MODBUS Protocol – Family NG E33

Revision 1.3 December/2019

1. OBJECTIVE

To describe the general characteristics of the NG family, such as MULT-K NG, MPK NG, and AQE 02 in the E33 versions concerning the MODBUS Protocol.

2. MODBUS PROTOCOL DETAILS

MODBUS Functions:

The MODBUS functions implemented for the NG E33 version analyzers are:

- Read Holding Register (3)
- Read Input Register (4)
- Force Single Coil * (5)
- Preset Single Register * (6)
- Read Exception Status (7)
- Preset Multiple Register * (16)
- Report Slave ID (17)
- Read File Record (20)

* Broadcast - Functions that can be addressed to all slaves (address 0)

SPECIAL Functions:

- Config Address (00/42H)
- Read Address (00/71H)
- Read Partidas (00/75H)
- Report Slave Id Kron (00/76H)

Device Code: **A1 33**

3. HOLDING REGISTERS

They can be read using the "Read Holding Register (3)" function and written using the "Preset Single Register (6)" or "Preset Multiple Register (16)" functions. A maximum of **8 registers** can be read, and up to **8 registers** can be written in each request.

HOLDING REGISTERS – STANDARD BLOCK:

These are the configuration registers of the analyzer available for the user to configure.

ADDRESS	DESCRIPTION	FORMAT	RANGE (MIN – MAX)
40.001, 40.002	TP	IEEE 32-bit fp (F2,F1), (F0,EXP)	0,01 – 9999,99
40.003, 40.004	TC	IEEE 32-bit fp (F2,F1), (F0,EXP)	0,01 – 9999,99
40.005	Reserved		
40.006	TL and TI	Unsigned int 8-bit (LSB) / Unsigned int 8-bit (MSB)	00 – 80 / 00 – 60
40.007	Settings	*	*
40.008, 40.009	Nominal Voltage	IEEE 32-bit fp (F2,F1), (F0,EXP)	0,00 – 999,9 GV

***** For further details, see item 12.

HOLDING REGISTERS – RTC:

Example: 25/03/10 – 13:24:07:96 (04 = Thursday).

HOLDING REGISTER	VALUE	MEANING
42.001	0x9607	CENTIEME and SECOND
42.002	0x2413	MINUTE and HOUR
42.003	0x0425	DAY OF WEEK and DAY
42.004	0x0310	MONTH and YEAR

DAY OF THE WEEK	VALUE
Monday	01
Tuesday	02
Wednesday	03
Thursday	04
Friday	05
Saturday	06
Sunday	07

HOLDING REGISTERS – EVENT SETTINGS:

Limitations: Writing a maximum of 8 Holding Registers at a time.

HOLDING REGISTER	CONFIGURATION	IEEE fp 32-bit
42.011 e 42.012	Voltage Dip – Limit Value	F2, F1, F0 e EXP
42.013 e 42.014	Voltage Dip – Hysteresis	F2, F1, F0 e EXP
42.015 e 42.016	Voltage Swell – Limit Value	F2, F1, F0 e EXP
42.017 e 42.018	Voltage Swell – Hysteresis	F2, F1, F0 e EXP
42.019 e 42.020	Interruptions – Limit Value	F2, F1, F0 e EXP
42.021 e 42.022	Interruptions – Hysteresis	F2, F1, F0 e EXP

Example: DIP Threshold = 200.5 V.

(200,5 = 0x43, 0x48, 0x80 e 0x00)

HOLDING REGISTER	VALUE
42.011	0x0080
42.012	0x4843

HOLDING REGISTERS – PRODIST:

Limitations:

- Writing a maximum of 8 Holding Registers at a time.

HOLDING REGISTER	CONFIGURATION	IEEE fp 32-bit
42.031 e 42.032	Lower Limit for Adequate	F2, F1, F0 e EXP
42.033 e 42.034	Upper Limit for Adequate	F2, F1, F0 e EXP
42.035 e 42.036	Lower Limit for Poor	F2, F1, F0 e EXP
42.037 e 42.038	Upper Limit for Poor	F2, F1, F0 e EXP
42.039	Reading Quantity for DRP / DRC Calculation	(MSB,LSB)

HOLDING REGISTERS – SPECIAL BLOCK:

Used to configure the sequence of floating-point numbers used by the device in the return of requested information during the "Input Registers" reading process.

These "Input Registers" are in IEEE 32-bit floating-point format, with the default factory sequence being F2, F1, F0, and EXP. This order can be adjusted to another sequence by modifying the content of this register.

ADDRESS	DESCRIPTION	FORMAT	RANGE (MIN – MAX)
42.901	Floating-Point Sequence	Unsigned int 8-bit (LSB) / Unsigned int 8-bit (MSB)	0 – 65535

Examples:

42.901 (MSB , LSB)	LAYOUT	COMMENT
0x32, 0x10	F2, F1, F0, EXP	KRON Standard
0x23, 0x01	F1, F2, EXP, F0	float
0x01, 0x23	EXP, F0, F1, F2	float inverse

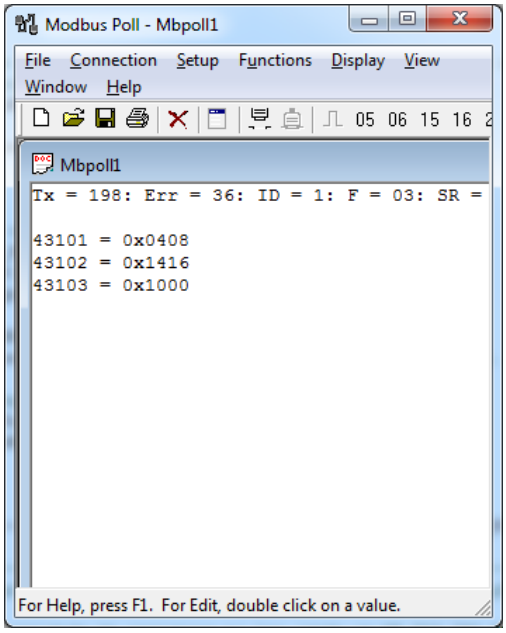
HOLDING REGISTERS – TRPs Start Time Configurations:

Used to configure the Start Time of the Measurement Campaign.

HOLDING REGISTER	VALUE	MEANING
43.101	0x0408	DAY AND MONTH
43.102	0x1416	YEAR AND HOUR
43.103	0x1000	MINUTE

Configuration Example:

- In the example below, the date and time configuration are 04/08/14 and 16:10.
- The least significant byte of register 43.103 will always be 0x00.



Observation 1: When the TRP Start Time is configured, regardless of whether it is configured incorrectly or set to a time earlier than the current RTC time, either through the HMI or Modbus, the Prodist Memory will be completely cleared, including Percentiles, Minimum and Maximum Values of the TRPs, and Aggregation Memory.

Observation 2: These three registers must be read all at once. It is not possible to read, for example, only register 43.101.

Observation 3: The configuration of the minutes (MSB byte of register 43.103) must always be a multiple of 10 minutes. Therefore, only the values 0x00, 0x10, 0x20, 0x30, 0x40, and 0x50 are valid for the MSB byte of this register. Otherwise, the date and time value written to these registers will be 01/01/00 00:00.

Observation 4: All Events (Sag, Swell, and Interruptions) generated while the Clock has not reached the programmed time will be discarded, meaning they will not be stored.

HOLDING REGISTERS – DISPLAY CONTRAST CONFIGURATION:

Used to adjust the OLED Display Contrast.

ADDRESS	DESCRIPTION	FORMAT	RANGE (MIN – MAX)
43.201	HMI Contrast Configuration	Unsigned int 16-bit	1 (5%) – 20 (100%)

The contrast increment is 5% at a time. Therefore, a register value of 1 represents 5%, 2 represents 10%, and so on. Any invalid value will result in the contrast being set to the default value of 30%.

HOLDING REGISTERS – DEVICE IDENTIFICATION TAG CONFIGURATION

Limitations:

- Reading (using the Read Holding Register function – 0x03) and writing (using the Preset Multiple Register function – 0x10) must be done in all 8 registers (43.301 to 43.308) at once. Otherwise, the device will respond with "Illegal Data Value

In the NG family analyzers, version E-33, it is possible to read and write a TAG for field identification of the device. This TAG consists of 16 characters and can be modified via Modbus, as well as being read via Modbus and the HMI by accessing the System Mode.

Via Modbus, reading/configuration are performed by accessing the Holding Registers 43.301 to 43.308.

Each register is responsible for 2 characters, totaling a maximum of 16 characters. For writing, simply convert the desired ASCII character to hexadecimal. If the user wants to fill all 16 characters, just write in all the registers. Otherwise, insert the value 0x00 after writing the last character (in the following example table, this idea was applied to register 43.107).

Also, in the example, it can be seen that even though register 43.108 is not being used (since the string "Kron: 1234567" contains only 13 characters), this register 43.108 must still be written due to the limitation mentioned above.

After writing the value 0x00 (in the case of the example, in register 43.107), the subsequent characters can have any value, since the value 0x00 signals the end of the string, meaning the end of the description. Therefore, we could write any value in the two bytes of register 43.108, and it would not make a difference.

Highlighting, the following example shows the configuration of the information “Kron: 1234567” as the Identification TAG:

Holding Register	43.301	43.302	43.303	43.304	43.305	43.306	43.307	43.308
Register Value	0x4B72	0x6F6E	0x3A20	0x3132	0x3334	0x3536	0x3700	0x0000
Conversion to ASCII	Kr	on	:	12	34	56	7	

The characters that the supervisory system (e.g., RedeMB) must accept for this configuration are as follows:

- “A ~ Z” (Uppercase letters from A to Z)
- “a ~ z” (Lowercase letters from a to z)
- “0 ~ 9” (Numbers from 0 to 9)
- “:”(Colon)
- “-“(Dash or minus sign/subtraction)
- “+”(Plus sign)
- “=”(Space)

Any character different from the ones listed above should be blocked from being written in the supervisory system, as the display does not support all possible character fonts.

The analyzer will leave the factory with its default description in the Identification TAG, which is "Kron: 1234567".

When a write is made to registers 43.301 to 43.308, the analyzer is automatically reset.

HOLDING REGISTERS – DESCRIPTION AND AUTHENTICATION PASSWORD OF BLUETOOTH

Registers:
43.001 a 43.008 → Bluetooth Module Description.
43.011 a 43.018 → Bluetooth Module Authentication Password.

In each register, two ASCII characters are sent. The last character of the string must always be 0x00 to mark the end of the string. If not all characters are used, the data sent after the 0x00 will be ignored.

Here's the translation:

To write the description "Mult-k NG" (without quotes)

43.001 = 0x4D75
43.002 = 0x6C74
43.003 = 0x2D6B
43.004 = 0xA04E
43.005 = 0x4700

In this case, as the description has less than 15 characters, the user must write any value in registers 43,006 to 43,008, as these will be ignored due to the value 0x00 in the least significant byte of register 43,005. Reinforcing, the value 0x00 indicates the end of the string.

Observation 1: It is not possible to read or write only part of the registers. All the registers must be read at once. For example, if the user wants to read only the first four characters of the description, they will not be able to read just registers 43.001 to 43.002. They will be required to read from 43.001 to 43.008. The same applies to the Authentication Password registers.

Observation 2: For the changes to the configurations above to take effect, a Reset Coil command must be sent to the analyzer after the modifications, as this change is only executed after the Bluetooth module is initialized.

Default values:

The default description will be "MULTKNG_0000001", where 0000001 is the serial number that was recorded. The default pairing password is "123".

4. INPUT REGISTERS

4.1. Electrical Quantities.

ADDRESS	REGISTER	DESCRIPTION	FORMAT
30.001, 30.002	NS	Serial Number	Unsigned int 32-bit (MSB,LSB)
30.003, 30.004	U0	Three-Phase Voltage (V)	IEEE 32-bit fp (F2,F1,F0,EXP)
30.005, 30.006	U12	Phase-to-Phase Voltage (A-B)	IEEE 32-bit fp (F2,F1,F0,EXP)
30.007, 30.008	U23	Phase-to-Phase Voltage (B-C)	IEEE 32-bit fp (F2,F1,F0,EXP)
30.009, 30.010	U31	Phase-to-Phase Voltage (C-A)	IEEE 32-bit fp (F2,F1,F0,EXP)
30.011, 30.012	U1	Line 1 Voltage (V)	IEEE 32-bit fp (F2,F1,F0,EXP)
30.013, 30.014	U2	Line 2 Voltage (V)	IEEE 32-bit fp (F2,F1,F0,EXP)
30.015, 30.016	U3	Line 3 Voltage (V)	IEEE 32-bit fp (F2,F1,F0,EXP)
30.017, 30.018	I0	Three-Phase Current (A)	IEEE 32-bit fp (F2,F1,F0,EXP)
30.019, 30.020	IN	Neutral Current	IEEE 32-bit fp (F2,F1,F0,EXP)
30.021, 30.022	I1	Line 1 Current (A)	IEEE 32-bit fp (F2,F1,F0,EXP)
30.023, 30.024	I2	Line 2 Current (A)	IEEE 32-bit fp (F2,F1,F0,EXP)
30.025, 30.026	I3	Line 3 Current (A)	IEEE 32-bit fp (F2,F1,F0,EXP)
30.027, 30.028	Freq - FA	Line 1 Frequency	IEEE 32-bit fp (F2,F1,F0,EXP)
30.029, 30.030	Freq - FB	Line 2 Frequency	IEEE 32-bit fp (F2,F1,F0,EXP)
30.031, 30.032	Freq - FC	Line 3 Frequency	IEEE 32-bit fp (F2,F1,F0,EXP)
30.033, 30.034	Freq - IEC	Freqüência Line 1 Frequency (IEC – 10s)	IEEE 32-bit fp (F2,F1,F0,EXP)
30.035, 30.036	P0	Three-Phase Active Power (W)	IEEE 32-bit fp (F2,F1,F0,EXP)
30.037, 30.038	P1	Line 1 Active Power (W)	IEEE 32-bit fp (F2,F1,F0,EXP)
30.039, 30.040	P2	Line 2 Active Power (W)	IEEE 32-bit fp (F2,F1,F0,EXP)
30.041, 30.042	P3	Line 3 Active Power (W)	IEEE 32-bit fp (F2,F1,F0,EXP)
30.043, 30.044	Q0	Three-Phase Reactive Power (VAr)	IEEE 32-bit fp (F2,F1,F0,EXP)
30.045, 30.046	Q1	Line 1 Reactive Power (VAr)	IEEE 32-bit fp (F2,F1,F0,EXP)
30.047, 30.048	Q2	Line 2 Reactive Power (VAr)	IEEE 32-bit fp (F2,F1,F0,EXP)
30.049, 30.050	Q3	Line 3 Reactive Power (VAr)	IEEE 32-bit fp (F2,F1,F0,EXP)
30.051, 30.052	S0	ree-Phase Apparent Power (VA)	IEEE 32-bit fp (F2,F1,F0,EXP)
30.053, 30.054	S1	Line 1 Apparent Power (VA)	IEEE 32-bit fp (F2,F1,F0,EXP)
30.055, 30.056	S2	Line 2 Apparent Power (VA)	IEEE 32-bit fp (F2,F1,F0,EXP)
30.057, 30.058	S3	Line 3 Apparent Power (VA)	IEEE 32-bit fp (F2,F1,F0,EXP)
30.059, 30.060	FP0	Three-Phase Power Factor	IEEE 32-bit fp (F2,F1,F0,EXP)
30.061, 30.062	FP1	Line 1 Power Factor	IEEE 32-bit fp (F2,F1,F0,EXP)
30.063, 30.064	FP2	Line 2 Power Factor	IEEE 32-bit fp (F2,F1,F0,EXP)
30.065, 30.066	FP3	Line 3 Power Factor	IEEE 32-bit fp (F2,F1,F0,EXP)
30.067, 30.068	FP0 - D	Three-Phase Displacement Power Factor	IEEE 32-bit fp (F2,F1,F0,EXP)
30.069, 30.070	FP1 - D	Line 1 Displacement Power Factor	IEEE 32-bit fp (F2,F1,F0,EXP)
30.071, 30.072	FP2 - D	Line 2 Displacement Power Factor	IEEE 32-bit fp (F2,F1,F0,EXP)
30.073, 30.074	FP3 - D	Line 3 Displacement Power Factor	IEEE 32-bit fp (F2,F1,F0,EXP)
30.075, 30.076	Factor K	Voltage Unbalance	IEEE 32-bit fp (F2,F1,F0,EXP)
30.077, 30.078	Pinst A	Instantaneous Flicker Sensation Line 1	IEEE 32-bit fp (F2,F1,F0,EXP)
30.079, 30.080	Pinst B	Instantaneous Flicker Sensation Line 2	IEEE 32-bit fp (F2,F1,F0,EXP)
30.081, 30.082	Pinst C	Instantaneous Flicker Sensation Line 3	IEEE 32-bit fp (F2,F1,F0,EXP)
30.083, 30.084	PST A	10-Minute Flicker Level Line 1	IEEE 32-bit fp (F2,F1,F0,EXP)
30.085, 30.086	PST B	10-Minute Flicker Level Line 2	IEEE 32-bit fp (F2,F1,F0,EXP)
30.087, 30.088	PST C	10-Minute Flicker Level Line 3	IEEE 32-bit fp (F2,F1,F0,EXP)
30.089, 30.090	PLT A	2-Hour Flicker Level Line 1	IEEE 32-bit fp (F2,F1,F0,EXP)
30.091, 30.092	PLT B	2-Hour Flicker Level Line 2	IEEE 32-bit fp (F2,F1,F0,EXP)
30.093, 30.094	PLT C	2-Hour Flicker Level Line 3	IEEE 32-bit fp (F2,F1,F0,EXP)

