PFC24 TCR

MODBUS

USER MANUAL

REV01- MARCH 2017

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COMMUNICATION

PFC24S-TCR relays are designed to communicate with the RS485 data bus in series with Modbus[1] RTU protocol.

The PFC24S-TCR stores the data that it can use for communication in the recording cells, making it possible to access them with the parameters of the protocol.

PFC24S-TCR can be set to different parity bit and baud rate options for use in different devices.

In communication, there are some restrictions due to different reasons. It allows interpretation of errors in case of violation of these restrictions by returning error messages. It is advised that software that will communicate with PFC24S-TCR should be able to take into account the restrictions and interpret the returns.

This document is about communication method with Modbus RTU protocol, register addresses of PFC24S-TCR and related restrictions.

Modbus

Modbus is a serial communication protocol developed by Modicon for use with PLCs in 1979. Modbus can provide communication between 247 devices. The operational logic is based on data exchange between a master device and more devices(slaves) connected to the master device on the same network.

Modbus protocol has many versions; PFC24S-TCR uses Modbus RTU among these versions.

Data Model

The Modbus data model is created by separating data according to the distinguishing characteristic of the data. Accordingly, 4 basic data tables have occurred.

Table Name	Data Type	Features	Explanation
Discrete Input	bit	Read-Only	It covers only the readable bits of the system.
Coils	bit	Read and Write	It covers the exchangeable bits of the system.
Analog Recording Cells	16-bit	Read-Only	It covers the readable analog data of the system.
Writable Recording Cells	16-bit	Read and Write	Reserved modifiable registers of the system.

Table 1: Modbus Data Model

[1] Detailed information for modbus: http://www.modbus.org/docs/Modbus_Application_Protocol_V1_1b.pdf

Discrete input values hold values used as single-bit status indicators. Since there is no such status indicator variable in PFC24S-TCR, there is not any defined discrete input in this version.

The coils are defined in the modbus as user-modifiable values. Step status and digital inputs/ outputs in the PFC24S-TCR are mapped as coils.

Analog Recording Cells: These units are 16 bits long and hold values that cannot be modified by the user. Some values in the PFC24S-TCR are divided into 2-bit recording cells by the data coding method because the lengths are 32-bit (4-byte).

Writeable Registry Cells: These units are 16-bit long and holds user-modifiable values. The PFC24S-TCR has a total of 249 recordable cells for different variables. Some recording cells in the device have 32-bit (4-byte) lengths and are divided into 2-bit recording cells by data coding method. Since the information held here will directly affect the operation of the device, a write request should not be sent without confirmation during operation.

Data Codes

Modbus generate data frames by encoding with "Big-Endian" representations for addresses and the data. For the data that do not fit in a byte, the big-bytes are send as the first bytes.

Example:

Register Size	Value	MSB	LSB
16-bit (2-byte)	**0x2450**	first byte **0x24**	last byte **0x50**

Figure 1: "Big-Endian" Representation

Addressing Model

Separate registers are used for each data model in the device. Therefore, there is an addressing starting from "0" to "65535" for each data model. This addressing model is configured in accordance with the "IEC-61131 object" standard.

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Necessary addresses and data types in the device are shown on the relevant tables.

Functions

The device interprets the data frame sent by the mainframe and generates an appropriate response. The second byte of sent data frame gives information that will be performed by the device.

The vast majority of the basic functions that provide Modbus communication are pre-defined and standardized. Some of these functions can be used for PFC24S-TCR, but others are not available because they indicate non-existent registers and functional features.

02 function is used to read discrete inputs but it has an invalid function value because there are no discrete inputs to be read on the device. Modbus can provide up to 65 predefined functions, but not these

functions are standard, as well as allowing user-defined functions after 65. Function values can have up to 255 values, starting with 01, allowing a byte in a data frame.

Functions that can be used in the device:

Function 01 – The discrete values used to **Read the Coil Values** are processed in bytes and returned as data blocks. More information on this topic can be found under the heading “Discrete Inputs” entry.

Function 03 – The function used to read the **Writable Recording Cells** can be used to read a single register or multiple register. The return values return as a data frame.

Function 04 –The function used to read the **Analog Recording Cells** allows single or multiple reads.

Function 06 –Single Recording Cell Writing function is used to assign a new value to one of the registers that can be written.

The functions except above functions are not included in this user manual because they are not used for this device.

Data Frame

Modbus provides serial communication by sending and receiving data as block. The first byte of this block carries the address information. So, devices that communicate with Modbus must have an address value less than 255(0xFF), which is the maximum value that a byte can represent.

The second byte of data frame carries function information. The data received after the function byte are evaluated in different ways according to the function information

The last two cells (2 bytes) of each data frame are reserved for CRC (Cyclic Redundancy Check) values, which are special mathematical operations designed for error checking and are frequently referred to in serial communication protocols.

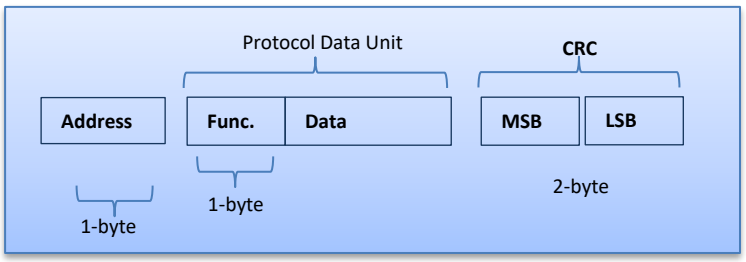

Figure 2: Modbus Data Frame

Restrictions

In addition to general Modbus restrictions, there are different restrictions on device communication. These restrictions are important for communication and healthy operation of the device.

Modbus Restrictions

Modbus protocols can only be realized the communication between devices under certain conditions. For example, if the message is send to the device with a wrong address by a master device, it cannot be returned.

In addition, Modbus also includes serial communication restrictions, so it can send and received up to 256 bytes data frame. In this device, up to 60 bytes message frames can be carried.

CRC (Cyclic Redundancy Check)

The last two bytes of each message is reserved for CRC. The control is done by these two bytes whether the message block is damaged and changed for any reason.

The CRC is valid used method of fault control method for digital communication and is also valid method for Modbus. If a data frame with fault is send, a fault message will be returned.

Wrong and Undefined Functions

Even if the wrong and undefined functions are routed to the correct device address, no action will be taken and an error will be returned. Therefore, it is important to use defined functions in the specified way.

Infraction of the Read-Only Feature

If it is tried to write a value to the only-read data structure, this message will be interpreted but the value will not be written. In such a case, there will be a fault return due to the Modbus protocol.

PFC24S-TCR Restrictions

In addition to device protocol dependencies, there are registers that are subject to some restrictions and special writing rules due to capacity of device, usage safety and structural safety.

The device allows 60 bytes of data to be exchanged. This restriction has been made so that the number of registers is low and communication can run smoothly

The device can provide 6 baud rates (2400, 4800, 9600, 19200, 38400, 57600).

There are 4 parity bits and stop bit options (8E1, 8O1, 8N1, 8N2) for communication. If the registered cell value is 0, it is 8E1, 1 is it is 8O1, 2 is 8N1, 3 is it is 8N2.

8E1: 8-bit data even parity 1 stop bit

8O1: 8-bit data odd parity 1 stop bit

8N1: 8-bit data no parity 1 stop bit

8N2: 8-bit data no parity 2 stop bit

Coils

There are 28 coils defined in the device.

Each coil has a bit value and is processed into bytes in the data blocks. Each byte tries to perform 8-bit operation from left to right as if it were the smallest leftmost address value.

Address	Coil	0 equivalent	1 equivalent
0	Step 1 Status	Out of Circuit	Run
1	Step 2 Status	Out of Circuit	Run
2	Step 3 Status	Out of Circuit	Run
3	Step 4 Status	Out of Circuit	Run
4	Step 5 Status	Out of Circuit	Run
5	Step 6 Status	Out of Circuit	Run
6	Step 7 Status	Out of Circuit	Run
7	Step 8 Status	Out of Circuit	Run
8	Step 9 Status	Out of Circuit	Run
9	Step 10 Status	Out of Circuit	Run
10	Step 11 Status	Out of Circuit	Run
11	Step 12 Status	Out of Circuit	Run
12	Step 13 Status	Out of Circuit	Run
13	Step 14 Status	Out of Circuit	Run
14	Step 15 Status	Out of Circuit	Run
15	Step 16 Status	Out of Circuit	Run
16	Step 17 Status	Out of Circuit	Run
17	Step 18 Status	Out of Circuit	Run
18	Step 19 Status	Out of Circuit	Run
19	Step 20 Status	Out of Circuit	Run
20	Step 21 Status	Out of Circuit	Run
21	Step 22 Status	Out of Circuit	Run
22	Step 23 Status	Out of Circuit	Run
23	Step 24 Status	Out of Circuit	Run
24	OUTPUT 1	Off	On
25	OUTPUT 2	Off	On
26	INPUT 1	Off	On
27	INPUT 2	Off	On

Table 2: Coil Table

Reading Function

01 function is used to read coils. On return of the function a bit is allocated in the data field for each coil. Since the return of the data blocks will be in bytes, the coil values are resolved in the return message.

