1 ORION ITALIA SERIES MODBUS PROTOCOL.

The ORION ITALIA SERIES implement a subset of the AEG Modicon Modbus serial communication standard. Many devices support this protocol directly with suitable interface card, allowing direct connection of relays. The Modbus protocol is hardware-independent; that is, the physical layer can be any of variety of standard hardware configurations, this includes RS232, RS422, RS485, fibber optics, etc. The ORION ITALIA RELAYS include rear terminals one RS232 and two RS485 ports. Modbus is a single master multiple slave protocol suitable for a multi-drop configuration as provided by RS485 hardware. In this configuration up to 32 slaves can be daisy-chained together on a single communication channel.

The ORION ITALIA SERIES is always a Modbus slave. It cannot be programmed as a Modbus master. The Modbus protocol exists in two versions: Remote Terminal Unit (RTU, binary) and ASCII. Only the RTU version is supported by the Orion Italia Relay. Monitoring, programming and control functions are possible using read and write register commands.

2 ELECTRICAL INTERFACE.

The hardware or electrical interface is any of the following:

a. Two two-wire RS485 for Com2 and Com3 rear terminals connector.

b. One RS232 for Com1 rear terminal connector.

In a two-wire RS485 link, data flow is bi-directional. RS232 port uses 3-pin Rx for receive data, Tx for Transmit data and signal ground. Different ports Com1, Com2 and Com3 can be used at the same time. Data flow is half duplex. That is, data is never transmitted and received at the same time.

In RS485 lines should be connected in a daisy chain configuration (avoid star connections) with terminating resistors and capacitors installed each end of the link, i.e. at the master end and the slave farthest from the master. That value of the terminating resistors should be equal to the characteristic impedance of the line. This is approximately 120 Ohms for standard 24 AWG twisted pair wire. The value of the capacitors should be 1 nF. Shielded wire should always be used to minimize noise. Polarity is important in RS485 communications. See figure below for more details.

3 DATA FRAME FORMAT AND DATA RATE.

One data frame of an asynchronous transmission to or from a Orion Italia Relay consists of 1 start bit, 8 data bits, not parity and 1 stop bit. This produces a 10 bit frame. This is important for transmission throught modems at high bit rates (11 bit data frames are not supported by hayes modems at bit rates of greater than 300 bps).

The rear RS485 and RS232 external communication ports of the Orion Italia Relay supports operation at 1200,2400,4800, 9600, 19200, 38400 and 57600 baud.

4 DATA PACKET FORMAT.

A complete request/response consists of the following bytes transmitted as separate data frames:

Master Query Message:

SLAVE ADDRESS	(1 byte)
FUNCTION CODE	(1 byte)
DATA	(variable number of bytes depending on FUNCTION CODE)
CRC	(2 bytes)

Slave Response Message

SLAVE ADDRESS	(1 byte)
FUNCTION CODE	(1 byte)
DATA	(variable number of bytes depending on FUNCTION CODE)
CRC	(2 bytes)

A message is terminated when no data is received for a period of 3 1/2 character transmission times. Consequently, the transmitting device must not allow gaps between bytes larger than this interval (about 3ms at 9600 baud).

SLAVE ADDRESS: This is the first byte of every message. This byte represents the user-assigned address of the slave device that is to receive the message sent by the master. Each slave device must be assigned a unique address, and only the addressed slave will respond to a message that starts with its address. In a master query message the SLAVE ADDRESS represents the address of the slave to which the request is being sent. In a slave response message the SLAVE ADDRESS is a confirmation representing the address of the slave that is sending the response. A master query message with a SLAVE ADDRESS of 0 indicates a broadcast command. All slaves on the communication link will take action based on the message, but none will respond to the master.

FUNCTION CODE: This is the second byte of every message. Modbus defines function codes of 1 to 127. The Orion Italia Relay implements some of this functions. See section 7 for details of the function codes supported by the Orion Italia Relay Series Modbus Protocol. In a master query message the FUNCTIONS CODE tells the slave what action to perform. In a slave response message, if the FUNCTION CODE sent from the slave is the same as the FUNCTION CODE sent from the master then the slave performed the function as requested.

DATA: This will be a variable number of bytes on the FUNCTION CODE. This may include actual values, setpoints or addresses sent by the master to the slave or by the slave to the master. See section 7 for a description of the Orion-supported functions and the data required for each.

CRC: This is a two byte error checking code. CRC is sent LSByte first followed by the MSByte. The RTU version of Modbus includes a two byte CRC-16 (16 bit cyclic redundancy check) with every message. The CRC-16 algorithm essentially treats the entire data stream (data bits only; start, stop and parity ignored) as one continuous binary number. This number is first shifted left 16 bits and then divided by a characteristic polynomial (11000000000000101B). The 16 bit remainder of the division is appended to the end of the message, MSByte first. The resulting message including CRC, when divided by the same polynomial at the receiver will give a zero remainder if no transmission errors have occurred. If a Orion Modbus slave device receives a message in which an error is indicated by the CRC-16 calculation, the slave device will not respond to the message. A CRC-16 error indicates that one or more bytes of the message were received incorrectly and thus the entire message should be ignored in order to avoid the slave device performing any incorrect operation. The CRC-16 calculation is an industry standard method used for error detection. An algorithm is included in section 5 CRC-16 algorithm to assist programmers in situations where no standard CRC-16 calculation routines are available.

5 CRC-16 ALGORITHM

Once the following algorithm is completed, the working register "A" will contain the CRC value to be transmitted. Note that this algorithm requires the characteristic polynomial to be reverse bit ordered. The most significant bit of the characteristic polynomial is dropped, since it does not affect the value of the remainder. The following symbols are used in the algorithm:

Symbols:

-->	data transfer
A	16 bit working register
Alow	low order byte of A
Ahigh	high order byte of A
CRC	16 bit CRC-16 value
i,j	loop counter
(+)	logical EXCLUSIVE-OR operator
N	total number of data bytes
Di	i-th data byte (i=0 to N-1)
G	16 bit characteristic polynomial =1010000000000001(binary) with MSbit dropped and bit order reversed
shr(x)	right shit operator (the LSbit of x is shifted into a carry lag, a '0' is shifted into the MSbit of x, all other bits are shifted right one location)

Algorithm:

1.	**FFFF(hex) --> A**	
2.	**O --> i**	
3.	**O --> j**	
4.	**Di (+) Alow --> Alow**	
5.	**j + 1 --> j**	
6.	**shr (A)**	
7.	**Is there a carry ?**	**No: go to step 8**
		Yes: G (+) A --> A and continue
8.	**Is j = 8 ?**	**No: go to 5**
		Yes: continue
9.	**i + 1 --> i**	
10.	**Is i = N ?**	**No: go to 3**
		Yes: continue
11.	**A ----> CRC**	

6 MESSAGE TIMING

Communication message synchronization is maintained by timing constraints. The receiving device must measure the time between the reception of characters. If three and one half character times elapse without a new character or completion of the message, then the communication link must be reset (i.e. all slaves start listening for a new query message from the master). Thus at 1200 baud a delay of greater than 3.5 x 1/1200 x 10 = 29.2 msec cause the communication link to be reset. At 9600 baud a delay of greater than 3.5 x 1/9600 x 10 = 3.6 ms will cause the communication link to be reset. Most master query messages will be responded to in less than 50 ms. The maximum time for the Orion Italia Relay to return a slave response message for any function code will never exceed 1 second.

7 SUPPORTED FUNTION CODES

The second byte of every message is the function code. Modbus defines function codes of 01h to 7Fh. The Orion Italia Relay Modbus protocol supports some of these functions, as summarized in Table No. 1

TABLE No. 1

FUNCTION CODE MODBUS PROT. (HEX)	FUNCTION CODE ORION ITALIA (HEX)	DEFINITION
03	03	READ SETPOINTS or ACTUAL VALUES
04	04	READ SETPOINTS or ACTUAL VALUES
05	05	EXECUTE OPERATION
06	06	STORE SINGLE SETPOINTS
10	10	STORE MULTIPLES SETPOINTS

Since some programmable logic controllers only support function codes 03h (or 04h) and 10h, most of the above Modbus commands can be performed by reading from or writing to special addresses in the Orion Italia Relay memory map using these function codes.