4.2. Electrical Quantities: Minimum and Maximum Group.

NORMAL	MINIMUM VALUE	MAXIMUM VALUE	REGISTER	DESCRIPTION
30.003, 30.004	31.003, 31.004	32.003, 32.004	U0	Three-Phase Voltage (V)
30.005, 30.006	31.005, 31.006	32.005, 32.006	U12	Phase-to-Phase Voltage (A-B)
30.007, 30.008	31.007, 31.008	32.007, 32.008	U23	Phase-to-Phase Voltage (B-C)
30.009, 30.010	31.009, 31.010	32.009, 32.010	U31	Phase-to-Phase Voltage (C-A)
30.011, 30.012	31.011, 31.012	32.011, 32.012	U1	Line 1 Voltage (V)
30.013, 30.014	31.013, 31.014	32.013, 32.014	U2	Line 2 Voltage (V)
30.015, 30.016	31.015, 31.016	32.015, 32.016	U3	Line 3 Voltage (V)
30.017, 30.018	31.017, 31.018	32.017, 32.018	I0	Three-Phase Current (A)
30.019, 30.020	31.019, 31.020	32.019, 32.020	IN	Neutral Current
30.021, 30.022	31.021, 31.022	32.021, 32.022	I1	Line 1 Current (A)
30.023, 30.024	31.023, 31.024	32.023, 32.024	I2	Line 2 Current (A)
30.025, 30.026	31.025, 31.026	32.025, 32.026	I3	Line 3 Current (A)
30.027, 30.028	31.027, 31.028	32.027, 32.028	Freq - FA	Line 1 Frequency
30.029, 30.030	31.029, 31.030	32.029, 32.030	Freq - FB	Line 2 Frequency
30.031, 30.032	31.031, 31.032	32.031, 32.032	Freq - FC	Line 3 Frequency
30.033, 30.034	31.033, 31.034	32.033, 32.034	Freq - IEC	Line 1 Frequency (IEC – 10s)
30.035, 30.036	31.035, 31.036	32.035, 32.036	P0	Three-Phase Active Power (W)
30.037, 30.038	31.037, 31.038	32.037, 32.038	P1	Line 1 Active Power (W)
30.039, 30.040	31.039, 31.040	32.039, 32.040	P2	Line 2 Active Power (W)
30.041, 30.042	31.041, 31.042	32.041, 32.042	P3	Line 3 Active Power (W)
30.043, 30.044	31.043, 31.044	32.043, 32.044	Q0	Three-Phase Reactive Power (VAr)
30.045, 30.046	31.045, 31.046	32.045, 32.046	Q1	Line 1 Reactive Power (VAr)
30.047, 30.048	31.047, 31.048	32.047, 32.048	Q2	Line 2 Reactive Power (VAr)
30.049, 30.050	31.049, 31.050	32.049, 32.050	Q3	Line 3 Reactive Power (VAr)
30.051, 30.052	31.051, 31.052	32.051, 32.052	S0	Three-Phase Apparent Power (VA)
30.053, 30.054	31.053, 31.054	32.053, 32.054	S1	Line 1 Apparent Power (VA)
30.055, 30.056	31.055, 31.056	32.055, 32.056	S2	Line 2 Apparent Power (VA)
30.057, 30.058	31.057, 31.058	32.057, 32.058	S3	Line 3 Apparent Power (VA)
30.059, 30.060	31.059, 31.060	32.059, 32.060	FP0	Three-Phase Power Factor
30.061, 30.062	31.061, 31.062	32.061, 32.062	FP1	Line 1 Power Factor
30.063, 30.064	31.063, 31.064	32.063, 32.064	FP2	Line 2 Power Factor
30.065, 30.066	31.065, 31.066	32.065, 32.066	FP3	Line 3 Power Factor
30.067, 30.068	31.067, 31.068	32.067, 32.068	FP0 - D	Three-Phase Displacement Power Factor
30.069, 30.070	31.069, 31.070	32.069, 32.070	FP1 - D	Line 1 Displacement Power Factor
30.071, 30.072	31.071, 31.072	32.071, 32.072	FP2 - D	Line 2 Displacement Power Factor
30.073, 30.074	31.073, 31.074	32.073, 32.074	FP3 - D	Line 3 Displacement Power Factor
30.075, 30.076	31.075, 31.076	32.075, 32.076	Factor K	Voltage Unbalance

4.3. Energies and Demands.

ADDRESS	REGISTER	DESCRIPTION	FORMAT
30.201, 30.202	EA+	Active Energy Positive (kWh)	IEEE 32-bit fp (F2,F1,F0,EXP)
30.203, 30.204	ER+	Reactive Energy Positive (kVArh)	IEEE 32-bit fp (F2,F1,F0,EXP)
30.205, 30.206	EA-	Active Energy Negative (kWh)	IEEE 32-bit fp (F2,F1,F0,EXP)
30.207, 30.208	ER-	Reactive Energy Negative (kVArh)	IEEE 32-bit fp (F2,F1,F0,EXP)
30.209, 30.210	MDA	Maximum Active Demand (kW)	IEEE 32-bit fp (F2,F1,F0,EXP)
30.211, 30.212	DA	Active Demand (kW)	IEEE 32-bit fp (F2,F1,F0,EXP)
30.213, 30.214	MDS	Maximum Apparent Demand (kVA)	IEEE 32-bit fp (F2,F1,F0,EXP)
30.215, 30.216	DS	Apparent Demand (kVA)	IEEE 32-bit fp (F2,F1,F0,EXP)

4.4. Prodist (DRP e DRC).

Range 16 bits:

WEEK A	WEEK B	WEEK C	WEEK D	DESCRIPTION
30.601	30.621	30.641	30.661	DAY/MONTH
30.602	30.622	30.642	30.662	YEAR/TIME
30.603	30.623	30.643	30.663	MIN./SEC.
30.604	30.624	30.644	30.664	CENT./DAY
30.605	30.625	30.645	30.665	MONTH/YEAR
30.606	30.626	30.646	30.666	HOUR/MIN.
30.607	30.627	30.647	30.667	SEC./CENT.
30.608	30.628	30.648	30.668	Quantity of Readings
30.609	30.629	30.649	30.669	nlp Phase A
30.610	30.630	30.650	30.670	nlp Phase B
30.611	30.631	30.651	30.671	nlp Phase C
30.612	30.632	30.652	30.672	nlc Phase A
30.613	30.633	30.653	30.673	nlc Phase B
30.614	30.634	30.654	30.674	nlc Phase C

Range of 32 bits (IEEE fp 32 bit):

WEEK A	WEEK B	WEEK C	WEEK D	DESCRIPTION
30.761, 30.762	30.781, 30.782	30.801, 30.802	30.821, 30.822	DRP Phase A
30.763, 30.764	30.783, 30.784	30.803, 30.804	30.823, 30.824	DRP Phase B
30.765, 30.766	30.785, 30.786	30.805, 30.806	30.825, 30.826	DRP Phase C
30.767, 30.768	30.787, 30.788	30.807, 30.808	30.827, 30.828	DRP (worst between phases)
30.769, 30.770	30.789, 30.790	30.809, 30.810	30.829, 30.830	DRC Phase A
30.771, 30.772	30.791, 30.792	30.811, 30.812	30.831, 30.832	DRC Phase B
30.773, 30.774	30.793, 30.794	30.813, 30.814	30.833, 30.834	DRC Phase C
30.775, 30.776	30.795, 30.796	30.815, 30.816	30.835, 30.836	DRC (worst between phases)

4.5. Prodist (Classification of the VTCD's).

ADDRESS	DESCRIPTION
30.921	DAY/MONTH
30.922	YEAR/HOUR
30.923	MINUTE/SECOND
30.924	HUNDREDTHS/0x00
30.925	IMT
30.926	IMT F1
30.927	IMT F2
30.928	IMT F3
30.929	AMT
30.930	EMT
30.931	ITT
30.932	ITT F1
30.933	ITT F2
30.934	ITT F3
30.935	ATT
30.936	ETT
30.937	ILT
30.938	ILT F1
30.939	ILT F2
30.940	ILT F3
30.941	ALT
30.942	ELT

4.6. Register Group 16-bit.

ADDRESS	REGISTER	DESCRIPTION	FORMAT
33.001	UAN THD	THD of Voltage in Phase 1.	Int 16-bit (MSB,LSB)
33.002	UBN THD	THD of Voltage in Phase 2.	Int 16-bit (MSB,LSB)
33.003	UCN THD	THD of Voltage in Phase 3.	Int 16-bit (MSB,LSB)
33.004	IA THD	THD of Current in Phase 1.	Int 16-bit (MSB,LSB)
33.005	IB THD	THD of Current in Phase 2.	Int 16-bit (MSB,LSB)
33.006	IC THD	THD of Current in Phase 3.	Int 16-bit (MSB,LSB)
33.007	U1 THD (agrup.)	THD of Aggregated Voltage in Phase 1.	Int 16-bit (MSB,LSB)
33.008	U2 THD (agrup.)	THD of Aggregated Voltage in Phase 2.	Int 16-bit (MSB,LSB)
33.009	U3 THD (agrup.)	THD of Aggregated Voltage in Phase 3.	Int 16-bit (MSB,LSB)
33.010	I1 THD (agrup.)	THD of Aggregated Current in Phase 1.	Int 16-bit (MSB,LSB)
33.011	I2 THD (agrup.)	THD of Aggregated Current in Phase 2.	Int 16-bit (MSB,LSB)
33.012	I3 THD (agrup.)	THD of Aggregated Current in Phase 3.	Int 16-bit (MSB,LSB)
33.013	DTT1Par	THD of Voltage in Phase 1 (even orders not multiple of 3).	Int 16-bit (MSB,LSB)
33.014	DTT2Par	THD of Voltage in Phase 2 (even orders not multiple of 3).	Int 16-bit (MSB,LSB)
33.015	DTT3Par	THD of Voltage in Phase 3 (even orders not multiple of 3).	Int 16-bit (MSB,LSB)
33.016	DTC1Par	THD of Current in Phase 1 (even orders not multiple of 3).	Int 16-bit (MSB,LSB)
33.017	DTC2Par	THD of Current in Phase 2 (even orders not multiple of 3).	Int 16-bit (MSB,LSB)
33.018	DTC3Par	THD of Current in Phase 3 (even orders not multiple of 3).	Int 16-bit (MSB,LSB)
33.019	DTT1Imp	THD of Phase 1 Voltage (odd orders not multiples of 3).	Int 16-bit (MSB,LSB)
33.020	DTT2Imp	THD of Phase 2 Voltage (odd orders not multiples of 3).	Int 16-bit (MSB,LSB)
33.021	DTT3Imp	THD of Phase 3 Voltage (odd orders not multiples of 3).	Int 16-bit (MSB,LSB)
33.022	DTC1Imp	THD of Phase 1 Current (odd orders not multiples of 3).	Int 16-bit (MSB,LSB)
33.023	DTC2Imp	THD of Phase 2 Current (odd orders not multiples of 3).	Int 16-bit (MSB,LSB)
33.024	DTC3Imp	THD of Phase 3 Current (odd orders not multiples of 3).	Int 16-bit (MSB,LSB)
33.025	DTT1Tripl	THD of Phase 1 Voltage (orders multiples of 3).	Int 16-bit (MSB,LSB)
33.026	DTT2Tripl	THD of Phase 2 Voltage (orders multiples of 3).	Int 16-bit (MSB,LSB)
33.027	DTT3Tripl	THD of Phase 3 Voltage (orders multiples of 3).	Int 16-bit (MSB,LSB)
33.028	DTC1Tripl	THD of Phase 1 Current (orders multiples of 3).	Int 16-bit (MSB,LSB)
33.029	DTC2Tripl	THD of Phase 2 Current (orders multiples of 3).	Int 16-bit (MSB,LSB)
33.030	DTC3Tripl	THD of Phase 3 Current (orders multiples of 3).	Int 16-bit (MSB,LSB)

4.7. Group of 16-bit Registers: Minimum and Maximum

NORMAL	MINIMUM VALUE	MAXIMUM VALUE	REGISTER	DESCRIPTION
33.001	33.201	33.401	UAN THD	THD of Phase 1 Voltage.
33.002	33.202	33.402	UBN THD	THD of Phase 2 Voltage.
33.003	33.203	33.403	UCN THD	THD of Phase 3 Voltage.

33.004	33.204	33.404	IA THD	THD of Phase 1 Current.
33.005	33.205	33.405	IB THD	THD of Phase 2 Current.
33.006	33.206	33.406	IC THD	THD of Phase 3 Current.
33.007	33.207	33.407	U1 THD (agrup.)	THD phase 1 voltage grouping.
33.008	33.208	33.408	U2 THD (agrup.)	THD phase 2 voltage grouping.
33.009	33.209	33.409	U3 THD (agrup.)	THD phase 3 voltage grouping.
33.010	33.210	33.410	I1 THD (agrup.)	THD phase 1 current grouping.
33.011	33.211	33.411	I2 THD (agrup.)	THD phase 2 current grouping.
33.012	33.212	33.412	I3 THD (agrup.)	THD phase 3 current grouping.
33.013	33.213	33.413	DTT1Par	THD of Voltage of phase 1 (even orders not multiples of 3).
33.014	33.214	33.414	DTT2Par	THD of Voltage of phase 2 (even orders not multiples of 3).
33.015	33.215	33.415	DTT3Par	THD of Voltage of phase 3 (even orders not multiples of 3).
33.016	33.216	33.416	DTC1Par	THD of Current of phase 1 (even orders not multiples of 3).
33.017	33.217	33.417	DTC2Par	THD of Current of phase 2 (even orders not multiples of 3).
33.018	33.218	33.418	DTC3Par	THD of Current of phase 3 (even orders not multiples of 3).
33.019	33.219	33.419	DTT1Imp	THD of Voltage of phase 1 (odd orders not multiples of 3).
33.020	33.220	33.420	DTT2Imp	THD of Voltage of phase 2 (odd orders not multiples of 3).
33.021	33.221	33.421	DTT3Imp	THD of Voltage of phase 3 (odd orders not multiples of 3).
33.022	33.222	33.422	DTC1Imp	THD of Current of phase 1 (odd orders not multiples of 3).
33.023	33.223	33.423	DTC2Imp	THD of Current of phase 2 (odd orders not multiples of 3).
33.024	33.224	33.424	DTC3Imp	THD of Current of phase 3 (odd orders not multiples of 3).
33.025	33.225	33.425	DTT1Tripl	THD of Voltage of phase 1 (multiples of 3).
33.026	33.226	33.426	DTT2Tripl	THD of Voltage of phase 2 (multiples of 3).
33.027	33.227	33.427	DTT3Tripl	THD of Voltage of phase 3 (multiples of 3).
33.028	33.228	33.428	DTC1Tripl	THD of Current of phase 1 (multiples of 3).
33.029	33.229	33.429	DTC2Tripl	THD of Current of phase 2 (multiples of 3).
33.030	33.230	33.430	DTC3Tripl	THD of Current of phase 3 (multiples of 3).