Example: The coils are wanted to read with using 01 function;

If it is wanted to read 6 coils started from the device address 4 and 0,

Sent Message: **04 01 00 00 00 06 BC 5D -** This is the display in hexadecimal format.

04 – Device address

01 – Function code

0000 – First coil address

0006 – Amount of the total coil wanted to read

BC5D – CRC fault control bytes

Returned Message: **04 01 01 04 50 87** - This is the display in hexadecimal format.

04 – Device address

01 – Function code

01 – The number of bytes of incoming data has

04 – Incoming byte value (0000 0101) Because the coil value is read from 0 to 5, the first two bits from the left are undefined as 0. The lowest coil address is read starting from the left. Accordingly, the 0th coil value is 0, the 1st coil value is 0, the 2nd coil value is 1, the 3rd value is 0, the 4th value is 0, and the 5th value is 1. This knowledge shows that the 2nd and 5th step are active.

5087 - CRC fault control bytes

If the total size of the values to be read is longer than one byte, the data bits after the largest addressed coils are returned as "0". If it is wanted to read 11 coils and assume that the return value is **"04 01 02 04 05 7B 3F":**

04 – Device address

01 – Function Code

02 – The number of bytes of incoming data has

04 – (**0000 0100**) between 7-0 coil values

05 – (**0000 0101**) between 10-8 coil values, it indicates space 5 bits on the left.

Writable Recording Cells

There are 249 writable recording cells in this device.

Writable recording cells are both writable and readable recording cells. They hold different values from device address to thermal protection values. All of them has 16-bit digital data type.

Function 03 is used to read writeable cells, and function 06 is used to write values to the writable cells. However, it should not be forgotten that when they change their values, there are also fields that directly affect communication. If the address value is changed, the newly registered value must be written to the address of the device. It should not be forgotten that communication will not be possible otherwise. To avoid problems like this, be sure to write the values before writing.

Address	Writable Cell Name	Step Number	Explanation
1	Step Type	1	0: Inductive 1: Capacitive
2	Step Status	1	0: Active 1: Constant 2: Passive
3	Step Power (kVAr)	1	Integer Part (see Explanation 1)
4	Step Power (kVAr)	1	Decimal Part (see Explanation 1)
5	Step Connection	1	0: AN - 1: BN - 2: CN - 3: AB - 4: BC - 5: CA - 6: 3P
6	Run the Step	1	Value can be entered between 0-999 (waiting time)
7	Out of Circuit the Step	1	Value can be entered between 0-999 (waiting time)
8	Time Unit	1	0: Minute - 1: Second - 2: Millisecond
9	Step Type	2	0: Inductive 1: Capacitive
10	Step Status	2	0: Active 1: Constant 2: Passive
11	Step Power (kVAr)	2	Integer Part (see Explanation 1)
12	Step Power (kVAr)	2	Decimal Part (see Explanation 1)
13	Step Connection	2	0: AN - 1: BN - 2: CN - 3: AB - 4: BC - 5: CA - 6: 3P
14	Run the Step	2	Value can be entered between 0-999 (waiting time)
15	Out of Circuit the Step	2	Value can be entered between 0-999 (waiting time)
16	Time Unit	2	0: Minute - 1: Second - 2: Millisecond
17	Step Type	3	0: Inductive 1: Capacitive
18	Step Status	3	0: Active 1: Constant 2: Passive
19	Step Power (kVAr)	3	Integer Part (see Explanation 1)
20	Step Power (kVAr)	3	Decimal Part (see Explanation 1)
21	Step Connection	3	0: AN - 1: BN - 2: CN - 3: AB - 4: BC - 5: CA - 6: 3P
22	Run the Step	3	Value can be entered between 0-999 (waiting time)
23	Out of Circuit the Step	3	Value can be entered between 0-999 (waiting time)
24	Time Unit	3	0: Minute - 1: Second - 2: Millisecond
25	Step Type	4	0: Inductive 1: Capacitive
26	Step Status	4	0: Active 1: Constant 2: Passive
27	Step Power (kVAr)	4	Integer Part (see Explanation 1)
28	Step Power (kVAr)	4	Decimal Part (see Explanation 1)

29	Step Connection	4	0: AN - 1: BN - 2: CN - 3: AB - 4: BC - 5: CA - 6: 3P
30	Run the Step	4	Value can be entered between 0-999 (waiting time)
31	Out of Circuit the Step	4	Value can be entered between 0-999 (waiting time)
32	Time Unit	4	0: Minute - 1: Second - 2: Millisecond
33	Step Type	5	0: Inductive 1: Capacitive
34	Step Status	5	0: Active 1: Constant 2: Passive
35	Step Power (kVAr)	5	Integer Part (see Explanation 1)
36	Step Power (kVAr)	5	Decimal Part (see Explanation 1)
37	Step Connection	5	0: AN - 1: BN - 2: CN - 3: AB - 4: BC - 5: CA - 6: 3P
38	Run the Step	5	Value can be entered between 0-999 (waiting time)
39	Out of Circuit the Step	5	Value can be entered between 0-999 (waiting time)
40	Time Unit	5	0: Minute - 1: Second - 2: Millisecond
41	Step Type	6	0: Inductive 1: Capacitive
42	Step Status	6	0: Active 1: Constant 2: Passive
43	Step Power (kVAr)	6	Integer Part (see Explanation 1)
44	Step Power (kVAr)	6	Decimal Part (see Explanation 1)
45	Step Connection	6	0: AN - 1: BN - 2: CN - 3: AB - 4: BC - 5: CA - 6: 3P
46	Run the Step	6	Value can be entered between 0-999 (waiting time)
47	Out of Circuit the Step	6	Value can be entered between 0-999 (waiting time)
48	Time Unit	6	0: Minute - 1: Second - 2: Millisecond
49	Step Type	7	0: Inductive 1: Capacitive
50	Step Status	7	0: Active 1: Constant 2: Passive
51	Step Power (kVAr)	7	Integer Part (see Explanation 1)
52	Step Power (kVAr)	7	Decimal Part (see Explanation 1)
53	Step Connection	7	0: AN - 1: BN - 2: CN - 3: AB - 4: BC - 5: CA - 6: 3P
54	Run the Step	7	Value can be entered between 0-999 (waiting time)
55	Out of Circuit the Step	7	Value can be entered between 0-999 (waiting time)
56	Time Unit	7	0: Minute - 1: Second - 2: Millisecond
57	Step Type	8	0: Inductive 1: Capacitive
58	Step Status	8	0: Active 1: Constant 2: Passive
59	Step Power (kVAr)	8	Integer Part (see Explanation 1)
60	Step Power (kVAr)	8	Decimal Part (see Explanation 1)
61	Step Connection	8	0: AN - 1: BN - 2: CN - 3: AB - 4: BC - 5: CA - 6: 3P
62	Run the Step	8	Value can be entered between 0-999 (waiting time)
63	Out of Circuit the Step	8	Value can be entered between 0-999 (waiting