7.1 FUNCTION CODE 03H or 04H - READ SETPOINTS OR ACTUAL VALUES.

Modbus implementation: Read Holding Registers
Orion Italia Relay implementation: Read Actual Values or Setpoint

The Orion Italia Relay implementation of Modbus views "holding registers" as any setpoint or actual values register in the Orion Italia Relay memory map. Registers are 16 (two byte) values transmitted high order byte first. Thus all Orion Italia Relay setpoints and actual values in the memory map are sent as two byte registers. This function code allows the master to read one or more consecutive setpoints or actual values from addressed slave device.

The slave response to these function codes is the slave address, function code, a count of the number of data bytes to follow, the data itself and the CRC. Each data item is sent as a two byte number with the high order byte sent first. The CRC is sent as a two byte number with the low order byte sent first.

The maximum number of values of Setpoints that can be read in a single message is 97 word (194 bytes). The EVAR Setpoint data starts at address 0100h.

MESSAGE FORMAT EXAMPLE:
Request to read 4 register values starting address 0102h from slave device 1.

Master query message	Example(hex)	
SLAVE ADDRESS	01	query message for slave 01 = 01h
FUNCTION CODE	03	read Setpoints
DATA STARTING ADDRESS-high order	01	data starting at address 0102h
DATA STARTING ADDRESS-low order byte	02	
NUMBER OF REGISTERS-high order byte	00	4 register value = 4 word total

NUMBER OF REGISTER-low order byte	04	
CRC-low order byte	E4	CRC calculated by the master
CRC-high order byte	35	

If the function code or the address of any of the requested data is illegal, the slave will not respond the message. Otherwise, the slave will respond as follows:

Slave response message	Example (hex)	
SLAVE ADDRESS	01	response message from slave 1 = 01h
FUNCTION CODE	03	read Setpoints
BYTE COUNT	08	4 register values = 8 bytes total
DATA #1-high order byte	00	register value in address 0102= 0064h
DATA #1-low order byte	64	
DATA #2-high order byte	00	register value in address 0103=0064h
DATA #2-low order byte	64	
DATA #3-high order byte	03	register value in address 0104=03E8h
DATA #3-low order byte	E8	
DATA #4-high order byte	00	register value in address 0105=0064h
DATA #4-low order byte	64	
CRC-low order byte	40	CRC calculated by the slave
CRC-high order byte	42	

7.2 FUNCTION CODE 05H - EXECUTE OPERATION

Modbus implementation: Force Single Coil
Orion Italia Relay implementation : Execute Operation

This function code allows the master to request EVAR to perform specific command operations. The commands Number Listed in the table 2: Commands; correspond to operations codes for function code 05h.

The Slave Response to this function is to echo the entire master transmission.

TABLE 2. COMMANDS

ACTION	COMMAND (HEX)
Reset Relay	01
Alarm Relay Activation	02
Aux1 Relay Activation	03
Aux2 Relay Activation	04
Set Clock	05
Clear Energy	06
Clear Maximum Current Demand	07
Clear Maximum Power Demand	08
Clear Events	09
Clear Pulse Counter	0A
Activation PC Control	0B
Deactivation PC Control	0C
Simulate Setpoints Key	C8
Simulate Actual Values Key	C9
Simulate Reset Key	CA
Simulate Page Up Key	CB
Simulate Value UP Key	CC
Simulate Line Key	CD
Simulate Page Down Key	CE
Simulate Value Down Key	CF
Simulate Store Key	D0
Simulate Prog Key	D1

MESSAGE FORMAT EXAMPLE:
Request to Reset Relay EVAR.

Master query message	Example(hex)	
SLAVE ADDRESS	01	Query message for slave 01 = 01h
FUNCTION CODE	05	Execute Operation
OPERATION CODE-high order	00	Reset Relay Command
OPERATION CODE-low order byte	01	
NUMBER OF REGISTERS-high order byte	FF	Perform Function
NUMBER OF REGISTER-low order byte	00	
CRC-low order byte	DD	CRC calculated by the master
CRC-high order byte	FA	

Slave response message	Example (hex)	
SLAVE ADDRESS	01	Message from slave 01 = 01h
FUNCTION CODE	05	Execute Operation
DATA STARTING ADDRESS-high order	00	Reset Relay Command
DATA STARTING ADDRESS-low order byte	01	
NUMBER OF REGISTERS-high order byte	FF	Perform Function
NUMBER OF REGISTER-low order byte	00	

CRC-low order byte	DD	CRC calculated by theSlave
CRC-high order byte	FA	

7.3 FUNCTION CODE 06H - STORE SINGLE SETPOINTS

Modbus implementation: Preset Single Register
Orion Italia Relay implementation : Store Single Setpoints

This function code allows the master to store single setpoints into the memory map of the EVAR.
The Slave Response to this function is to echo the entire master transmission.

MESSAGE FORMAT EXAMPLE:
Request slave device 01h to write the value 0190h at setpoint address 0102h

Master query message	Example(hex)	
SLAVE ADDRESS	01	query message for slave 01 = 01h
FUNCTION CODE	06	Store Single Setpoints
DATA STARTING ADDRESS-high order	01	Setpoint Address 0102h
DATA STARTING ADDRESS-low order byte	02	
NUMBER OF REGISTERS-high order byte	01	Data for Address 0102h = 0190h
NUMBER OF REGISTER-low order byte	90	
CRC-low order byte	28	CRC calculated by the master
CRC-high order byte	0A	

Slave response message	Example (hex)	
SLAVE ADDRESS	01	Message from slave 01 = 01h
FUNCTION CODE	06	Store Single Setpoints
DATA STARTING ADDRESS-high order	01	Setpoint Address 0102h
DATA STARTING ADDRESS-low order byte	02	
NUMBER OF REGISTERS-high order byte	01	Data Stored in Address 0102h = 0190h
NUMBER OF REGISTER-low order byte	90	
CRC-low order byte	28	CRC calculated by the Slave
CRC-high order byte	0A	

7.4 FUNCTION CODE 10H -STORE MULTIPLE SETPOINTS

Modbus implementation: Preset Multiple Register
Orion Italia Relay implementation : Store Multiple Setpoints

This function code allows the master to modify the contest of a one or more consecutive setpoint in the addressed slave device. Setpoint registers are 16 bit (two byte) values transmitted high order byte first.

The maximum number of register values (setpoints) that can be stored in a single message is 97 word (194 bytes). The EVAR Setpoint data starts at address 0100h.

To store the value of one or more setpoints in the internal memory of the EVAR, the following steps shall be realized:

a) First shall be read setpoint group to modify with function 03h or 04h.
b) Then, modify the values of setpoints according to memory map.
c) Send setpoint group back to relay with function 10h.

The EVAR response to this function code is to echo the slave address, function code, starting address, the number of setpoints stored, and the CRC.

MESSAGE FORMAT AND EXAMPLE:

Request slave device 11h to write the value 0190h at setpoint address 0102h, and the value 012Ch at setpoint address 0103h.

Master query message	Example (hex)
SLAVE ADDRESS	11 query for slave 11h
FUNCTION CODE	10 store multiple setpoint values
DATA STARTING ADDRESS-high order byte	01 data starting at address 0102
DATA STARTING ADDRESS-low order byte	02
NUMBER OF SETPOINTS-high order byte	00 2 setpoint values = 2 word
NUMBER OF SETPOINTS-low order byte	02
BYTE COUNT	04 4 byte of data
DATA #1-high order byte	01 data for address 0102h=012Ch
DATA #1-low order byte	2C
DATA #2-high order byte	01 data for address 0103h=012Ch
DATA #2-low order byte	2C
CRC-low order byte	9E CRC calculated by the master
CRC-high order byte	46

If the function code or the address or value of any of the data, is illegal, the slave will not respond to the message. Otherwise, the slave will respond as follows:

Master query message	Example (hex)
SLAVE ADDRESS	11 Message from slave 11h
FUNCTION CODE	10 store multiple setpoint values
DATA STARTING ADDRESS-high order byte	01 data starting at address 0102h
DATA STARTING ADDRESS-low order byte	02
NUMBER OF SETPOINTS-high order byte	00 2 setpoint values = 2 word
NUMBER OF SETPOINTS-low order byte	02
CRC-low order byte	E1 CRC calculated by the slave
CRC-high order byte	5E

8 MEMORY MAP INFORMATION

The data stored in the EVAR is grouped as Setpoints, Actual Values and Product ID. Setpoints can be read and written by a master computer. Actual Values & Product ID are read only. All setpoints and Actual Values are stored as two bytes values. Addresses are listed in hexadecimal. Data values (Setpoint ranges, increments, factory value) are in decimal.