4.8. Electrical Quantities (Fundamental).

ADDRESS	REGISTER.	DESCRIPTION	FORMAT
33.801, 33.802	U1	Line Voltage 1 (V)	IEEE 32-bit fp (F2,F1,F0,EXP)
33.803, 33.804	U2	Line Voltage 2 (V)	IEEE 32-bit fp (F2,F1,F0,EXP)
33.805, 33.806	U3	Line Voltage 3 (V)	IEEE 32-bit fp (F2,F1,F0,EXP)
33.807, 33.808	I1	Line Current 1 (A)	IEEE 32-bit fp (F2,F1,F0,EXP)
33.809, 33.810	I2	Line Current 2 (A)	IEEE 32-bit fp (F2,F1,F0,EXP)
33.811, 33.812	I3	Line Current 3 (A)	IEEE 32-bit fp (F2,F1,F0,EXP)
33.813, 33.814	P1	Active Power Line 1 (W)	IEEE 32-bit fp (F2,F1,F0,EXP)
33.815, 33.816	P2	Active Power Line 2 (W)	IEEE 32-bit fp (F2,F1,F0,EXP)
33.817, 33.818	P3	Active Power Line 3 (W)	IEEE 32-bit fp (F2,F1,F0,EXP)
33.819, 33.820	S1	Apparent Power Line 1 (VA)	IEEE 32-bit fp (F2,F1,F0,EXP)
33.821, 33.822	S2	Apparent Power Line 2 (VA)	IEEE 32-bit fp (F2,F1,F0,EXP)
33.823, 33.824	S3	Apparent Power Line 3 (VA)	IEEE 32-bit fp (F2,F1,F0,EXP)
33.825, 33.826	U12	Phase-to-Phase Voltage (A-B)	IEEE 32-bit fp (F2,F1,F0,EXP)
33.827, 33.828	U23	Phase-to-Phase Voltage (B-C)	IEEE 32-bit fp (F2,F1,F0,EXP)
33.829, 33.830	U31	Phase-to-Phase Voltage (C-A)	IEEE 32-bit fp (F2,F1,F0,EXP)
33.831, 33.832	FP1 - D	Power Factor Line 1 - Displacement	IEEE 32-bit fp (F2,F1,F0,EXP)
33.833, 33.834	FP2 - D	Power Factor Line 2 - Displacement	IEEE 32-bit fp (F2,F1,F0,EXP)
33.835, 33.836	FP3 - D	Power Factor Line 3 - Displacement	IEEE 32-bit fp (F2,F1,F0,EXP)
33.837, 33.838	Q1	Reactive Power Line 1 (VAr)	IEEE 32-bit fp (F2,F1,F0,EXP)
33.839, 33.840	Q2	Reactive Power Line 2 (VAr)	IEEE 32-bit fp (F2,F1,F0,EXP)
33.841, 33.842	Q3	Reactive Power Line 3 (VAr)	IEEE 32-bit fp (F2,F1,F0,EXP)
33.843, 33.844	ϕV1	Phase Angle V1/V12	IEEE 32-bit fp (F2,F1,F0,EXP)
33.845, 33.846	ϕV2	Phase Angle V2/V23	IEEE 32-bit fp (F2,F1,F0,EXP)
33.847, 33.848	ϕV3	Phase Angle V3/V31	IEEE 32-bit fp (F2,F1,F0,EXP)
33.849, 33.850	ϕI1	Phase Angle I1	IEEE 32-bit fp (F2,F1,F0,EXP)

33.851, 33.852	ϕI2	Phase Angle I2	IEEE 32-bit fp (F2,F1,F0,EXP)
33.853, 33.854	ϕI3	Phase Angle I3	IEEE 32-bit fp (F2,F1,F0,EXP)

4.9. Error Codes.

ADDRESS	REGISTER.	DESCRIPTION	FORMAT
33.901	Error	Error code*	Int 16-bit (MSB,LSB)

* For more details, see item 9.

4.10. Events (File Details).

ADDRESS	REGISTER.	DESCRIPTION	FORMAT
33.905	Status	Memory Status: 0 - available. 1 - occupied, deleting. 2 - occupied, generating file.	Int 16-bit (MSB,LSB)
33.906	Type	Type of file that was generated: 0x0013 – File with Voltage Dips. 0x0014 – File with Voltage Swells. 0x0015 – File with Interruptions. 0x0016 – File with Interruptions Phase 1. 0x0017 – File with Interruptions Phase 2. 0x0018 – File with Interruptions Phase 3.	Int 16-bit (MSB,LSB)
33.907	DAY/MONTH	Day/month the file was generated.	Int 16-bit (MSB,LSB)
33.908	YEAR/HOUR	Year/hour the file was generated.	Int 16-bit (MSB,LSB)
33.909	MINUTE/SECOND	Minute/second the file was generated.	Int 16-bit (MSB,LSB)
33.910	Quantity	Quantity of events in the file	Int 16-bit (MSB,LSB)

4.11. Harmonic Grouping.

Grouping of voltage harmonics relative to the fundamental (phase 1)

ADDRESS	REGISTER.	DESCRIPTION	FORMAT
34.001, 34.002	U1 Agrup. H1	Grouping of the 1st harmonic of phase 1	IEEE 32-bit fp (F2,F1,F0,EXP)
...	...	...	IEEE 32-bit fp (F2,F1,F0,EXP)
34.079, 34.080	U1 Agrup. H40	Grouping of the 40th harmonic of phase 1	IEEE 32-bit fp (F2,F1,F0,EXP)

Grouping of voltage harmonics relative to the fundamental (phase 2)

ADDRESS	REGISTER.	DESCRIPTION	FORMAT
34.081, 34.082	U2 Agrup. H1	Grouping of the 1st harmonic of phase 2	IEEE 32-bit fp (F2,F1,F0,EXP)
...	...	...	IEEE 32-bit fp (F2,F1,F0,EXP)
34.159, 34.160	U2 Agrup. H40	Grouping of the 40th harmonic of phase 2	IEEE 32-bit fp (F2,F1,F0,EXP)

Grouping of voltage harmonics relative to the fundamental (phase 3)

ADDRESS	REGISTER.	DESCRIPTION	FORMAT
34.161, 34.162	U3 Agrup. H1	Grouping of the 1st harmonic of phase 3	IEEE 32-bit fp (F2,F1,F0,EXP)
...	...	...	IEEE 32-bit fp (F2,F1,F0,EXP)
34.239, 34.240	U3 Agrup. H40	Grouping of the 40th harmonic of phase 3	IEEE 32-bit fp (F2,F1,F0,EXP)

Grouping of current harmonics in relation to the fundamental (phase 1)

ADDRESS	REGISTER.	DESCRIPTION	FORMAT
34.241, 34.242	I1 Agrup. H1	Grouping of the 1st harmonic of phase 1	IEEE 32-bit fp (F2,F1,F0,EXP)
...	...	...	IEEE 32-bit fp (F2,F1,F0,EXP)
34.319, 34.320	I1 Agrup. H40	Grouping of the 40th harmonic of phase 1	IEEE 32-bit fp (F2,F1,F0,EXP)

Grouping of current harmonics in relation to the fundamental (phase 2)

ADDRESS	REGISTER.	DESCRIPTION	FORMAT
34.321, 34.322	I2 Agrup. H1	Grouping of the 1st harmonic of phase 2	IEEE 32-bit fp (F2,F1,F0,EXP)
...	...	...	IEEE 32-bit fp (F2,F1,F0,EXP)
34.399, 34.400	I2 Agrup. H40	Grouping of the 40th harmonic of phase 2	IEEE 32-bit fp (F2,F1,F0,EXP)

Grouping of current harmonics in relation to the fundamental (phase 3)

ADDRESS	REGISTER.	DESCRIPTION	FORMAT
34.401, 34.402	I3 Agrup. H1	Grouping of the 1st harmonic of phase 3	IEEE 32-bit fp (F2,F1,F0,EXP)
...	...	...	IEEE 32-bit fp (F2,F1,F0,EXP)
34.479, 34.480	I3 Agrup. H40	Grouping of the 40th harmonic of phase 3	IEEE 32-bit fp (F2,F1,F0,EXP)

4.12. Minimum and Maximum Values of Harmonic Groupings

NORMAL	MINIMUM VALUE	MAXIMUM VALUE	REGISTER	DESCRIPTION
34.003, 34.004	35.003, 35.004	36.003, 36.004	U1 Agrup. H2	Grouping of the 2nd harmonic voltage phase 1
34.005, 34.006	35.005, 35.006	36.005, 36.006	U1 Agrup. H3	Grouping of the 3rd harmonic voltage phase 1
34.007, 34.008	35.007, 35.008	36.007, 36.008	U1 Agrup. H4	Grouping of the 4th harmonic voltage phase 1
34.009, 34.010	35.009, 35.010	36.009, 36.010	U1 Agrup. H5	Grouping of the 5th harmonic voltage phase 1
34.011, 34.012	35.011, 35.012	36.011, 36.012	U1 Agrup. H6	Grouping of the 6th harmonic voltage phase 1
34.013, 34.014	35.013, 35.014	36.013, 36.014	U1 Agrup. H7	Grouping of the 7th harmonic voltage phase 1

NORMAL	MINIMUM VALUE	MAXIMUM VALUE	REGISTER	DESCRIPTION
34.083, 34.084	35.083, 35.084	36.083, 36.084	U2 Agrup. H2	Grouping of the 2nd harmonic voltage phase 2
34.085, 34.086	35.085, 35.086	36.085, 36.086	U2 Agrup. H3	Grouping of the 3rd harmonic voltage phase 2
34.087, 34.088	35.087, 35.088	36.087, 36.088	U2 Agrup. H4	Grouping of the 4th harmonic voltage phase 2
34.089, 34.090	35.089, 35.090	36.089, 36.090	U2 Agrup. H5	Grouping of the 5th harmonic voltage phase 2
34.091, 34.092	35.091, 35.092	36.091, 36.092	U2 Agrup. H6	Grouping of the 6th harmonic voltage phase 2
34.093, 34.094	35.093, 35.094	36.093, 36.094	U2 Agrup. H7	Grouping of the 7th harmonic voltage phase 2

NORMAL	MINIMUM VALUE	MAXIMUM VALUE	REGISTER	DESCRIPTION
34.163, 34.164	35.163, 35.164	36.163, 36.164	U3 Agrup. H2	Grouping of the 2nd harmonic voltage phase 3
34.165, 34.166	35.165, 35.166	36.165, 36.166	U3 Agrup. H3	Grouping of the 3rd harmonic voltage phase 3
34.167, 34.168	35.167, 35.168	36.167, 36.168	U3 Agrup. H4	Grouping of the 4th harmonic voltage phase 3
34.169, 34.170	35.169, 35.170	36.169, 36.170	U3 Agrup. H5	Grouping of the 5th harmonic voltage phase 3
34.171, 34.172	35.171, 35.172	36.171, 36.172	U3 Agrup. H6	Grouping of the 6th harmonic voltage phase 3
34.173, 34.174	35.173, 35.174	36.173, 36.174	U3 Agrup. H7	Grouping of the 7th harmonic voltage phase 3

NORMAL	MINIMUM VALUE	MAXIMUM VALUE	REGISTER	DESCRIPTION
34.243, 34.244	35.243, 35.244	36.243, 36.244	I1 Agrup. H2	Grouping of the 2nd harmonic current phase 1
34.245, 34.246	35.245, 35.246	36.245, 36.246	I1 Agrup. H3	Grouping of the 3rd harmonic current phase 1
34.247, 34.248	35.247, 35.248	36.247, 36.248	I1 Agrup. H4	Grouping of the 4th harmonic current phase 1
34.249, 34.250	35.249, 35.250	36.249, 36.250	I1 Agrup. H5	Grouping of the 5th harmonic current phase 1
34.251, 34.252	35.251, 35.252	36.251, 36.252	I1 Agrup. H6	Grouping of the 6th harmonic current phase 1
34.253, 34.254	35.253, 35.254	36.253, 36.254	I1 Agrup. H7	Grouping of the 7th harmonic current phase 1

NORMAL	MINIMUM VALUE	MAXIMUM VALUE	REGISTER	DESCRIPTION
34.323, 34.324	35.323, 35.324	36.323, 36.324	I2 Agrup. H2	Grouping of the 2nd harmonic current phase 2
34.325, 34.326	35.325, 35.326	36.325, 36.326	I2 Agrup. H3	Grouping of the 3rd harmonic current phase 2
34.327, 34.328	35.327, 35.328	36.327, 36.328	I2 Agrup. H4	Grouping of the 4th harmonic current phase 2

34.329, 34.330	35.329, 35.230	36.329, 36.330	I2 Agrup. H5	Grouping of the 5th harmonic current phase 2
34.331, 34.332	35.331, 35.332	36.331, 36.332	I2 Agrup. H6	Grouping of the 6th harmonic current phase 2
34.333, 34.334	35.333, 35.334	36.233, 36.334	I2 Agrup. H7	Grouping of the 7th harmonic current phase 2

NORMAL	MINIMUM VALUE	MAXIMUM VALUE	REGISTER	DESCRIPTION
34.403, 34.404	35.403, 35.404	36.403, 36.404	I3 Agrup. H2	Grouping of the 2nd harmonic current phase 3
34.405, 34.406	35.405, 35.406	36.405, 36.406	I3 Agrup. H3	Grouping of the 3rd harmonic current phase 3
34.407, 34.408	35.407, 35.408	36.407, 36.408	I3 Agrup. H4	Grouping of the 4th harmonic current phase 3
34.409, 34.410	35.409, 35.410	36.409, 36.410	I3 Agrup. H5	Grouping of the 5th harmonic current phase 3
34.411, 34.412	35.411, 35.412	36.411, 36.412	I3 Agrup. H6	Grouping of the 6th harmonic current phase 3
34.413, 34.414	35.413, 35.414	36.413, 36.414	I3 Agrup. H7	Grouping of the 7th harmonic current phase 3

4.13. 10-minute Voltage Aggregations

10-minute aggregation (phase 1)

ADDRESS	REGISTER.	DESCRIPTION	FORMAT
37.001, 37.002	A10m_U1NRMS	10-minute aggregation of U1	IEEE 32-bit fp (F2,F1,F0,EXP)
37.003, 37.004	A10m_THD_U1	10-minute aggregation of THD of U1	IEEE 32-bit fp (F2,F1,F0,EXP)
37.005, 37.006	A10m_THD_AGRUP_U1	10-minute aggregation of THD of U1 grouping	IEEE 32-bit fp (F2,F1,F0,EXP)
37.007, 37.008	A10m_THD_DTT1Par	10-minute aggregation of THD of U1 (even orders not multiples of 3)	IEEE 32-bit fp (F2,F1,F0,EXP)
37.009, 37.010	A10m_THD_DTT1Imp	10-minute aggregation of THD of U1 (odd orders not multiples of 3)	IEEE 32-bit fp (F2,F1,F0,EXP)
37.011, 37.012	A10m_THD_DTT1Tripl	10-minute aggregation of THD of U1 (orders multiples of 3)	IEEE 32-bit fp (F2,F1,F0,EXP)
37.013, 37.014	A10m_AGRUP_U1_1	10-minute aggregation of the grouping of H1 of U1	IEEE 32-bit fp (F2,F1,F0,EXP)
37.015, 37.016	A10m_AGRUP_U1_2	10-minute aggregation of the grouping of H2 of U1	IEEE 32-bit fp (F2,F1,F0,EXP)
...	...	...	IEEE 32-bit fp (F2,F1,F0,EXP)
37.091, 37.092	A10m_AGRUP_U1_40	10-minute aggregation of the grouping of H40 of U1v	IEEE 32-bit fp (F2,F1,F0,EXP)

Agregação de 10 min (fase 2)

ADDRESS	REGISTER	DESCRIPTION	FORMAT
37.093, 37.094	A10m_U2NRMS	10-minute aggregation of U2	IEEE 32-bit fp (F2,F1,F0,EXP)
37.095, 37.096	A10m_THD_U2	10-minute aggregation of THD of U2	IEEE 32-bit fp (F2,F1,F0,EXP)
37.097, 37.098	A10m_THD_AGRUP_U2	10-minute aggregation of THD of the grouping of U2	IEEE 32-bit fp (F2,F1,F0,EXP)
37.099, 37.100	A10m_THD_DTT2Par	10-minute aggregation of THD of U2 (even orders not multiples of 3)	IEEE 32-bit fp (F2,F1,F0,EXP)
37.101, 37.102	A10m_THD_DTT2Imp	10-minute aggregation of THD of U2 (odd orders not multiples of 3)	IEEE 32-bit fp (F2,F1,F0,EXP)
37.103, 37.104	A10m_THD_DTT2Tripl	10-minute aggregation of THD of U2 (orders multiples of 3)	IEEE 32-bit fp (F2,F1,F0,EXP)
37.105, 37.106	A10m_AGRUP_U2_1	10-minute aggregation of the grouping of H1 of U2	IEEE 32-bit fp (F2,F1,F0,EXP)
37.107, 37.108	A10m_AGRUP_U2_2	10-minute aggregation of the grouping of H2 of U2	IEEE 32-bit fp (F2,F1,F0,EXP)
...	...	...	IEEE 32-bit fp (F2,F1,F0,EXP)
37.183, 37.184	A10m_AGRUP_U2_40	10-minute aggregation of the grouping of H40 of U2	IEEE 32-bit fp (F2,F1,F0,EXP)

vAgregação de 10 min (fase 3)

ADDRESS	REGISTER	DESCRIPTION	FORMAT
37.185, 37.186	A10m_U3NRMS	10-minute aggregation of U3	IEEE 32-bit fp (F2,F1,F0,EXP)
37.187, 37.188	A10m_THD_U3	10-minute aggregation of THD of U3	IEEE 32-bit fp (F2,F1,F0,EXP)
37.189, 37.190	A10m_THD_AGRUP_U3	10-minute aggregation of THD of the grouping of U3	IEEE 32-bit fp (F2,F1,F0,EXP)
37.191, 37.192	A10m_THD_DTT3Par	10-minute aggregation of THD of U3 (even orders not multiples of 3)	IEEE 32-bit fp (F2,F1,F0,EXP)
37.193, 37.194	A10m_THD_DTT3Imp	10-minute aggregation of THD of U3 (odd orders not multiples of 3)	IEEE 32-bit fp (F2,F1,F0,EXP)
37.195, 37.196	A10m_THD_DTT3Tripl	10-minute aggregation of THD of U3 (orders multiples of 3)	IEEE 32-bit fp (F2,F1,F0,EXP)
37.197, 37.198	A10m_AGRUP_U3_1	10-minute aggregation of the grouping of H1 of U3	IEEE 32-bit fp (F2,F1,F0,EXP)
37.199, 37.200	A10m_AGRUP_U3_2	10-minute aggregation of the grouping of H2 of U3	IEEE 32-bit fp (F2,F1,F0,EXP)
...	...	...	IEEE 32-bit fp (F2,F1,F0,EXP)
37.275, 37.276	A10m_AGRUP_U3_40	10-minute aggregation of the grouping of H40 of U3	IEEE 32-bit fp (F2,F1,F0,EXP)
37.277, 37.278	A10m_K	10-minute aggregation of voltage imbalance	IEEE 32-bit fp (F2,F1,F0,EXP)

