/W	T40	UNIT 16	Pickup Condition
	R/W			Reserved
TIME RPR				
47861	R/W	T9	UINT 16	Function

47862	R/W	T10	UINT 16	Aux. Relay
47863	R/W	0.01 – 2.4 / 0.01 x CT x PT	S2 UINT16	Pickup value
47864	R/W	IEC Curve B(Only)	UINT 16	Selected Curve
47865	R/W	0.05 – 10.0 / 0.01	S2 UINT16	Multiplier
47866	R/W	T11	UINT 16	Reset Method
47867	R/W	T44	UINT 16	Direction
47868	R/W	T40	UNIT 16	Pickup Condition
	R/W			Reserved
32Q_1				
47871	R/W	T9	UINT 16	Function
47872	R/W	T10	UINT 16	Aux. Relay
47873	R/W	0.01 – 20.0 / 0.01 x CT x PT	S2 UINT16	Pickup value
47874	R/W	0.03 – 600.0 / 0.01 sec	S2 UINT16	Delay
47875	R/W	0.0 – 600.0 / 0.01 sec	S2 UINT16	Reset Delay
47876	R/W	T44	UINT 16	Direction
47877	R/W	T40	UNIT 16	Pickup Condition
47878	R/W	T45	UNIT 16	Reference Voltage
47879	R/W	T13	UNIT 16	UVR AND Logic
47880	R/W	0.01 – 1.00 / 0.01 x PT	S2 UNIT 16	UVR Pickup
32Q_2				
47881	R/W	T9	UINT 16	Function
47882	R/W	T10	UINT 16	Aux. Relay
47883	R/W	0.01 – 20.0 / 0.01 x CT x PT	S2 UINT16	Pickup value
47884	R/W	0.03 – 600.0 / 0.01 sec	S2 UINT16	Delay
47885	R/W	0.0 – 600.0 / 0.01 sec	S2 UINT16	Reset Delay
47886	R/W	T44	UINT 16	Direction
47887	R/W	T40	UNIT 16	Pickup Condition
47888	R/W	T45	UNIT 16	Reference Voltage
47889	R/W	T13	UNIT 16	UVR AND Logic
47890	R/W	0.01 – 1.00 / 0.01 x PT	S2 UNIT 16	UVR Pickup
37P				
47891	R/W	T9	UINT 16	Function
47892	R/W	T10	UINT 16	Aux. Relay
47893	R/W	0.01 – 20.0 / 0.01 x CT x PT	S2 UINT16	Pickup value
47894	R/W	0.03 – 600.0 / 0.01 sec	S2 UINT16	Delay

47895	R/W	0.0 – 600.0 / 0.01 sec	S2 UINT16	Reset Delay
47896	R/W	T44	UINT 16	Direction
47897	R/W	T40	UNIT 16	Pickup Condition
47898	R/W	T35	UNIT 16	CB Status
47899	R/W	T21	UNIT 16	DIN Blocking
47900	R/W			Reserved

Setup [Others] Address

Address	Attribute	Value	Format	Descriptions
BF				
47901	R/W	T9	UINT 16	Function
47902	R/W	T10	UINT 16	Aux. Relay
47903	R/W	0.05 – 20.0 / 0.01 x CT	S2 UINT16	Current Level
47904	R/W	0.03 – 10.0 / 0.01 sec	S2 UINT16	Trip Delay
47905	R/W	0 – 10.0 / 0.01 sec	S2 UINT16	Reset Delay
	R/W			Reserved
Manual Close Blocking				
47911	R/W	T13	UINT 16	Function
47912	R/W	T10	UINT 16	Aux. Relay
47913	R/W	0 - 1,000 / 1 sec	UINT 16	Block Time
47914	R/W	T13	UINT 16	Inst. OCR1 Blocking
47915	R/W	T13	UINT 16	Inst. OCGR1 Blocking
47916	R/W	T13	UINT 16	Inst. NOCR Blocking
47917	R/W	T13	UINT 16	Inst NSOCR Blocking
47918	R/W	0 – 100 / 1 %	UINT 16	Time OCR1 Raised Pickup
47919	R/W	0 – 100 / 1 %	UINT 16	Time OCGR1 Raised Pickup
47920	R/W	0 – 100 / 1 %	UINT 16	Time NOCR Raised Pickup
47921	R/W	0 – 100 / 1 %	UINT 16	Time NSOCR Raised Pickup
	R/W			Reserved
CLP Blocking				
47931	R/W	T13	UINT 16	Function
47932	R/W	T10	UINT 16	Aux. Relay
47933	R/W	0 - 1,000 / 1 sec	UINT 16	Block Time
47934	R/W	T13	UINT 16	Inst. OCR1 Blocking

47935	R/W	T13	UINT 16	Inst. OCGR1 Blocking
47936	R/W	T13	UINT 16	Inst. NOCR Blocking
47937	R/W	T13	UINT 16	Inst NSOCR Blocking
47938	R/W	0 – 100 / 1 %	UINT 16	Time OCR1 Raised Pickup
47939	R/W	0 – 100 / 1 %	UINT 16	Time OCGR1 Raised Pickup
47940	R/W	0 – 100 / 1 %	UINT 16	Time NOCR Raised Pickup
47941	R/W	0 – 100 / 1 %	UINT 16	Time NSOCR Raised Pickup
	R/W			Reserved
81R[df/dt]				
47951	R/W	T9	UINT 16	Function
47952	R/W	T10	UINT 16	Aux. Relay
47953	R/W	0.2 – 2.5 / 0.1 Hz/s	S1 UNIT 16	Pickup Value
47954	R/W	10 – 250 / 1 cycle	UNIT 16	Delay
47955	R/W	0 – 250 / 1 cycle	UNIT 16	Minimum Delay
47956	R/W	15 – 999 / 1 cycle	UNIT 16	Start Delay
47957	R/W	T46	UNIT 16	Direction
47958	R/W	0.0 – 0.99 / 0.01 x PT	S2 UINT16	Minimum Voltage
47959	R/W	0.0 – 1.0 / 0.01 x CT	S2 UINT16	Minimum Current
47960	R/W			Reserved
81U[Under Frequency]				
47961	R/W	T9	UINT 16	Function
47962	R/W	T10	UINT 16	Aux. Relay
47963	R/W	45.0 – 60.0 / 0.01 Hz	S2 UNIT16	Pickup Value
47964	R/W	0.05 – 600.0 / 0.01 sec	S2 UNIT 16	Delay
47965	R/W	0.1 – 0.99 / 0.01 x PT	S2 UINT16	Minimum Voltage
47966	R/W	0.0 – 1.0 / 0.01 x CT	S2 UINT16	Minimum Current
	R/W			Reserved
81O[Over Frequency]				
47971	R/W	T9	UINT 16	Function
47972	R/W	T10	UINT 16	Aux. Relay
47973	R/W	50.0 – 65.0 / 0.01 Hz	S2 UNIT16	Pickup Value
47974	R/W	0.05 – 600.0 / 0.01 sec	S2 UNIT 16	Delay
47975	R/W	0.1 – 0.99 / 0.01 x PT	S2 UINT16	Minimum Voltage
47976	R/W	0.0 – 1.0 / 0.01 x CT	S2 UINT16	Minimum Current
	R/W			Reserved