EVAR - MODBUS MEMORY MAP

Add (Hex)	Type	Size	Description	Unit	Range	Step	Initial Value	Format	Read/ Write
0000	**Product ID**	1 W	Product Code	---	---	---	4	F2	R
0001		1 W	Product Model	---	---	---	1	F2	R
0002		1 W	Version Number	---	---	---	1.00	F6	R
0090	**TimeSet**	3 W	Date & Time Preset Data	---	---	---	---	F8	R/W
0100	**Setpoints**	1 W	Access Code	---	111~999	1	111	F2	R/W
0101		1 W	System Setup Register	BitField	---	---	9232	F9	R/W
0102		1 W	Phase CT	A	5~5000	5	100	F2	R/W
0103		1 W	Ground CT	A	5~5000	5	100	F2	R/W
0104		1 W	VT Primary	KV	0.10~69.00	0,01	10.00	F6	R/W
0105		1 W	VT Secondary	V	55~254	1	100	F2	R/W
0106		1 W	Event Recorder Config	BitField	---	---	2047	F10	R/W
0107		1 W	Output Relays Config	BitField	---	---	0	F11	R/W
0108		1 W	Switch Inputs Activation Config	BitField	---	---	0	F12	R/W
0109		1 B	Switch Input 1 Function Upper Byte	---	0~6	1	0	F13	R/W
		1 B	Switch Input 2 Function Lower Byte	---	0~6	1	0	F13	R/W
010A		1 B	Switch Input 3 Function Upper Byte	---	0~6	1	0	F13	R/W
		1 B	Switch Input 4 Function Lower Byte	---	0~6	1	0	F13	R/W
010B		1 W	Not Used (Reserved for Future Expansion)	---	---	---	---	---	R/W
010C		1 B	UnderCurrent Relay Upper Byte	---	0~3	1	0	F13	R/W
		1 B	UnderCurrent Detection Below 2% CT Lower Byte	---	0~1	1	0	F14	R/W
010D		1 B	UnderCurrent Level Upper Byte	%CT	2~100	1	50	F2	R/W
		1 B	UnderCurrent Dropout Lower Byte	%CT	2~100	1	2	F2	R/W
010E		1 W	UnderCurrent Delay	Sec	0.5~600.0	0.5	1.0	F4	R/W
010F		1 B	OverCurrent Relay Upper Byte	---	0~3	1	0	F13	R/W
		1 B	OverCurrent Curve Lower Byte	---	0~12	1	0	F15	R/W
0110		1 W	OverCurrent Level	%CT	2~500	1	110	F2	R/W
0111		1 W	OverCurrent Dropout	%CT	1~100	1	2	F2	R/W
0112		1 B	OverCurrent Curve Multiplier Upper Byte	---	1~10	1	10	F2	R/W
		1 B	OverCurrent Curve Shift Lower Byte	---	0.5~1.1	0.1	1.0	F4	R/W
0113		1 W	OverCurrent Delay	Sec	0.5~600.0	0.5	1.0	F4	R/W
0114		1 B	Ground OverCurrent Relay Upper Byte	---	0~3	1	0	F13	R/W
		1 B	Ground OverCurrent Curve Lower Byte	---	0~12	1	0	F15	R/W
0115		1 W	Ground OverCurrent Level	%CT	2~500	1	10	F2	R/W
0116		1 W	Ground OverCurrent Dropout	%CT	1~100	1	2	F2	R/W
0117		1 B	Ground OverCurrent Curve Multiplier Upper Byte	---	1~10	1	10	F2	R/W
		1 B	Ground OverCurrent Curve Shift Lower Byte	---	0.5~1.1	0.1	1.0	F4	R/W
0118		1 W	Ground OverCurrent Delay	Sec	0.5~600.0	0.5	1.0	F4	R/W
0119		1 B	OverVoltage Relay Upper Byte	---	0~3	1	0	F13	R/W
		1 B	Phases for O/V Operation Lower Byte	---	0~2	1	0	F16	R/W
011A		1 B	OverVoltage Level Upper Byte	%VT	101~125	1	110	F2	R/W
		1 B	OverVoltage Dropout Lower Byte	%VT	1~25	1	2	F2	R/W
011B		1 W	OverVoltage Delay	Sec	0.5~600.0	0.5	1.0	F4	R/W
011C		1 B	UnderVoltage Relay Upper Byte	---	0~3	1	0	F13	R/W
		1 B	UnderVoltage Level Lower Byte	%VT	30~100	1	90	F2	R/W
011D		1 B	UnderVoltage Dropout Upper Byte	%VT	1~100	1	5	F2	R/W
		1 B	Phases for U/V Operation Lower Byte	---	0~2	1	0	F16	R/W
011E		1 W	Undervoltage Delay	Sec	0.5~600.0	0.5	1.0	F4	R/W
011F		1 B	UnderVoltage Detection Below 20% VT Upper Byte	---	0~1	1	0	F14	R/W
		1 B	Phase Reversal Relay Lower Byte	---	0~3	1	0	F13	R/W
0120		1 W	Phase Reversal Delay	Sec	0.5~600.0	0.5	1.0	F4	R/W
0121		1 B	Currrent Unbalance Relay Upper Byte	---	0~3	1	0	F13	R/W
		1 B	Voltage Unbalance Relay Lower Byte	---	0~3	1	0	F13	R/W
0122		1 B	Currrent Unbalance Level Upper Byte	%	1~100	1	10	F2	R/W
		1 B	Current Unbalance Droput Lower Byte	%	1~100	1	2	F2	R/W
0123		1 B	Voltage Unbalance Level Upper Byte	%	1~100	1	3	F2	R/W
		1 B	Voltage Unbalance Dropout Lower Byte	%	1~100	1	1	F2	R/W
0124		1 W	Current Unbalance Delay Upper Byte	Sec	0.5~600.0	0.5	1.0	F4	R/W
0125		1 W	Voltage Unbalance Delay Lower Byte	Sec	0.5~600.0	0.5	1.0	F4	R/W
0126		1 B	UnderFrequency Relay Upper Byte	---	0~3	1	0	F13	R/W
		1 B	OverFrequency Relay Lower Byte	---	0~3	1	0	F13	R/W
0127		1 W	UnderFrequency Level	Hz	40.00~70.00	0.01	49.00	F6	R/W
0128		1 W	UnderFrequency Dropout	Hz	0.01~5.00	0.01	0.50	F6	R/W
0129		1 W	UnderFrequency Delay	Sec	0.5~600.0	0.5	10.0	F4	R/W
012A		1 W	OverFrequency Level	Hz	40.00~70.00	0.5	51.00	F6	R/W
012B		1 W	OverFrequency Dropout	Hz	0.01~5.00	0.01	0.50	F6	R/W
012C		1 W	OverFrequency Delay	Sec	0.5~600.0	0.5	10.0	F4	R/W
012D		1 B	Positive KW Relay Upper Byte	---	0~3	1	0	F13	R/W
		1 B	Negative KW Relay Lower Byte	---	0~3	1	0	F13	R/W
012E		2 W	Positive KW Level	KW	10~650000	---	10000	F2	R/W
0130		1 W	Positive KW Delay	Sec	0.5~600.0	0.5	10.0	F4	R/W
0131		2 W	Negative KW Level	KW	10~650000	---	10000	F2	R/W
0133		1 W	Negative KW Delay	Sec	0.5~600.0	0.5	10.0	F4	R/W
0134		1 B	Positive KVAR Relay Upper Byte	---	0~3	1	0	F13	R/W
		1 B	Negative KVAR Relay Lower Byte	---	0~3	1	0	F13	R/W
0135		2 W	Positive KVAR Level	KVAR	10~650000	---	10000	F2	R/W
0137		1 W	Positive KVAR Delay	Sec	0.5~600.0	0.5	10.0	F4	R/W