4.14 Agregações 10 minutos de Corrente

Agregação de 10 min (fase 1)

ADDRESS	REGISTER	DESCRIPTION	FORMAT
37.301, 37.302	A10m_I1	10-minute aggregation of I1	IEEE 32-bit fp (F2,F1,F0,EXP)
37.303, 37.304	A10m_THD_FP1D	10-minute aggregation of Displacement Power Factor - Line 1	IEEE 32-bit fp (F2,F1,F0,EXP)
37.305, 37.306	A10m_THD_AGRUP_P1	10-minute aggregation of Active Power Line 1	IEEE 32-bit fp (F2,F1,F0,EXP)
37.307, 37.308	A10m_THD_AGRUP_Q1	10-minute aggregation of Reactive Power Line 1	IEEE 32-bit fp (F2,F1,F0,EXP)
37.309, 37.310	A10m_THD_AGRUP_S1	10-minute aggregation of Apparent Power Line 1	IEEE 32-bit fp (F2,F1,F0,EXP)
37.311, 37.312	A10m_THD_AGRUP_I1	10-minute aggregation of THD of the grouping of I1	IEEE 32-bit fp (F2,F1,F0,EXP)
37.313, 37.314	A10m_THD_DTT2Par_I1	10-minute aggregation of THD of I1 (even orders not multiples of 3)	IEEE 32-bit fp (F2,F1,F0,EXP)
37.315, 37.316	A10m_THD_DTT2Imp_I1	10-minute aggregation of THD of I1 (odd orders not multiples of 3)	IEEE 32-bit fp (F2,F1,F0,EXP)
37.317, 37.318	A10m_THD_DTT2Tripl_I1	10-minute aggregation of THD of I1 (multiples of 3 orders)	IEEE 32-bit fp (F2,F1,F0,EXP)
37.319, 37.320	A10m_AGRUP_I1_2	10-minute aggregation of H2 grouping of I1	IEEE 32-bit fp (F2,F1,F0,EXP)
37.321, 37.322	A10m_AGRUP_I1_3	10-minute aggregation of H3 grouping of I1	IEEE 32-bit fp (F2,F1,F0,EXP)
...	...	...	IEEE 32-bit fp (F2,F1,F0,EXP)
37.395, 37.396	A10m_AGRUP_I1_40	10-minute aggregation of H40 grouping of I1	IEEE 32-bit fp (F2,F1,F0,EXP)

10-minute aggregation (phase 2)

ADDRESS	REGISTER	DESCRIPTION	FORMAT
37.397, 37.398	A10m_I2	10-minute aggregation of I2	IEEE 32-bit fp (F2,F1,F0,EXP)
37.399, 37.400	A10m_THD_FP2D	10-minute aggregation of Displacement Power Factor - Line 2	IEEE 32-bit fp (F2,F1,F0,EXP)
37.401, 37.402	A10m_THD_AGRUP_P2	10-minute aggregation of Active Power - Line 2	IEEE 32-bit fp (F2,F1,F0,EXP)
37.403, 37.404	A10m_THD_AGRUP_Q 2	10-minute aggregation of Reactive Power - Line 2	IEEE 32-bit fp (F2,F1,F0,EXP)
37.405, 37.406	A10m_THD_AGRUP_S2	10-minute aggregation of Apparent Power - Line 2	IEEE 32-bit fp (F2,F1,F0,EXP)
37.407, 37.408	A10m_THD_AGRUP_I2	10-minute aggregation of THD grouping of I2	IEEE 32-bit fp (F2,F1,F0,EXP)
37.409, 37.410	A10m_THD_DTT2Par_I 2	10-minute aggregation of THD of I2 (even orders not multiples of 3)	IEEE 32-bit fp (F2,F1,F0,EXP)
37.411, 37.412	A10m_THD_DTT2Imp_I 2	10-minute aggregation of THD of I2 (odd orders not multiples of 3)	IEEE 32-bit fp (F2,F1,F0,EXP)
37.413, 37.414	A10m_THD_DTT2Tripl_I 2	10-minute aggregation of THD of I2 (multiples of 3 orders)	IEEE 32-bit fp (F2,F1,F0,EXP)
37.415, 37.416	A10m_AGRUP_I2_2	10-minute aggregation of H2 grouping of I2	IEEE 32-bit fp (F2,F1,F0,EXP)
37.417, 37.418	A10m_AGRUP_I2_3	10-minute aggregation of H3 grouping of I2	IEEE 32-bit fp (F2,F1,F0,EXP)
...	...	...	IEEE 32-bit fp (F2,F1,F0,EXP)
37.491, 37.492	A10m_AGRUP_I2_40	10-minute aggregation of H3 grouping of I2	IEEE 32-bit fp (F2,F1,F0,EXP)

10-minute aggregation (phase 3)

ADDRESS	REGISTER	DESCRIPTION	FORMAT
37.493, 37.494	A10m_I3	10-minute aggregation of I3	IEEE 32-bit fp (F2,F1,F0,EXP)
37.495, 37.496	A10m_THD_FP3D	10-minute aggregation of Displacement Power Factor - Line 3	IEEE 32-bit fp (F2,F1,F0,EXP)
37.497, 37.498	A10m_THD_AGRUP_P3	10-minute aggregation of Active Power - Line 3	IEEE 32-bit fp (F2,F1,F0,EXP)
37.499, 37.500	A10m_THD_AGRUP_Q3	10-minute aggregation of Reactive Power - Line 3	IEEE 32-bit fp (F2,F1,F0,EXP)
37.501, 37.502	A10m_THD_AGRUP_S3	10-minute aggregation of Apparent Power - Line 3	IEEE 32-bit fp (F2,F1,F0,EXP)
37.503, 37.504	A10m_THD_AGRUP_I3	10-minute aggregation of THD grouping of I3	IEEE 32-bit fp (F2,F1,F0,EXP)
37.505, 37.506	A10m_THD_DTT2Par_I3	10-minute aggregation of THD of I3 (even orders not multiples of 3)	IEEE 32-bit fp (F2,F1,F0,EXP)
37.507, 37.508	A10m_THD_DTT2Imp_I3	10-minute aggregation of THD of I3 (odd orders not multiples of 3)	IEEE 32-bit fp (F2,F1,F0,EXP)
37.509, 37.510	A10m_THD_DTT2Tripl_I3	10-minute aggregation of THD of I3 (multiples of 3 orders)	IEEE 32-bit fp (F2,F1,F0,EXP)
37.511, 37.512	A10m_AGRUP_I3_2	10-minute aggregation of H2 grouping of I3	IEEE 32-bit fp (F2,F1,F0,EXP)
37.513, 37.514	A10m_AGRUP_I3_3	10-minute aggregation of H3 grouping of I3	IEEE 32-bit fp (F2,F1,F0,EXP)
...	...	...	IEEE 32-bit fp (F2,F1,F0,EXP)
37.587, 37.588	A10m_AGRUP_I3_40	10-minute aggregation of H40 grouping of I3	IEEE 32-bit fp (F2,F1,F0,EXP)

10-minute aggregation (Three-phase)

ADDRESS	REGISTER	DESCRIPTION	FORMAT
37.589, 37.590	A10m_IN	10-minute aggregation of IN	IEEE 32-bit fp (F2,F1,F0,EXP)
37.591, 37.592	A10m_THD_FP0D	10-minute aggregation of Displacement Power Factor - Three-phase	IEEE 32-bit fp (F2,F1,F0,EXP)
37.593, 37.594	A10m_THD_AGRUP_P0	10-minute aggregation of Active Power - Three-phase	IEEE 32-bit fp (F2,F1,F0,EXP)
37.595, 37.596	A10m_THD_AGRUP_Q0	10-minute aggregation of Reactive Power - Three-phase	IEEE 32-bit fp (F2,F1,F0,EXP)

37.597, 37.598	A10m_THD_AGRUP_S0	10-minute aggregation of Apparent Power - Three-phase	IEEE 32-bit fp (F2,F1,F0,EXP)

4.15 Events and Timestamps.

ADDRESS	REGISTER	DESCRIPTION	FORMAT
37.983, 37.984	-	Aggregation events	-
37.985, 37.986	-	10-minute timestamp of phase 1	-
37.987, 37.988	-	10-minute timestamp of phase 2	-
37.989, 37.990	-	10-minute timestamp of phase 3	-

4.16 Sliding Reference Voltage

ADDRESS	REGISTER	DESCRIPTION	FORMAT
38.001, 38.002	VrefDesl_A	Sliding Reference Voltage FA	IEEE 32-bit fp (F2,F1,F0,EXP)
38.003, 38.004	VrefDesl_B	Sliding Reference Voltage FB	IEEE 32-bit fp (F2,F1,F0,EXP)
38.005, 38.006	VrefDesl_C	Sliding Reference Voltage FC	IEEE 32-bit fp (F2,F1,F0,EXP)

4.17 Quantity of Steady-State Voltages Purged.

ADDRESS	REGISTER	DESCRIPTION	FORMAT	Range
32.901	Qtd. Exp. SA	Quantity of Purged TRPs – Week A	Unsigned int 16-bit	0 to 96
32.902	Qtd. Exp. SB	Quantity of Purged TRPs – Week B	Unsigned int 16-bit	0 to 96
32.903	Qtd. Exp. SC	Quantity of Purged TRPs – Week C	Unsigned int 16-bit	0 to 96
32.904	Qtd. Exp. SD	Quantity of Purged TRPs – Week D	Unsigned int 16-bit	0 to 96

4.18 Average Values of Electrical Quantities.

ADDRESS	REGISTER	DESCRIPTION	FORMAT
39.001, 39.002	U0_Med	Average Three-Phase Voltage	IEEE 32-bit fp (F2,F1,F0,EXP)
39.003, 39.004	U12_Med	Average Phase-to-Phase Voltage U12	IEEE 32-bit fp (F2,F1,F0,EXP)
39.005, 39.006	U23_Med	Average Phase-to-Phase Voltage U23	IEEE 32-bit fp (F2,F1,F0,EXP)
39.007, 39.008	U31_Med	Average Phase-to-Phase Voltage U31	IEEE 32-bit fp (F2,F1,F0,EXP)
39.009, 39.010	U1_Med	Average Phase-to-Neutral Voltage U1	IEEE 32-bit fp (F2,F1,F0,EXP)
39.011, 39.012	U2_Med	Average Phase-to-Neutral Voltage U2	IEEE 32-bit fp (F2,F1,F0,EXP)
39.013, 39.014	U3_Med	Average Phase-to-Neutral Voltage U3	IEEE 32-bit fp (F2,F1,F0,EXP)
39.015, 39.016	I0_Med	Average Three-Phase Current	IEEE 32-bit fp (F2,F1,F0,EXP)
39.017, 39.018	IN_Med	Average Neutral Current	IEEE 32-bit fp (F2,F1,F0,EXP)
39.019, 39.020	I1_Med	Average Current I1	IEEE 32-bit fp (F2,F1,F0,EXP)
39.021, 39.022	I2_Med	Average Current I2	IEEE 32-bit fp (F2,F1,F0,EXP)
39.023, 39.024	I3_Med	Average Current I3	IEEE 32-bit fp (F2,F1,F0,EXP)
39.025, 39.026	Freq1_Med	Average Frequency Phase 1	IEEE 32-bit fp (F2,F1,F0,EXP)
39.027, 39.028	Freq2_Med	Average Frequency Phase 2	IEEE 32-bit fp (F2,F1,F0,EXP)
39.029, 39.030	Freq3_Med	Average Frequency Phase 3	IEEE 32-bit fp (F2,F1,F0,EXP)
39.031, 39.032	P0_Med	Average Three-Phase Active Power	IEEE 32-bit fp (F2,F1,F0,EXP)
39.033, 39.034	P1_Med	Average Three-Phase Active Power Phase 1	IEEE 32-bit fp (F2,F1,F0,EXP)
39.035, 39.036	P2_Med	Average Three-Phase Active Power Phase 2	IEEE 32-bit fp (F2,F1,F0,EXP)
39.037, 39.038	P3_Med	Average Three-Phase Active Power Phase 3	IEEE 32-bit fp (F2,F1,F0,EXP)
39.039, 39.040	Q0_Med	Average Three-Phase Reactive Power	IEEE 32-bit fp (F2,F1,F0,EXP)
39.041, 39.042	Q1_Med	Average Three-Phase Reactive Power Phase 1	IEEE 32-bit fp (F2,F1,F0,EXP)
39.043, 39.044	Q2_Med	Average Three-Phase Reactive Power Phase 2	IEEE 32-bit fp (F2,F1,F0,EXP)
39.045, 39.046	Q3_Med	Average Three-Phase Reactive Power Phase 3	IEEE 32-bit fp (F2,F1,F0,EXP)
39.047, 39.048	S0_Med	Average Three-Phase Apparent Power	IEEE 32-bit fp (F2,F1,F0,EXP)
39.049, 39.050	S1_Med	Average Three-Phase Apparent Power Phase 1	IEEE 32-bit fp (F2,F1,F0,EXP)
39.051, 39.052	S2_Med	Average Three-Phase Apparent Power Phase 2	IEEE 32-bit fp (F2,F1,F0,EXP)
39.053, 39.054	S3_Med	Average Three-Phase Apparent Power Phase 3	IEEE 32-bit fp (F2,F1,F0,EXP)

39.055, 39.056	FP0_Med	Average Three-Phase Power Factor	IEEE 32-bit fp (F2,F1,F0,EXP)
39.057, 39.058	FP1_Med	Average Power Factor Phase 1	IEEE 32-bit fp (F2,F1,F0,EXP)
39.059, 39.060	FP2_Med	Average Power Factor Phase 2	IEEE 32-bit fp (F2,F1,F0,EXP)
39.061, 39.062	FP3_Med	Average Power Factor Phase 3	IEEE 32-bit fp (F2,F1,F0,EXP)
39.063, 39.064	FPD0_Med	Average Three-Phase Displacement Power Factor	IEEE 32-bit fp (F2,F1,F0,EXP)
39.065, 39.066	FPD1_Med	Average Displacement Power Factor Phase 1	IEEE 32-bit fp (F2,F1,F0,EXP)
39.067, 39.068	FPD2_Med	Average Displacement Power Factor Phase 2	IEEE 32-bit fp (F2,F1,F0,EXP)
39.069, 39.070	FPD3_Med	Average Displacement Power Factor Phase 3	IEEE 32-bit fp (F2,F1,F0,EXP)