78[Vector Shift]				
47981	R/W	T9	UINT 16	Function
47982	R/W	T10	UINT 16	Aux. Relay
47983	R/W	2 – 22 / 1°	UNIT 16	Pickup Value
47984	R/W	0.0 – 0.99 / 0.01 x PT	S2 UINT16	Minimum Voltage
47985	R/W	0.0 – 1.0 / 0.01 x CT	S2 UINT16	Minimum Current
47986	R/W	T38	UNIT 16	Fault Phase Condition
	R/W			Reserved

Setup [MOTOR] Address

Address	Attribute	Value	Format	Descriptions
THR[49]				
48001	R/W	T9	UINT 16	Function
48002	R/W	T10	UINT 16	Aux. Relay
48003	R/W	0.1 – 3.0 / 0.01 x CT	S2 UINT16	Rated Motor Current [Im]
48004	R/W	1.0 – 1.5 / 0.01	S2 UINT16	Constant k
48005	R/W	1 – 600 / 1 min	UINT 16	Heat Rise Time Constant τ
48006	R/W	0.0 – 1.0 / 0.01 x Im	S2 UNIT 16	Previous Load Current [Ip]
48007	R/W	T11	UINT 16	Reset Method
48008	R/W	1 – 6000 / 1 min	UINT 16	Cooling TC (Running)
48009	R/W	1 – 6000 / 1 min	UINT 16	Cooling TC (Stopped)
48010	R/W	0.0 – 20.0 / 0.1	S1 UINT16	Unbalance Bias K Factor
	R/W			Reserved
Stall/Lock				
48011	R/W	T9	UINT 16	Function
48012	R/W	T10	UINT 16	Aux. Relay
48013	R/W	0.1 – 2.0 / 0.01 x CT	S2 UINT16	Rated Motor Current [Im]
48014	R/W	1.0 – 20.0 / 0.01 x Im	S2 UNIT16	Pickup Value
48015	R/W	0.05 – 600.0 / 0.01 sec	S2 UINT16	Time Delay
	R/W			Reserved
Starting Overcurrent				
48021	R/W	T9	UINT 16	Function
48022	R/W	T10	UINT 16	Aux. Relay
48023	R/W	0.1 – 2.0 / 0.01 x CT	S2 UINT16	Rated Motor Current [Im]
48024	R/W	1.0 – 20.0 / 0.01 x Im	S2 UNIT16	Permissible Start Current [Is]

48025	R/W	0.03 – 600.0 / 0.01 sec	S2 UNIT16	Permissible Start Time
48026	R/W	0.1 – 0.8 / 0.01 x Is	S2 UNIT16	Start Pickup Current
	R/W			Reserved
Motor Startup				
48031	R/W	T9	UINT 16	Function
48032	R/W	T10	UINT 16	Aux. Relay
48033	R/W	1 – 10 / 1	UNIT 16	Number of Warm Starts
48034	R/W	1 – 10 / 1	UNIT 16	Number of Cold Starts
48035	R/W	1 – 6,000 / 1 sec	UNIT 16	Reset Time
	R/W			Reserved
UCR				
48041	R/W	T9	UINT 16	Function
48042	R/W	T10	UINT 16	Aux. Relay
48043	R/W	0.1 – 1.00 / 0.01 x CT	S2 UINT16	Pickup value
48044	R/W	0.03 – 600.0 / 0.01 sec	S2 UINT16	Delay
48045	R/W	0.0 – 600.0 / 0.01 sec	S2 UINT16	Reset Time
48046	R/W	T47	UINT 16	Motor Status
	R/W			Reserved

Short-formed data block Address

Address	Attribute	Measurement	Format	Scale	Descriptions
49001	R	Voltage R	Float		
49003	R	Voltage S	Float		
49005	R	Voltage T	Float		
49007	R	Voltage RS	Float		
49009	R	Voltage ST	Float		
49011	R	Voltage TR	Float		
49013	R	Current R	Float		
49015	R	Current S	Float		
49017	R	Current T	Float		
49019	R	Current G	Float		
49021	R	W R	Float		
49023	R	W S	Float		
49025	R	W T	Float		
49027	R	Total W	Float		
49029	R	VAR R	Float		
49031	R	VAR S	Float		
49033	R	VAR T	Float		
49035	R	Total VAR	Float		
49037	R	VA R	Float		
49039	R	VA S	Float		
49041	R	VA T	Float		
49043	R	Total VA	Float		
49045	R	PF R	INT16	x0.001	
49046	R	PF S	INT16	x0.001	
49047	R	PF T	INT16	x0.001	
49048	R	Total PF	INT16	x0.001	
49049	R	Frequency	UINT16	x0.01	
49050	R	kWh	INT32	x1	
49052	R	kVARh	INT32	x1	
49054	R	Voltage R THD	UINT16	x0.1	
49055	R	Voltage S THD	UINT16	x0.1	
49056	R	Voltage T THD	UINT16	x0.1	
49057	R	Current R THD	UINT16	x0.1	

