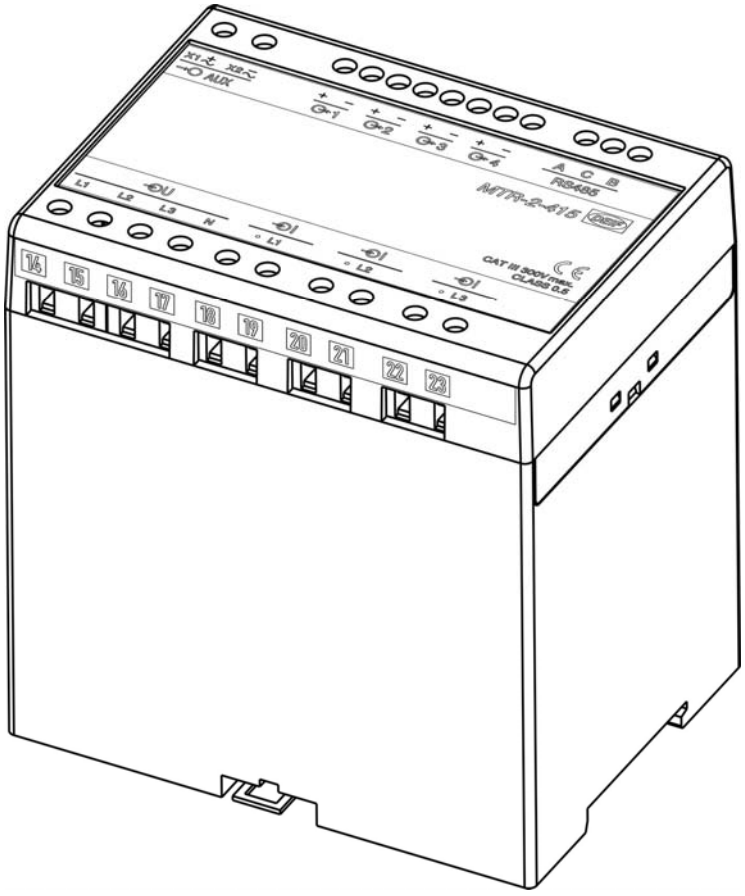
DEIF A/S

Modbus Communication Manual

MTR-2-015, -315, -415, MTR-2F-215

Multi-configurable AC transducer
4189300020C



- *Modbus protocol*
- *Modbus addresses*

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1. Warnings and legal information

This chapter includes important information about general legal issues relevant in the handling of DEIF products. Furthermore, some overall safety precautions will be introduced and recommended. Finally, the highlighted notes and warnings, which will be used throughout the document, are presented.

Legal information and responsibility

DEIF takes no responsibility for installation or operation of the engine set. If there is any doubt about how to install or operate the engine controlled by the unit, the company responsible for the installation or the operation of the set must be contacted.

The units are not to be opened by unauthorised personnel. If opened anyway, the warranty will be lost.

Electrostatic discharge awareness

Sufficient care must be taken to protect the terminals against static discharges during the installation. Once the unit is installed and connected, these precautions are no longer necessary.

Safety issues

Installing the unit implies work with dangerous currents and voltages. Therefore, the installation should only be carried out by authorised personnel who understand the risks involved in working with live electrical equipment.

Be aware of the hazardous live currents and voltages. Do not touch any AC measurement inputs as this could lead to injury or death.

CE-marking

The MTR-2 is CE-marked according to the EMC-directive for industrial environments, which normally covers the most common use of the product.

Definitions

Throughout this document, a number of notes and warnings will be presented. To ensure that these are noticed, they will be highlighted in order to separate them from the general text.