4.19. Average Values of THDs.

ADDRESS	REGISTER	DESCRIPTION	FORMAT
39.101	Med UA THD	Average THD of Voltage Phase 1	Int 16-bit (MSB,LSB)
39.102	Med UB THD	Average THD of Voltage Phase 2	Int 16-bit (MSB,LSB)
39.103	Med UC THD	Average THD of Voltage Phase 3	Int 16-bit (MSB,LSB)
39.104	Med IA THD	Average THD of Current Phase 1	Int 16-bit (MSB,LSB)
39.105	Med IB THD	Average THD of Current Phase 2	Int 16-bit (MSB,LSB)
39.106	Med IC THD	Average THD of Current Phase 3	Int 16-bit (MSB,LSB)
39.107	Med U1 THD (agrup.)	Average THD Grouping of Voltage Phase 1	Int 16-bit (MSB,LSB)
39.108	Med U2 THD (agrup.)	Average THD Grouping of Voltage Phase 2	Int 16-bit (MSB,LSB)
39.109	Med U3 THD (agrup.)	Average THD Grouping of Voltage Phase 3	Int 16-bit (MSB,LSB)
39.110	Med I1 THD (agrup.)	Average THD Grouping of Current Phase 1	Int 16-bit (MSB,LSB)
39.111	Med I2 THD (agrup.)	Average THD Grouping of Current Phase 2	Int 16-bit (MSB,LSB)
39.112	Med I3 THD (agrup.)	Average THD Grouping of Current Phase 3	Int 16-bit (MSB,LSB)
39.113	Med DTT1Par	Average THD of Voltage Phase 1 (even orders not multiples of 3)	Int 16-bit (MSB,LSB)
39.114	Med DTT2Par	Average THD of Voltage Phase 2 (even orders not multiples of 3)	Int 16-bit (MSB,LSB)
39.115	Med DTT3Par	Average THD of Voltage Phase 3 (even orders not multiples of 3)	Int 16-bit (MSB,LSB)
39.116	Med DTC1Par	Average THD of Current Phase 1 (even orders not multiples of 3)	Int 16-bit (MSB,LSB)
39.117	Med DTC2Par	Average THD of Current Phase 2 (even orders not multiples of 3)	Int 16-bit (MSB,LSB)
39.118	Med DTC3Par	Average THD of Current Phase 3 (even orders not multiples of 3)	Int 16-bit (MSB,LSB)
39.119	Med DTT1Imp	Average THD of Voltage Phase 1 (odd orders not multiples of 3)	Int 16-bit (MSB,LSB)
39.120	Med DTT2Imp	Average THD of Voltage Phase 2 (odd orders not multiples of 3)	Int 16-bit (MSB,LSB)
39.121	Med DTT3Imp	Average THD of Voltage Phase 3 (odd orders not multiples of 3)	Int 16-bit (MSB,LSB)
39.122	Med DTC1Imp	Average THD of Current Phase 1 (odd orders not multiples of 3)	Int 16-bit (MSB,LSB)
39.123	Med DTC2Imp	Average THD of Current Phase 2 (odd orders not multiples of 3)	Int 16-bit (MSB,LSB)
39.124	Med DTC3Imp	Average THD of Current Phase 3 (odd orders not multiples of 3)	Int 16-bit (MSB,LSB)
39.125	Med DTT1Tripl	Average THD of Voltage Phase 1 (multiples of 3 orders)	Int 16-bit (MSB,LSB)
39.126	Med DTT2Tripl	Average THD of Voltage Phase 2 (multiples of 3 orders)	Int 16-bit (MSB,LSB)
39.127	Med DTT3Tripl	Average THD of Voltage Phase 3 (multiples of 3 orders)	Int 16-bit (MSB,LSB)
39.128	Med DTC1Tripl	Average THD of Current Phase 1 (multiples of 3 orders)	Int 16-bit (MSB,LSB)
39.129	Med DTC2Tripl	Average THD of Current Phase 2 (multiples of 3 orders)	Int 16-bit (MSB,LSB)
39.130	Med DTC3Tripl	Average THD of Current Phase 3 (multiples of 3 orders)	Int 16-bit (MSB,LSB)

4.20 Average Values of Harmonics.

ADDRESS	REGISTER	DESCRIPTION	FORMAT
39.501, 39.502	H1_I1_Med	Average Harmonic 1 – Current I1	IEEE 32-bit fp (F2,F1,F0,EXP)
39.503, 39.504	H2_I1_Med	Average Harmonic 2 – Current I1	IEEE 32-bit fp (F2,F1,F0,EXP)
39.505, 39.506	H3_I1_Med	Average Harmonic 3 – Current I1	IEEE 32-bit fp (F2,F1,F0,EXP)
39.507, 39.508	H4_I1_Med	Average Harmonic 4 – Current I1	IEEE 32-bit fp (F2,F1,F0,EXP)
39.509, 39.510	H5_I1_Med	Average Harmonic 5 – Current I1	IEEE 32-bit fp (F2,F1,F0,EXP)
39.511, 39.512	H6_I1_Med	Average Harmonic 6 – Current I1	IEEE 32-bit fp (F2,F1,F0,EXP)
39.513, 39.514	H7_I1_Med	Average Harmonic 7 – Current I1	IEEE 32-bit fp (F2,F1,F0,EXP)
39.515, 39.516	H19_I1_Med	Average Harmonic 9 – Current I1	IEEE 32-bit fp (F2,F1,F0,EXP)

39.517, 39.518	H11_I1_Med	Average Harmonic 11 – Current I1	IEEE 32-bit fp (F2,F1,F0,EXP)
39.519, 39.520	H13_I1_Med	Average Harmonic 13 – Current I1	IEEE 32-bit fp (F2,F1,F0,EXP)
39.521, 39.522	H15_I1_Med	Average Harmonic 15 – Current I1	IEEE 32-bit fp (F2,F1,F0,EXP)
39.523, 39.524	H17_I1_Med	Average Harmonic 17 – Current I1	IEEE 32-bit fp (F2,F1,F0,EXP)
39.525, 39.526	H19_I1_Med	Average Harmonic 19 – Current I1	IEEE 32-bit fp (F2,F1,F0,EXP)

ADDRESS	REGISTER	DESCRIPTION	FORMAT
39.601, 39.602	H1_I2_Med	Average Harmonic 1 – Current I2	IEEE 32-bit fp (F2,F1,F0,EXP)
39.603, 39.604	H2_I2_Med	Average Harmonic 2 – Current I2	IEEE 32-bit fp (F2,F1,F0,EXP)
39.605, 39.606	H3_I2_Med	Average Harmonic 3 – Current I2	IEEE 32-bit fp (F2,F1,F0,EXP)
39.607, 39.608	H4_I2_Med	Average Harmonic 4 – Current I2	IEEE 32-bit fp (F2,F1,F0,EXP)
39.609, 39.610	H5_I2_Med	Average Harmonic 5 – Current I2	IEEE 32-bit fp (F2,F1,F0,EXP)
39.611, 39.612	H6_I2_Med	Average Harmonic 6 – Current I2	IEEE 32-bit fp (F2,F1,F0,EXP)
39.613, 39.614	H7_I2_Med	Average Harmonic 7 – Current I2	IEEE 32-bit fp (F2,F1,F0,EXP)
39.615, 39.616	H19_I2_Med	Average Harmonic 9 – Current I2	IEEE 32-bit fp (F2,F1,F0,EXP)
39.617, 39.618	H11_I2_Med	Average Harmonic 11 – Current I2	IEEE 32-bit fp (F2,F1,F0,EXP)
39.619, 39.620	H13_I2_Med	Average Harmonic 13 – Current I2	IEEE 32-bit fp (F2,F1,F0,EXP)
39.621, 39.622	H15_I2_Med	Average Harmonic 15 – Current I2	IEEE 32-bit fp (F2,F1,F0,EXP)
39.623, 39.624	H17_I2_Med	Average Harmonic 17 – Current I2	IEEE 32-bit fp (F2,F1,F0,EXP)
39.625, 39.626	H19_I2_Med	Average Harmonic 19 – Current I2	IEEE 32-bit fp (F2,F1,F0,EXP)
39.701, 39.702	H1_I3_Med	Average Harmonic 1 – Current I3	IEEE 32-bit fp (F2,F1,F0,EXP)
39.703, 39.704	H2_I3_Med	Average Harmonic 2 – Current I3	IEEE 32-bit fp (F2,F1,F0,EXP)
39.705, 39.706	H3_I3_Med	Average Harmonic 3 – Current I3	IEEE 32-bit fp (F2,F1,F0,EXP)
39.707, 39.708	H4_I3_Med	Average Harmonic 4 – Current I3	IEEE 32-bit fp (F2,F1,F0,EXP)
39.709, 39.710	H5_I3_Med	Average Harmonic 5 – Current I3	IEEE 32-bit fp (F2,F1,F0,EXP)
39.711, 39.712	H6_I3_Med	Average Harmonic 6 – Current I3	IEEE 32-bit fp (F2,F1,F0,EXP)
39.713, 39.714	H7_I3_Med	Average Harmonic 7 – Current I3	IEEE 32-bit fp (F2,F1,F0,EXP)
39.715, 39.716	H19_I3_Med	Average Harmonic 9 – Current I3	IEEE 32-bit fp (F2,F1,F0,EXP)
39.717, 39.718	H11_I3_Med	Average Harmonic 11 – Current I3	IEEE 32-bit fp (F2,F1,F0,EXP)
39.719, 39.720	H13_I3_Med	Average Harmonic 13 – Current I3	IEEE 32-bit fp (F2,F1,F0,EXP)
39.721, 39.722	H15_I3_Med	Average Harmonic 15 – Current I3	IEEE 32-bit fp (F2,F1,F0,EXP)
39.723, 39.724	H17_I3_Med	Average Harmonic 17 – Current I3	IEEE 32-bit fp (F2,F1,F0,EXP)
39.725, 39.726	H19_I3_Med	Average Harmonic 19 – Current I3	IEEE 32-bit fp (F2,F1,F0,EXP)

5 FORCE SINGLE COIL

This function allows the execution of the following commands on the NG family analyzers, version E33:

COMMAND	DESCRIPTION
001	Reset Active Demand
002	Reset Apparent Demand
003	Reset Maximum Active Demand
004	Reset Maximum Apparent Demand
005	Reset Positive Active Energy
006	Reinitialize Device
007	Synchronize Demand Calculation
040	Reset all Energies and Demands
050	Reset Positive Reactive Energy
051	Reset Negative Active Energy
052	Reset Negative Reactive Energy
053	Reset Minima and Maxima

100	Delete all stored events
101	Generate file with DIP's
102	Generate file with SWELL's
103	Generate file with Interruptions
104	Generate file with Interruptions of Phase 1
105	Generate file with Interruptions of Phase 2
106	Generate file with Interruptions of Phase 3
107	Reset Prodist, Aggregation Memory, Percentile, and Minima and Maxima of TRPs
108	Initialize Prodist Measurements, Aggregation Memory, Percentile, and MinMax of TRPs at the next Full Hour.

Observations:

The differences between Coils 107 and 108 are:

- With Coil 107, the memories will be erased, but the aggregations will continue to be calculated normally. With Coil 108, the same aggregations will only start being calculated after the next full hour.
- If the TRP Time is scheduled, Coil 107 will not trigger the start of TRP storage or force the configured time to the default (01/01/00 00:00). Therefore, its behavior is the opposite of Coil 108.
- Coil 108 clears the event memory, whereas Coil 107 does not.

6 SLAVE ID

The functions "ReportSlaveID" and "ReportSlaveIDKron" return the following sequence of codes:

BYTE COUNT	0x04
DEVICE CODE	0xA1
SPECIAL CODE	0x33 – for MULT-K/NG E33
SOFTWARE VERSION	0x0A (10 decimal – V1.0) to 0xFF (255 decimal – V25.5)
CONFIGURATION	See description

7 ERROR CODES

The error code allows verifying the integrity of the device. In the NG E33 Analyzer, it consists of 2 bytes, identified as LSB and MSB.

The MODBUS function "Read Exception Status (0x07)" displays only the LSB byte. To obtain the complete error code information, the function "Read Input Register (0x04)", register 33.901, is used.

1.1. LSB:

CODE (decimal)	DESCRIPTION
00	Voltage connected and in the correct sequence (R-S-T)
01	Phase Reversal or Phase Loss (voltage inputs)
02	Mathematical Error.
08	Exceeded the allowed limit for Urms and/or Irms.
16	System improperly restarted.
32	Parallel FRAM Error.
64	RTC – Low Battery.
128	Aggregation Memory Error.

1.2. MSB:

CODE (decimal)	DESCRIPTION
00	Correct Operation.
01	System synchronizing the Phases.
02	Out of frequency range.
04	Error in the event module.
08	Firmware protection active
16	Incorrect connection of TCs
32	Bluetooth Module Failure

It is worth noting that the code is binary, meaning there can be a combination of codes. Therefore, an error code 09 indicates the simultaneous presence of error codes 01 and 08.

8 BAUDRATES

The NG analyzers can use the following baud rates, configurable through the IHM:

- 9600 bps
- 19200 bps
- 38400 bps
- 57600 bps

9 DATA FORMAT

The NG analyzers, version E33, can use the 10-bit format (for the 8N1 case) or the 11-bit format (for the 8N2, 8E1, or 8O1 cases). All these options are also selectable via the IHM.

FORMAT	OTAL NUMBER OF BITS	OBS
8N1 (1 start bit, 8 data bits, 1 stop bit)	10	-
8N2 (1 start bit, 8 data bits, 2 stop bits)	11	-
8E1 (1 start bit, 8 data bits, 1 parity bit, 1 stop bit)	11	Even parity
8O1 (1 start bit, 8 data bits, 1 parity bit, 1 stop bit)	11	Odd parity

10 HOLDING REGISTER 40.007 "Configurations"

Accessing Holding Register 40.007 (Configurations), the following configurations can be made:

D7	D6	D5	**D4**	**D3**	**D2**	**D1**	**D0**
D15	**D14**	**D13**	**D12**	**D11**	**D10**	**D9**	**D8**

D0 – Return to the opening screen configuration of the HMI (0 – Disabled / 1 – Enabled).
D1 – Current Harmonics Configuration (0 – Percentage / 1 – Absolute).
D2 – Voltage Harmonics Configuration (0 – Percentage / 1 – Absolute).
D3 - Purge Temporary TRPs (0 – Do not purge / 1 – Purge).
D4 - Purge Long Duration TRP Interruptions (0 – Do not purge / 1 – Purge).
D5..D7 - Reserved for future expansion
D8 - Grouping Type Configuration (0 – Subgroup / 1 – Group).
D9 - Frequency Selection: (0 – 50Hz / 1 – 60Hz).
D10 - MM Storage Buffer Type (0 – Circular / 1 – Linear). Not used for E33 version.
D11 - Reference Voltage (0 – Fixed / 1 – Sliding).
D12 - Purge Momentary TRPs (0 – Do not purge / 1 – Purge).
D13 - TRP Storage Buffer Type (0 – Circular / 1 – Linear).
D14 - Event Storage Buffer Type (0 – Circular / 1 – Linear).
D15 - Flicker Nominal Voltage (0 – 120V / 1 – 230V).

BIT	DESCRIPTION	VALUES
D0	Return to the opening screen configuration of the IHM	0 –Disabled 1 – Enabled
D1	Current Harmonics	0 – Percentage 1 – Absolute
D2	Voltage Harmonics	0 – Percentage 1 – Absolute
D3	Purge Temporary TRP	0 – Does not purge 1 – Purges
D4	Purge Long-Duration Interruption TRP	0 – Does not purge 1 – Purges
D8	Grouping Type	0 – Subgroup 1 – Group
D9	Frequency Selection	0 – 50Hz 1 – 60Hz
D10	Mass Memory Storage Buffer Type	0 – Circular 1 – Linear

D11	Reference Voltage	0 – Fixed 1 – Sliding
D12	Purge Momentary TRP	0 – Does not purge 1 – Purges
D13	Type of TRP Storage Buffer	0 – Circular 1 – Linear
D14	Type of Event Storage Buffer	0 – Circular 1 – Linear
D15	Nominal Flicker Voltage	0 – 120V 1 – 230V

11. AGGREGATION MEMORY

The aggregation memory for the E-33 version of NG analyzers has a storage capacity of up to 4 weeks, with 1008 readings of 304 quantities. The sectors used for recording measurements range from **11** to **70**.