			time)
64	Time Unit	8	0: Minute - 1: Second - 2: Millisecond
65	Step Type	9	0: Inductive 1: Capacitive
66	Step Status	9	0: Active 1: Constant 2: Passive
67	Step Power (kVAr)	9	Integer Part (see Explanation 1)
68	Step Power (kVAr)	9	Decimal Part (see Explanation 1)
69	Step Connection	9	0: AN - 1: BN - 2: CN - 3: AB - 4: BC - 5: CA - 6: 3P
70	Run the Step	9	Value can be entered between 0-999 (waiting time)
71	Out of Circuit the Step	9	Value can be entered between 0-999 (waiting time)
72	Time Unit	9	0: Minute - 1: Second - 2: Millisecond
73	Step Type	10	0: Inductive 1: Capacitive
74	Step Status	10	0: Active 1: Constant 2: Passive
75	Step Power (kVAr)	10	Integer Part (see Explanation 1)
76	Step Power (kVAr)	10	Decimal Part (see Explanation 1)
77	Step Connection	10	0: AN - 1: BN - 2: CN - 3: AB - 4: BC - 5: CA - 6: 3P
78	Run the Step	10	Value can be entered between 0-999 (waiting time)
79	Out of Circuit the Step	10	Value can be entered between 0-999 (waiting time)
80	Time Unit	10	0: Minute - 1: Second - 2: Millisecond
81	Step Type	11	0: Inductive 1: Capacitive
82	Step Status	11	0: Active 1: Constant 2: Passive
83	Step Power (kVAr)	11	Integer Part (see Explanation 1)
84	Step Power (kVAr)	11	Decimal Part (see Explanation 1)
85	Step Connection	11	0: AN - 1: BN - 2: CN - 3: AB - 4: BC - 5: CA - 6: 3P
86	Run the Step	11	Value can be entered between 0-999 (waiting time)
87	Out of Circuit the Step	11	Value can be entered between 0-999 (waiting time)
88	Time Unit	11	0: Minute - 1: Second - 2: Millisecond
89	Step Type	12	0: Inductive 1: Capacitive
90	Step Status	12	0: Active 1: Constant 2: Passive
91	Step Power (kVAr)	12	Integer Part (see Explanation 1)
92	Step Power (kVAr)	12	Decimal Part (see Explanation 1)
93	Step Connection	12	0: AN - 1: BN - 2: CN - 3: AB - 4: BC - 5: CA - 6: 3P
94	Run the Step	12	Value can be entered between 0-999 (waiting time)
95	Out of Circuit the Step	12	Value can be entered between 0-999 (waiting time)
96	Time Unit	12	0: Minute - 1: Second - 2: Millisecond
97	Step Type	13	0: Inductive 1: Capacitive
98	Step Status	13	0: Active 1: Constant 2: Passive

99	Step Power (kVAr)	13	Integer Part (see Explanation 1)
100	Step Power (kVAr)	13	Decimal Part (see Explanation 1)
101	Step Connection	13	0: AN - 1: BN - 2: CN - 3: AB - 4: BC - 5: CA - 6: 3P
102	Run the Step	13	Value can be entered between 0-999 (waiting time)
103	Out of Circuit the Step	13	Value can be entered between 0-999 (waiting time)
104	Time Unit	13	0: Minute - 1: Second - 2: Millisecond
105	Step Type	14	0: Inductive 1: Capacitive
106	Step Status	14	0: Active 1: Constant 2: Passive
107	Step Power (kVAr)	14	Integer Part (see Explanation 1)
108	Step Power (kVAr)	14	Decimal Part (see Explanation 1)
109	Step Connection	14	0: AN - 1: BN - 2: CN - 3: AB - 4: BC - 5: CA - 6: 3P
110	Run the Step	14	Value can be entered between 0-999 (waiting time)
111	Out of Circuit the Step	14	Value can be entered between 0-999 (waiting time)
112	Time Unit	14	0: Minute - 1: Second - 2: Millisecond
113	Step Type	15	0: Inductive 1: Capacitive
114	Step Status	15	0: Active 1: Constant 2: Passive
115	Step Power (kVAr)	15	Integer Part (see Explanation 1)
116	Step Power (kVAr)	15	Decimal Part (see Explanation 1)
117	Step Connection	15	0: AN - 1: BN - 2: CN - 3: AB - 4: BC - 5: CA - 6: 3P
118	Run the Step	15	Value can be entered between 0-999 (waiting time)
119	Out of Circuit the Step	15	Value can be entered between 0-999 (waiting time)
120	Time Unit	15	0: Minute - 1: Second - 2: Millisecond
121	Step Type	16	0: Inductive 1: Capacitive
122	Step Status	16	0: Active 1: Constant 2: Passive
123	Step Power (kVAr)	16	Integer Part (see Explanation 1)
124	Step Power (kVAr)	16	Decimal Part (see Explanation 1)
125	Step Connection	16	0: AN - 1: BN - 2: CN - 3: AB - 4: BC - 5: CA - 6: 3P
126	Run the Step	16	Value can be entered between 0-999 (waiting time)
127	Out of Circuit the Step	16	Value can be entered between 0-999 (waiting time)
128	Time Unit	16	0: Minute - 1: Second - 2: MiliSecond
129	Step Type	17	0: Inductive 1: Capacitive
130	Step Status	17	0: Active 1: Constant 2: Passive
131	Step Power (kVAr)	17	Integer Part (see Explanation 1)
132	Step Power (kVAr)	17	Decimal Part (see Explanation 1)
133	Step Connection	17	0: AN - 1: BN - 2: CN - 3: AB - 4: BC - 5: CA - 6: 3P
134	Run the Step	17	Value can be entered between 0-999 (waiting

			time)
135	Out of Circuit the Step	17	Value can be entered between 0-999 (waiting time)
136	Time Unit	17	0: Minute - 1: Second - 2: Millisecond
137	Step Type	18	0: Inductive 1: Capacitive
138	Step Status	18	0: Active 1: Constant 2: Passive
139	Step Power (kVAr)	18	Integer Part (see Explanation 1)
140	Step Power (kVAr)	18	Decimal Part (see Explanation 1)
141	Step Connection	18	0: AN - 1: BN - 2: CN - 3: AB - 4: BC - 5: CA - 6: 3P
142	Run the Step	18	Value can be entered between 0-999 (waiting time)
143	Out of Circuit the Step	18	Value can be entered between 0-999 (waiting time)
144	Time Unit	18	0: Minute - 1: Second - 2: Millisecond
145	Step Type	19	0: Inductive 1: Capacitive
146	Step Status	19	0: Active 1: Constant 2: Passive
147	Step Power (kVAr)	19	Integer Part (see Explanation 1)
148	Step Power (kVAr)	19	Decimal Part (see Explanation 1)
149	Step Connection	19	0: AN - 1: BN - 2: CN - 3: AB - 4: BC - 5: CA - 6: 3P
150	Run the Step	19	Value can be entered between 0-999 (waiting time)
151	Out of Circuit the Step	19	Value can be entered between 0-999 (waiting time)
152	Time Unit	19	0: Minute - 1: Second - 2: Millisecond
153	Step Type	20	0: Inductive 1: Capacitive
154	Step Status	20	0: Active 1: Constant 2: Passive
155	Step Power (kVAr)	20	Integer Part (see Explanation 1)
156	Step Power (kVAr)	20	Decimal Part (see Explanation 1)
157	Step Connection	20	0: AN - 1: BN - 2: CN - 3: AB - 4: BC - 5: CA - 6: 3P
158	Run the Step	20	Value can be entered between 0-999 (waiting time)
159	Out of Circuit the Step	20	Value can be entered between 0-999 (waiting time)
160	Time Unit	20	0: Minute - 1: Second - 2: Millisecond
161	Step Type	21	0: Inductive 1: Capacitive
162	Step Status	21	0: Active 1: Constant 2: Passive
163	Step Power (kVAr)	21	Integer Part (see Explanation 1)
164	Step Power (kVAr)	21	Decimal Part (see Explanation 1)
165	Step Connection	21	0: AN - 1: BN - 2: CN - 3: AB - 4: BC - 5: CA - 6: 3P
166	Run the Step	21	Value can be entered between 0-999 (waiting time)
167	Out of Circuit the Step	21	Value can be entered between 0-999 (waiting time)
168	Time Unit	21	0: Minute - 1: Second - 2: Millisecond

169	Step Type	22	0: Inductive 1: Capacitive
170	Step Status	22	0: Active 1: Constant 2: Passive
171	Step Power (kVAr)	22	Integer Part (see Explanation 1)
172	Step Power (kVAr)	22	Decimal Part (see Explanation 1)
173	Step Connection	22	0: AN - 1: BN - 2: CN - 3: AB - 4: BC - 5: CA - 6: 3P
174	Run the Step	22	Value can be entered between 0-999 (waiting time)
175	Out of Circuit the Step	22	Value can be entered between 0-999 (waiting time)
176	Time Unit	22	0: Minute - 1: Second - 2: Millisecond
177	Step Type	23	0: Inductive 1: Capacitive
178	Step Status	23	0: Active 1: Constant 2: Passive
179	Step Power (kVAr)	23	Integer Part (see Explanation 1)
180	Step Power (kVAr)	23	Decimal Part (see Explanation 1)
181	Step Connection	23	0: AN - 1: BN - 2: CN - 3: AB - 4: BC - 5: CA - 6: 3P
182	Run the Step	23	Value can be entered between 0-999 (waiting time)
183	Out of Circuit the Step	23	Value can be entered between 0-999 (waiting time)
184	Time Unit	23	0: Minute - 1: Second - 2: Millisecond
185	Step Type	24	0: Inductive 1: Capacitive
186	Step Status	24	0: Active 1: Constant 2: Passive
187	Step Power (kVAr)	24	Integer Part (see Explanation 1)
188	Step Power (kVAr)	24	Decimal Part (see Explanation 1)
189	Step Connection	24	0: AN - 1: BN - 2: CN - 3: AB - 4: BC - 5: CA - 6: 3P
190	Run the Step	24	Value can be entered between 0-999 (waiting time)
191	Out of Circuit the Step	24	Value can be entered between 0-999 (waiting time)
192	Time Unit	24	0: Minute - 1: Second - 2: Millisecond
193	Cos(Phi1)		It can be entered 0 or 1 (Integer Part)
194	Cos(Phi1) Decimal		(see Explanation 1)
195	Sign Cos1		0: Inductive - 1: Capacitive
196	Cos(Phi2)		It can be entered 0 or 1 (Integer Part)
197	Cos(Phi2) Decimal		Value can be entered between 0-99(see Explanation 1)
198	Sign Cos2		0: Inductive - 1: Capacitive
199	Reference Var 1		It can be entered between 0-999
200	Reference Modu İşaret1		0: Inductive - 1: Capacitive
201	Reference Var 2		It can be entered between 0 or 999
202	Reference Modu İşaret2		0: Inductive - 1: Capacitive
203	Unusable		
204	Unusable		