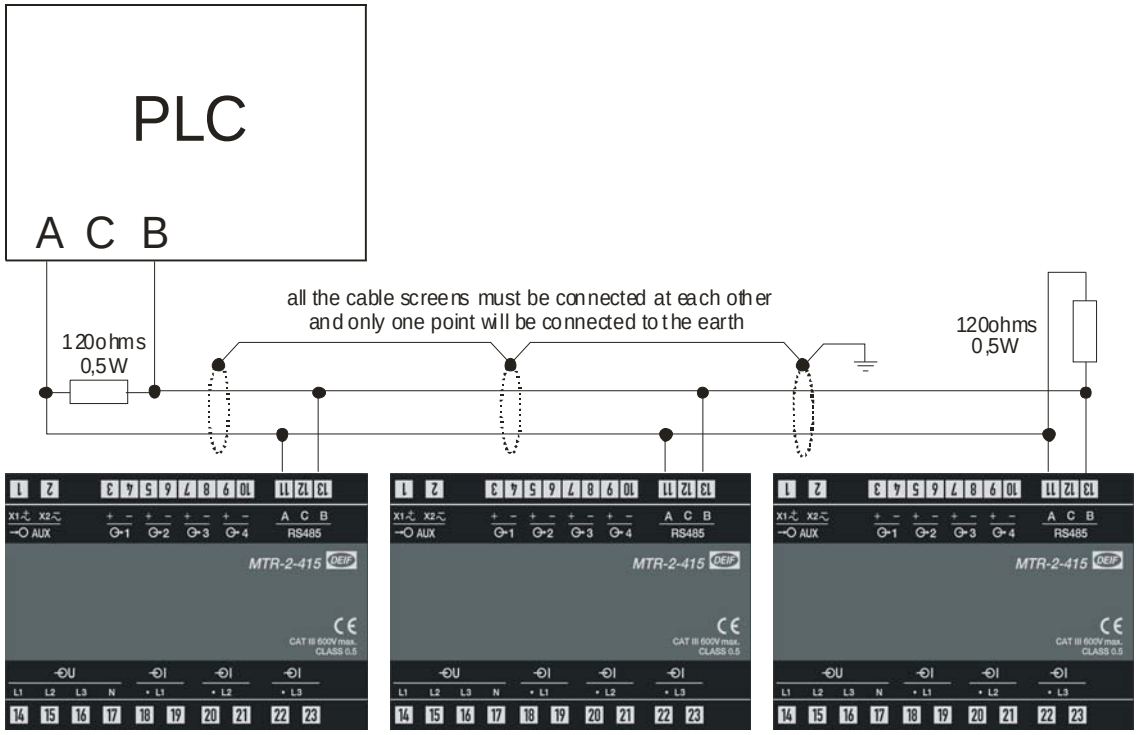
Notes

The notes provide general information which will be helpful for the reader to bear in mind.

Warnings

The warnings indicate a potentially dangerous situation which could result in death, personal injury or damaged equipment, if certain guidelines are not followed.

2. Wiring



Cable: Belden 3107 A or equivalent. 22 AWG or 0.34 mm^2 double twisted pair, shielded, min. 95% shield coverage.

3. Modbus protocol

Introduction of the Modbus protocol

Modbus Protocol is a messaging structure developed by Modicon in 1979. It is used to establish master-slave/client-server communication between intelligent devices. It is a de facto standard, truly open and the most widely used network protocol in the industrial manufacturing environment. It has been implemented by hundreds of vendors on thousands of different devices to transfer discrete/analogue I/O and register data between control devices. It's a lingua franca or common denominator between different manufacturers. One report called it the "de facto standard in multi-vendor integration". Industry analysts have reported over 7 million Modbus nodes in North America and Europe alone.

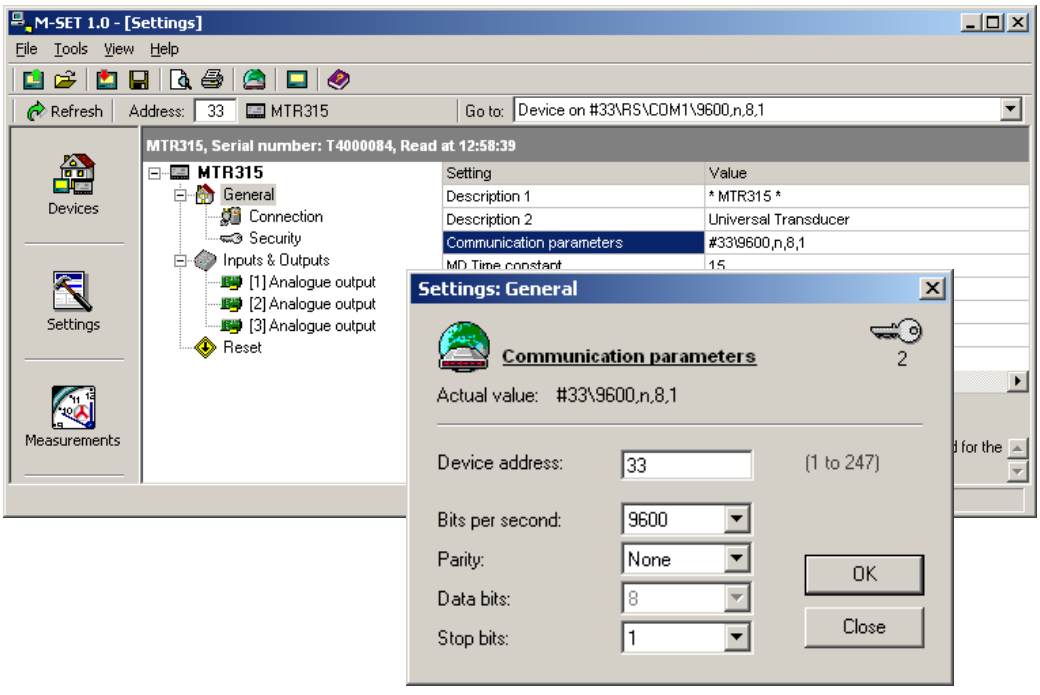
The Modbus RTU protocol is used for communication in the MTR-2. The data format and error check method is defined in the Modbus protocol. The half duplex query and response mode is adopted in the Modbus protocol. There is only one master device in the communication net. The others are slave devices, waiting for the query of the master.