49058	R	Current S THD	UINT16	x0.1	
49059	R	Current T THD	UINT16	x0.1	
49060	R	Digital Input channels Bit 0 → Channel 1 Bit 1 → Channel 2 Bit 2 → Channel 3 Bit 3 → Channel 4 Bit 4 → Channel 5 Bit 5 → Channel 6 Bit 6 → Channel 7 Bit 7 → Channel 8 Bit 8 → Channel 9 Bit 9 → Channel 10 Bit 10 → Reserved Bit 11 → Reserved Bit 12 → Reserved Bit 13 → Reserved Bit 14 → Reserved Bit 15 → CB Status	UINT16		Bit '1' = On Bit '0' = Off
49061	R	Digital Output Status Bit 0 → DO 1 status Bit 1 → DO 2 status Bit 2 → DO 3 status Bit 3 → DO 4 status Bit 4 → DO 5 status Bit 5 → DO 6 status Bit 6 → Reserved Bit 7 → Reserved Bit 8 → Reserved Bit 9 → Reserved Bit 10 → Reserved Bit 11 → Reserved Bit 12 → Reserved Bit 13 → Reserved Bit 14 → Reserved Bit 15 → Reserved	UINT16		Bit '1' = On Bit '0' = Off
49062	W	Digital Output channel 1	UINT16		0x0001 = On 0x0000 = Off
49063	W	Digital Output channel 2	UINT16		0x0001 = On 0x0000 = Off
49064	W	Digital Output channel 3	UINT16		0x0001 = On 0x0000 = Off
49065	W	Digital Output channel 4	UINT16		0x0001 = On 0x0000 = Off
49066	W	Digital Output channel 5	UINT16		0x0001 = On 0x0000 = Off
49067	W	Digital Output channel 6	UINT16		0x0001 = On 0x0000 = Off

49068	W	Digital Output channel 7	UINT16		0x0001 = On 0x0000 = Off
49069	W	Digital Output channel 8	UINT16		0x0001 = On 0x0000 = Off
49070	W	Digital Output channel 9	UINT16		0x0001 = On 0x0000 = Off
49071	W	Digital Output channel 10	UINT16		0x0001 = On 0x0000 = Off
49072	W	CB On(Close) Command	UINT16		0x0001 = CB On
49073	W	CB Off(Open) Command	UINT16		0x0001 = CB Off
49074	W	kWh/kVARh Reset	UINT16		0x0001 = Reset
49075	W	Fault Reset	UINT16		0x0001 = Reset
49076	R	Local/Remote Mode Flag	UINT16		0x0001 = Local 0x0000 = Remote
49077	R	Phase A Fault Status Bit 0 → Inv. OCR Bit 1 → Def. OCR Bit 2 → Inst. OCR Bit 3 → Inv. OCGR Bit 4 → Def. OCGR Bit 5 → Inst. OCGR Bit 6 → Def. OVR Bit 7 → Inst. OVR Bit 8 → Def. UVR Bit 9 → Inst. UVR Bit 10 → Def. POR Bit 11 → Def. OVGR Bit 12 → Inst. OVGR Bit 13 → Def. SGR Bit 14 → Reserved Bit 15 → Reserved	UINT16		Bit '1' = On Bit '0' = Off
49078	R	Phase B Fault Status Bit 0 → Inv. OCR Bit 1 → Def. OCR Bit 2 → Inst. OCR Bit 3 → Inv. OCGR Bit 4 → Def. OCGR Bit 5 → Inst. OCGR Bit 6 → Def. OVR Bit 7 → Inst. OVR Bit 8 → Def. UVR Bit 9 → Inst. UVR Bit 10 → Def. POR Bit 11 → Def. OVGR Bit 12 → Inst. OVGR Bit 13 → Def. SGR Bit 14 → Reserved	UINT16		Bit '1' = On Bit '0' = Off

		Bit 15 → Reserved			
49079	R	Phase C Fault Status Bit 0 → Inv. OCR Bit 1 → Def. OCR Bit 2 → Inst. OCR Bit 3 → Inv. OCGR Bit 4 → Def. OCGR Bit 5 → Inst. OCGR Bit 6 → Def. OVR Bit 7 → Inst. OVR Bit 8 → Def. UVR Bit 9 → Inst. UVR Bit 10 → Def. POR Bit 11 → Def. OVGR Bit 12 → Inst. OVGR Bit 13 → Def. SGR Bit 14 → Reserved Bit 15 → Reserved	UINT16		Bit '1' = On Bit '0' = Off
49080	R	Phase G Fault Status Bit 0 → Inv. OCR Bit 1 → Def. OCR Bit 2 → Inst. OCR Bit 3 → Inv. OCGR Bit 4 → Def. OCGR Bit 5 → Inst. OCGR Bit 6 → Def. OVR Bit 7 → Inst. OVR Bit 8 → Def. UVR Bit 9 → Inst. UVR Bit 10 → Def. POR Bit 11 → Def. OVGR Bit 12 → Inst. OVGR Bit 13 → Def. SGR Bit 14 → Reserved Bit 15 → Reserved	UINT16		Bit '1' = On Bit '0' = Off
49081	R	Reserved	UINT16		
49082	R	Reserved	UINT16		
49083	R	Reserved	UINT16		
49084	R	Reserved	UINT16		
49085	R	Phase A Fault Status (계통연계 요소) Bit 0 → 81R Bit 1 → 81U Bit 2 → 81O Bit 3 → 78 Bit 4 → Inverse 32P Bit 5 → Inst. 32P Bit 6 → Inverse 32Q	UINT16		Bit '1' = On Bit '0' = Off