205	Unusable		
206	Unusable		
207	Target		0: Cos(Phi) - 1: Reference Mode
208	Current Transformer		It can be entered between 0-999
209	Current Transformer Connection		0: Three phase - 1: Single Phase
210	Voltage Transformer		It can be entered between 0-999
211	Voltage Transformer Connection		0: Three Phase N - 1: Single Phase N - 2: Phase
212	Star TCR Power		It can be entered between 0-9999(Integer Part)
213	Star TCR Power Decimal		It can be entered between 0-99(see Explanation 1)
214	Star TCR Status		0: Passive - 1: Active
215	Update Star Kp Ki	Only Writable	1: Makes active
216	Delta TCR Power		It can be entered between 0-9999(Integer Part)
217	Delta TCR Power Decimal		It can be entered between 0-99(see Explanation 1)
218	Delta TCR Status		0: Passive - 1: Active
219	Update Delta Kp Ki	Only Writable	1: Makes active
220	Harmonic Protection		It can be entered 0 or 99
221	Har. Protection Status		0: Passive - 1: Fault - 2: Alarm
222	Har. Protection Output		0: Passive - 1: O1 - 2: O2
223	Overvoltage Protection		It can be entered between 0-99999
224	O. Volt. Protection Status		0: Passive - 1: Fault - 2: Alarm
225	O. Volt. Protection Output		0: Passive - 1: O1 - 2: O2
226	Low Voltage Protection		It can be entered between 0-99999
227	L. Volt. Protection Status		0: Passive - 1: Fault - 2: Alarm
228	L. Volt. Protection Output		0: Passive - 1: O1 - 2: O2
229	Over Current Protection		It can be entered between 0-9999
230	O. Cur. Protection Status		0: Passive - 1: Fault - 2: Alarm
231	O. Cur. Protection Output		0: Passive - 1: O1 - 2: O2
232	Temperature Protection		It can be entered between 0-99
233	Temp. Protection Status		0: Passive - 1: Fault - 2: Alarm
234	Temp. Protection Output		0: Passive - 1: O1 - 2: O2
235	FAN ON		It can be entered between 0-99
236	FAN OFF		It can be entered between 0-99
237	FAN Protection Output		0: Passive - 1: O1 - 2: O2
238	Unusable		0: Passive - 1: Active
239	Unusable		0: Passive - 1: Active
240	Compensation Status		0: Passive - 1: Active
241	Password		It can be entered between 0-9999

242	Language		0: English - 1: Turkish
243	Address		It can be entered between 0-255
244	Baud Rate		0: 2400 - 1: 4800 - 2: 9600 - 3: 19200 - 4: 38400 - 5: 57600
245	Stop bit and Parity Bit		0: 8E1 - 1: 8O1 - 2: 8N1 - 3: 8N2
246	Energy Reset Period		It can be entered between 0-99
247	Energy Reset Period Time		0: Day - 1: Month - 2: Year
248	Device Reset Period		It can be entered between 0-99
249	Device Reset Period Time		0: sec - 1: min

Table 3: Writable Recording Cells Table

Explanation 1: The decimal part of this type of recording cells refers to the next 2 digits after the comma. The integer part of the recording cell with a value of "2.05" is "2" and the decimal part is "5".

If a value such as "3.54" is to be written to this type of recording cell, "3" should be written in the integer part of the recording cell, and "54" in the decimal part.

Special Recording Cell Values

Baud: It is a total of 6 elements holding rates ranging from 4800 kbps to 38400 kbps.

Baud recording cell if 0, it is 2400,

if 1, it is 4800,

if 2, it is 9600,

if 3, it is 19200,

if 4, it is 38400,

if 5, 57600 will be selected. When a value greater 5 is written to the Baud register cell, the Baud setting does not change and an error message is received.

Stop Bit and Parity: It can be written values to the recording cell that holds values of stop bit and parity.

0: 8-bit data length, even parity bit and 1 stop bit (8E1)
1: 8-bit data length, odd parity bit and 1 stop bit (8O1)
2: 8-bit data length, none parity bit and 1 stop bit (8N1)
3: 8-bit data length, none parity bit and 2 stop bit (8N2)

TCR KP-KI Update: These recording cells are found for both the star TCR and the delta TCR, and allow the coefficients used when updating to be updated according to the TCR power. KP and KI values are automatically calculated when 1 is sent to these recording cells.

Reading Function

Read function 03 is used for writable recording cells.

Example:

If 2 recording cells are read that the device address started from 2 and 1.

Send Message: **02 03 00 01 00 05 D4 3A**

02 – Device address

03 – Function code

0001 – The first recording cell address that is wanted to read.

0005 – The first recording cell amount that is wanted to read.

D43A – CRC fault control bytes.

Returned Message : **02 03 0A 00 00 00 00 00 01 00 0A 00 00 3C B7**

02 – Device address

03 – Function code

0A – The data byte number informs that the next 4 bytes will hold the register cell data.

0000 – The first recording cell is wanted to read 1. ***Step*** value (0000 -> Inductive)

0000 – The second recording cell is wanted to read *1.* ***Step Status*** value (0000 -> Active)

0001 –The third recording cell *1.* ***Step Power Integer Part*** value (0001 -> 1)

000A – The fourth recording cell *1* ***Step Power Decimal Part*** value (000A -> 10)

Step power is interpreted as 1.10 kVAr.

0000 – The fifth recording cell 1. ***Step Connection Type*** value (0000 -> AN)

3CB7 – CRC fault control bytes

Writable Function

The value of the function that writes value to the register cell is 06.

Example:

If the integer part of device address and step power that is third recording cell is wanted to be 5,

Send message: **02 06 00 03 00 05 B9 FA**

02 – Device address

06 – Function code

0003 – Address of recording cell

0005 – Write value

B9FA - CRC fault control bytes

Returned Message: 02 06 00 03 00 05 B9 FA if there is no problem with the writing operation, send message will be the same with returned message. If there is a problem, fault message will return.

If writing value operation fails in the writing functions, 5-byte fault message will return.

Analog Recording Cells

There are total of 657 analog input recording cells have been introduced below table. These recording cells hold only readable input values. They hold different type data that each one is 32- bit length.

Two recording cells must be read together for full reading of any of the analog values. If it is needed, it can be read only high values or only low values of a value.

Address	ANALOG INPUTS	Explanations
0	Phase-Neutral Voltage A (V)	
1	Phase-Neutral Voltage A (V)	Decimal (see Explanation 2)
2	Phase-Neutral Voltage B (V)	
3	Phase-Neutral Voltage B (V)	Decimal (see Explanation 2)
4	Phase-Neutral Voltage C (V)	
5	Phase-Neutral Voltage C (V)	Decimal (see Explanation 2)
6	Phase-Phase Voltage AB (V)	
7	Phase-Phase Voltage AB (V)	Decimal (see Explanation 2)
8	Phase-Phase Voltage BC (V)	
9	Phase-Phase Voltage BC (V)	Decimal (see Explanation 2)
10	Phase-Phase Voltage CA (V)	
11	Phase-Phase Voltage CA (V)	Decimal (see Explanation 2)
12	Voltage Neutral (V)	
13	Voltage Neutral (V)	Decimal (see Explanation 2)
14	Current A (A)	
15	Current A (A)	Decimal (see Explanation 2)
16	Current B (A)	
17	Current B (A)	Decimal (see Explanation 2)
18	Current C (A)	
19	Current C (A)	Decimal (see Explanation 2)
20	Earth Current (A)	
21	Earth Current (A)	Decimal (see Explanation 2)
22	Active Power A (kW)	
23	Active Power A (kW)	Decimal (see Explanation 3)