Transmission mode

The mode of transmission defines the data structure within a frame and the rules used to transmit data. The mode is defined in the following which is compatible with Modbus RTU mode:

Coding system	8-bit binary
Start bit	1
Data bits	8
Parity	No parity
Stop bit	1
Error checking	CRC check

The above values are configurable by means of using the MTR-2 configuration software. This can be done by double-clicking on the communication parameters line (see below);



Framing

Address	Function	Data	Check
8-bits	8-bits	N x 8-bits	16-bits

Table 3.1 Data frame format

Address field

The address field of a message frame contains eight bits. Valid slave device addresses are in the range of 0~247 decimals. A master addresses a slave by placing the slave address in the address field of the message. When the slave sends its response, it places its own address in this address field of the response to let the master know which slave is responding.

Function field

The function code field of a message frame contains eight bits. Valid codes are in the range of 1~255 decimals. When a message is sent from a master to a slave device, the function code field tells the slave what kind of action to perform.

Code	Modbus meaning	Action
03	Read holding registers	Read configuration data that can also be written by using the function 06 or 16
04	Read input registers	Read configuration or measured data that cannot be written
06	Write holding registers	Write configuration data that can be read by using the function 03
16	Preset multiple-registers	Write configuration data that can be read by using the function 03

Table 3.2 Function code

Data field

The data field is constructed using sets of two hexadecimal digits in the range of 00 to FF hexadecimal. The data field of messages sent from a master to slave devices contains additional information which the slave must use to take the action defined by the function code. This can include items like discrete and register addresses, the quantity of items to be handled and the count of actual data bytes in the field. For example, if the master requests a slave to read a group of holding registers (function code 03), the data field specifies the starting register and how many registers are to be read. If the master writes to a group of registers in the slave (function code 10 hexadecimal), the data field specifies the starting register, how many registers to write, the count of data bytes to follow in the data field and the data to be written into the registers.

If no error occurs, the data field of a response from a slave to a master contains the data requested. If an error occurs, the field contains an exception code that the master application can use to determine the next action to be taken. The data field can be nonexistent (of zero length) in certain kinds of messages.

Error check field

Messages include an error checking field that is based on a Cyclical Redundancy Check (CRC) method. The CRC field checks the contents of the entire message. It is applied regardless of any parity check method used for the individual characters of the message. The CRC field is two bytes, containing a 16 bit binary value. The CRC value is calculated by the transmitting device, which appends the CRC to the message.

The receiving device recalculates a CRC during receipt of the message and compares the calculated value to the actual value it received in the CRC field. If the two values are not equal, an error occurs. The CRC is started by first preloading a 16-bit register to all 1s. Then a process begins of applying successive 8-bit bytes of the message to the current contents of the register. Only the eight bits of data in each character are used for generating the CRC. Start and stop bits and the parity bit do not apply to the CRC. During generation of the CRC, each 8-bit character is exclusive ORed with the register contents. Then the result is shifted in the direction of the least significant bit (LSB), with a zero filled into the most significant bit (MSB) position. The LSB is extracted and examined. If the LSB was a 1, the register is then exclusive ORed with a preset, fixed value. If the LSB was a 0, no exclusive OR takes place. This process is repeated until eight shifts have been performed. After the last (eighth) shift, the next 8-bit byte is exclusive ORed with the register current value, and the process is repeated for eight more shifts as described above. The final contents of the register, after all the bytes of the message have been applied, is the CRC value. When the CRC is appended to the message, the low-order byte is appended first, followed by the high-order byte.

Format of the Modbus communication frames

As the Modbus frames are defined by the standard Modbus protocol, it will not be explained in this present document. Please refer to the Modbus protocol specification for more details. This specification is freely available at: http://www.modbus-ida.org.

4. Modbus addresses

Modbus data types

Registers defined in the Modbus database will define data as one of the data types described in the following table:

Type	Value/bit mask	Description
T1		Unsigned value (16 bit) Example: 12345 stored as 12345 = $3039_{(16)}$
T2		Signed value (16 bit) Example: 12345 stored as -12345 = $CFC7_{(16)}$
T3		Signed long value (32 bit) Example: 123456789 stored as 123456789 = 075B CD $15_{(16)}$
T4		Text string Two characters per 16 bit register
T5	Bits # 31..24 Bits # 23..00	Unsigned measurement (32 bit) Decade exponent (signed 8 bit) Binary unsigned value (24 bit) Example: $123456*10^{-3}$ stored as FD01 $E240_{(16)}$
T6	Bits # 31..24 Bits # 23..00	Signed measurement (32 bit) Decade exponent (signed 8 bit) Binary signed value (24 bit) Example: - $123456*10^{-4}$ stored as FCFE $1DC0_{(16)}$
T7	Bits # 31..24 Bits # 23..16 Bits # 15..00	Power factor (32 bit) Sign: Import/export (00/FF) Sign: Inductive/capacitive (00/FF) Unsigned value (16 bit), 4 decimal places Example: 0.9876 CAP stored as 00FF $2694_{(16)}$
T8	Bits # 31..24 Bits # 23..16 Bits # 15..08 Bits # 07..00	Time stamp (32 bit) Minutes 00 - 59 (BCD) Hours 00 - 23 (BCD) Day of month 01 - 31 (BCD) Month of year 01 - 12 (BCD) Example: 15:42, 1. SEP stored as 4215 $0109_{(16)}$
T9	Bits # 31..24 Bits # 23..16 Bits # 15..08 Bits # 07..00	Time (32 bit) 1/100s 00 - 99 (BCD) Seconds 00 - 59 (BCD) Minutes 00 - 59 (BCD) Hours 00 - 24 (BCD) Example: 15:42:03.75 stored as 7503 $4215_{(16)}$
T10	Bits # 31..24 Bits # 23..16 Bits # 15..00	Date (32 bit) Bit# 31..24 Day of month 01 - 31 (BCD) Bit# 23..16 Month of year 01 - 12 (BCD) Bit# 15..00 Year (unsigned integer) 1998..4095 Example: 10, SEP 1998 stored as 1009 $07CE_{(16)}$
T11		Text string 4 characters Two characters per 16 bit register
T12		Text string 6 characters Two characters per 16 bit register

Measurement data

Fct.	Add.	Contents	D Type	Ind	Values/Dependencies	Type	Min	Max	Step	Passcode	1W/1b	1W3/3b	1W4/4b	2W3/3u	3W4/4u
04	48	Frequency	T5		Hz	Data				0	x	x	x	x	x
04	56	U1	T5		V	Data				0	x		x		x
04	58	U2	T5		V	Data				0			U1		x
04	60	U3	T5		V	Data				0			U1		x
04	62	Uavg (phase to neutral)	T5		V	Data				0			U1		x
04	64	j12 (angle between U1 and U2)	T17		deg	Data	-180,00	179,99	0,01	0			120		x
04	65	j23 (angle between U2 and U3)	T17		deg	Data	-180,00	179,99	0,01	0			120		x
04	66	j31 (angle between U3 and U1)	T17		deg	Data	-180,00	179,99	0,01	0			120		x
04	67	U12	T5		V	Data				0		x	1)	x	x
04	69	U23	T5		V	Data				0		x	1)	x	x
04	71	U31	T5		V	Data				0		x	1)	x	x
04	73	Uavg (phase to phase)	T5		V	Data				0		x	1)	x	x
04	75	I1	T5		A	Data				0	x	x	x	x	x
04	77	I2	T5		A	Data				0		I1	I1	X	x
04	79	I3	T5		A	Data				0		I1	I1	x	x
04	81	IN	T5		A	Data				0		0	0	0	x
04	85	Iavg	T5		A	Data				0		I1	I1	X	*
04	87	S I	T5		A	Data				0		2)	2)	X	x
04	89	Active Power Total (Pt)	T6		W	Data				0	x	x	3*P1	x	x
04	91	Active Power Phase L1 (P1)	T6		W	Data				0			x		x
04	93	Active Power Phase L2 (P2)	T6		W	Data				0			P1		x
04	95	Active Power Phase L3 (P3)	T6		W	Data				0			P1		x
04	97	Reactive Power Total (Qt)	T6		VAr L (if > 0) VAr C (if < 0)	Data				0	x	x	3*Q1	x	x

Fct.	Add.	Contents	D Type	Ind	Values/Dependencies	Type	Min	Max	Step	Passcode	1W/1b	1W3/3b	1W4/4b	2W3/3u	3W4/4u
04	99	Reactive Power Phase L1 (Q1)	T6		VAr L (if > 0) VAr C (if < 0)	Data				0			x		x
04	101	Reactive Power Phase L2 (Q2)	T6		VAr L (if > 0) VAr C (if < 0)	Data				0			Q1		x
04	103	Reactive Power Phase L3 (Q3)	T6		VAr L (if > 0) VAr C (if < 0)	Data				0			Q1		x
04	105	Apparent Power Total (St)	T5		VA	Data				0	x	x	3*S1	x	x
04	107	Apparent Power Phase L1 (S1)	T5		VA	Data				0			x		x
04	109	Apparent Power Phase L2 (S2)	T5		VA	Data				0			S1		x
04	111	Apparent Power Phase L3 (S3)	T5		VA	Data				0			S1		x
04	113	Power Factor Total (PFt)	T7			Data				0	x	x	PF1	x	x
04	115	Power Factor Phase 1 (PF1)	T7			Data				0			x		x
04	117	Power Factor Phase 2 (PF2)	T7			Data				0			PF1		x
04	119	Power Factor Phase 3 (PF3)	T7			Data				0			PF1		x
04	121	Power Angle Total (atan2(Pt,Qt))	T17		deg	Data	-180,00	179,99	0,01	0	x	x	x	x	x
04	122	j1 (angle between U1 and I1)	T17		deg	Data	-180,00	179,99	0,01	0			x		x
04	123	j2 (angle between U2 and I2)	T17		deg	Data	-180,00	179,99	0,01	0			j1		x
04	124	j3 (angle between U3 and I3)	T17		deg	Data	-180,00	179,99	0,01	0			j1		x
04	125	Internal Temperature	T17		deg C	Data				0	x	x	x	x	x