EVAR - MODBUS MEMORY MAP

Add (Hex)	Type	Size	Description	Unit	Range	Step	Initial Value	Format	Read/ Write
0138		2 W	Negative KVAR Level	KVAR	10~650000	---	10000	F2	R/W
013A		1 W	Negative KVAR Delay	Sec	0.5~600.0	0.5	10.0	F4	R/W
013B		1 B	P.F. Leading 1 Relay Upper Byte	---	0~3	1	0	F13	R/W
		1 B	P.F. Leading 2 Relay Lower Byte	---	0~3	1	0	F13	R/W
013C		1 B	P.F. Leading 1 Level Upper Byte	---	0.05~1.00	0.01	0.92	F6	R/W
		1 B	P.F. Leading 1 Dropout Lower Byte	---	0.01~1.00	0.01	0.02	F6	R/W
013D		1 B	P.F. Leading 2 Level Upper Byte	---	0.05~1.00	0.01	0.96	F6	R/W
		1 B	P.F. Leading 2 Dropout Lower Byte	---	0.01~1.00	0.01	0.02	F6	R/W
013E		1 W	P.F. Leading 1 Delay	Sec	0.5~600.0	0.5	10.0	F4	R/W
013F		1 W	P.F. Leading 2 Delay	Sec	0.5~600.0	0.5	10.0	F4	R/W
0140		1 B	P.F. Lagging 1 Relay Upper Byte	---	0~3	1	0	F13	R/W
		1 B	P.F. Lagging 2 Relay Lower Byte	---	0~3	1	0	F13	R/W
0141		1 B	P.F. Lagging 1 Level Upper Byte	---	0.05~1.00	0.01	0.92	F6	R/W
		1 B	P.F Lagging 1 Dropout Lower Byte	---	0.01~1.00	0.01	0.02	F6	R/W
0142		1 B	P.F. Lagging 2 Level Upper Byte	---	0.05~1.00	0.01	0.96	F6	R/W
		1 B	P.F Lagging 2 Dropout Lower Byte	---	0.01~1.00	0.01	0.02	F6	R/W
0143		1 W	P.F. Lagging 1 Delay	Sec	0.5~600.0	0.5	10.0	F4	R/W
0144		1 W	P.F. Lagging 2 Delay	Sec	0.5~600.0	0.5	10.0	F4	R/W
0145		1 W	Current Demand Time Period	Min	5~60	1	5	F2	R/W
0146		1 B	Phase A Amps Demand Relay Upper Byte	---	0~3	1	0	F13	R/W
		1 B	Phase B Amps Demand Relay Lower Byte	---	0~3	1	0	F13	R/W
0147		1 B	Phase C Amps Demand Relay Upper Byte	---	0~3	1	0	F13	R/W
		1 B	Gnd Amps Demand Relay Lower Byte	---	0~3	1	0	F13	R/W
0148		1 W	Phase A Amps Demand Level	%CT	2~500	1	110	F2	R/W
0149		1 W	Phase B Amps Demand Level	%CT	2~500	1	110	F2	R/W
014A		1 W	Phase C Amps Demand Level	%CT	2~500	1	110	F2	R/W
014B		1 W	Gnd Amps Demand Level	%CT	2~500	1	20	F2	R/W
014C		1 W	Power Demand Time Period	Min	5~60	1	5	F2	R/W
014D		1 W	KW Demand Relay	---	0~3	1	0	F13	R/W
014E		1 B	KVAR Demand Relay Upper Byte	---	0~3	1	0	F13	R/W
		1 B	KVA Demand Relay Lower Byte	---	0~3	1	0	F13	R/W
014F		2 W	KW Demand Level	kW	10~650000	---	10000	F2	R/W
0151		2 W	KVAR Demand Level	KVAR	10~650000	---	10000	F2	R/W
0153		2 W	KVA Demand Level	KVA	10~650000	---	10000	F2	R/W
0155		1 B	Avg Current THD Relay	---	0~3	1	0	F13	R/W
		1 B	Avg Voltage THD Relay	---	0~3	1	0	F13	R/W
0156		1 W	Avg Current THD Level	%	0.5~100.0	0.5	2.0	F4	R/W
0157		1 W	Avg Current THD Delay	Sec	0.5~600.0	0.5	20.0	F4	R/W
0158		1 W	Avg Voltage THD Level	%	0.5~100.0	0.5	1.0	F4	R/W
0159		1 W	Avg Voltage THD Delay	Sec	0.5~600.0	0.5	10.0	F4	R/W
015A		1 W	Pulse Counter Relay	---	0~3	1	0	F13	R/W
015B		1 W	Pulse Counter Level	---	1~65000	1	1000	F2	R/W
015C		1 W	Pulse Counter Delay	Sec	0.5~600.0	0.5	30.0	F4	R/W
015D		1 W	Slave Address	---	1~254	1	1	F2	R/W
015E		1 W	Com1 Baud Rate	Baud	0~6	1	3	F17	R/W
015F		1 W	Com2 Baud Rate	Baud	0~6	1	3	F17	R/W
0160		1 W	Com3 Baud Rate	Baud	0~6	1	3	F17	R/W
0200	**Actual**	3 W	EVAR Relay Date & Time	---	---	---	---	F8	R
0203	**Values**	1 W	Leds Status	BitField	---	---	---	F20	R
0204		1 W	Leds Blink Status	BitField	---	---	---	F21	R
0205		1 W	Output Relays Status	BitField	---	---	---	F22	R
0206		1 W	Input Status	BitField	---	---	---	F23	R
0207		1 W	Active Alarms Status Flags 1	BitField	---	---	---	F24	R
0208		1 W	Active Alarms Status Flags 2	BitField	---	---	---	F25	R
0209		1 W	Active Alarms Status Flags 3	BitField	---	---	---	F26	R
020A		1 W	Pickup Alarms Status Flags 1	BitField	---	---	---	F24	R
020B		1 W	Pickup Alarms Status Flags 2	BitField	---	---	---	F25	R
020C		1 W	Pickup Alarms Status Flags 3	BitField	---	---	---	F26	R
020D		1 W	Alarm Output Status Flags 1	BitField	---	---	---	F24	R
020E		1 W	Alarm Output Status Flags 2	BitField	---	---	---	F25	R
020F		1 W	Alarm Output Status Flags 3	BitField	---	---	---	F26	R
0210		1 W	Aux1 Output Status Flags 1	BitField	---	---	---	F24	R
0211		1 W	Aux1 Output Status Flags 2	BitField	---	---	---	F25	R
0212		1 W	Aux1 Output Status Flags 3	BitField	---	---	---	F26	R
0213		1 W	Aux2 Output Status Flags 1	BitField	---	---	---	F24	R
0214		1 W	Aux2 Output Status Flags 2	BitField	---	---	---	F25	R
0215		1 W	Aux2 Output Status Flags 3	BitField	---	---	---	F26	R
0216		2 W	Phase A RMS Current	A	---	---	---	F6	R
0218		2 W	Phase B RMS Current	A	---	---	---	F6	R
021A		2 W	Phase C RMS Current	A	---	---	---	F6	R
021C		2 W	Average Current	A	---	---	---	F6	R
021E		2 W	Ground RMS Current	A	---	---	---	F6	R