1	U1 Average	34	Harmonic U1 - 11	67	Harmonic U2 - 5	100	Harmonic U2 - 38	133	Harmonic U3 - 32
2	U2 Average	35	Harmonic U1 - 12	68	Harmonic U2 - 6	101	Harmonic U2 - 39	134	Harmonic U3 - 33
3	U3 Average	36	Harmonic U1 - 13	69	Harmonic U2 - 7	102	Harmonic U2 - 40	135	Harmonic U3 - 34
4	U1 Minimum	37	Harmonic U1 - 14	70	Harmonic U2 - 8	103	Harmonic U3 - 2	136	Harmonic U3 - 35
5	U2 Minimum	38	Harmonic U1 - 15	71	Harmonic U2 - 9	104	Harmonic U3 - 3	137	Harmonic U3 - 36
6	U3 Minimum	39	Harmonic U1 - 16	72	Harmonic U2 - 10	105	Harmonic U3 - 4	138	Harmonic U3 - 37
7	Freq. IEC Minimum	40	Harmonic U1 - 17	73	Harmonic U2 - 11	106	Harmonic U3 - 5	139	Harmonic U3 - 38
8	U1 Maximum	41	Harmonic U1 - 18	74	Harmonic U2 - 12	107	Harmonic U3 - 6	140	Harmonic U3 - 39
9	U2 Maximum	42	Harmonic U1 - 19	75	Harmonic U2 - 13	108	Harmonic U3 - 7	141	Harmonic U3 - 40
10	U3 Maximum	43	Harmonic U1 - 20	76	Harmonic U2 - 14	109	Harmonic U3 - 8	142	PST Phase 1
11	Freq. IEC Maximum	44	Harmonic U1 - 21	77	Harmonic U2 - 15	110	Harmonic U3 - 9	143	PST Phase 2
12	Unbalance	45	Harmonic U1 - 22	78	Harmonic U2 - 16	111	Harmonic U3 - 10	144	PST Phase 3
13	THD U1	46	Harmonic U1 - 23	79	Harmonic U2 - 17	112	Harmonic U3 - 11	145	PLT Phase 1
14	THD U1 (DTT1Par)	47	Harmonic U1 - 24	80	Harmonic U2 - 18	113	Harmonic U3 - 12	146	PLT Phase 2
15	THD U1 (DTT1Imp)	48	Harmonic U1 - 25	81	Harmonic U2 - 19	114	Harmonic U3 - 13	147	PLT Phase 3
16	THD U1 (DTT1Trip)	49	Harmonic U1 - 26	82	Harmonic U2 - 20	115	Harmonic U3 - 14		
17	THD U2	50	Harmonic U1 - 27	83	Harmonic U2 - 21	116	Harmonic U3 - 15		
18	THD U2 (DTT2Par)	51	Harmonic U1 - 28	84	Harmonic U2 - 22	117	Harmonic U3 - 16		
19	THD U2 (DTT2Imp)	52	Harmonic U1 - 29	85	Harmonic U2 - 23	118	Harmonic U3 - 17		
20	THD U2 (DTT2Trip)	53	Harmonic U1 - 30	86	Harmonic U2 - 24	119	Harmonic U3 - 18		
21	THD U3	54	Harmonic U1 - 31	87	Harmonic U2 - 25	120	Harmonic U3 - 19		
22	THD U3 (DTT3Par)	55	Harmonic U1 - 32	88	Harmonic U2 - 26	121	Harmonic U3 - 20		
23	THD U3 (DTT3Imp)	56	Harmonic U1 - 33	89	Harmonic U2 - 27	122	Harmonic U3 - 21		
24	THD U3 (DTT3Trip)	57	Harmonic U1 - 34	90	Harmonic U2 - 28	123	Harmonic U3 - 22		
25	Harmonic U1 - 2	58	Harmonic U1 - 35	91	Harmonic U2 - 29	124	Harmonic U3 - 23		
26	Harmonic U1 - 3	59	Harmonic U1 - 36	92	Harmonic U2 - 30	125	Harmonic U3 - 24		
27	Harmonic U1 - 4	60	Harmonic U1 - 37	93	Harmonic U2 - 31	126	Harmonic U3 - 25		
28	Harmonic U1 - 5	61	Harmonic U1 - 38	94	Harmonic U2 - 32	127	Harmonic U3 - 26		
29	Harmonic U1 - 6	62	Harmonic U1 - 39	95	Harmonic U2 - 33	128	Harmonic U3 - 27		
30	Harmonic U1 - 7	63	Harmonic U1 - 40	96	Harmonic U2 - 34	129	Harmonic U3 - 28		

148	I1 Average	181	Harmonic I1 - 11	214	Harmonic I2 - 5	247	Harmonic I2 - 38	280	Harmonic U3 - 32
149	I2 Average	182	Harmonic I1 - 12	215	Harmonic I2 - 6	248	Harmonic I2 - 39	281	Harmonic U3 - 33
150	I3 Average	183	Harmonic I1 - 13	216	Harmonic I2 - 7	249	Harmonic I2 - 40	282	Harmonic U3 - 34
151	IN Average	184	Harmonic I1 - 14	217	Harmonic I2 - 8	250	Harmonic I3 - 2	283	Harmonic U3 - 35
152	I1 Minimum	185	Harmonic I1 - 15	218	Harmonic I2 - 9	251	Harmonic I3 - 3	284	Harmonic U3 - 36
153	I2 Minimum	186	Harmonic I1 - 16	219	Harmonic I2 - 10	252	Harmonic I3 - 4	285	Harmonic U3 - 37
154	I3 Minimum	187	Harmonic I1 - 17	220	Harmonic I2 - 11	253	Harmonic I3 - 5	286	Harmonic U3 - 38
155	IN Minimum	188	Harmonic I1 - 18	221	Harmonic I2 - 12	254	Harmonic I3 - 6	287	Harmonic U3 - 39
156	I1 Maximum	189	Harmonic I1 - 19	222	Harmonic I2 - 13	255	Harmonic I3 - 7	288	Harmonic U3 - 40
157	I2 Maximum	190	Harmonic I1 - 20	223	Harmonic I2 - 14	256	Harmonic I3 - 8	289	Displacement PF F1
158	I3 Maximum	191	Harmonic I1 - 21	224	Harmonic I2 - 15	257	Harmonic I3 - 9	290	Displacement PF F2
159	IN Maximum	192	Harmonic I1 - 22	225	Harmonic I2 - 16	258	Harmonic I3 - 10	291	Displacement PF F3
160	THD I1	193	Harmonic I1 - 23	226	Harmonic I2 - 17	259	Harmonic I3 - 11	292	Displacement PF Total
161	THD I1 (DTT1Par)	194	Harmonic I1 - 24	227	Harmonic I2 - 18	260	Harmonic I3 - 12	293	Active Power F1
162	THD I1 (DTT1Imp)	195	Harmonic I1 - 25	228	Harmonic I2 - 19	261	Harmonic I3 - 13	294	Active Power F2
163	THD I1 (DTT1Trip)	196	Harmonic I1 - 26	229	Harmonic I2 - 20	262	Harmonic I3 - 14	295	Active Power F3
164	THD I2	197	Harmonic I1 - 27	230	Harmonic I2 - 21	263	Harmonic I3 - 15	296	Active Power Total
165	THD I2 (DTT2Par)	198	Harmonic I1 - 28	231	Harmonic I2 - 22	264	Harmonic I3 - 16	297	Reactive Power F1

166	THD I2 (DTT2Imp)	199	Harmonic I1 - 29	232	Harmonic I2 - 23	265	Harmonic I3 - 17	298	Reactive Power F2
167	THD I2 (DTT2Trip)	200	Harmonic I1 - 30	233	Harmonic I2 - 24	266	Harmonic I3 - 18	299	Reactive Power F3
168	THD I3	201	Harmonic I1 - 31	234	Harmonic I2 - 25	267	Harmonic I3 - 19	300	Reactive Power Total
169	THD I3 (DTT3Par)	202	Harmonic I1 - 32	235	Harmonic I2 - 26	268	Harmonic I3 - 20	301	Apparent Power F1
170	THD I3 (DTT3Imp)	203	Harmonic I1 - 33	236	Harmonic I2 - 27	269	Harmonic I3 - 21	302	Apparent Power F2
171	THD I3 (DTT3Trip)	204	Harmonic I1 - 34	237	Harmonic I2 - 28	270	Harmonic I3 - 22	303	Apparent Power F3
172	Harmonic I1 - 2	205	Harmonic I1 - 35	238	Harmonic I2 - 29	271	Harmonic I3 - 23	304	Apparent Power Total
173	Harmonic I1 - 3	206	Harmonic I1 - 36	239	Harmonic I2 - 30	272	Harmonic I3 - 24		
174	Harmonic I1 - 4	207	Harmonic I1 - 37	240	Harmonic I2 - 31	273	Harmonic I3 - 25		
175	Harmonic I1 - 5	208	Harmonic I1 - 38	241	Harmonic I2 - 32	274	Harmonic I3 - 26		
176	Harmonic I1 - 6	209	Harmonic I1 - 39	242	Harmonic I2 - 33	275	Harmonic I3 - 27		
177	Harmonic I1 - 7	210	Harmonic I1 - 40	243	Harmonic I2 - 34	276	Harmonic I3 - 28		
178	Harmonic I1 - 8	211	Harmonic I2 - 2	244	Harmonic I2 - 35	277	Harmonic I3 - 29		
179	Harmonic I1 - 9	212	Harmonic I2 - 3	245	Harmonic I2 - 36	278	Harmonic I3 - 30		
180	Harmonic I1 - 10	213	Harmonic I2 - 4	246	Harmonic I2 - 37	279	Harmonic I3 - 31		

Reading the Control Block and Sector Size

Before starting the reading process, it is necessary to check the memory status and storage information. This is done using function **04 - Read Input Register**, to read the registers between **33.915** and **33.979** (65 registers). The first 5 registers correspond to the control block; from register 33.920 onwards, the number of records in each memory sector is indicated.

The user can request the entire address range, only the control block, or only the memory sector information. However, the meter will not respond if only part of the control block is requested. Below is an example of a request:

Request (Frame sent by the Master, considering address 1 for the meter):

0	1	2	3	4	5	6	7
END	FUN	REG		QTD		CRC	
		MSB	LSB	MSB	LSB	LSB	MSB
01	**04**	**0F**	**4A**	**00**	**41**	**xx**	**xx**

Response:

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
END	FUN	BC	Number of Recorded Quantities		Number of Completed Weeks		Sector where the First Block of Week 1 starts	Sector where the First Block of Week 2 starts	Sector Where the First Block of Week 3 Begins	Sector Where the First Block of Week 4 or Ongoing Week Begins	Quantity of Blocks of the Ongoing Week		Total of Blocks in Sector 11		Total of Blocks in Sector 12		Total of Blocks in Sector 13		Total of Blocks in Sector 14		Total of Blocks in Sector 15	
MSB	LSB		MSB	LSB	MSB	LSB					MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB
01	**04**	**82**	**01**	**30**	**00**	**04**	**0B**	**1A**	**29**	**38**	**00**	**A2**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**47**

23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
Total of Blocks in Sector 16		Total of Blocks in Sector 17		Total of Blocks in Sector 18		Total of Blocks in Sector 19		Total of Blocks in Sector 20		Total of Blocks in Sector 21		Total of Blocks in Sector 22		Total of Blocks in Sector 23		Total of Blocks in Sector 24		Total of Blocks in Sector 25		Total of Blocks in Sector 26		Total of Blocks in Sector 27	
MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB
00	**47**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**0E**	**00**	**47**	**00**	**47**

47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72
Total of Blocks in Sector 28		Total of Blocks in Sector 29		Total of Blocks in Sector 30		Total of Blocks in Sector 31		Total of Blocks in Sector 32		Total of Blocks in Sector 33		Total of Blocks in Sector 34		Total of Blocks in Sector 35		Total of Blocks in Sector 36		Total of Blocks in Sector 37		Total of Blocks in Sector 38		Total of Blocks in Sector 39		Total of Blocks in Sector 40	

MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB
00	**47**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**0E**

73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96
Total of Blocks in Sector 41		Total of Blocks in Sector 42		Total of Blocks in Sector 43		Total of Blocks in Sector 44		Total of Blocks in Sector 45		Total of Blocks in Sector 46		Total of Blocks in Sector 47		Total of Blocks in Sector 48		Total of Blocks in Sector 49		Total of Blocks in Sector 50		Total of Blocks in Sector 51		Total of Blocks in Sector 52	
MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB
00	**47**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**47**

97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
Total of Blocks in Sector 53		Total of Blocks in Sector 54		Total of Blocks in Sector 55		Total of Blocks in Sector 56		Total of Blocks in Sector 57		Total of Blocks in Sector 58		Total of Blocks in Sector 59		Total of Blocks in Sector 60		Total of Blocks in Sector 61		Total of Blocks in Sector 62		Total of Blocks in Sector 63		TTotal of Blocks in Sector 64	
MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB
00	**47**	**00**	**47**	**00**	**0E**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**47**

121	122	123	124	125	126	127	128	129	130	131	132	133	134
Total of Blocks in Sector 65		Total of Blocks in Sector 66		Total of Blocks in Sector 67		Total of Blocks in Sector 68		Total of Blocks in Sector 69		Total of Blocks in Sector 70		CRC	
MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB
00	**47**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**47**	**00**	**0E**	**xx**	**xx**

Here is the detailed response sent by the meter:

Byte 3-4 – Number of quantities stored by the device (304 quantities)
Byte 5-6 – Number of weeks already completed in the storage period
Byte 7-10 – Flash memory sectors where each storage week begins
Byte 11-12 – Number of readings stored in the ongoing week (once 1,008 readings are reached, the storage of the eight weeks is complete)
Byte 13-14 – Block capacity of sector 11 of the Flash
Byte 15-16 – Block capacity of sector 12 of the Flash
...
Byte 131-32 –Block Capacity of Sector 70 in Flash

Reading the Aggregation Memory

Request Step 0:

0	1	2	3	4	5	6	7	8	9	10	11
END	FUN	BC	RT	SECTOR	BLOCK		STEP	QUANTITY		CRC	
					MSB	LSB		MSB	LSB	LSB	MSB
32	**64**	**07**	**06**	**0B**	**00**	**01**	**00**	**00**	**3C**	**XX**	**XX**

Response for Step 0 – Reading of 60 Quantities + Timestamp:

0	1	2	3	4	5	6	7	8	9
END	FUN	FILE RESP LENGTH		RT	DATE/TIME				

		MSB	LSB		SEC	MIN/HOUR	HOUR/DAY	DAY/MONTH	YEAR
32	**64**	**00**	**B9**	**06**	**56**	**08**	**92**	**48**	**12**

10	11	12	13	14	15	16	17	18	...	...	...	187	188	189	190	191
MAGNITUDE 1			MAGNITUDE 2			MAGNITUDE 3			...			MAGNITUDE 60			CRC	
F1	F0	EXP	F1	F0	EXP	F1	F0	EXP	...	...	...	F1	F0	EXP	LSB	MSB
32	**80**	**01**	**F2**	**06**	**56**	**08**	**92**	**48**	**...**	**...**	**...**	**00**	**45**	**3C**	**2E**	**39**

Request for Steps 1 to 4:

0	1	2	3	4	5	6	7	8	9	10	11
END	FUN	BC	RT	SECTOR	BLOCK		STEP	QUANTITY		CRC	
					MSB	LSB		MSB	LSB	LSB	MSB
32	**64**	**07**	**06**	**0B**	**00**	**01**	**0X**	**00**	**3C**	**XX**	**XX**

Where 0X corresponds to the requested step.

Response for Step 1 – Reading 60 Electrical Greatnesses:

0	1	2	3	4	5	6	7	8	9	10	...	...	...	182	183	184	185	186
END	FUN	FILE RESP LENGTH		RT	ELETRICAL GREATNESSES 61			ELETRICAL GREATNESSES 62			...			ELETRICAL GREATNESSES 120			CRC	
		MSB	LSB		F1	F0	EXP	F1	F0	EXP	...	...	...	F1	F0	EXP	LSB	MSB
32	**64**	**00**	**B4**	**06**	**xx**	**xx**	**xx**	**xx**	**xx**	**xx**	**...**	**...**	**...**	**xx**	**xx**	**xx**	**xx**	**xx**

Response for Step 2 – Reading 60 Electrical Greatnesses:

0	1	2	3	4	5	6	7	8	9	10	...	...	...	182	183	184	185	186
END	FUN	FILE RESP LENGTH		RT	ELETRICAL GREATNESSES 121			ELETRICAL GREATNESSES 122			...			ELETRICAL GREATNESSES 180			CRC	
		MSB	LSB		F1	F0	EXP	F1	F0	EXP	...	...	...	F1	F0	EXP	LSB	MSB
32	**64**	**00**	**B4**	**06**	**xx**	**xx**	**xx**	**xx**	**xx**	**xx**	**...**	**...**	**...**	**xx**	**xx**	**xx**	**xx**	**xx**

Response for Step 3 – Reading 60 Electrical Greatnesses:

0	1	2	3	4	5	6	7	8	9	10	...	...	...	182	183	184	185	186
END	FUN	FILE RESP LENGTH		RT	ELETRICAL GREATNESSES 181			ELETRICAL GREATNESSES 182			...			ELETRICAL GREATNESSES 240			CRC	
		MSB	LSB		F1	F0	EXP	F1	F0	EXP	...	...	...	F1	F0	EXP	LSB	MSB
32	**64**	**00**	**B4**	**06**	**xx**	**xx**	**xx**	**xx**	**xx**	**xx**	**...**	**...**	**...**	**xx**	**xx**	**xx**	**xx**	**xx**

Response for Step 4 – Reading 60 Electrical Greatnesses:

0	1	2	3	4	5	6	7	8	9	10	...	...	...	182	183	184	185	186
END	FUN	FILE RESP LENGTH		RT	ELETRICAL GREATNESSES 241			ELETRICAL GREATNESSES 242			...			ELETRICAL GREATNESSES 300			CRC	
		MSB	LSB		F1	F0	EXP	F1	F0	EXP	...	...	...	F1	F0	EXP	LSB	MSB
32	**64**	**00**	**B4**	**06**	**xx**	**xx**	**xx**	**xx**	**xx**	**xx**	**...**	**...**	**...**	**xx**	**xx**	**xx**	**xx**	**xx**

Request for Step 5:

0	1	2	3	4	5	6	7	8	9	10	11
END	FUN	BC	RT	SECTOR	BLOCK		STEP	QUANTITY		CRC	
					MSB	LSB		MSB	LSB	LSB	MSB
32	**64**	**07**	**06**	**0B**	**00**	**01**	**05**	**00**	**04**	**XX**	**XX**

Response for Step 5 – Reading 4 Electrical Greatnesses:

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	86	87
END	FUN	FILE RESP LENGTH		RT	ELETRICAL GREATNESSES 301			ELETRICAL GREATNESSES 302			ELETRICAL GREATNESSES 303			ELETRICAL GREATNESSES 304			CRC	
		MSB	LSB		F1	F0	EXP	F1	F0	EXP	F1	F0	EXP	F1	F0	EXP	LSB	MSB
32	**64**	**00**	**51**	**06**	**xx**	**xx**	**xx**	**xx**	**xx**	**xx**	**xx**	**xx**	**xx**	**xx**	**xx**	**xx**	**xx**	**xx**

Where:

END = Modbus address of the meter in the network (1 byte)
FUNC = Special Modbus function 0x64 (1 byte)
BC = Reference Type (this value will always be the same) (1 byte)
RT = Reference Type (this value will always be the same) (1 byte)
SECTOR = Sector to be read from the memory (1 byte)
BLOCK = Block to be read from the sector (2 bytes)
STEP = Passo a ser lido de cada Bloco (0, 1, 2, 3, 4 ou 5) (1 byte)
QUANTITY = Quantity of Bytes in the Response (use the calculation shown below)
CRC = Checksum of the packet (2 bytes)
FILE RESP LENGTH = Quantity of Bytes in the response (2 bytes)
SEC = Seconds (bit 0 to 7)
MIN/HOUR = Minutes (bit 0 to 6) and Hour (bit 7).
HOUR/DAY = Hour (bit 0 to 4) and Day (bit 5 to 7).
DAY/MONTH = Day (bit 0 to 2) and Month (bit 3 to 7).
YEAR = Year (bit 0 to 7).