Fct.	Add.	Contents	D Type	Ind	Values/Dependencies	Type	Min	Max	Step	Passcode	1W/1b	1W3/3b	1W4/4b	2W3/3u	3W4/4u
		DEMAND VALUES													
		DYNAMIC DEMAND VALUES													
04	173	Time Into Period (minutes)	T1			Data				0	x	x	x	x	x
04	174	I1	T5			Data				0	x	x	x	x	x
04	176	I2	T5			Data				0	x	I1	I1	X	x
04	178	I3	T5			Data				0	x	I1	I1	x	x
04	180	Apparent Power Total (St)	T5			Data				0	x	x	x	x	x
04	182	Active Power Total (Pt) - (positive)	T6			Data				0	x	x	x	x	x
04	184	Active Power Total (Pt) - (negative)	T6			Data				0	x	x	x	x	x
04	186	Reactive Power Total (Qt) - L	T6			Data				0	x	x	x	x	x
04	188	Reactive Power Total (Qt) - C	T6			Data				0	x	x	x	x	x

Fct.	Add.	Contents	D Type	Ind	Values/Dependencies	Type	Min	Max	Step	Passcode	1W/1b	1W3/3b	1W4/4b	2W3/3u	3W4/4u
		MAX DEMAND SINCE LAST RESET													
04	206	I1	T5			Data				0	x	x	x	x	x
04	208	Time Stamp	T_Time			Data				0	x	x	x	x	x
04	212	I2	T5			Data				0	x	I1	I1	X	x
04	214	Time Stamp	T_Time			Data				0	x	x	x	x	x
04	218	I3	T5			Data				0	x	I1	I1	x	x
04	220	Time Stamp	T_Time			Data				0	x	x	x	x	x
04	224	Apparent Power Total (St)	T5			Data				0	x	x	x	x	x
04	226	Time Stamp	T_Time			Data				0	x	x	x	x	x
04	230	Active Power Total (Pt) - (positive)	T6			Data				0	x	x	x	x	x
04	232	Time Stamp	T_Time			Data				0	x	x	x	x	x
04	236	Active Power Total (Pt) - (negative)	T6			Data				0	x	x	x	x	x
04	238	Time Stamp	T_Time			Data				0	x	x	x	x	x
04	242	Reactive Power Total (Qt) - L	T6			Data				0	x	x	x	x	x
04	244	Time Stamp	T_Time			Data				0	x	x	x	x	x
04	248	Reactive Power Total (Qt) - C	T6			Data				0	x	x	x	x	x
04	250	Time Stamp	T_Time			Data				0	x	x	x	x	x
04	638	U1 THD%	T16			Data				0	x		x		x
04	639	U2 THD%	T16			Data				0			U1		x
04	640	U3 THD%	T16			Data				0			U1		x
04	641	U12 THD%	T16			Data				0		x	U1	x	x
04	642	U23 THD%	T16			Data				0		x	U1	x	x
04	643	U31 THD%	T16			Data				0		x	U1	x	x