EVAR - MODBUS MEMORY MAP									
Add (Hex)	**Type**	**Size**	**Description**	**Unit**	**Range**	**Step**	**Initial Value**	**Format**	**Read/ Write**
0220		1 W	Current Unbalance	%	---	---	---	F4	R
0221		2 W	A-N RMS Voltage	V	---	---	---	F4	R
0223		2 W	B-N RMS Voltage	V	---	---	---	F4	R
0225		2 W	C-N RMS Voltage	V	---	---	---	F4	R
0227		2 W	A-B RMS Voltage	V	---	---	---	F4	R
0229		2 W	B-C RMS Voltage	V	---	---	---	F4	R
022B		2 W	C-A RMS Voltage	V	---	---	---	F4	R
022D		2 W	Average Voltage	V	---	---	---	F4	R
022F		1 W	Voltage Unbalance	%	---	---	---	F4	R
0230		1 W	Phase Sequence	---	---	---	---	F18	R
0231		1 W	Phase A Voltage Phasor Angle	° Angle	---	---	---	F3	R
0232		1 W	Phase B Voltage Phasor Angle	° Angle	---	---	---	F3	R
0233		1 W	Phase C Voltage Phasor Angle	° Angle	---	---	---	F3	R
0234		1 W	Phase A Current Phasor Angle	° Angle	---	---	---	F3	R
0235		1 W	Phase B Current Phasor Angle	° Angle	---	---	---	F3	R
0236		1 W	Phase C Current Phasor Angle	° Angle	---	---	---	F3	R
0237		1 W	Frequency	Hz	---	---	---	F6	R
0238		2 W	3Ø Active Power	KW	---	---	---	F5	R
023A		2 W	3Ø Reactive Power	KVAR	---	---	---	F5	R
023C		2 W	3Ø Aparent Power	KVA	---	---	---	F5	R
023E		1 W	3Ø Power Factor	---	---	---	---	F19	R
023F		2 W	Active Power Phase A	KW	---	---	---	F5	R
0241		2 W	Reactive Power Phase A	KVAR	---	---	---	F5	R
0243		2 W	Aparent Power Phase A	KVA	---	---	---	F5	R
0245		1 W	Power Factor Phase A	---	---	---	---	F19	R
0246		2 W	Active Power Phase B	KW	---	---	---	F5	R
0248		2 W	Reactive Power Phase B	KVAR	---	---	---	F5	R
024A		2 W	Aparent Power Phase B	KVA	---	---	---	F5	R
024C		1 W	Power Factor Phase B	---	---	---	---	F19	R
024D		2 W	Active Power Phase C	KW	---	---	---	F5	R
024F		2 W	Reactive Power Phase C	KVAR	---	---	---	F5	R
0251		2 W	Aparent Power Phase C	KVA	---	---	---	F5	R
0253		1 W	Power Factor Phase C	---	---	---	---	F19	R
0254		2 W	Positive Active Energy	Kwh	---	---	---	F2	R
0256		2 W	Negative Active Energy	Kwh	---	---	---	F2	R
0258		2 W	Positive Reactive Energy	Kvrh	---	---	---	F2	R
025A		2 W	Negative Reactive Energy	Kvrh	---	---	---	F2	R
025C		2 W	Not Used (Reserved for Future Expansion)	---	---	---	---	---	R
025E		2 W	Pulse Counter	---	---	---	---	F2	R
0300		2 W	Phase A Current Demand	A	---	---	---	F6	R
0302		2 W	Phase B Current Demand	A	---	---	---	F6	R
0304		2 W	Phase C Current Demand	A	---	---	---	F6	R
0306		2 W	Ground Current Demand	A	---	---	---	F6	R
0308		2 W	Active Power Demand	KW	---	---	---	F5	R
030A		2 W	Reactive Power Demand	KVAR	---	---	---	F5	R
030C		2 W	Aparent Power Demand	KVA	---	---	---	F5	R
030E		2 W	Maximum Phase A Current Demand	A	---	---	---	F6	R
0310		2 W	Maximum Phase B Current Demand	A	---	---	---	F6	R
0312		2 W	Maximum Phase C Current Demand	A	---	---	---	F6	R
0314		2 W	Maximum Ground Current Demand	A	---	---	---	F6	R
0316		2 W	Maximum Active Power Demand	KW	---	---	---	F5	R
0318		2 W	Maximum Reactive Power Demand	KVAR	---	---	---	F5	R
031A		2 W	Maximum Apararente Power Demand	KVA	---	---	---	F5	R
031C		3 W	Energy Reset Date	---	---	---	---	F8	R
031F		3 W	Maximum Active Power Demand Date	---	---	---	---	F8	R
0322		3 W	Maximum Reactive Power Demand Date	---	---	---	---	F8	R
0325		3 W	Maximum Apararente Power Demand Date	---	---	---	---	F8	R
0328		3 W	Maximum Phase A Current Demand Date	---	---	---	---	F8	R
032B		3 W	Maximum Phase B Current Demand Date	---	---	---	---	F8	R
032E		3 W	Maximum Phase C Current Demand Date	---	---	---	---	F8	R
0331		3 W	Maximum Ground Current Demand Date	---	---	---	---	F8	R
0334		1 W	Phase A Current THD	%	---	---	---	F4	R
0335		1 W	Phase B Current THD	%	---	---	---	F4	R
0336		1 W	Phase C Current THD	%	---	---	---	F4	R
0337		1 W	Ground Current THD	%	---	---	---	F4	R
0338		1 W	A-N Voltage THD	%	---	---	---	F4	R
0339		1 W	B-N Voltage THD	%	---	---	---	F4	R

EVAR - MODBUS MEMORY MAP

Add (Hex)	Type	Size	Description	Unit	Range	Step	Initial Value	Format	Read/ Write
033A		1 W	C-N Voltage THD	%	---	---	---	F4	R
033B		1 W	A-B Voltage THD	%	---	---	---	F4	R
033C		1 W	B-C Voltage THD	%	---	---	---	F4	R
033D		1 W	C-A Voltage THD	%	---	---	---	F4	R
033E		1 W	Phase A Current K Factor	---	---	---	---	F6	R
033F		1 W	Phase B Current K Factor	---	---	---	---	F6	R
0340		1 W	Phase C Current K Factor	---	---	---	---	F6	R
0400		1 W	Phase A Current 1st Harmonic	%	---	---	---	F4	R
0401		1 W	Phase A Current 2nd Harmonic	%	---	---	---	F4	R
0402		1 W	Phase A Current 3th Harmonic	%	---	---	---	F4	R
0403		1 W	Phase A Current 4th Harmonic	%	---	---	---	F4	R
0404		1 W	Phase A Current 5th Harmonic	%	---	---	---	F4	R
0405		1 W	Phase A Current 6th Harmonic	%	---	---	---	F4	R
0406		1 W	Phase A Current 7th Harmonic	%	---	---	---	F4	R
0407		1 W	Phase A Current 8th Harmonic	%	---	---	---	F4	R
0408		1 W	Phase A Current 9th Harmonic	%	---	---	---	F4	R
0409		1 W	Phase A Current 10th Harmonic	%	---	---	---	F4	R
040A		1 W	Phase A Current 11th Harmonic	%	---	---	---	F4	R
040B		1 W	Phase A Current 12th Harmonic	%	---	---	---	F4	R
040C		1 W	Phase A Current 13th Harmonic	%	---	---	---	F4	R
040D		1 W	Phase B Current 1st Harmonic	%	---	---	---	F4	R
040E		1 W	Phase B Current 2nd Harmonic	%	---	---	---	F4	R
040F		1 W	Phase B Current 3th Harmonic	%	---	---	---	F4	R
0410		1 W	Phase B Current 4th Harmonic	%	---	---	---	F4	R
0411		1 W	Phase B Current 5th Harmonic	%	---	---	---	F4	R
0412		1 W	Phase B Current 6th Harmonic	%	---	---	---	F4	R
0413		1 W	Phase B Current 7th Harmonic	%	---	---	---	F4	R
0414		1 W	Phase B Current 8th Harmonic	%	---	---	---	F4	R
0415		1 W	Phase B Current 9th Harmonic	%	---	---	---	F4	R
0416		1 W	Phase B Current 10th Harmonic	%	---	---	---	F4	R
0417		1 W	Phase B Current 11th Harmonic	%	---	---	---	F4	R
0418		1 W	Phase B Current 12th Harmonic	%	---	---	---	F4	R
0419		1 W	Phase B Current 13th Harmonic	%	---	---	---	F4	R
041A		1 W	Phase C Current 1st Harmonic	%	---	---	---	F4	R
041B		1 W	Phase C Current 2nd Harmonic	%	---	---	---	F4	R
041C		1 W	Phase C Current 3th Harmonic	%	---	---	---	F4	R
041D		1 W	Phase C Current 4th Harmonic	%	---	---	---	F4	R
041E		1 W	Phase C Current 5th Harmonic	%	---	---	---	F4	R
041F		1 W	Phase C Current 6th Harmonic	%	---	---	---	F4	R
0420		1 W	Phase C Current 7th Harmonic	%	---	---	---	F4	R
0421		1 W	Phase C Current 8th Harmonic	%	---	---	---	F4	R
0422		1 W	Phase C Current 9th Harmonic	%	---	---	---	F4	R
0423		1 W	Phase C Current 10th Harmonic	%	---	---	---	F4	R
0424		1 W	Phase C Current 11th Harmonic	%	---	---	---	F4	R
0425		1 W	Phase C Current 12th Harmonic	%	---	---	---	F4	R
0426		1 W	Phase C Current 13th Harmonic	%	---	---	---	F4	R
0427		1 W	Ground Current 1st Harmonic	%	---	---	---	F4	R
0428		1 W	Ground Current 2nd Harmonic	%	---	---	---	F4	R
0429		1 W	Ground Current 3th Harmonic	%	---	---	---	F4	R
042A		1 W	Ground Current 4th Harmonic	%	---	---	---	F4	R
042B		1 W	Ground Current 5th Harmonic	%	---	---	---	F4	R
042C		1 W	Ground Current 6th Harmonic	%	---	---	---	F4	R
042D		1 W	Ground Current 7th Harmonic	%	---	---	---	F4	R
042E		1 W	Ground Current 8th Harmonic	%	---	---	---	F4	R
042F		1 W	Ground Current 9th Harmonic	%	---	---	---	F4	R
0430		1 W	Groung Current 10th Harmonic	%	---	---	---	F4	R
0431		1 W	Groung Current 11th Harmonic	%	---	---	---	F4	R
0432		1 W	Groung Current 12th Harmonic	%	---	---	---	F4	R
0433		1 W	Groung Current 13th Harmonic	%	---	---	---	F4	R
0500		1 W	A-N Voltage 1st Harmonic	%	---	---	---	F4	R
0501		1 W	A-N Voltage 2nd Harmonic	%	---	---	---	F4	R
0502		1 W	A-N Voltage 3th Harmonic	%	---	---	---	F4	R
0503		1 W	A-N Voltage 4th Harmonic	%	---	---	---	F4	R
0504		1 W	A-N Voltage 5th Harmonic	%	---	---	---	F4	R
0505		1 W	A-N Voltage 6th Harmonic	%	---	---	---	F4	R