		Bit 7 → Inst. 32Q Bit 8 → 37P Bit 9 → Reserved Bit 10 → Reserved Bit 11 → Reserved Bit 12 → Reserved Bit 13 → Reserved Bit 14 → Reserved Bit 15 → Reserved			
49086	R	Phase B Fault Status (계통연계 요소) Bit 0 → Reserved Bit 1 → Reserved Bit 2 → Reserved Bit 3 → 78 Bit 4 → Inverse 32P Bit 5 → Inst. 32P Bit 6 → Inverse 32Q Bit 7 → Inst. 32Q Bit 8 → 37P Bit 9 → Reserved Bit 10 → Reserved Bit 11 → Reserved Bit 12 → Reserved Bit 13 → Reserved Bit 14 → Reserved Bit 15 → Reserved	UINT16		Bit '1' = On Bit '0' = Off
49087	R	Phase C Fault Status (계통연계 요소) Bit 0 → Reserved Bit 1 → Reserved Bit 2 → Reserved Bit 3 → 78 Bit 4 → Inverse 32P Bit 5 → Inst. 32P Bit 6 → Inverse 32Q Bit 7 → Inst. 32Q Bit 8 → 37P Bit 9 → Reserved Bit 10 → Reserved Bit 11 → Reserved Bit 12 → Reserved Bit 13 → Reserved Bit 14 → Reserved Bit 15 → Reserved	UINT16		Bit '1' = On Bit '0' = Off
49088	R	Phase A Fault Status (모터보호 요소) Bit 0 → THR[49] Bit 1 → Lock Bit 2 → Starting OCR Bit 3 → M[66] Bit 4 → UCR	UINT16		Bit '1' = On Bit '0' = Off

		Bit 5 → Reserved Bit 6 → Reserved Bit 7 → Reserved Bit 8 → Reserved Bit 9 → Reserved Bit 10 → Reserved Bit 11 → Reserved Bit 12 → Reserved Bit 13 → Reserved Bit 14 → Reserved Bit 15 → Reserved			
49089	R	Phase A Fault Status (모터보호 요소) Bit 0 → THR[49] Bit 1 → Lock Bit 2 → Starting OCR Bit 3 → M[66] Bit 4 → UCR Bit 5 → Reserved Bit 6 → Reserved Bit 7 → Reserved Bit 8 → Reserved Bit 9 → Reserved Bit 10 → Reserved Bit 11 → Reserved Bit 12 → Reserved Bit 13 → Reserved Bit 14 → Reserved Bit 15 → Reserved	UINT16		Bit '1' = On Bit '0' = Off
49090	R	Phase A Fault Status (모터보호 요소) Bit 0 → THR[49] Bit 1 → Lock Bit 2 → Starting OCR Bit 3 → M[66] Bit 4 → UCR Bit 5 → Reserved Bit 6 → Reserved Bit 7 → Reserved Bit 8 → Reserved Bit 9 → Reserved Bit 10 → Reserved Bit 11 → Reserved Bit 12 → Reserved Bit 13 → Reserved Bit 14 → Reserved Bit 15 → Reserved	UINT16		Bit '1' = On Bit '0' = Off
49091	R	Reserved	UINT16		
49092	R	Reserved	UINT16		
49093	R	Reserved	UINT16		

49094	R	Reserved	UINT16		
49095	R	Reserved	UINT16		
49096	R	Reserved	UINT16		
49097	R	Reserved	UINT16		
49098	R	Reserved	UINT16		

Value Type 1 : Time

Value	Descriptions
	Hours / Minutes (HH:MM:xx.xxx) 1 st 16bits
0xFF00	Hours (0=12am, 1=1am,..., 12=12pm,..., 23 = 11pm)
0x00FF	Minutes (0 to 59 in step of 1)
	Seconds(xx:xx:SS.SSS) 2 nd 16bits
0xFFFF	(0 = 00.000s, 1 = 00.001s, 59999 = 59.999s)
	Note: If the time has never been set then all 32 bits will be 1.

Value Type 2 : Date

Value	Descriptions
	Month / Day (MM / DD / xxxx) (1 st 16bits)
0xFF00	Month (1=January, 2=February,..., 12=December)
0x00FF	Day (1 to 31 in step of 1)
	Year (xx/xx/YYYY) (2 nd 16bits)
0xFFFF	2003 to 2102 in step of 1
	Note: If the data has never been set then all 32 bits will be 1.

Value Type 3 : Digital Input Status

Bit	Attribute	Descriptions
0	R	외부 디지털입력 IN1
1	R	외부 디지털입력 IN2
2	R	외부 디지털입력 IN3
3	R	외부 디지털입력 IN4
4	R	외부 디지털입력 IN5
5	R	외부 디지털입력 IN6
6	R	외부 디지털입력 IN7
7	R	외부 디지털입력 IN8
8	R	외부 디지털입력 IN9
9	R	외부 디지털입력 IN10
10	R	외부 디지털입력 CB 52a
11	R	Reserved[Bit 11]
12	R	Reserved[Bit 12]
13	R	Reserved[Bit 13]
14	R	Reserved[Bit 14]

15	R	Reserved[Bit 15]
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[주의] Digital Input Status에서 Bit 값이 1이면 메터의 해당 접점이 Off 이고 Bit값이 0이면 해당 접점이 On이다.

Value Type 4 : Digital Output Status (Word Type)

Value	Descriptions
0x00FF	외부 디지털 접점 출력 ON 명령 혹은 ON 상태
0x0000	외부 디지털 접점 출력 OFF 명령 혹은 OFF 상태

Value Type 4-1 : Digital Output Status (Bit Type)

Bit	Attribute	Descriptions
0	R	외부 디지털출력 DOUT 1
1	R	외부 디지털출력 DOUT 2
2	R	외부 디지털출력 DOUT 3
3	R	외부 디지털출력 DOUT 4
4	R	외부 디지털출력 DOUT 5
5	R	외부 디지털출력 DOUT 6
6	R	외부 디지털출력 DOUT 7
7	R	외부 디지털출력 DOUT 8
8	R	외부 디지털출력 DOUT 9
9	R	외부 디지털출력 DOUT 10
10	R	외부 디지털출력 CB ON
11	R	외부 디지털출력 CB OFF
12	R	외부 디지털출력 CB Trip

Value Type 5 : Fault [Pickup] Phase and Local/Remote Indicator

Value	Descriptions
0x0001	Fault Phase R
0x0002	Fault Phase S
0x0004	Fault Phase T
0x0F00	0 : Local, 1: Remote

Value Type 6 : Fault [Pickup] Status 1

Bit	Attribute	Descriptions
0	R	Phase Time Overcurrent 1
1	R	Phase Time Overcurrent 2
2	R	Phase Instantaneous Overcurrent 1
3	R	Phase Instantaneous Overcurrent 2
4	R	Negative Sequence Time Overcurrent
5	R	Negative Sequence Instantaneous Overcurrent
6	R	Ground Time Overcurrent 1
7	R	Ground Time Overcurrent 2
8	R	Ground Instantaneous Overcurrent 1
9	R	Ground Instantaneous Overcurrent 2
10	R	Neutral Time Overcurrent
11	R	Neutral Instantaneous Overcurrent
12	R	Time Overvoltage 1
13	R	Time Overvoltage 2
14	R	Instantaneous Overvoltage 1
15	R	Instantaneous Overvoltage 2

[주의] Fault [Pickup] Status에서 Bit 값이 1이면 해당 보호기능이 동작 [검출]된 상황이고 Bit값이 0이면 해당 Fault가 발생하지 않았음을 표시.