24	Active Power B (kW)	
25	Active Power B (kW)	Decimal (see Explanation 3)
26	Active Power C (kW)	
27	Active Power C (kW)	Decimal (see Explanation 3)
28	Total Active Power (kW)	
29	Total Active Power (kW)	Decimal (see Explanation 3)
30	Reactive Power A (kVAr)	
31	Reactive Power A (kVAr)	Decimal (see Explanation 3)
32	Reactive Power B (kVAr)	
33	Reactive Power B (kVAr)	Decimal (see Explanation 3)
34	Reactive Power C (kVAr)	
35	Reactive Power C (kVAr)	Decimal (see Explanation 3)
36	Total Reactive Power (kVAr)	
37	Total Reactive Power (kVAr)	Decimal (see Explanation 3)
38	Apparent Power A (kVA)	
39	Apparent Power A (kVA)	Decimal (see Explanation 3)
40	Apparent Power B (kVA)	
41	Apparent Power B (kVA)	Decimal (see Explanation 3)
42	Apparent Power C (kVA)	
43	Apparent Power C (kVA)	Decimal (see Explanation 3)
44	Total Apparent Power (kVA)	
45	Total Apparent Power (kVA)	Decimal (see Explanation 3)
46	Power Factor A	
47	Power Factor A	Decimal (see Explanation 5)
48	Power Factor B	
49	Power Factor B	Decimal (see Explanation 5)
50	Power Factor C	
51	Power Factor C	Decimal (see Explanation 5)
52	Frequency (Hz)	
53	Frequency (Hz)	Decimal (see Explanation 3)
54	Unusable	
56	Unusable	
58	IA_THD Harmonic	
59	IA_THD Harmonic	Decimal (see Explanation 2)
60	IA_1 Harmonic	
61	IA_1 Harmonic	Decimal (see Explanation 2)
62	IA_2 Harmonic	
63	IA_2 Harmonic	Decimal (see Explanation 2)
64	IA_3 Harmonic	
65	IA_3 Harmonic	Decimal (see Explanation 2)
66	IA_4 Harmonic	

67	IA_4 Harmonic	Decimal (see Explanation 2)
68	IA_5 Harmonic	
69	IA_5 Harmonic	Decimal (see Explanation 2)
70	IA_6 Harmonic	
71	IA_6 Harmonic	Decimal (see Explanation 2)
72	IA_7 Harmonic	
73	IA_7 Harmonic	Decimal (see Explanation 2)
74	IA_8 Harmonic	
75	IA_8 Harmonic	Decimal (see Explanation 2)
76	IA_9 Harmonic	
77	IA_9 Harmonic	Decimal (see Explanation 2)
78	IA_10 Harmonic	
79	IA_10 Harmonic	Decimal (see Explanation 2)
80	IA_11 Harmonic	
81	IA_11 Harmonic	Decimal (see Explanation 2)
82	IA_12 Harmonic	
83	IA_12 Harmonic	Decimal (see Explanation 2)
84	IA_13 Harmonic	
85	IA_13 Harmonic	Decimal (see Explanation 2)
86	IA_14 Harmonic	
87	IA_14 Harmonic	Decimal (see Explanation 2)
88	IA_15 Harmonic	
89	IA_15 Harmonic	Decimal (see Explanation 2)
90	IA_16 Harmonic	
91	IA_16 Harmonic	Decimal (see Explanation 2)
92	IA_17 Harmonic	
93	IA_17 Harmonic	Decimal (see Explanation 2)
94	IA_18 Harmonic	
95	IA_18 Harmonic	Decimal (see Explanation 2)
96	IA_19 Harmonic	
97	IA_19 Harmonic	Decimal (see Explanation 2)
98	IA_20 Harmonic	
99	IA_20 Harmonic	Decimal (see Explanation 2)
100	IA_21 Harmonic	
101	IA_21 Harmonic	Decimal (see Explanation 2)
102	IA_22 Harmonic	
103	IA_22 Harmonic	Decimal (see Explanation 2)
104	IA_23 Harmonic	
105	IA_23 Harmonic	Decimal (see Explanation 2)
106	IA_24 Harmonic	
107	IA_24 Harmonic	Decimal (see Explanation 2)

108	IA_25 Harmonic	
109	IA_25 Harmonic	Decimal (see Explanation 2)
110	IA_26 Harmonic	
111	IA_26 Harmonic	Decimal (see Explanation 2)
112	IA_27 Harmonic	
113	IA_27 Harmonic	Decimal (see Explanation 2)
114	IA_28 Harmonic	
115	IA_28 Harmonic	Decimal (see Explanation 2)
116	IA_29 Harmonic	
117	IA_29 Harmonic	Decimal (see Explanation 2)
118	IA_30 Harmonic	
119	IA_30 Harmonic	Decimal (see Explanation 2)
120	IA_31 Harmonic	
121	IA_31 Harmonic	Decimal (see Explanation 2)
122	IB_THD Harmonic	
123	IB_THD Harmonic	Decimal (see Explanation 2)
124	IB_1 Harmonic	
125	IB_1 Harmonic	Decimal (see Explanation 2)
126	IB_2 Harmonic	
127	IB_2 Harmonic	Decimal (see Explanation 2)
128	IB_3 Harmonic	
129	IB_3 Harmonic	Decimal (see Explanation 2)
130	IB_4 Harmonic	
131	IB_4 Harmonic	Decimal (see Explanation 2)
132	IB_5 Harmonic	
133	IB_5 Harmonic	Decimal (see Explanation 2)
134	IB_6 Harmonic	
135	IB_6 Harmonic	Decimal (see Explanation 2)
136	IB_7 Harmonic	
137	IB_7 Harmonic	Decimal (see Explanation 2)
138	IB_8 Harmonic	
139	IB_8 Harmonic	Decimal (see Explanation 2)
140	IB_9 Harmonic	
141	IB_9 Harmonic	Decimal (see Explanation 2)
142	IB_10 Harmonic	
143	IB_10 Harmonic	Decimal (see Explanation 2)
144	IB_11 Harmonic	
145	IB_11 Harmonic	Decimal (see Explanation 2)
146	IB_12 Harmonic	
147	IB_12 Harmonic	Decimal (see Explanation 2)
148	IB_13 Harmonic	

149	IB_13 Harmonic	Decimal (see Explanation 2)
150	IB_14 Harmonic	
151	IB_14 Harmonic	Decimal (see Explanation 2)
152	IB_15 Harmonic	
153	IB_15 Harmonic	Decimal (see Explanation 2)
154	IB_16 Harmonic	
155	IB_16 Harmonic	Decimal (see Explanation 2)
156	IB_17 Harmonic	
157	IB_17 Harmonic	Decimal (see Explanation 2)
158	IB_18 Harmonic	
159	IB_18 Harmonic	Decimal (see Explanation 2)
160	IB_19 Harmonic	
161	IB_19 Harmonic	Decimal (see Explanation 2)
162	IB_20 Harmonic	
163	IB_20 Harmonic	Decimal (see Explanation 2)
164	IB_21 Harmonic	
165	IB_21 Harmonic	Decimal (see Explanation 2)
166	IB_22 Harmonic	
167	IB_22 Harmonic	Decimal (see Explanation 2)
168	IB_23 Harmonic	
169	IB_23 Harmonic	Decimal (see Explanation 2)
170	IB_24 Harmonic	
171	IB_24 Harmonic	Decimal (see Explanation 2)
172	IB_25 Harmonic	
173	IB_25 Harmonic	Decimal (see Explanation 2)
174	IB_26 Harmonic	
175	IB_26 Harmonic	Decimal (see Explanation 2)
176	IB_27 Harmonic	
177	IB_27 Harmonic	Decimal (see Explanation 2)
178	IB_28 Harmonic	
179	IB_28 Harmonic	Decimal (see Explanation 2)
180	IB_29 Harmonic	
181	IB_29 Harmonic	Decimal (see Explanation 2)
182	IB_30 Harmonic	
183	IB_30 Harmonic	Decimal (see Explanation 2)
184	IB_31 Harmonic	
185	IB_31 Harmonic	Decimal (see Explanation 2)
186	IC_THD Harmonic	
187	IC_THD Harmonic	Decimal (see Explanation 2)
188	IC_1 Harmonic	
189	IC_1 Harmonic	Decimal (see Explanation 2)