EVAR - MODBUS MEMORY MAP

Add (Hex)	Type	Size	Description	Unit	Range	Step	Initial Value	Format	Read/ Write
0506		1 W	A-N Voltage 7th Harmonic	%	---	---	---	F4	R
0507		1 W	A-N Voltage 8th Harmonic	%	---	---	---	F4	R
0508		1 W	A-N Voltage 9th Harmonic	%	---	---	---	F4	R
0509		1 W	A-N Voltage 10th Harmonic	%	---	---	---	F4	R
050A		1 W	A-N Voltage 11th Harmonic	%	---	---	---	F4	R
050B		1 W	A-N Voltage 12th Harmonic	%	---	---	---	F4	R
050C		1 W	A-N Voltage 13th Harmonic	%	---	---	---	F4	R
050D		1 W	B-N Voltage 1st Harmonic	%	---	---	---	F4	R
050E		1 W	B-N Voltage 2nd Harmonic	%	---	---	---	F4	R
050F		1 W	B-N Voltage 3th Harmonic	%	---	---	---	F4	R
0510		1 W	B-N Voltage 4th Harmonic	%	---	---	---	F4	R
0511		1 W	B-N Voltage 5th Harmonic	%	---	---	---	F4	R
0512		1 W	B-N Voltage 6th Harmonic	%	---	---	---	F4	R
0513		1 W	B-N Voltage 7th Harmonic	%	---	---	---	F4	R
0514		1 W	B-N Voltage 8th Harmonic	%	---	---	---	F4	R
0515		1 W	B-N Voltage 9th Harmonic	%	---	---	---	F4	R
0516		1 W	B-N Voltage 10th Harmonic	%	---	---	---	F4	R
0517		1 W	B-N Voltage 11th Harmonic	%	---	---	---	F4	R
0518		1 W	B-N Voltage 12th Harmonic	%	---	---	---	F4	R
0519		1 W	B-N Voltage 13th Harmonic	%	---	---	---	F4	R
051A		1 W	C-N Voltage 1st Harmonic	%	---	---	---	F4	R
051B		1 W	C-N Voltage 2nd Harmonic	%	---	---	---	F4	R
051C		1 W	C-N Voltage 3th Harmonic	%	---	---	---	F4	R
051D		1 W	C-N Voltage 4th Harmonic	%	---	---	---	F4	R
051E		1 W	C-N Voltage 5th Harmonic	%	---	---	---	F4	R
051F		1 W	C-N Voltage 6th Harmonic	%	---	---	---	F4	R
0520		1 W	C-N Voltage 7th Harmonic	%	---	---	---	F4	R
0521		1 W	C-N Voltage 8th Harmonic	%	---	---	---	F4	R
0522		1 W	C-N Voltage 9th Harmonic	%	---	---	---	F4	R
0523		1 W	C-N Voltage 10th Harmonic	%	---	---	---	F4	R
0524		1 W	C-N Voltage 11th Harmonic	%	---	---	---	F4	R
0525		1 W	C-N Voltage 12th Harmonic	%	---	---	---	F4	R
0526		1 W	C-N Voltage 13th Harmonic	%	---	---	---	F4	R
0527		1 W	A-B Voltage 1st Harmonic	%	---	---	---	F4	R
0528		1 W	A-B Voltage 2nd Harmonic	%	---	---	---	F4	R
0529		1 W	A-B Voltage 3th Harmonic	%	---	---	---	F4	R
052A		1 W	A-B Voltage 4th Harmonic	%	---	---	---	F4	R
052B		1 W	A-B Voltage 5th Harmonic	%	---	---	---	F4	R
052C		1 W	A-B Voltage 6th Harmonic	%	---	---	---	F4	R
052D		1 W	A-B Voltage 7th Harmonic	%	---	---	---	F4	R
052E		1 W	A-B Voltage 8th Harmonic	%	---	---	---	F4	R
052F		1 W	A-B Voltage 9th Harmonic	%	---	---	---	F4	R
0530		1 W	A-B Voltage 10th Harmonic	%	---	---	---	F4	R
0531		1 W	A-B Voltage 11th Harmonic	%	---	---	---	F4	R
0532		1 W	A-B Voltage 12th Harmonic	%	---	---	---	F4	R
0533		1 W	A-B Voltage 13th Harmonic	%	---	---	---	F4	R
0534		1 W	B-C Voltage 1st Harmonic	%	---	---	---	F4	R
0535		1 W	B-C Voltage 2nd Harmonic	%	---	---	---	F4	R
0536		1 W	B-C Voltage 3th Harmonic	%	---	---	---	F4	R
0537		1 W	B-C Voltage 4th Harmonic	%	---	---	---	F4	R
0538		1 W	B-C Voltage 5th Harmonic	%	---	---	---	F4	R
0539		1 W	B-C Voltage 6th Harmonic	%	---	---	---	F4	R
053A		1 W	B-C Voltage 7th Harmonic	%	---	---	---	F4	R
053B		1 W	B-C Voltage 8th Harmonic	%	---	---	---	F4	R
053C		1 W	B-C Voltage 9th Harmonic	%	---	---	---	F4	R
053D		1 W	B-C Voltage 10th Harmonic	%	---	---	---	F4	R
053E		1 W	B-C Voltage 11th Harmonic	%	---	---	---	F4	R
053F		1 W	B-C Voltage 12th Harmonic	%	---	---	---	F4	R
0540		1 W	B-C Voltage 13th Harmonic	%	---	---	---	F4	R
0541		1 W	C-A Voltage 1st Harmonic	%	---	---	---	F4	R
0542		1 W	C-A Voltage 2nd Harmonic	%	---	---	---	F4	R
0543		1 W	C-A Voltage 3th Harmonic	%	---	---	---	F4	R
0544		1 W	C-A Voltage 4th Harmonic	%	---	---	---	F4	R
0545		1 W	C-A Voltage 5th Harmonic	%	---	---	---	F4	R
0546		1 W	C-A Voltage 6th Harmonic	%	---	---	---	F4	R
0547		1 W	C-A Voltage 7th Harmonic	%	---	---	---	F4	R
0548		1 W	C-A Voltage 8th Harmonic	%	---	---	---	F4	R
0549		1 W	C-A Voltage 9th Harmonic	%	---	---	---	F4	R
054A		1 W	C-A Voltage 10th Harmonic	%	---	---	---	F4	R