The value of the "QUANTITY" field must be calculated as follows:
For Steps 0, 1, 2, 3, and 4, the quantity will be 60 (0x003C) magnitudes.
For Step 5, the remaining number of readings. In our example, since there is a total of 304 magnitudes stored in the Aggregation Memory, there are 4 magnitudes left to be read (0x0004).

If the value of the "STEP" or "QUANTITY" field is not valid, the device will respond with the exception "Illegal Data Address."

Observations:

All magnitude values in the response are in 24-bit floating-point format (F1, F0, EXP).
THD values in the Aggregation Memory are stored in floating-point format. The obtained value must be divided by 100 for correct interpretation.
Harmonic values in the Aggregation Memory are also stored in floating-point format. The obtained value must be multiplied by 100 for correct interpretation.

If a block that has not yet been recorded is requested, the meter will return 0xFF in the timestamp and magnitude fields.

12. READING OF TRPs

For the reading of the Steady-State Voltages (TRP), the "Read File Record" (0x14) function is used. To allow the user to know the number of records stored each week and for the current week, it is recommended to perform a prior read of the aggregation memory control block (refer to the chapter on aggregation memory).

The files are divided as follows:

FILE NUMBER	MAXIMUM RECORD NUMBER	PERMANENT REG VOLTAGE
0x1C	1008 (from 0 to 1007)	1008 TRP for each Phase (Week A)
0x1D	1008 (from 0 to 1007)	1008 TRP for each Phase (Week B)
0x1E	1008 (from 0 to 1007)	1008 TRP for each Phase (Week C)
0x1F	1008 (from 0 to 1007)	1008 TRP for each Phase (Week D)

READING OF TRPs

Request:

0	1	2	3	4	5	6	7	8	9	10	11
END	FUN	BC	RT	FILE NUMBER		RECORD NUMBER		RECORD LENGTH		CRC	
				MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB
02	**14**	**07**	**06**	**00**	**1C**	**00**	**00**	**00**	**06**	**11**	**28**

Response:

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
END	FUN	BC	FILE RESPONSE LENGTH	RT	VA				VB				VC				CRC	
					F2	F1	F0	EXP	F2	F1	F0	EXP	F2	F1	F0	EXP	MSB	LSB
02	**14**	**0E**	**0D**	**06**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**

Where:
END = Modbus address of the meter on the network (1 byte)
FUNC = Special Modbus Function 0x14 (1 byte)
BC = Byte Count (this value will always be the same) (1 byte)
RT = Reference Type (this value will always be the same) (1 byte)
FILE NUMBER = Requested file (28 to 31) (2 bytes)
RECORD NUMBER = Record number (0 to 1007) (2 bytes)
RECORD LENGTH = Each reading has 6 records (always this number) (2 bytes)
FILE RESP LENGTH = Number of bytes in the response (this value will always be the same) (2 bytes)

Observation: When requesting a record number that has not yet been written, the meter will return 0x00 in the fields related to the magnitudes.

13. READING OF EXPIRED TRPs

For reading the expired TRPs, which may be present due to events occurring during the 10-minute aggregation calculation, the user must first read the Input Registers that provide the number of expired TRPs for each week. After obtaining this information, it is possible to read the timestamps and the values of the expired TRPs using function 0x64. The stored magnitudes are the same as those defined in the aggregation memory table.

a. Reading of the number of expired TRPs

ADDRESS	DESCRIPTION	FORMAT	Range
32.901	Number of Expired TRPs – Week A	Unsigned int 16-bit	0 to 96
32.902	Number of Expired TRPs – Week B	Unsigned int 16-bit	0 to 96
32.903	Number of Expired TRPs – Week C	Unsigned int 16-bit	0 to 96
32.904	Number of Expired TRPs – Week D	Unsigned int 16-bit	0 to 96

b. Reading of the Expired TRPs

Request Step 0:

0	1	2	3	4	5	6	7	8	9	10	11
END	FUNC	BC	RT	WEEK	BLOCK		STEP	QUANTITY		CRC	
					MSB	LSB		MSB	LSB	LSB	MSB
32	**64**	**07**	**07**	**00**	**00**	**01**	**00**	**00**	**3C**	**XX**	**XX**

Response for Step 0 – Reading of 60 Magnitudes + Timestamp

0	1	2	3	4	5	6	7	8	9
END	FUNC	FILE RESP LENGTH		RT	DATE/HOUR				
		MSB	LSB		SEC	MIN/HOUR	HOUR/DAY	DAY/MONTH	YEAR
32	**64**	**00**	**B9**	**07**	**56**	**08**	**92**	**48**	**12**

10	11	12	13	14	15	16	17	18	...	...	...	187	188	189	190	191
ELETRICAL GREATNESSES 1			ELETRICAL GREATNESSES 2			ELETRICAL GREATNESSES 3			...			ELETRICAL GREATNESSES 60			CRC	
F1	F0	EXP	F1	F0	EXP	F1	F0	EXP	...	...	...	F1	F0	EXP	LSB	MSB
32	**80**	**01**	**F2**	**06**	**56**	**08**	**92**	**48**	**...**	**...**	**...**	**00**	**45**	**3C**	**2E**	**39**

Request Step 1 to 4:

0	1	2	3	4	5	6	7	8	9	10	11
END	FUNC	BC	RT	WEEK	BLOCK		STEP	QUANTITY		CRC	
					MSB	LSB		MSB	LSB	LSB	MSB
32	**64**	**07**	**07**	**00**	**00**	**01**	**0X**	**00**	**3C**	**XX**	**XX**

Where 0X corresponds to the requested step.

Response for Step 1 – Reading of 60 Magnitudes:

0	1	2	3	4	5	6	7	8	9	10	...	...	...	182	183	184	185	186
END	FUN	FILE RESP LENGTH		RT	ELETRICAL GREATNESSES 61			ELETRICAL GREATNESSES 62			...			ELETRICAL GREATNESSES 120			CRC	
		MSB	LSB		F1	F0	EXP	F1	F0	EXP	...	...	...	F1	F0	EXP	LSB	MSB
32	**64**	**00**	**B4**	**07**	**08**	**92**	**08**	**92**	**48**	**48**	**...**	**...**	**...**	**00**	**45**	**3C**	**2E**	**39**

Response for Step 2 – Reading of 60 Magnitudes:

0	1	2	3	4	5	6	7	8	9	10	...	...	...	182	183	184	185	186
END	FUN	FILE RESP LENGTH		RT	ELETRICAL GREATNESSES 121			ELETRICAL GREATNESSES 122			...			ELETRICAL GREATNESSES 180			CRC	
		MSB	LSB		F1	F0	EXP	F1	F0	EXP	...	...	...	F1	F0	EXP	LSB	MSB
32	**64**	**00**	**B4**	**07**	**08**	**92**	**08**	**92**	**48**	**48**	**...**	**...**	**...**	**00**	**45**	**3C**	**2E**	**39**

Response for Step 3 – Reading of 60 Magnitudes:

0	1	2	3	4	5	6	7	8	9	10	...	...	...	182	183	184	185	186
END	FUN	FILE RESP LENGTH		RT	ELETRICAL GREATNESSES 181			ELETRICAL GREATNESSES 182			...			ELETRICAL GREATNESSES 240			CRC	
		MSB	LSB		F1	F0	EXP	F1	F0	EXP	...	...	...	F1	F0	EXP	LSB	MSB
32	**64**	**00**	**B4**	**07**	**08**	**92**	**08**	**92**	**48**	**48**	**...**	**...**	**...**	**00**	**45**	**3C**	**2E**	**39**

Response for Step 4 – Reading of 60 Magnitudes:

0	1	2	3	4	5	6	7	8	9	10	...	...	...	182	183	184	185	186
END	FUN	FILE RESP LENGTH		RT	ELETRICAL GREATNESSES 241			ELETRICAL GREATNESSES 242			...			ELETRICAL GREATNESSES 300			CRC	
		MSB	LSB		F1	F0	EXP	F1	F0	EXP	...	...	...	F1	F0	EXP	LSB	MSB
32	**64**	**00**	**B4**	**07**	**08**	**92**	**08**	**92**	**48**	**48**	**...**	**...**	**...**	**00**	**45**	**3C**	**2E**	**39**

Requisição Step 5:

0	1	2	3	4	5	6	7	8	9	10	11
END	FUNC	BC	RT	WEEK	BLOCK		STEP	QUANTITY		CRC	
					MSB	LSB		MSB	LSB	LSB	MSB
32	**64**	**07**	**07**	**00**	**00**	**01**	**05**	**00**	**04**	**XX**	**XX**

Response for Step 5 – Reading of the Remaining 4 Magnitudes:

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
END	FUN	FILE RESP LENGTH		RT	ELETRICAL GREATNESSES 301			ELETRICAL GREATNESSES 302			ELETRICAL GREATNESSES 303			ELETRICAL GREATNESSES 304			CRC	
		MSB	LSB		F1	F0	EXP	F1	F0	EXP	F1	F0	EXP	F1	F0	EXP	LSB	MSB
32	**64**	**00**	**51**	**07**	**xx**	**xx**	**xx**	**xx**	**xx**	**xx**	**xx**	**xx**	**xx**	**xx**	**xx**	**xx**	**xx**	**xx**

Where:
END = Modbus address of the meter on the network (1 byte)
FUNC = Modbus special function 0x64 (1 byte)
BC = Byte Count (this value will always be the same) (1 byte)
RT = Reference Type (this value will always be the same) (1 byte)
WEEK = Week to be read from Memory (0 to 3) (1 byte)
BLOCK = Block to be read from the sector (2 bytes)
STEP = Step to be read from each block (0, 1, 2, 3, 4, or 5) (1 byte)
QUANTITY = Number of bytes in the response (use the calculation shown below)
CRC = Checksum of the packet (2 bytes)
FILE RESP LENGTH = Number of bytes in the response (2 bytes)

SEC = Seconds (bit 0 to 7)
MIN/HOUR = Minutes (bit 0 to 6) and Hour (bit 7).
HOUR/DAY = Hour (bit 0 to 4) and Day (bit 5 to 7).
DAY/MONTH = Day (bit 0 to 2) and Month (bit 3 to 7).
YEAR = Year (bit 0 to 7).

Observation 1: If a Record Number that has not yet been stored is requested, i.e., greater than the number of readings in Input Registers 32,901 to 32,904, the Modbus error "Illegal Data Value" will be returned.

Observation 2: Considering the linear writing mode, if the memory is already completely filled, i.e., 1008 valid TRP readings have been stored for all 4 weeks, the recording of expired readings will also stop.

Observation 3: The clock compression algorithm for expired readings is the same as the one used for reading the Aggregation memory.

14. Minimum and Maximum TRPs

The minimum and maximum TRP values must be read using the "Read File Record" (0x14) function. To allow the user to know the number of records stored for each week and for the current week, it is recommended to first read the aggregation memory control block (refer to the chapter on aggregation memory).

The files are divided as follows:

FILE NUMBER	MAXIMUM RECORD NUMBER	PERMANENT REG VOLTAGE
0x30	1008 (from 0 to 1007)	Minimum Week A
0x31	1008 (from 0 to 1007)	Maximum Week A
0x32	1008 (from 0 to 1007)	Minimum Week B
0x33	1008 (from 0 to 1007)	Maximum Week B
0x34	1008 (from 0 to 1007)	Minimum Week C
0x35	1008 (from 0 to 1007)	Maximum Week C
0x36	1008 (from 0 to 1007)	Minimum Week D
0x37	1008 (from 0 to 1007)	Maximum Week D

Reading of the minimum and maximum TRPs

Request:

0	1	2	3	4	5	6	7	8	9	10	11
END	FUNC	BC	RT	FILE NUMBER		RECORD NUMBER		RECORD LENGTH		CRC	
				MSB	LSB	MSB	LSB	MSB	LSB	MSB	LSB
01	**14**	**07**	**06**	**00**	**30**	**00**	**00**	**00**	**10**	**B8**	**EC**

Response:

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
END	FUNC	BC	FILE RESPONSE	RT	Mín. VA				Mín. VB				Mín. VC				Mín. Freq IEC			
					F2	F1	F0	EXP	F2	F1	F0	EXP	F2	F1	F0	EXP	F2	F1	F0	EXP

			LENGTH																	
01	**14**	**22**	**21**	**06**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**

21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38
Mín. I1				Mín. I2				Mín. I3				Mín. IN				CRC	
F2	F1	F0	EXP	F2	F1	F0	EXP	F2	F1	F0	EXP	F2	F1	F0	EXP	MSB	LSB
XX	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**	**XX**

Where:
END = Modbus address of the meter on the network (1 byte)
FUNC = Modbus special function 0x14 (1 byte)
BC = Byte Count (this value will always be the same) (1 byte)
RT = Reference Type (this value will always be the same) (1 byte)
FILE NUMBER = Requested file (48 to 55) (2 bytes)
RECORD NUMBER = Record number (0 to 1007) (2 bytes)
RECORD LENGTH = Each reading contains 8 records (this value is always the same) (2 bytes)
FILE RESP LENGTH = Number of bytes in the response (this value will always be the same) (2 bytes)

Observation: If a record that has not yet been stored is requested, the meter will return the code "ILLEGAL OPERATION".

15. EVENT FLAGS

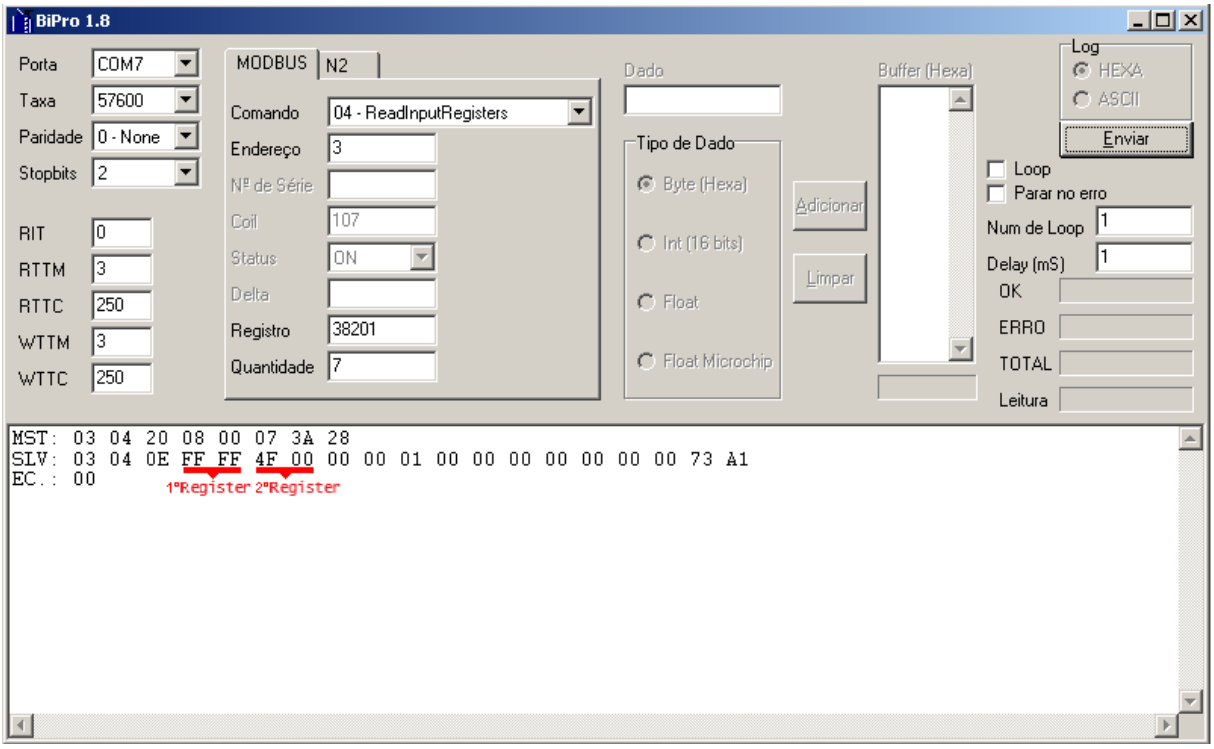
When the meter is configured to purge aggregations in which events have been detected, reading the flags will indicate exactly in which aggregation(s) the events occurred. Each bit of the flags represents a 10-minute aggregation. If the bit is set to 0, it means no event occurred during the aggregation. If the bit is set to 1, it means an event occurred during the aggregation.