Fct.	Add.	Contents	D Type	Ind	Values/Dependencies	Type	Min	Max	Step	Passcode	1W/1b	1W3/3b	1W4/4b	2W3/3u	3W4/4u
04	644	I1 THD%	T16			Data				0	x	x	x	x	x
04	645	I2 THD%	T16			Data				0		I1	I1	X	x
04	646	I3 THD%	T16			Data				0		I1	I1	x	x
		PHASE VOLTAGE HARMONIC DATA													
		U1 Harmonic Data													
04	647	U1 2nd Harmonic Abs %	T16			Data				0					
04	648	U1 2nd Harmonic Phase Angle	T17			Data	-180,00	179,99	0,01	0					
		U1 Harmonics from 3rd to 30th													
04	705	U1 31st Harmonic Abs %	T16			Data				0					
04	706	U1 31st Harmonic Phase Angle	T17			Data	-180,00	179,99	0,01	0					
		U2 Harmonic Data													
04	707	U2 2nd Harmonic Abs %	T16			Data				0					
04	708	U2 2nd Harmonic Phase Angle	T17			Data	-180,00	179,99	0,01	0					
		U2 Harmonics from 3rd to 30th													
04	765	U2 31st Harmonic Abs %	T16			Data				0					
04	766	U2 31st Harmonic Phase Angle	T17			Data	-180,00	179,99	0,01	0					
		U3 Harmonic Data													
04	767	U3 2nd Harmonic Abs %	T16			Data				0					
04	768	U3 2nd Harmonic Phase Angle	T17			Data	-180,00	179,99	0,01	0					
		U3 Harmonics from 3rd to 30th													
04	825	U3 31st Harmonic Abs %	T16			Data				0					
04	826	U3 31st Harmonic Phase Angle	T17			Data	-180,00	179,99	0,01	0					
		LINE VOLTAGE HARMONIC DATA													
		U12 Harmonic Data													
04	827	U12 2nd Harmonic Abs %	T16			Data				0					
04	828	U12 2nd Harmonic Phase Angle	T17			Data	-180,00	179,99	0,01	0					
		U12 Harmonics from 3rd to 30th													

Fct.	Add.	Contents	D Type	Ind	Values/Dependencies	Type	Min	Max	Step	Passcode	1W/1b	1W3/3b	1W4/4b	2W3/3u	3W4/4u
04	885	U12 31st Harmonic Abs %	T16			Data				0					
04	886	U12 31st Harmonic Phase Angle	T17			Data	-180,00	179,99	0,01	0					
		U23 Harmonic Data													
04	887	U23 2nd Harmonic Abs %	T16			Data				0					
04	888	U23 2nd Harmonic Phase Angle	T17			Data	-180,00	179,99	0,01	0					
		U23 Harmonics from 3rd to 30th													
04	945	U23 31st Harmonic Abs %	T16			Data				0					
04	946	U23 31st Harmonic Phase Angle	T17			Data	-180,00	179,99	0,01	0					
		U31 Harmonic Data													
04	947	U31 2nd Harmonic Abs %	T16			Data				0					
04	948	U31 2nd Harmonic Phase Angle	T17			Data	-180,00	179,99	0,01	0					
		U31 Harmonics from 3rd to 30th													
04	1005	U31 31st Harmonic Abs %	T16			Data				0					
04	1006	U31 31st Harmonic Phase Angle	T17			Data	-180,00	179,99	0,01	0					
		PHASE CURRENT HARMONIC DATA													
		I1 Harmonic Data													
04	1007	I1 2nd Harmonic Abs %	T16			Data				0					
04	1008	I1 2nd Harmonic Phase Angle	T17			Data	-180,00	179,99	0,01	0					
		I1 Harmonics from 3rd to 30th													
04	1065	I1 31st Harmonic Abs %	T16			Data				0					
04	1066	I1 31st Harmonic Phase Angle	T17			Data	-180,00	179,99	0,01	0					
		I2 Harmonic Data													
04	1067	I2 2nd Harmonic Abs %	T16			Data				0					
04	1068	I2 2nd Harmonic Phase Angle	T17			Data	-180,00	179,99	0,01	0					
		I2 Harmonics from 3rd to 30th													
04	1125	I2 31st Harmonic Abs %	T16			Data				0					
04	1126	I2 31st Harmonic Phase Angle	T17			Data	-180,00	179,99	0,01	0					

Fct.	Add.	Contents	D Type	Ind	Values/Dependencies	Type	Min	Max	Step	Passcode	1W/1b	1W3/3b	1W4/4b	2W3/3u	3W4/4u
		I3 Harmonic Data													
04	1127	I3 2nd Harmonic Abs %	T16			Data				0					
04	1128	I3 2nd Harmonic Phase Angle	T17			Data	-180,00	179,99	0,01	0					
		I3 Harmonics from 3rd to 30th													
04	1185	I3 31st Harmonic Abs %	T16			Data				0					
04	1186	I3 31st Harmonic Phase Angle	T17			Data	-180,00	179,99	0,01	0					
		Directional Currents (=Ix * sign(Px))													
04	1399	Directional Iavg	T6		A	Data				0	x	x	I1	x	x
04	1401	Directional I1	T6		A	Data				0			x		x
04	1403	Directional I2	T6		A	Data				0			I1		x
04	1405	Directional I3	T6		A	Data				0			I1		x
04	1407	Directional Iavg (float IEEEE 754)	T_float		A	Data				0	x	x	I1	x	x
04	1409	Directional I1 (float IEEEE 754)	T_float		A	Data				0			x		x
04	1411	Directional I2 (float IEEEE 754)	T_float		A	Data				0			I1		x
04	1413	Directional I3 (float IEEEE 754)	T_float		A	Data				0			I1		x