EVAR - MODBUS MEMORY MAP

Add (Hex)	Type	Size	Description	Unit	Range	Step	Initial Value	Format	Read/ Write
054B		1 W	C-A Voltage 11th Harmonic	%	---	---	---	F4	R
054C		1 W	C-A Voltage 12th Harmonic	%	---	---	---	F4	R
054D		1 W	C-A Voltage 13th Harmonic	%	---	---	---	F4	R
						---	---		
0600	**Events**	1 W	Last Event Number	---	---	---	---	F2	R
0601		3 W	Last Event Clear Date & Time	---	---	---	---	F8	R
0610		1 W	Actual Event Number	---	1~65535	1	1	F2	R/W
0611		3 W	Actual Event Date & Time	---	---	---	---	F8	R
0700	**Real Time**	2 W	Sample ID Number	---	---	---	---	F2	R
0702	**Sampling**	2 W	Phase A Current Gain	---	---	---	---	F7	R
0704		32 W	Sample Buffer of Phase A Current	---	---	---	---	F27	R
0724		2 W	Phase B Current Gain	---	---	---	---	F7	R
0726		32 W	Sample Buffer of Phase B Current	---	---	---	---	F27	R
0746		2 W	Phase C Current Gain	---	---	---	---	F7	R
0748		32 W	Sample Buffer of Phase C Current	---	---	---	---	F27	R
0800		2 W	Sample ID Number	---	---	---	---	F2	R
0802		2 W	Ground Current Gain	---	---	---	---	F7	R
0804		32 W	Sample Buffer of Ground Current	---	---	---	---	F27	R
0900		2 W	Sample ID Number	---	---	---	---	F2	R
0902		2 W	Phase A Voltage Gain	---	---	---	---	F7	R
0904		32 W	Sample Buffer of Phase A Voltage	---	---	---	---	F27	R
0924		2 W	Phase B Voltage Gain	---	---	---	---	F7	R
0926		32 W	Sample Buffer of Phase B Voltage	---	---	---	---	F27	R
0946		2 W	Phase C Voltage Gain	---	---	---	---	F7	R
0948		32 W	Sample Buffer of Phase C Voltage	---	---	---	---	F27	R

EVAR DATA FORMATS

Format Code	Type	Value	Definition
F1	**Integer**		**Signed Integer Value**
			Example: -123 saved as -123
F2	**Integer**		**Unsigned Integer Value**
			Example: 123 saved as 123
F3	**Integer**		**Signed Integer Value with 1 decimals**
			Example: -1.0 saved as -10
F4	**Integer**		**Unsigned Integer Value with 1 decimals**
			Example: 1.0 saved as 10
F5	**Integer**		**Signed Integer Value with 2 decimals**
			Example: -1.00 saved as -100
F6	**Integer**		**Unsigned Integer Value with 2 decimals**
			Example: 1.00 saved as 100
F7	**Floating Point**		**(4 Byte) Floating Point Value**
			4-byte floating-point format The memory layout of 4-byte floating-point numbers is: 31 30 23 22 0 S | Exponent | Mantissa The value of the number is: $(-1)^S * 2^{(Exponent-127)} * 1.Mantissa$ Zero is represented by 4 bytes of zeros. The precision of the float operators (+ , -, *, and /) is approximately 7 decimal digits.
F8	**Clock**		**Date & Time Format**
			1st Word: bits 15–7: Event Cause (Only for EVENTS Date & Time Register) Otherwise NOT USED (0~511) See Events List; bits 6–0: YEAR (00~99) Ex. 00 = 2000, 01=2001 ... **2nd Word**: bits 15–14: Not Used; bits 13–10: MONTH (1~12); bits 9–5: DAYS (1~31/30/29/28) Depending on the Month & Year; bits 4–0: HOURS (00~23) **3th Word**: bits 15–10: MINUTES (00~59); bits 9–0: SECONDS (00.0~59.9)
F9	**16 Bits BitMap**		**System Setup Register Format**
		Bit 0 ~ Bit 3	**Not Used**
		Bit 4 ~ Bit 6	**Ground Sensing:** 0 = Disabled, 1 = Residual, 2 = Separate CT
		Bit 7 ~ Bit 9	**System Frequency:** 0 = 50hz, 1 = 60hz
		Bit 10 ~ Bit 12	**VT Conections:** 0 = None, 1 = Wye, 2 = DeltaDelta, 3 = OpenDelta, 4 = Van Only, 5 = Vab Only
		Bit 13 ~ Bit 15	**CT Conections:** 1 = 2 or 3 CTs, 2 = 1 Current Transf.
F10	**16 Bits BitMap**		**Events Recorder Configuration Register Format**
		Bit 0	Switch Inputs Events { 0 = OFF, 1 = ON }
		Bit 1	Current Protection Events { 0 = OFF, 1 = ON }
		Bit 2	Voltage Protection Events { 0 = OFF, 1 = ON }
		Bit 3	Unbalance Protection Events { 0 = OFF, 1 = ON }
		Bit 4	Frequency Protection Events { 0 = OFF, 1 = ON }
		Bit 5	Power Protection Events { 0 = OFF, 1 = ON }
		Bit 6	PowerFactor Protection Events { 0 = OFF, 1 = ON }
		Bit 7	Demand Protection Events { 0 = OFF, 1 = ON }
		Bit 8	THD Protection Events { 0 = OFF, 1 = ON }
		Bit 9	Pulse Counter Protection Events { 0 = OFF, 1 = ON }
		Bit 10	OutPuts Relays Status Change Events { 0 = OFF, 1 = ON }

EVAR DATA FORMATS			
Format Code	**Type**	**Value**	**Definition**
		Bit 11 ~ Bit 15	Not Used
F11	**16 Bits BitMap**		**Outputs Relays Configuration Register Format**
		Bit 0 ~ Bit 9	Not Used
		Bit 10	Aux.2 Activation { 0 = Latched , 1 = Unlatched }
		Bit 11	Aux.2 Non Operation State { 0 = DeEnergized , 1 = Energized }
		Bit 12	Aux.1 Activation { 0 = Latched , 1 = Unlatched }
		Bit 13	Aux.1 Non Operation State { 0 = DeEnergized , 1 = Energized }
		Bit 14	Alarm Activation { 0 = Latched , 1 = Unlatched }
		Bit 15	Alarm Non Operation State { 0 = DeEnergized , 1 = Energized }
F12	**16 Bits BitMap**		**Inputs Switch Activation Register Format**
		Bit 0	Input 1 Activattion { 0 = Open to Closed , 1 = Closed to Open }
		Bit 1	Input 2 Activattion { 0 = Open to Closed , 1 = Closed to Open }
		Bit 2	Input 3 Activattion { 0 = Open to Closed , 1 = Closed to Open }
		Bit 3	Input 4 Activattion { 0 = Open to Closed , 1 = Closed to Open }
		Bit 4 ~ Bit 15	Not Used
F13	**Integer**		**Protections Activation Format**
		0	None
		1	Alarm
		2	Aux.1
		3	Aux.2
		4	Counter
		5	New Demand Period
		6	Remote Reset
F14	**Integer**		**True or False (Yes or No) Register Format**
		0	FALSE (NO)
		1	TRUE (YES)
F15	**Integer**		**Protection Curve Definition Format**
		0	DefiniteTime
		1	ANSI Moderate Inverse
		2	ANSI Normal Inverse
		3	ANSI Very Inverse
		4	ANSI Extrem Inverse
		5	IAC Short Time
		6	IAC Inverse
		7	IAC Very Inverse
		8	IAC Extrem rInverse
		9	IEC ShortTime
		10	IEC A Normal Inverse
		11	IEC B Very Inverse
		12	IEC C Extrem Inverse
F16	**Integer**		**Voltage Protections Operation Mode**
		0	Any One
		1	Any Two
		2	Any Three
F17	**Integer**		**BaudRate Definitions**
		0	1200 Bps
		1	2400 Bps
		2	4800 Bps
		3	9600 Bps
		4	19200 Bps
		5	38400 Bps
		6	57600 Bps
F18	**Integer**		**Phase Sequence**
		0	Not Sequence
		1	ABC Sequence
		2	ACB Sequence
F19	**Integer**		**Power Factor Format**
			Signed Integer Value with 2 decimals, when PF is Negative means Leading & if PF is Positive means Lagging Ex. -96 = 0,96 Leading ; +89 = 0,89 Lagging