Modbus Registers

WEEK A	WEEK B	WEEK C	WEEK D	FLAGS
38.101	38.201	38.301	38.401	Reading 1 to 16
38.102	38.202	38.302	38.402	Reading 17 to 32
38.103	38.203	38.303	38.403	Reading 33 to 48
...	...	...	...	...
...	...	...	...	...
...	...	...	...	...
...	...	...	...	...
38.163	38.263	38.363	38.463	Reading 993 to 1008

To allow the user to know the number of records stored for each week and for the current week, it is recommended to first read the aggregation memory control block (refer to the chapter on aggregation memory).

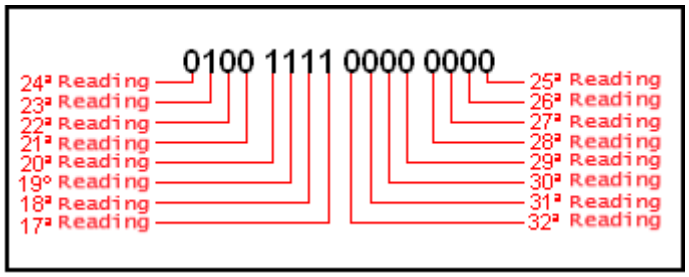
In the example below, 7 records from week B (38,201 to 38,207) are read. Seven records are equivalent to 112 readings, since each record has 16 bits, and each bit corresponds to one reading.



Below, the interpretation of the obtained reading:

Registro 38.201 = 0xFFFF – That is, event flag on all readings (1 to 16).
Registro 38.202 = 0x4F00 – That is, event flag on readings 17 to 20 and 23.
Registro 38.203 = 0x0000 – That is, no event between readings 33 to 48.
Registro 38.204 = 0x0100 – That is, event flag only on reading 49.
Registro 38.205 a 38.207 = 0x0000 – That is, no event between readings 65 to 112.

The second record (readings 17 to 32) has the value 0x4F00 (0b0100111100000000). See the detail in red in the figure below:



Observation 1: The limit of records in this area that can be read consecutively is 7.

16. PERCENTILE

The percentile values should be read using the "Read Input Registers" function. All magnitudes are in 32-bit floating-point format (IEEE, F2, F1, F0, EXP), except for the timestamp. The following values are stored **line voltage, voltage THDs (including grouping,**

non-multiple of 3, and multiple of 3), voltage imbalance, and PSTs. To read the values from the Input Registers for the timestamps, the following example should be followed:

Reading the Timestamp of the 1st Day of Week 1.
Registers: 50.001, 50.002, and 50.003 (DD/MM/YY HH:MM:SS).

Register	Value
50.001	0x0904
50.002	0x1216
50.003	0x5945

The read timestamp is:
Date: 09/04/12
Hour: 16:59:45

Observation 1: The obtained THD values must be divided by 100 for correct interpretation.

Observation 2: The maximum number of records that can be read at once for the timestamp is 21 records.

Observation 3: The timestamp of the weekly indicator is the same as the timestamp of the 7th day.

17. FUNÇÃO MODBUS PARA LEITURA DA TENSÃO DE REGIME PERMANENTE

To read the steady-state voltages (TRP) in NG Analyzers, the MODBUS function "Read File Record (0x14)" must be used.

FILE NUMBER	TENSÃO REG PERMANENTE
0x1C	File with TRP - Completed Week
0x1D	File with TRP - Ongoing Week

Each file will consist of recordings (Record Number), with each recording corresponding to the storage of three voltage values (VA, VB, and VC). The maximum number of values stored in each file will be:

FILE NUMBER	MAXIMUM RECORD NUMBER	TOTAL
0x1C	1008 (de 0 até 1007)	1008 TRP for each Phase (Completed Week)
0x1D	1008 (de 0 até 1007)	1008 TRP for each Phase (Ongoing Week)

Example:

File with Steady-State Voltages (TRP) of the completed week (FILE NUMBER = 0x1C), with 9 TRP's stored.

RECORD NUMBER	TRP
0	1st record of VA, VB, and VC
1	2nd record of VA, VB, and VC
2	3rd record of VA, VB, and VC
3	4th record of VA, VB, and VC
4	5th record of VA, VB, and VC
5	6th record of VA, VB, and VC
6	7th record of VA, VB, and VC
7	8th record of VA, VB, and VC
8	9th record of VA, VB, and VC
9	-
↓	↓
1007	-

a. Request details:

An example of a TRP request (1st stored TRP) for an NG analyzer with address 2 is shown below

SLAVE ADDRESS	0x02
FUNCTION CODE	0x14
BYTE COUNT	0x07
REFERENCE TYPE	0x06
FILE NUMBER (HIGH)	0x00
FILE NUMBER (LOW)	0x1C
RECORD NUMBER (HIGH)	0x00
RECORD NUMBER (LOW)	0x00
RECORD LENGTH (HIGH)	0x00
RECORD LENGTH (LOW)	0x06
CRC (HIGH)	
CRC (LOW)	

b. Limitations related to the request:

FILE NUMBER	RECORD LENGTH	OBSERVATION
0x1C (TRP's - Finalized Week)	0x06	Each TRP has 6 records
0x1D (Ongoing Week)	0x06	Each TRP has 6 records

BYTE COUNT = 0x07 (cannot be any other value). REFERENCE TYPE = 0x06 (cannot be any other value).

Observation: Although the "Read File Record" function allows requesting more than one file, the NG Analyzer only allows the request of one file at a time.

c. Details related to the response sent by Analyzers NG:

Response:

FIELD	VALUE	OBSERVATION
SLAVE ADDRESS	0x02	
FUNCTION CODE	0x14	
RESPONSE DATA LENGTH	0x0E	
FILE RESPONSE LENGTH	0x0D	
REFERENCE TYPE	0x06	
1° REGISTER DATA HIGH	F2	VA
1° REGISTER DATA LOW	F1	VA
2° REGISTER DATA HIGH	F0	VA
2° REGISTER DATA LOW	EXP	VA
3° REGISTER DATA HIGH	F2	VB
3° REGISTER DATA LOW	F1	VB
4° REGISTER DATA HIGH	F0	VB
4° REGISTER DATA LOW	EXP	VB
5° REGISTER DATA HIGH	F2	VC
5° REGISTER DATA LOW	F1	VC
6° REGISTER DATA HIGH	F0	VC
6° REGISTER DATA LOW	EXP	VC
CRC HIGH		
CRC LOW		

18. MODBUS FUNCTION FOR READING THE HISTOGRAMS

The histogram for each phase in the **Analyzer NG** is constructed as follows: each Permanent Regime Voltage (the value of the 10-minute aggregation) is divided by the nominal voltage. The result is classified into one of the 42 ranges of the histogram. For example, if the nominal voltage value is 220.0V and the reading value is 213.13V, the result will be 0.968773. Therefore, the histogram range will be "≥ 0.96 and < 0.97". The value corresponding to this range is then incremented by one unit

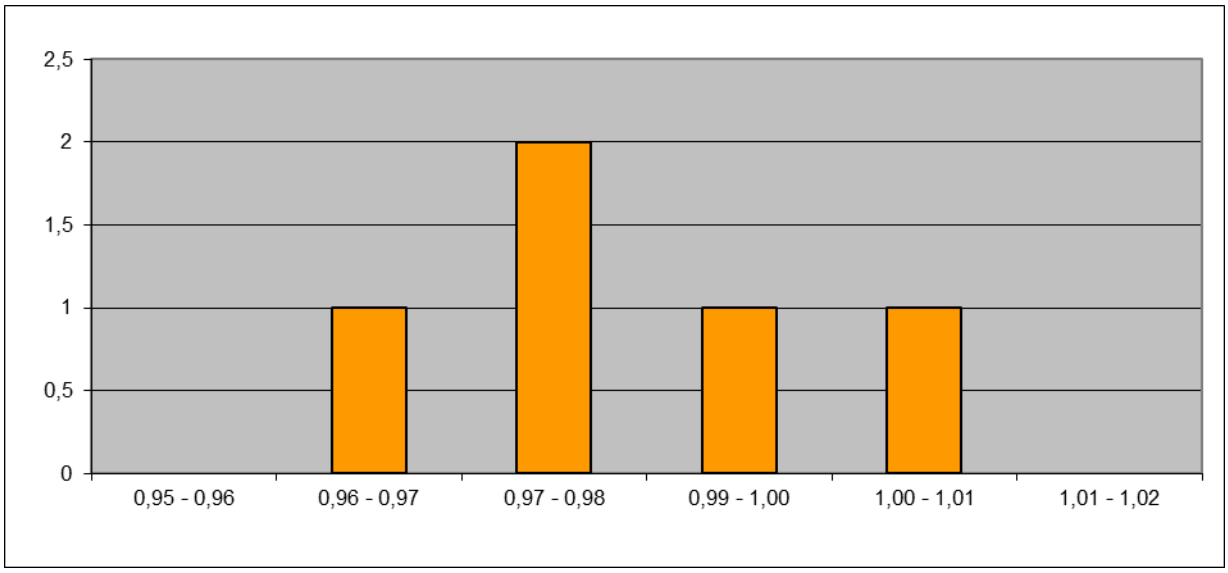
In summary, the NG Analyzer records the number of times the result of the reading divided by the nominal voltage is classified into a specific range of the histogram, and this quantity can be obtained by reading the Input Registers.

Example for phase A (completed week), of a new histogram with 5 completed readings:

READING	VALUE	/V NOMINAL	HISTOGRAM RANGE
1ª	219,80	0,99909	≥ 0,99 and < 1,00
2ª	215,00	0,97727	≥ 0,97 and < 0,98
3ª	215,00	0,97727	≥ 0,97 and < 0,98
4ª	213,13	0,96877	≥ 0,96 and < 0,97
5ª	220,00	1,00000	≥ 1,00 and < 1,01

ADDRESS	RANGE	QUANTITY
30.718	≥ 0,96 and < 0,97	1
30.719	≥ 0,97 and < 0,98	2
30.721	≥ 0,99 and < 1,00	1
30.722	≥ 1,00 and < 1,01	1

Graphically:



	WEEK COMPLETED			WEEK IN PROGRESS		
RANGE	PHASE A	PHASE B	PHASE C	PHASE A	PHASE B	PHASE C
< 0,80	30.701	30.801	30.901	31.701	31.801	31.901
≥ 0,80 and < 0,81	30.702	30.802	30.902	31.702	31.802	31.902
≥ 0,81 and < 0,82	30.703	30.803	30.903	31.703	31.803	31.903
≥ 0,82 and < 0,83	30.704	30.804	30.904	31.704	31.804	31.904
≥ 0,83 and < 0,84	30.705	30.805	30.905	31.705	31.805	31.905
≥ 0,84 and < 0,85	30.706	30.806	30.906	31.706	31.806	31.906
≥ 0,85 and < 0,86	30.707	30.807	30.907	31.707	31.807	31.907
≥ 0,86 and < 0,87	30.708	30.808	30.908	31.708	31.808	31.908
≥ 0,87 and < 0,88	30.709	30.809	30.909	31.709	31.809	31.909
≥ 0,88 and < 0,89	30.710	30.810	30.910	31.710	31.810	31.910
≥ 0,89 and < 0,90	30.711	30.811	30.911	31.711	31.811	31.911

≥ 0,90 and < 0,91	30.712	30.812	30.912	31.712	31.812	31.912
≥ 0,91 and < 0,92	30.713	30.813	30.913	31.713	31.813	31.913
≥ 0,92 and < 0,93	30.714	30.814	30.914	31.714	31.814	31.914
≥ 0,93 and < 0,94	30.715	30.815	30.915	31.715	31.815	31.915
≥ 0,94 and < 0,95	30.716	30.816	30.916	31.716	31.816	31.916
≥ 0,95 and < 0,96	30.717	30.817	30.917	31.717	31.817	31.917
≥ 0,96 and < 0,97	30.718	30.818	30.918	31.718	31.818	31.918
≥ 0,97 and < 0,98	30.719	30.819	30.919	31.719	31.819	31.919
≥ 0,98 and < 0,99	30.720	30.820	30.920	31.720	31.820	31.920
≥ 0,99 and < 1,00	30.721	30.821	30.921	31.721	31.821	31.921
≥ 1,00 and < 1,01	30.722	30.822	30.922	31.722	31.822	31.922
≥ 1,01 and < 1,02	30.723	30.823	30.923	31.723	31.823	31.923
≥ 1,02 and < 1,03	30.724	30.824	30.924	31.724	31.824	31.924
≥ 1,03 and < 1,04	30.725	30.825	30.925	31.725	31.825	31.925
≥ 1,04 and < 1,05	30.726	30.826	30.926	31.726	31.826	31.926
≥ 1,05 and < 1,06	30.727	30.827	30.927	31.727	31.827	31.927
≥ 1,06 and < 1,07	30.728	30.828	30.928	31.728	31.828	31.928
≥ 1,07 and < 1,08	30.729	30.829	30.929	31.729	31.829	31.929
≥ 1,08 and < 1,09	30.730	30.830	30.930	31.730	31.830	31.930
≥ 1,09 and < 1,10	30.731	30.831	30.931	31.731	31.831	31.931
≥ 1,10 and < 1,11	30.732	30.832	30.932	31.732	31.832	31.932
≥ 1,11 and < 1,12	30.733	30.833	30.933	31.733	31.833	31.933
≥ 1,12 and < 1,13	30.734	30.834	30.934	31.734	31.834	31.934
≥ 1,13 and < 1,14	30.735	30.835	30.935	31.735	31.835	31.935
≥ 1,14 and < 1,15	30.736	30.836	30.936	31.736	31.836	31.936
≥ 1,15 and < 1,16	30.737	30.837	30.937	31.737	31.837	31.937
≥ 1,16 and < 1,17	30.738	30.838	30.938	31.738	31.838	31.938
≥ 1,17 and < 1,18	30.739	30.839	30.939	31.739	31.839	31.939
≥ 1,18 and < 1,19	30.740	30.840	30.940	31.740	31.840	31.940
≥ 1,19 and < 1,20	30.741	30.841	30.941	31.741	31.841	31.941
≥ 1,20	30.742	30.842	30.942	31.742	31.842	31.942

19. MODBUS FUNCTION FOR READING THE CLASSIFICATION OF THE VTCDS

The classification of the VTCDS is available through the following Input Registers:

ADDRESS	DESCRIPTION
30.671	DAY/MONTH
30.672	YEAR/HOUR
30.673	MINUTE/SECOND
30.674	HUNDREDTH/0x00
30.675	IMT
30.676	IMT F1
30.677	IMT F2
30.678	IMT F3
30.679	AMT

30.680	EMT
30.681	ITT
30.682	ITT F1
30.683	ITT F2
30.684	ITT F3
30.685	ATT
30.686	ETT
30.687	ILT
30.688	ILT F1
30.689	ILT F2
30.690	ILT F3
30.691	ALT
30.692	ELT

IMT –momentary voltage interruption quantity
AMT – momentary voltage dip quantity.
EMT – momentary voltage swell quantity.
ITT – temporary voltage interruption quantity.
ATT – temporary voltage dip quantity.
ETT – temporary voltage swell quantity.

ILT – long-duration voltage interruption quantity.
ALT – long-duration voltage dip quantity.
ELT – long-duration voltage swell quantity.

20. COILS

The following commands can be executed through the 'Force Single Coil (0x05)' function:

COIL	FUNCTION
107	Delete the entire Prodist.

21. HOLDING REGISTERS

For the configuration of the Permanent Regime Voltage classification.

Limitations:

- Writing a maximum of 8 Holding Registers at once.

HOLDING REGISTER	CONFIGURATION	IEEE fp 32-bit
42.031 and 42.032	Lower Limit for Adequate	F2, F1, F0 and EXP
42.033 and 42.034	Upper Limit for Adequate	F2, F1, F0 and EXP
42.035 and 42.036	Lower Limit for Poor	F2, F1, F0 and EXP
42.037 and 42.038	Upper Limit for Poor	F2, F1, F0 and EXP
42.039	Number of Readings for DRP / DRC Calculation	(MSB,LSB)

Example: Lower Limit for Adequate = 216.0 V.

(216,0 = 0x43, 0x58, 0x00 e 0x00)

HOLDING REGISTER	VALUE
42.031	0x0000
42.032	0x5843

22. BASIC PROCEDURE FOR READING THE TRP

All information about the Prodist in the NG Analyzer is stored in non-volatile memory.

Procedure:

a. The user selects the week they wish to read. Once the week is chosen (Completed or Ongoing), it is necessary to obtain, by reading the corresponding Input Registers, the current number of TRPs stored. (Completed Week: 30,608 or Ongoing Week: 31,608).

b. Knowing this quantity, the user can start reading the file using the 'Read File Record (0x14)' function. The user can request each stored TRP (VA, VB, and VC) in any order, but it is more appropriate to request from the first (Record Number 0) to the last (which will always be the quantity minus one) or vice versa.