190	IC_2 Harmonic	
191	IC_2 Harmonic	Decimal (see Explanation 2)
192	IC_3 Harmonic	
193	IC_3 Harmonic	Decimal (see Explanation 2)
194	IC_4 Harmonic	
195	IC_4 Harmonic	Decimal (see Explanation 2)
196	IC_5 Harmonic	
197	IC_5 Harmonic	Decimal (see Explanation 2)
198	IC_6 Harmonic	
199	IC_6 Harmonic	Decimal (see Explanation 2)
200	IC_7 Harmonic	
201	IC_7 Harmonic	Decimal (see Explanation 2)
202	IC_8 Harmonic	
203	IC_8 Harmonic	Decimal (see Explanation 2)
204	IC_9 Harmonic	
205	IC_9 Harmonic	Decimal (see Explanation 2)
206	IC_10 Harmonic	
207	IC_10 Harmonic	Decimal (see Explanation 2)
208	IC_11 Harmonic	
209	IC_11 Harmonic	Decimal (see Explanation 2)
210	IC_12 Harmonic	
211	IC_12 Harmonic	Decimal (see Explanation 2)
212	IC_13 Harmonic	
213	IC_13 Harmonic	Decimal (see Explanation 2)
214	IC_14 Harmonic	
215	IC_14 Harmonic	Decimal (see Explanation 2)
216	IC_15 Harmonic	
217	IC_15 Harmonic	Decimal (see Explanation 2)
218	IC_16 Harmonic	
219	IC_16 Harmonic	Decimal (see Explanation 2)
220	IC_17 Harmonic	
221	IC_17 Harmonic	Decimal (see Explanation 2)
222	IC_18 Harmonic	
223	IC_18 Harmonic	Decimal (see Explanation 2)
224	IC_19 Harmonic	
225	IC_19 Harmonic	Decimal (see Explanation 2)
226	IC_20 Harmonic	
227	IC_20 Harmonic	Decimal (see Explanation 2)
228	IC_21 Harmonic	
229	IC_21 Harmonic	Decimal (see Explanation 2)
230	IC_22 Harmonic	

231	IC_22 Harmonic	Decimal (see Explanation 2)
232	IC_23 Harmonic	
233	IC_23 Harmonic	Decimal (see Explanation 2)
234	IC_24 Harmonic	
235	IC_24 Harmonic	Decimal (see Explanation 2)
236	IC_25 Harmonic	
237	IC_25 Harmonic	Decimal (see Explanation 2)
238	IC_26 Harmonic	
239	IC_26 Harmonic	Decimal (see Explanation 2)
240	IC_27 Harmonic	
241	IC_27 Harmonic	Decimal (see Explanation 2)
242	IC_28 Harmonic	
243	IC_28 Harmonic	Decimal (see Explanation 2)
244	IC_29 Harmonic	
245	IC_29 Harmonic	Decimal (see Explanation 2)
246	IC_30 Harmonic	
247	IC_30 Harmonic	Decimal (see Explanation 2)
248	IC_31 Harmonic	
249	IC_31 Harmonic	Decimal (see Explanation 2)
250	VA_THD Harmonic	
251	VA_THD Harmonic	Decimal (see Explanation 2)
252	VA_1 Harmonic	
253	VA_1 Harmonic	Decimal (see Explanation 2)
254	VA_2 Harmonic	
255	VA_2 Harmonic	Decimal (see Explanation 2)
256	VA_3 Harmonic	
257	VA_3 Harmonic	Decimal (see Explanation 2)
258	VA_4 Harmonic	
259	VA_4 Harmonic	Decimal (see Explanation 2)
260	VA_5 Harmonic	
261	VA_5 Harmonic	Decimal (see Explanation 2)
262	VA_6 Harmonic	
263	VA_6 Harmonic	Decimal (see Explanation 2)
264	VA_7 Harmonic	
265	VA_7 Harmonic	Decimal (see Explanation 2)
266	VA_8 Harmonic	
267	VA_8 Harmonic	Decimal (see Explanation 2)
268	VA_9 Harmonic	
269	VA_9 Harmonic	Decimal (see Explanation 2)
270	VA_10 Harmonic	
271	VA_10 Harmonic	Decimal (see Explanation 2)

272	VA_11 Harmonic	
273	VA_11 Harmonic	Decimal (see Explanation 2)
274	VA_12 Harmonic	
275	VA_12 Harmonic	Decimal (see Explanation 2)
276	VA_13 Harmonic	
277	VA_13 Harmonic	Decimal (see Explanation 2)
278	VA_14 Harmonic	
279	VA_14 Harmonic	Decimal (see Explanation 2)
280	VA_15 Harmonic	
281	VA_15 Harmonic	Decimal (see Explanation 2)
282	VA_16 Harmonic	
283	VA_16 Harmonic	Decimal (see Explanation 2)
284	VA_17 Harmonic	
285	VA_17 Harmonic	Decimal (see Explanation 2)
286	VA_18 Harmonic	
287	VA_18 Harmonic	Decimal (see Explanation 2)
288	VA_19 Harmonic	
289	VA_19 Harmonic	Decimal (see Explanation 2)
290	VA_20 Harmonic	
291	VA_20 Harmonic	Decimal (see Explanation 2)
292	VA_21 Harmonic	
293	VA_21 Harmonic	Decimal (see Explanation 2)
294	VA_22 Harmonic	
295	VA_22 Harmonic	Decimal (see Explanation 2)
296	VA_23 Harmonic	
297	VA_23 Harmonic	Decimal (see Explanation 2)
298	VA_24 Harmonic	
299	VA_24 Harmonic	Decimal (see Explanation 2)
300	VA_25 Harmonic	
301	VA_25 Harmonic	Decimal (see Explanation 2)
302	VA_26 Harmonic	
303	VA_26 Harmonic	Decimal (see Explanation 2)
304	VA_27 Harmonic	
305	VA_27 Harmonic	Decimal (see Explanation 2)
306	VA_28 Harmonic	
307	VA_28 Harmonic	Decimal (see Explanation 2)
308	VA_29 Harmonic	
309	VA_29 Harmonic	Decimal (see Explanation 2)
310	VA_30 Harmonic	
311	VA_30 Harmonic	Decimal (see Explanation 2)
312	VA_31 Harmonic	

313	VA_31 Harmonic	Decimal (see Explanation 2)
314	VB_THD Harmonic	
315	VB_THD Harmonic	Decimal (see Explanation 2)
316	VB_1 Harmonic	
317	VB_1 Harmonic	Decimal (see Explanation 2)
318	VB_2 Harmonic	
319	VB_2 Harmonic	Decimal (see Explanation 2)
320	VB_3 Harmonic	
321	VB_3 Harmonic	Decimal (see Explanation 2)
322	VB_4 Harmonic	
323	VB_4 Harmonic	Decimal (see Explanation 2)
324	VB_5 Harmonic	
325	VB_5 Harmonic	Decimal (see Explanation 2)
326	VB_6 Harmonic	
327	VB_6 Harmonic	Decimal (see Explanation 2)
328	VB_7 Harmonic	
329	VB_7 Harmonic	Decimal (see Explanation 2)
330	VB_8 Harmonic	
331	VB_8 Harmonic	Decimal (see Explanation 2)
332	VB_9 Harmonic	
333	VB_9 Harmonic	Decimal (see Explanation 2)
334	VB_10 Harmonic	
335	VB_10 Harmonic	Decimal (see Explanation 2)
336	VB_11 Harmonic	
337	VB_11 Harmonic	Decimal (see Explanation 2)
338	VB_12 Harmonic	
339	VB_12 Harmonic	Decimal (see Explanation 2)
340	VB_13 Harmonic	
341	VB_13 Harmonic	Decimal (see Explanation 2)
342	VB_14 Harmonic	
343	VB_14 Harmonic	Decimal (see Explanation 2)
344	VB_15 Harmonic	
345	VB_15 Harmonic	Decimal (see Explanation 2)
346	VB_16 Harmonic	
347	VB_16 Harmonic	Decimal (see Explanation 2)
348	VB_17 Harmonic	
349	VB_17 Harmonic	Decimal (see Explanation 2)
350	VB_18 Harmonic	
351	VB_18 Harmonic	Decimal (see Explanation 2)
352	VB_19 Harmonic	
353	VB_19 Harmonic	Decimal (see Explanation 2)