Value Type 7 : Fault [Pickup] Status 2

Bit	Attribute	Descriptions
0	R	Negative Sequence Instantaneous Overvoltage
1	R	Phase Out Relay
2	R	Time Undervoltage 1
3	R	Time Undervoltage 1
4	R	Instantaneous Undervoltage 1
5	R	Instantaneous Undervoltage 2
6	R	Time OVGR 1
7	R	Time OVGR 2
8	R	Instantaneous OVGR 1
9	R	Instantaneous OVGR 2
10	R	Selective Ground Relay(SGR)
11	R	32P Time

12	R	32P Inst
13	R	32Q Time
14	R	32Q Inst
15	R	BF

[주의] Fault [Pickup] Status에서 Bit 값이 1이면 해당 보호기능이 동작 [검출]된 상황이고 Bit값이 0이면 해당 Fault가 발생하지 않았음을 표시.

Value Type 8 : Fault [Pickup] Status 3

Bit	Attribute	Descriptions
0	R	Manual Close Feature Blocking
1	R	Cold Load Pickup Feature Blocking
2	R	Thermal Relay
3	R	Stall/Lock
4	R	Under Current
5	R	Under Power(32P)
6	R	VT Failure
7	R	df/dt(81R)
8	R	Under Frequency(81U)
9	R	Over Frequency(81O)
10	R	Vector Surge(78)
11	R	A/D Check Error
12	R	Backup Memory error
13	R	Time Error
14	R	CB Open Operation Error
15	R	CB ON Operation Error

[주의] Fault [Pickup] Status에서 Bit 값이 1이면 해당 보호기능이 동작 [검출]된 상황이고 Bit값이 0이면 해당 Fault가 발생하지 않았음을 표시.

[주의] 11Bit에서 15Bit 까지는 내부 점검 Error에 대한 상태표시로서 Bit 값이 1이면 해당 Error 발생 상태를 표시한다.

Value Type 8-1 : Fault [Pickup] Status 4

Bit	Attribute	Descriptions
0	R	Motor Starting OCR
1	R	M[66]
2 - 15	R	Reserved

[주의] Fault [Pickup] Status에서 Bit 값이 1이면 해당 보호기능이 동작 [검출]된 상황이고 Bit값이 0이면 해당 Fault가 발생하지 않았음을 표시.

Value Type 9 : Relay Function Setup

Value	Descriptions
0x0000	Disable
0x0001	Trip
0x0002	Trip & Alarm
0x0003	Alarm
0x0004	Latched Alarm
0x0005	Control

Value Type 10 : Aux. Relay Setup

Value	Descriptions
0x0000	None(Disabled)
0x0001	DOUT 1
0x0002	DOUT 2
0x0003	DOUT 3
0x0004	DOUT 4
0x0005	DOUT 5
0x0006	DOUT 6

Value Type 10-1 : DOUT Setup for Demand Control

Value	Descriptions
0x0000	None
0x0001	DOUT 1
0x0002	DOUT 2
0x0003	DOUT 3
0x0004	DOUT 4
0x0005	DOUT 5
0x0006	DOUT 6
0x0007	CB ON
0x0008	CB OFF
0x0009	CB Trip

Value Type 11 : Reset Method

Value	Descriptions
0x0000	Instantaneous
0x0001	Time Delayed

Value Type 12 : Direction Setup

Value	Descriptions
0x0000	Disable
0x0001	Forward
0x0002	Reverse

Value Type 13 : Disable/Enable

Value	Descriptions
0x0000	Disable
0x0001	Enable

Value Type 14 : Event Type

Value	Descriptions
0xF000	EVENT TYPE
1	General
2	Pickup
3	Trip
4	Trip & Alarm
5	Alarm
6	Latched alarm
7	Control
8	Dropout
9	Logic Input
10	Self-Test Warning
	The format for the remainder of the register depends upon the event type
GENERAL EVENT TYPE	

0x00FF	EVENT CAUSES:
1	Breaker Opened
2	Breaker Closed
3	Breaker Not Connected
4	Reset
5	Open Breaker
6	Close Breaker
7	Set Time
8	Set Date
9	Trigger Trace Memory
10	Clear Energy Use Data
11	Clear Maximum Demand Data
12	Reset All Peak and Minimum Value (9 – 16)
13	Reset Current Peak Value
14	Reset Voltage Peak Value
15	Reset Voltage Minimum value
16	Reset Power Peak Value
17	Reset Energy Use Data
18	Reset Frequency Peak and Minimum Value
19	Reset Power Demand Peak Value
20	Reset Current Demand Peak Value
21	Reset Trip Counter Data
22	Clear Event Recorder Data
23	Clear Waveform Trace Memory
24	Reserved
25	Reserved
26	Reserved
27	Reserved
PICKUP/TRIP/ALARM/LATCHED ALARM/DROPOUT EVENT TYPES:	
	PHASES:
0x0100	Phase A (0 = No Fault, 1 = Fault)
0x0200	Phase B (0 = No Fault, 1 = Fault)
0x0400	Phase C (0 = No Fault, 1 = Fault)