EVAR DATA FORMATS			
Format Code	**Type**	**Value**	**Definition**
F20	**16 Bits BitMap**		**Led Status Register Format**
		Bit 0	Alarm Led { 0 = Led OFF , 1 = Led ON }
		Bit 1	Aux1 Led { 0 = Led OFF , 1 = Led ON }
		Bit 2	Aux2 Led { 0 = Led OFF , 1 = Led ON }
		Bit 3	Normal Led { 0 = Led OFF , 1 = Led ON }
		Bit 4	Current Faults Led { 0 = Led OFF , 1 = Led ON }
		Bit 5	Voltage Faults Led { 0 = Led OFF , 1 = Led ON }
		Bit 6	Unbalance Faults Led { 0 = Led OFF , 1 = Led ON }
		Bit 7	Frequency Faults Led { 0 = Led OFF , 1 = Led ON }
		Bit 8	Power Faults Led { 0 = Led OFF , 1 = Led ON }
		Bit 9	PowerFactor Faults Led { 0 = Led OFF , 1 = Led ON }
		Bit 10	Demand Faults Led { 0 = Led OFF , 1 = Led ON }
		Bit 11	THD Faults Led { 0 = Led OFF , 1 = Led ON }
		Bit 12 ~ Bit 15	Not Used
F21	**16 Bits BitMap**		**Led Blink Status Register Format**
		Bit 0	Alarm Led { 0 = Led Not Blinking , 1 = Led Blinking }
		Bit 1	Aux1 Led { 0 = Led Not Blinking , 1 = Led Blinking }
		Bit 2	Aux2 Led { 0 = Led Not Blinking , 1 = Led Blinking }
		Bit 3	Normal Led { 0 = Led Not Blinking , 1 = Led Blinking }
		Bit 4	Current Faults Led { 0 = Led Not Blinking , 1 = Led Blinking }
		Bit 5	Voltage Faults Led { 0 = Led Not Blinking , 1 = Led Blinking }
		Bit 6	Unbalance Faults Led { 0 = Led Not Blinking , 1 = Led Blinking }
		Bit 7	Frequency Faults Led { 0 = Led Not Blinking , 1 = Led Blinking }
		Bit 8	Power Faults Led { 0 = Led Not Blinking , 1 = Led Blinking }
		Bit 9	PowerFactor Faults Led { 0 = Led Not Blinking , 1 = Led Blinking }
		Bit 10	Demand Faults Led { 0 = Led Not Blinking , 1 = Led Blinking }
		Bit 11	THD Faults Led { 0 = Led Not Blinking , 1 = Led Blinking }
		Bit 12 ~ Bit 15	Not Used
F22	**16 Bits BitMap**		**Outputs Relays Status**
		Bit 0	Alarm Relay Status { 0 = OPEN , 1 = CLOSE }
		Bit 1	Aux1 Relay Status { 0 = OPEN , 1 = CLOSE }
		Bit 2	Aux2 Relay Status { 0 = OPEN , 1 = CLOSE }
		Bit 3	Service Relay Status { 0 = CLOSE , 1 = OPEN }
		Bit 4 ~ Bit 15	Not Used
F23	**16 Bits BitMap**		**Switch Input Status Register Format**
		Bit 0	Switch Input 1 Status { 0 = OPEN , 1 = CLOSE }
		Bit 1	Switch Input 2 Status { 0 = OPEN , 1 = CLOSE }
		Bit 2	Switch Input 3 Status { 0 = OPEN , 1 = CLOSE }
		Bit 3	Switch Input 4 Status { 0 = OPEN , 1 = CLOSE }
		Bit 4 ~ Bit 15	Not Used
F24	**16 Bits BitMap**		**Status Flags 1 Format**
		Bit 0	Phase UnderCurrent { 0 = UnActive , 1 = Active }
		Bit 1	Phase OverCurrent { 0 = UnActive , 1 = Active }
		Bit 2	Ground OverCurrent { 0 = UnActive , 1 = Active }
		Bit 3	UnderVoltage { 0 = UnActive , 1 = Active }
		Bit 4	OverVoltage { 0 = UnActive , 1 = Active }
		Bit 5	PhaseReversal { 0 = UnActive , 1 = Active }
		Bit 6	Current Unbalance { 0 = UnActive , 1 = Active }
		Bit 7	Voltage Unbalance { 0 = UnActive , 1 = Active }
		Bit 8	UnderFrequency { 0 = UnActive , 1 = Active }
		Bit 9	OverFrequency { 0 = UnActive , 1 = Active }
		Bit 10	Positive KW { 0 = UnActive , 1 = Active }
		Bit 11	Negative KW { 0 = UnActive , 1 = Active }
		Bit 12	Positive KVAR { 0 = UnActive , 1 = Active }
		Bit 13	Negative KVAR { 0 = UnActive , 1 = Active }
		Bit 14	PFleading 1 { 0 = UnActive , 1 = Active }
		Bit 15	PFlagging 1 { 0 = UnActive , 1 = Active }
F25	**16 Bits BitMap**		**Status Flags 2 Format**
		Bit 0	PFleading 2 { 0 = UnActive , 1 = Active }
		Bit 1	PFlagging 2 { 0 = UnActive , 1 = Active }
		Bit 2	Phase A Current Demand { 0 = UnActive , 1 = Active }
		Bit 3	Phase B Current Demand { 0 = UnActive , 1 = Active }
		Bit 4	Phase C Current Demand { 0 = UnActive , 1 = Active }
		Bit 5	Ground Current Demand { 0 = UnActive , 1 = Active }
		Bit 6	KW Demand { 0 = UnActive , 1 = Active }

EVAR DATA FORMATS			
Format Code	**Type**	**Value**	**Definition**
		Bit 7	KVAR Demand { 0 = UnActive , 1 = Active }
		Bit 8	KVA Demand { 0 = UnActive , 1 = Active }
		Bit 9	Current THD { 0 = UnActive , 1 = Active }
		Bit 10	Voltage THD { 0 = UnActive , 1 = Active }
		Bit 11	Pulse Counter { 0 = UnActive , 1 = Active }
		Bit 12	Input Switch 1 { 0 = UnActive , 1 = Active }
		Bit 13	Input Switch 2 { 0 = UnActive , 1 = Active }
		Bit 14	Input Switch 3 { 0 = UnActive , 1 = Active }
		Bit 15	Input Switch 4 { 0 = UnActive , 1 = Active }
F26	**16 Bits BitMap**		**Status Flags 3 Format**
		Bit 0 ~ Bit 15	Not Used (Reserved for Future Expansion)
F27	**Integer**		**Real Time Sampling Buffer Format**
			Array of **32** Unsigned Signed Integer Values that conforms one complit WaveForm of the signal. Note: The WaveForm has a Offset that generaly is about "511" decimal.

Event Cause List :	
0	No Event
1	Events Clear
4	Alarm Relay ON
5	Alarm Relay OFF
6	Aux.1 Relay ON
7	Aux.1 Relay OFF
8	Aux.2 Relay ON
9	Aux.2 Relay OFF
10	Phase UnderCurrent Protection
11	Phase OverCurren Protection
12	Ground OverCurren Protection
13	Phase UnderVolatege Protection
14	Phase OverVolatege Protection
15	Phase Reversal Protection
16	Current Unbalance Protection
17	Voltage Unbalance Protection
18	UnderFrequency Protection
19	OverFrequency Protection
20	Positive Real Power Protection
21	Negative Real Power Protection
22	Positive Reactive Power Protection
23	Negative Reactive Power Protection
24	Power Factor Leading 1 Protection
25	Power Factor Lagging 1 Protection
26	Power Factor Leading 2 Protection
27	Power Factor Lagging 2 Protection
28	Current THD Protection
29	Voltage THD Protection
30	Pulse Counter Protection
31	Phase A Current Demand Protection
32	Phase B Current Demand Protection
33	Phase C Current Demand Protection
34	Ground Current Demand Protection
35	Active Power Demand Protection
36	Reactive Power Demand Protection
37	Aparent Power Demand Protection
38	Switch Input 1 Activation
39	Switch Input 2 Activation
40	Switch Input 3 Activation
41	Switch Input 4 Activation