354	VB_20 Harmonic	
355	VB_20 Harmonic	Decimal (see Explanation 2)
356	VB_21 Harmonic	
357	VB_21 Harmonic	Decimal (see Explanation 2)
358	VB_22 Harmonic	
359	VB_22 Harmonic	Decimal (see Explanation 2)
360	VB_23 Harmonic	
361	VB_23 Harmonic	Decimal (see Explanation 2)
362	VB_24 Harmonic	
363	VB_24 Harmonic	Decimal (see Explanation 2)
364	VB_25 Harmonic	
365	VB_25 Harmonic	Decimal (see Explanation 2)
366	VB_26 Harmonic	
367	VB_26 Harmonic	Decimal (see Explanation 2)
368	VB_27 Harmonic	
369	VB_27 Harmonic	Decimal (see Explanation 2)
370	VB_28 Harmonic	
371	VB_28 Harmonic	Decimal (see Explanation 2)
372	VB_29 Harmonic	
373	VB_29 Harmonic	Decimal (see Explanation 2)
374	VB_30 Harmonic	
375	VB_30 Harmonic	Decimal (see Explanation 2)
376	VB_31 Harmonic	
377	VB_31 Harmonic	Decimal (see Explanation 2)
378	VC_THD Harmonic	
379	VC_THD Harmonic	Decimal (see Explanation 2)
380	VC_1 Harmonic	
381	VC_1 Harmonic	Decimal (see Explanation 2)
382	VC_2 Harmonic	
383	VC_2 Harmonic	Decimal (see Explanation 2)
384	VC_3 Harmonic	
385	VC_3 Harmonic	Decimal (see Explanation 2)
386	VC_4 Harmonic	
387	VC_4 Harmonic	Decimal (see Explanation 2)
388	VC_5 Harmonic	
389	VC_5 Harmonic	Decimal (see Explanation 2)
390	VC_6 Harmonic	
391	VC_6 Harmonic	Decimal (see Explanation 2)
392	VC_7 Harmonic	
393	VC_7 Harmonic	Decimal (see Explanation 2)
394	VC_8 Harmonic	

395	VC_8 Harmonic	Decimal (see Explanation 2)
396	VC_9 Harmonic	
397	VC_9 Harmonic	Decimal (see Explanation 2)
398	VC_10 Harmonic	
399	VC_10 Harmonic	Decimal (see Explanation 2)
400	VC_11 Harmonic	
401	VC_11 Harmonic	Decimal (see Explanation 2)
402	VC_12 Harmonic	
403	VC_12 Harmonic	Decimal (see Explanation 2)
404	VC_13 Harmonic	
405	VC_13 Harmonic	Decimal (see Explanation 2)
406	VC_14 Harmonic	
407	VC_14 Harmonic	Decimal (see Explanation 2)
408	VC_15 Harmonic	
409	VC_15 Harmonic	Decimal (see Explanation 2)
410	VC_16 Harmonic	
411	VC_16 Harmonic	Decimal (see Explanation 2)
412	VC_17 Harmonic	
413	VC_17 Harmonic	Decimal (see Explanation 2)
414	VC_18 Harmonic	
415	VC_18 Harmonic	Decimal (see Explanation 2)
416	VC_19 Harmonic	
417	VC_19 Harmonic	Decimal (see Explanation 2)
418	VC_20 Harmonic	
419	VC_20 Harmonic	Decimal (see Explanation 2)
420	VC_21 Harmonic	
421	VC_21 Harmonic	Decimal (see Explanation 2)
422	VC_22 Harmonic	
423	VC_22 Harmonic	Decimal (see Explanation 2)
424	VC_23 Harmonic	
425	VC_23 Harmonic	Decimal (see Explanation 2)
426	VC_24 Harmonic	
427	VC_24 Harmonic	Decimal (see Explanation 2)
428	VC_25 Harmonic	
429	VC_25 Harmonic	Decimal (see Explanation 2)
430	VC_26 Harmonic	
431	VC_26 Harmonic	Decimal (see Explanation 2)
432	VC_27 Harmonic	
433	VC_27 Harmonic	Decimal (see Explanation 2)
434	VC_28 Harmonic	
435	VC_28 Harmonic	Decimal (see Explanation 2)

436	VC_29 Harmonic	
437	VC_29 Harmonic	Decimal (see Explanation 2)
438	VC_30 Harmonic	
439	VC_30 Harmonic	Decimal (see Explanation 2)
440	VC_31 Harmonic	
441	VC_31 Harmonic	Decimal (see Explanation 2)
442	1. Step Number of Switching	Tens of thousands and over (see Explanation 6)
443	1. Step Number of Switching	Thousands and under (see Explanation 6)
444	2. Step Number of Switching	Tens of thousands and over (see Explanation 6)
445	2. Step Number of Switching	Thousands and under (see Explanation 6)
446	3. Step Number of Switching	Tens of thousands and over (see Explanation 6)
447	3. Step Number of Switching	Thousands and under (see Explanation 6)
448	4. Step Number of Switching	Tens of thousands and over (see Explanation 6)
449	4. Step Number of Switching	Thousands and under (see Explanation 6)
450	5. Step Number of Switching	Tens of thousands and over (see Explanation 6)
451	5. Step Number of Switching	Thousands and under (see Explanation 6)
452	6. Step Number of Switching	Tens of thousands and over (see Explanation 6)
453	6. Step Number of Switching	Thousands and under (see Explanation 6)
454	7. Step Number of Switching	Tens of thousands and over (see Explanation 6)
455	7. Step Number of Switching	Thousands and under (see Explanation 6)
456	8. Step Number of Switching	Tens of thousands and over (see Explanation 6)
457	8. Step Number of Switching	Thousands and under (see Explanation 6)
458	9. Step Number of Switching	Tens of thousands and over (see Explanation 6)
459	9. Step Number of Switching	Thousands and under (see Explanation 6)
460	10. Step Number of Switching	Tens of thousands and over (see Explanation 6)
461	10. Step Number of Switching	Thousands and under (see Explanation 6)
462	11. Step Number of Switching	Tens of thousands and over (see Explanation 6)

463	11. Step Number of Switching	Thousands and under (see Explanation 6)
464	12. Step Number of Switching	Tens of thousands and over (see Explanation 6)
465	12. Step Number of Switching	Thousands and under (see Explanation 6)
466	13. Step Number of Switching	Tens of thousands and over (see Explanation 6)
467	13. Step Number of Switching	Thousands and under (see Explanation 6)
468	14. Step Number of Switching	Tens of thousands and over (see Explanation 6)
469	14. Step Number of Switching	Thousands and under (see Explanation 6)
470	15. Step Number of Switching	Tens of thousands and over (see Explanation 6)
471	15. Step Number of Switching	Thousands and under (see Explanation 6)
472	16. Step Number of Switching	Tens of thousands and over (see Explanation 6)
473	16. Step Number of Switching	Thousands and under (see Explanation 6)
474	17. Step Number of Switching	Tens of thousands and over (see Explanation 6)
475	17. Step Number of Switching	Thousands and under (see Explanation 6)
476	18. Step Number of Switching	Tens of thousands and over (see Explanation 6)
477	18. Step Number of Switching	Thousands and under (see Explanation 6)
478	19. Step Number of Switching	Tens of thousands and over (see Explanation 6)
479	19. Step Number of Switching	Thousands and under (see Explanation 6)
480	20. Step Number of Switching	Tens of thousands and over (see Explanation 6)
481	20. Step Number of Switching	Thousands and under (see Explanation 6)
482	21. Step Number of Switching	Tens of thousands and over (see Explanation 6)
483	21. Step Number of Switching	Thousands and under (see Explanation 6)
484	22. Step Number of Switching	Tens of thousands and over (see Explanation 6)
485	22. Step Number of Switching	Thousands and under (see Explanation 6)
486	23. Step Number of Switching	Tens of thousands and over (see Explanation 6)
487	23. Step Number of Switching	Thousands and under (see Explanation

		6)
488	24. Step Number of Switching	Tens of thousands and over (see Explanation 6)
489	24. Step Number of Switching	Thousands and under (see Explanation 6)
490	1. Step Run Time (Hour)	
491	1. Step Run Time (Hour)	Decimal (see Explanation 3)
492	2. Step Run Time (Hour)	
493	2. Step Run Time (Hour)	Decimal (see Explanation 3)
494	3. Step Run Time (Hour)	
495	3. Step Run Time (Hour)	Decimal (see Explanation 3)
496	4. Step Run Time (Hour)	
497	4. Step Run Time (Hour)	Decimal (see Explanation 3)
498	5. Step Run Time (Hour)	
499	5. Step Run Time (Hour)	Decimal (see Explanation 3)
500	6. Step Run Time (Hour)	
501	6. Step Run Time (Hour)	Decimal (see Explanation 3)
502	7. Step Run Time (Hour)	
503	7. Step Run Time (Hour)	Decimal (see Explanation 3)
504	8. Step Run Time (Hour)	
505	8. Step Run Time (Hour)	Decimal (see Explanation 3)
506	9. Step Run Time (Hour)	
507	9. Step Run Time (Hour)	Decimal (see Explanation 3)
508	10. Step Run Time (Hour)	
509	10. Step Run Time (Hour)	Decimal (see Explanation 3)
510	11. Step Run Time (Hour)	
511	11. Step Run Time (Hour)	Decimal (see Explanation 3)
512	12. Step Run Time (Hour)	
513	12. Step Run Time (Hour)	Decimal (see Explanation 3)
514	13. Step Run Time (Hour)	
515	13. Step Run Time (Hour)	Decimal (see Explanation 3)
516	14. Step Run Time (Hour)	
517	14. Step Run Time (Hour)	Decimal (see Explanation 3)
518	15. Step Run Time (Hour)	
519	15. Step Run Time (Hour)	Decimal (see Explanation 3)
520	16. Step Run Time (Hour)	
521	16. Step Run Time (Hour)	Decimal (see Explanation 3)
522	17. Step Run Time (Hour)	
523	17. Step Run Time (Hour)	Decimal (see Explanation 3)
524	18. Step Run Time (Hour)	
525	18. Step Run Time (Hour)	Decimal (see Explanation 3)
526	19. Step Run Time (Hour)	