0x00FF	CAUSE OF EVENT
1	Phase Time Overcurrent 1
2	Phase Time Overcurrent 2
3	Phase Instantaneous Overcurrent 1
4	Phase Instantaneous Overcurrent 2
5	Negative Sequence Time Overcurrent
6	Negative Sequence Instantaneous Overcurrent
7	Ground Time Overcurrent 1
8	Ground Time Overcurrent 2
9	Ground Instantaneous Overcurrent 1
10	Ground Instantaneous Overcurrent 2
11	Neutral Time Overcurrent
12	Neutral Instantaneous Overcurrent
13	Time Overvoltage 1
14	Time Overvoltage 2
15	Instantaneous Overvoltage 1
16	Instantaneous Overvoltage 2
17	Negative Sequence Instantaneous Overvoltage
18	Phase Out Relay
19	Time Undervoltage 1
20	Time Undervoltage 1
21	Instantaneous Undervoltage 1
22	Instantaneous Undervoltage 2
23	Time OVGR 1
24	Time OVGR 2
25	Instantaneous OVGR 1
26	Instantaneous OVGR 2
27	Selective Ground Relay(SGR)
28	32P Time
29	32P Inst
30	32Q Time
31	32Q_1 Inst
32	BF
33	Manual Close Feature Blocking

34	Cold Load Pickup Feature Blocking
35	Thermal Relay
36	Stall/Lock
37	Under Current
38	User Setting Overload
39	VT Failure
40	df/dt(81R)
41	81U
42	81O
43	Vector Surge(78)
44	32Q_2 Inst
45	Under Power(37P)
46	Sag
47	Swell
LOGIC INPUT EVENT TYPE:	
0x0100	Contact State : Open
0x0200	Contact State : Closed
0x0400	Reserved
0x00FF	Input Function
1	Digital Input 1
2	Digital Input 2
3	Digital Input 3
4	Digital Input 4
5	Digital Input 5
6	Digital Input 6
7	Digital Input 7
8	Digital Input 8
9	Digital Input 9
10	Digital Input 10
11	Breaker Input
12	Local Mode

13	Remote Mode
14	Remote Open
15	Remote Close
16	Reserved
17	Reserved
18	Reserved
19	Reserved
20	Reserved
SELF-TEST WARNING EVENT TYPE	
0x00FF	EVENT CAUSE:
1	NVRAM Corrupt
2	EEPROM Corrupt
3	A/D
4	Breaker Not Opened
5	Breaker Not Closed
6	Reserved
7	Reserved
8	Reserved
9	Reserved
10	Reserved

Value Type 15 : Buffer Organization Setup

Value	Descriptions
0x0000	2event x 40cycle
0x0001	4event x 20cycle
0x0002	8event x 10cycle

Value Type 16 : Data Logger Sample Rate Setup

Value	Descriptions
0x0000	1 cycle

0x0001	1sec
0x0002	5sec
0x0003	30sec
0x0004	1min
0x0005	5min
0x0006	10min
0x0007	15min
0x0008	20min
0x0009	30min
0x0010	60min

Value Type 17 : Data Logger Mode Setup

Value	Descriptions
0x0000	Continuous
0x0001	Trigger

Value Type 18 : Data Logger Buffer Organization Setup

Value	Descriptions
0x0000	64event x 32sample
0x0001	32event x 64sample
0x0002	16event x 128sample
0x0003	8event x 256sample
0x0004	4event x 512sample

Value Type 19 : NO/YES Setup

Value	Descriptions
0x0000	NO
0x00FF	YES

Value Type 20 : Demand Measurement Type Setup

Value	Descriptions
0x0000	Block Interval
0x0001	Rolling demand

Value Type 21 : Digital Input Setup

Value	Descriptions
0x0000	Disabled
0x0001	DIN 1
0x0002	DIN 2
0x0003	DIN 3
0x0004	DIN 4
0x0005	DIN 5
0x0006	DIN 6
0x0007	DIN 7
0x0008	DIN 8
0x0009	DIN 9
0x0010	DIN 10

Value Type 22 : DOUT relay Type Setup

Value	Descriptions
0x0000	Self-resetting
0x0001	Latched
0x0002	Pulsed

Value Type 23 : L/R DOUT State Setup

Value	Descriptions
0x0000	Lo : Open, Re : Close
0x0001	Lo : Close, Re : Open

Value Type 24 : OCR, OCGR Relay Curve Setup

Value	Descriptions
0x0000	IEC Curve A
0x0001	IEC Curve B
0x0002	IEC Curve C
0x0003	ANSI Normal Inverse
0x0004	ANSI Very Inverse
0x0005	ANSI Extremely Inverse

0x0006	KEPCO Normal Inverse
0x0007	KEPCO Very Inverse

Value Type 25 : IEC Relay Curve Setup

Value	Descriptions
0x0000	IEC Curve A
0x0001	IEC Curve B
0x0002	IEC Curve C

Value Type 26 : Demand Control Function

Value	Descriptions
0x0000	Disable
0x0001	Sync. With External
0x0002	Internal Clock

Value Type 27 : Demand Control Method Setup

Value	Descriptions
0x0000	Priority
0x0001	Circular

Value Type 28: Demand Period Restart Indicator

Value	Descriptions
0x00FF	Restart Indicator
0x0000	Reset by Master

Value Type 29: Command to Slave

Value	Descriptions
0x00FF	Command
0x0000	Reset by Slave

Value Type 30: Waveform Channel

Value	Descriptions
0x0000	Vr

0x0001	Vs
0x0002	Vt
0x0003	Vg
0x0004	Ir
0x0005	Is
0x0006	It
0x0007	Ig

Value Type 31: Waveform Cycle

Value	Descriptions
0x0000	2.5 cycle
0x0001	5 cycle
0x0002	10 cycle
0x0003	20 cycle
0x0004	40 cycle

[주의] 어느 cycle로 설정하더라도 320개 파형 샘플 데이터가 제공된다. 2.5 cycle로 선택하였을 때 1주 기당 128 샘플링 데이터를 얻을 수 있어 가장 해상도가 높다. 40 cycle로 설정 시에는 주기 당 8 샘플링 데이터 밖에 제공되지 않으나 여러 주기 동안의 변화를 확인할 수 있다.