Measurement data in IEEE754 floating point format

Fct.	Add.	Contents	D Type	Ind	Values/Dependencies	Type	Min	Max	Step	Passcode	1W/1b	1W3/3b	1W4/4b	2W3/3u	3W4/4u
04	1507	Total Real Power	T_float			Data				0	x	x	3*P1	x	x
04	1509	Total Reactive Power	T_float			Data				0	x	x	3*Q1	x	x
04	1511	Total Apparent Power	T_float			Data				0	x	x	3*S1	x	x
04	1513	Total I	T_float			Data				0		x	x	x	x
04	1515	Average Voltage	T_float			Data				0			U1		x
04	1517	Average Uxy	T_float			Data				0		x	1)	x	x
04	1519	Iavg	T_float			Data				0		I1	I1	x	x
04	1521	IN	T_float			Data				0		0	0	0	x
04	1523	I1	T_float			Data				0	x	x	x	x	x
04	1525	I2	T_float			Data				0		I1	I1	x	x
04	1527	I3	T_float			Data				0		I1	I1	x	x
04	1529	U1	T_float			Data				0	x		x		x
04	1531	U2	T_float			Data				0			U1		x
04	1533	U3	T_float			Data				0			U1		x
04	1535	U12	T_float			Data				0		x	1)	x	x
04	1537	U23	T_float			Data				0		x	1)	x	x
04	1539	U31	T_float			Data				0		x	1)	x	x
04	1541	Phase 1 Real Power	T_float			Data				0			x		x
04	1543	Phase 2 Real Power	T_float			Data				0			P1		x

Fct.	Add.	Contents	D Type	Ind	Values/Dependencies	Type	Min	Max	Step	Passcode	1W/1b	1W3/3b	1W4/4b	2W3/3u	3W4/4u
04	1545	Phase 3 Real Power	T_float			Data				0			P1		x
04	1547	Phase 1 Reactive Power	T_float			Data				0			x		x
04	1549	Phase 2 Reactive Power	T_float			Data				0			Q1		x
04	1551	Phase 3 Reactive Power	T_float			Data				0			Q1		x
04	1553	Phase 1 Apparent Power	T_float			Data				0			x		x
04	1555	Phase 2 Apparent Power	T_float			Data				0			S1		x
04	1557	Phase 3 Apparent Power	T_float			Data				0			S1		x
04	1559	Dynamic Demand Value 1	T_float		Total Real Power (Pt +)	Data				0	x	x	x	x	x
04	1561	Dynamic Demand Value 2	T_float		Total Absolute Reactive Power (Qt L)	Data				0	x	x	x	x	x
04	1563	Dynamic Demand Value 3	T_float		Total Apparent Power	Data				0	x	x	x	x	x
04	1565	Dynamic Demand Value 4	T_float		I1	Data				0	x	x	x	x	x
04	1567	Dynamic Demand Value 5	T_float		I2	Data				0		I1	I1	x	x
04	1569	Dynamic Demand Value 6	T_float		I3	Data				0		I1	I1	x	x
04	1571	Dynamic Demand Value 7	T_float		Total Real Power (Pt -)	Data				0	x	x	x	x	x
04	1573	Dynamic Demand Value 8	T_float		Total Absolute Reactive Power (Qt C)	Data				0	x	x	x	x	x
04	1575	Max Demand Since Reset 1	T_float		Total Real Power (Pt +)	Data				0	x	x	x	x	x
04	1577	Max Demand Since Reset 2	T_float		Total Absolute Reactive Power (Qt L)	Data				0	x	x	x	x	x
04	1579	Max Demand Since Reset 3	T_float		Total Apparent Power	Data				0	x	x	x	x	x
04	1581	Max Demand Since Reset 4	T_float		I1	Data				0	x	x	x	x	x
04	1583	Max Demand Since Reset 5	T_float		I2	Data				0		I1	I1	x	x
04	1585	Max Demand Since Reset 6	T_float		I3	Data				0		I1	I1	x	x
04	1587	Max Demand Since Reset 7	T_float		Total Real Power (Pt -)	Data				0	x	x	x	x	x
04	1589	Max Demand Since Reset 8	T_float		Total Absolute Reactive Power (Qt C)	Data				0	x	x	x	x	x