527	19. Step Run Time (Hour)	Decimal (see Explanation 3)
528	20. Step Run Time (Hour)	
529	20. Step Run Time (Hour)	Decimal (see Explanation 3)
530	21. Step Run Time (Hour)	
531	21. Step Run Time (Hour)	Decimal (see Explanation 3)
532	22. Step Run Time (Hour)	
533	22. Step Run Time (Hour)	Decimal (see Explanation 3)
534	23. Step Run Time (Hour)	
535	23. Step Run Time (Hour)	Decimal (see Explanation 3)
536	24. Step Run Time (Hour)	
537	24. Step Run Time (Hour)	Decimal (see Explanation 3)
538	Unusable	
540	Unusable	
542	Unusable	
544	Total Active Power Consumption(kWh)	
545	Total Active Power Consumption(kWh)	Decimal (see Explanation 3)
546	Unusable	
548	Unusable	
550	Unusable	
552	Total Inductive Power Consumption (kVArh)	
553	Total Inductive Power Consumption (kVArh)	Decimal (see Explanation 3)
554	Unusable	
556	Unusable	
558	Unusable	
560	Total Capacitive Power Consumption(kVArh)	
561	Total Capacitive Power Consumption(kVArh)	Decimal (see Explanation 3)
562	Unusable	
564	Unusable	
566	Unusable	
568	Inductive Energy Rating	
569	Inductive Energy Rating	Decimal (see Explanation 3)
570	Unusable	
572	Unusable	
574	Unusable	
575	Capacitive Energy Rating	
577	Capacitive Energy Rating	Decimal (see Explanation 3)
578	1. Event Record	(see Explanation 7)
579	1. Event Value	

580	1. Event Value Decimal Part	Decimal (see Explanation 3)
581	1. Event Phase	1: A Phase – 2: B Phase – 3: C Phase (Explanation 4)
582	1. Event Day	
583	1. Event Month	
584	1. Event Year	
585	1. Olay Second	
586	1. Event Minute	
587	1. Event Hour	
588	2.Event Record	(see Explanation 7)
589	2. Event Value	
590	2. Event Value Decimal Part	Decimal (see Explanation 3)
591	2. Event Phase	1: A Phase – 2: B Phase – 3: C Phase (Explanation 4)
592	2. Event Day	
593	2. Event Month	
594	2. Event Year	
595	2. Event Second	
596	2. Event Minute	
597	2. Event Hour	
598	3.Event Record	(see Explanation 7)
599	3. Event Value	
600	3. Event Value Decimal Part	Decimal (see Explanation 3)
601	3. Event Phase	1: A Phase – 2: B Phase – 3: C Phase (Explanation 4)
602	3. Event Day	
603	3. Event Month	
604	3. Event Year	
605	3. Event Second	
606	3. Event Minute	
607	3. Event Hour	
608	4.Event Record	(see Explanation 7)
609	4. Event Value	
610	4. Event Value Decimal Part	Decimal (see Explanation 3)
611	4. Event Phase	1: A Phase – 2: B Phase – 3: C Phase (Explanation 4)
612	4. Event Day	
613	4. Event Month	
614	4. Event Year	
615	4. Event Second	
616	4. Event Minute	
617	4. Event Hour	

618	5.Event Record	(see Explanation 7)
619	5. Event Value	
620	5. Event Value Decimal Part	Decimal (see Explanation 3)
621	5. Event Phase	1: A Phase – 2: B Phase – 3: C Phase (Explanation 4)
622	5. Event Day	
623	5. Event Month	
624	5. Event Year	
625	5. Event Second	
626	5. Event Minute	
627	5. Event Hour	
628	6.Event Record	(see Explanation 7)
629	6. Event Value	
630	6. Event Value Decimal Part	Decimal (see Explanation 3)
631	6. Event Phase	1: A Phase – 2: B Phase – 3: C Phase (Explanation 4)
632	6. Event Day	
633	6. Event Month	
634	6. Event Year	
635	6. Event Second	
636	6. Event Minute	
637	6. Event Hour	
638	7.Event Record	(see Explanation 7)
639	7. Event Value	
640	7. Event Value Decimal Part	Decimal (see Explanation 3)
641	7. Event Phase	1: A Phase – 2: B Phase – 3: C Phase (Explanation 4)
642	7. Event Day	
643	7. Event Month	
644	7. Event Year	
645	7. Event Second	
646	7. Event Minute	
647	7. Event Hour	
648	8.Event Record	(see Explanation 7)
649	8. Event Value	
650	8. Event Value Decimal Part	Decimal (see Explanation 3)
651	8. Event Phase	1: A Phase – 2: B Phase – 3: C Phase (Explanation 4)
652	8. Event Day	
653	8. Event Month	
654	8. Event Year	
655	8. Event Second	

656	8. Event Minute	
657	8. Event Hour	

Table 4: Analog Recording Cells

Explanation 2: The decimal part of this type of recording cells refers to the next 2 digits after the comma. The integer part of the recording cell with a value of "2.05" is"2" and the decimal part is "5".

Explanation 3: The decimal part of this type of recording cells refers to the next 2 digits after the comma. The integer part of the recording cell with a value of "2.05" is "2" and the decimal part is "5".

Explanation 4: The corresponding values of the event phase values are as follows.

1: The event occurred in the "A" phase.
2: The event occurred in the "B" phase
3: The event occurred in the "C" phase

Explanation 5: The decimal part of this type of recording cells refers to the next 3 digits after the comma. The exact part of the recording cell with a value of "0.987" is "0" and the decimal part is "987".

Explanation 6: The number of steps of switching number is divided into 2 recording cells. In the recording cells that keep the values “thousands and under”, 10^3’s digit, 10^2’s digit, 10^1’s digit and 10^0’s digit of the switching number are displayed. In the recording cells that keep the values “ten thousands and over”, 10^7’s digit, 10^6’s digit, 10^5’s digit and 10^4’s digit of the switching number are displayed. When it is wanted to read the number of switching of a step with the number of switches of 121254, "ten thousands and over" is displayed as 12 in the recording cell, and 1254 in the recording cell "thousand and under". When reading the number of steps, read and interpret the integer and decimal addresses in a single message frame.

For example; in the communication response of a step with switching number of 121.254, 12 is seen as an integer part and 1254 is seen as a decimal part.

Explanation 7: The corresponding values of the event record values are as follows.

0: None
1: Overvoltage (U>>)
2: Low Voltage (U<<)
3: Over Current (I>>)
4: Total Harmonic Distortion(THD>>)
5: Over Temperature (C>>)
6: Digital Input (Ext)
7: Power Cut (LPS)

Reading Function

Function 04 is the reading function of analog recording cells.

Example: If the device address is set to 2 and it is wanted to read last event record, the starting address will be 578 and it means that a total of 10 recording cells are wanted to read.

Send Message: **02 04 02 42 00 0A D1 92**

02 – Device address

04 – Function code

0242 – Starting address (Hexadecimal)

000A –Number of recording cell wanted to read

D192 – CRC fault control bytes

Returned Message: **02 04 14 00 07 00 00 00 00 00 00 00 1A 00 04 00 11 00 0E 00 33 00 0D 6A C2** – if the message is successful

02 – Device address

04 – Function code

14 – Number of data byte

0007 – 1st recording cell value (7 -> LPS; Energy Cut)

0000 – 2nd recording cell value (in the LPS status phase voltage or current is 0.)

0000 – 3rd recording cell value (in the LPS status phase voltage or current is 0.)

0000 – 4th recording cell value (in the LPS status the phase information is 0.)

001A – 5th recording cell value (Day -> 26)

0004 – 6th recording cell value (Month -> 4)

0011 – 7th recording cell value (Year -> 17)

000E – 8th recording cell value (Second-> 14)

0033 – 9th recording cell value (Minute -> 51)

000D – 10th recording cell value (Hour -> 13)

6AC2 – CRC fault control bytes

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