Value Type 32: Number of Captured Event or Selected Event Number

Selectable Value	Descriptions
1	T15에서 2event x 40cycle로 설정했을 경우
1, 2, 3	T15에서 4event x 20cycle로 설정했을 경우
1, 2, 3, 4, 5, 6, 7	T15에서 8event x 10cycle로 설정했을 경우

[주의] Capture를 위한 Buffer 구조를 2event x 40cycle로 설정하면 Buffer는 보호계전을 위하여 샘플링 한 현재 실시간 데이터와 40cycle의 1 event 데이터의 저장 공간으로 이용된다. 따라서 2event x 40cycle로 설정한 경우 1 event에 대한 데이터를 받을 수 있다. 4event x 20cycle로 설정한 경우 Buffer 분할에 의하여 과거 3 event에 대한 데이터를 받을 수 있다. 8event x 10cycle로 설정한 경우 과거 7 event에 대한 데이터를 받을 수 있으나 10cycle에 한정된다. 어떤 설정에서나 한 cycle의 샘플링 데이터 수는 32개이다.

Value Type 33: Number of Selected Cycle in Event Captured Waveform

Selectable Value	Descriptions
1, 2, 3, 4	T15에서 2event x 40cycle로 설정했을 경우
1, 2	T15에서 4event x 20cycle로 설정했을 경우
1	T15에서 8event x 10cycle로 설정했을 경우

[주의] T32에 설명된 바와 같이 저장 Event 수가 적으면 1 Event 당 저장 데이터의 Cycle 수가 많고, 저장 Event의 수가 많으면 1 Event 당 저장 데이터의 Cycle 수가 작다. 10주기에서 40주기 까지 주기 당 32 샘플링 데이터를 동시에 수신하는 방식이 아니고 동시에 10 Cycle의 데이터[320개]를 전송하는 방법을 채택하였다. 2event x 40cycle로 설정된 경우 10 Cycle 씩 4번의 수신을 통하여 40cycle의 Event 데이터를 모두 얻을 수 있다.

Value Type 34: Event Type of Captured Waveform

Value	Descriptions
0x0001	Dropout
0x0002	Trip
0x0003	Alarm or Control
0x0004	Pickup
0x0006	Sag
0x0007	Swell

Value Type 35: CB Condition of UVR Operation

Value	Descriptions
0x0000	CB ON or OFF
0x0001	CB ON Only

Value Type 36: Set Day, Date and Time

Value	Descriptions
0x00FF	Set Day, Date and Time
0x0F00	Change Day of Week
0x0000	Day : No change
0x0100	Day : Monday
0x0200	Day : Tuesday
0x0300	Day : Wednesday
0x0400	Day : Thursday
0x0500	Day : Friday

0x0600	Day : Saturday
0x0700	Day : Sunday
0x0000	Reset by Slave

Value Type 37: Updated Status of Captured Events

Value	Descriptions
0x00FF	Updated Status
0x0000	Reset Status by Downloading Captured Waveform Data

[주의] Sag 등의 Event에 의하여 Updated된 파형이 있으면 0x00FF가 되고 상위시스템 요구에 의하여 파형을 전송한 후에는 0x00로 Reset 된다.

Value Type 38: Phase Voltage Condition of UVR Operation

Value	Descriptions
0x0000	3Phase OR
0x0001	3Phase AND

Value Type 39: Reference Voltage of DGR

Value	Descriptions
0x0000	Vo (Zero Sequence Voltage Calculated from 3Phase Voltage)
0x0001	Vg

Value Type 40: Pickup Condition of 32P, 32Q

Value	Descriptions
0x0000	Each Phase
0x0001	Average of 3Phase Power

[주의] Each Phase: 각 상 별로 계산하여 한 상이라도 동작조건이 되면 동작

Average of 3Phase Power: 3상 전력의 평균을 계산하여 동작조건이 되면 동작

Value Type 41 : Control Function Setup

Value	Descriptions
0x0000	Disable
0x0001	Control

Value Type 42 : Control/Alarm Function Setup

Value	Descriptions
-------	--------------

0x0000	Disable
0x0001	Alarm
0x0002	Latched Alarm
0x0003	Control

Value Type 43 : Phase Rotation

Value	Descriptions
0x0000	RST
0x0001	RTS

Value Type 44 : Direction

Value	Descriptions
0x0000	Positive
0x0001	Negative

Value Type 45 : Reference Voltage

Value	Descriptions
0x0000	L-N (Phase Voltage)
0x0001	L-L (Line to Line Voltage)

Value Type 46 : df/dt Direction

Value	Descriptions
0x0000	df SUM
0x0001	Increasing
0x0002	Decreasing

Value Type 47 : Motor Status[Motor ON Indicator]

Value	Descriptions
0x0000	by CB ON Status
0x0001	by Starting OCR Setting Condition

2.5 Calculation

각 데이터 타입에 따른 계산식은 아래와 같다.

UINT16: 16 bit unsigned Integer

INT16: 16 bit signed Integer

S1 UINT16: 16 bit unsigned Integer, 실제 값 x 10한 값

예: 123.4 라면 $\times 10$ 을 시켜 1234의 데이터를 전송

S1 INT16: 16 bit signed Integer, 실제 값 x 10한 값

예: -123.4 라면 $\times 10$ 을 시켜 -1234의 데이터를 전송

S2 UINT16: 16 bit unsigned Integer, 실제 값 x 100한 값

예: 123.45 라면 $\times 100$ 을 시켜 12345의 데이터를 전송

S2 INT16: 16 bit signed Integer, 실제 값 x 100한 값

예: -123.45 라면 $\times 100$ 을 시켜 -12345의 데이터를 전송

APPENDIX A CRC-16 Calculation

CRC-16 Generation

Modbus RTU Protocol은 Reverse CRC Generation 알고리즘을 사용한다.

CRC Generation Procedure

자세한 C code는 Appendix B 참조.

1. Load a 16-bit register with FFFF hex(all 1's). Call this the CRC register
2. Exclusive OR the first 8-bit byte of the message with the low-order byte of the 16-bit CRC register, putting the result in the CRC register.
3. Shift the CRC register one bit to the right (toward the LSB), zero-filling the MSB. Extract and examine the LSB.
4. (if the LSB was 0): Repeat Step 3(another shift)
(if the LSB was 1): Exclusive OR the CRC register with the polynomial value A)1 hex (1010 0000 0000 0001)
5. Repeat Steps 3 and 4 until 8 shifts have been performed. When this is done, a complete 8-bit byte will have been processed.

CRC Table

0000	c0c1	c181	0140	c301	03c0	0280	c241
c601	06c0	0780	c741	0500	c5c1	c481	0440
cc01	0cc0	0d80	cd41	0f00	cfc1	ce81	0e40
0a00	cac1	cb81	0b40	c901	09c0	0880	c841
d801	18c0	1980	d941	1b00	dbc1	da81	1a40
1e00	dec1	df81	1f40	dd01	1dc0	1c80	dc41
1400	d4c1	d581	1540	d701	17c0	1680	d641
d201	12c0	1380	d341	1100	d1c1	d081	1040
f001	30c0	3180	f141	3300	f3c1	f281	3240
3600	f6c1	f781	3740	f501	35c0	3480	f441
3c00	fcc1	fd81	3d40	ff01	3fc0	3e80	fe41
fa01	3ac0	3b80	fb41	3900	f9c1	f881	3840
2800	e8c1	e981	2940	eb01	2bc0	2a80	ea41
ee01	2ec0	2f80	ef41	2d00	edc1	ec81	2c40
e401	24c0	2580	e541	2700	e7c1	e681	2640
2200	e2c1	e381	2340	e101	21c0	2080	e041
a001	60c0	6180	a141	6300	a3c1	a281	6240
6600	a6c1	a781	6740	a501	65c0	6480	a441
6c00	acc1	ad81	6d40	af01	6fc0	6e80	ae41
aa01	6ac0	6b80	ab41	6900	a9c1	a881	6840
7800	b8c1	b981	7940	bb01	7bc0	7a80	ba41
be01	7ec0	7f80	bf41	7d00	bdc1	bc81	7c40
b401	74c0	7580	b541	7700	b7c1	b681	7640
7200	b2c1	b381	7340	b101	71c0	7080	b041
5000	90c1	9181	5140	9301	53c0	5280	9241
9601	56c0	5780	9741	5500	95c1	9481	5440
9c01	5cc0	5d80	9d41	5f00	9fc1	9e81	5e40
5a00	9ac1	9b81	5b40	9901	59c0	5880	9841
8801	48c0	4980	8941	4b00	8bc1	8a81	4a40
4e00	8ec1	8f81	4f40	8d01	4dc0	4c80	8c41
4400	84c1	8581	4540	8701	47c0	4680	8641
8201	42c0	4380	8341	4100	81c1	8081	4040

APPENDIX B Modbus RTU C Code Example

Data Receiving and CRC Generation& Checking

Modbus RTU Protocol의 Packet생성과 체크에 대한 간단한 C code 예제를 보인다.

Request Packet Generation

main module, Read Holding Registers Request Example

```
#define CRC_16    0xA001
unsigned int CrcTable[256];
main()
{
    unsigned char send_byte[12];
    unsigned short crc_out;

    MakeCrcTable(CRC_16);
    send_byte[0]= 0x01
    send_byte[1]= 0x03
    send_byte[2]= 0x00;
    send_byte[3]= 0x64;
    send_byte[4]= 0x00;
    send_byte[5]= 0x02;
    crc_out=MakeCrc(send_byte,6);

    send_byte[6]= ( crc_out >> 8 )& 0xFF;
    send_byte[7]=  crc_out & 0xFF;
}
```

← CRC 테이블 초기화

← RTP 300 ID = 1

Starting address = 100 or 64h[40101]

Word count = 2

← CRC상위= 133or 85h, CRC하위 = 212 or D4h

← CRC 연산 결과 전송

CRC 상위/하위바이트순 전송

Response Packet Checking

main module, Read Holding Registers Response Example

```
#define PacketLen 9
int status;
unsigned char receive_byte[PacketLen];
status =CheckCrc(receive_byte ,PacketLen);
```

← receive_byte는 수신된 데이터버퍼
← 수신데이터크기는 9 Bytes
← If(status == 0) “CRC Successful”
Else “CRC Error”

CRC functions

sub functions

```
unsigned int GenCrc( unsigned int Data, unsigned int Polynomial, unsigned int crc )
{
    unsigned int ccc;
    /* Reverse CRC >> Modicon Crc */
    for(ccc=0; ccc<8; ccc++){
        if( (Data ^ crc) & 1 ){
            crc = ( crc>>1 ) ^ Polynomial;
        }
        else{
            crc >>= 1;
        }
        Data >>= 1;
    }
    return( crc&0xFFFF );
}
```

```

void MakeCrcTable( unsigned int Polynomial )
{
    unsigned int ccc;
    for( ccc=0; ccc<256; ccc++ )
        CrcTable[ccc] = GenCrc( ccc, Polynomial, 0 );
}

unsigned int MakeCrc(unsigned char *buff, unsigned int CrcCount)
{
    unsigned int crc;
    crc = CRC16(buff, CrcCount);
    return crc;
}

unsigned short CRC16( unsigned char *puchMsg, unsigned short usDataLen )
{
    unsigned char uchCRCHi = 0xFF;
    unsigned char uchCRCLo = 0xFF;
    unsigned uIndex;
    while( usDataLen-- ) {
        uIndex = uchCRCHi ^ *puchMsg++;
        uchCRCHi = uchCRCLo ^ ( CrcTable[uIndex] & 0xFF );
        uchCRCLo = ( CrcTable[uIndex] >> 8 ) & 0xFF;
    }
    return( ( uchCRCHi << 8 ) | uchCRCLo );
}

unsigned int CheckCrc(unsigned char *buff, unsigned int CrcCount)
{
    unsigned int crc;
    CrcCount -= 2;
    crc = CRC16(buff, CrcCount);
    buff += CrcCount;
    if((( *buff++ & 0xff) != (( crc>>8) & 0xff)) || (( *buff & 0xff ) != (crc & 0xff )))
    {
        /* Error occured */
        return 1;
    }
    else {
        /* Error did not occur */
        return 0;
    }
}

```