System data, read only data

Fct.	Add.	Contents	D Type	Ind	Values/Dependencies	Type	Min	Max	Step	Passcode	1W/1b	1W3/3b	1W4/4b	2W3/3u	3W4/4u
04	0	Model Number	T_Str16		Example: MI416	Data				0	x	x	x	x	x
04	8	Serial Number	T_Str8			Data				0	x	x	x	x	x
04	12	Software Reference	T1			Data	105			0	x	x	x	x	x
04	13	Modbus Max. Register Read at Once	T1		Use 28 if (reg.30013) < 103	Data				0	x	x	x	x	x
04	14	Configuration Time Stamp	T_Time			Data				0	x	x	x	x	x
04	18	Calibration Time Stamp	T_Time			Data				0	x	x	x	x	x
04	22	Reserved Locations								0					
04	24	Hardware - I/O 4	T1	3	Jumperless Analogue Output	Data				0	x	x	x	x	x
04	25	Hardware - I/O 1	T1	0	No I/O	Data				0	x	x	x	x	x
				3	Jumperless Analogue Output						x	x	x	x	x
04	26	Hardware - I/O 2	T1		see Hardware - I/O 1	Data				0	x	x	x	x	x
04	27	Hardware - I/O 3	T1		see Hardware - I/O 1	Data				0	x	x	x	x	x
04	28	Hardware - Communication Type	T1	0	No Communication	Data				0	x	x	x	x	x
				1	RS 232						x	x	x	x	x
				2	RS 485						x	x	x	x	x
04	29	Hardware Configuration	T1	Bit-0	External Auxiliary Supply	Data				0	x	x	x	x	x
				Bit-1	N - Neutral						x		x		x
				Bit-2	Phase Voltage L1						x	x	x	x	x
				Bit-3	Phase Voltage L2							x		x	x
				Bit-4	Phase Voltage L3							x		x	x
				Bit-5	Phase Current L1						x	x	x	x	x
				Bit-6	Phase Current L2										x
				Bit-7	Phase Current L3									x	x

Fct.	Add.	Contents	D Type	Ind	Values/Dependencies	Type	Min	Max	Step	Passcode	1W/1b	1W3/3b	1W4/4b	2W3/3u	3W4/4u
		AVAILABLE MEASUREMENTS													
04	40	Measurements Parameter 1				Data				0	x	x	x	x	x
				Bit-0	Frequency						x	x	x	x	x
				Bit-4	U1						x		x		x
				Bit-5	U2								x		x
				Bit-6	U3								x		x
				Bit-7	Uavg (phase to neutral)								x		x
				Bit-8	j12 (angle between U1 and U2)								x		x
				Bit-9	j23 (angle between U2 and U3)								x		x
				Bit-10	j31 (angle between U3 and U1)								x		x
				Bit-11	U12							x	x	x	x
				Bit-12	U23							x	x	x	x
				Bit-13	U31							x	x	x	x
				Bit-14	Uavg (phase to phase)							x	x	x	x
				Bit-15	I1						x	x	x	x	x
04	41	Measurements Parameter 2				Data				0	x	x	x	x	x
				Bit-0	I2							x	x	x	x
				Bit-1	I3							x	x	x	x
				Bit-2	IN							x	x	x	x
				Bit-4	Iavg							x	x	x	x
				Bit-5	S I							x	x	x	x
				Bit-6	Active Power Total (Pt)							x	x	x	x
				Bit-7	Active Power Phase L1 (P1)						x		x		x
				Bit-8	Active Power Phase L2 (P2)								x		x
				Bit-9	Active Power Phase L3 (P3)								x		x
				Bit-10	Reactive Power Total (Qt)							x	x	x	x
				Bit-11	Reactive Power Phase L1 (Q1)						x		x		x
				Bit-12	Reactive Power Phase L2 (Q2)								x		x
				Bit-13	Reactive Power Phase L3 (Q3)								x		x
				Bit-14	Apparent Power Total (St)							x	x	x	x

				Bit-15	Apparent Power Phase L1 (S1)						x		x		x	
04	42	Measurements Parameter 3				Data				0	x	x	x	x	x	
				Bit-0	Apparent Power Phase L2 (S2)								x		x	
				Bit-1	Apparent Power Phase L3 (S3)								x		x	
				Bit-2	Power Factor Total (PFt)							x	x	x	x	
				Bit-3	Power Factor Phase 1 (PF1)						x		x		x	
				Bit-4	Power Factor Phase 2 (PF2)								x		x	
				Bit-5	Power Factor Phase 3 (PF3)								x		x	
				Bit-6	Power Angle Total (atan2(Pt,Qt))							x	x	x	x	
				Bit-7	j1 (angle between U1 and I1)						x		x		x	
				Bit-8	j2 (angle between U2 and I2)								x		x	
				Bit-9	j3 (angle between U3 and I3)								x		x	
				Bit-10	Internal Temperature						x	x	x	x	x	
				Bit-11	U1 THD%						x		x		x	
				Bit-12	U2 THD%								x		x	
				Bit-13	U3 THD%								x		x	
				Bit-14	U12 THD%							x	x	x	x	
				Bit-15	U23 THD%							x	x	x	x	
04	43	Measurements Parameter 4				Data				0	x	x	x	x	x	
				Bit-0	U31 THD%							x	x	x	x	
				Bit-1	I1 THD%						x	x	x	x	x	
				Bit-2	I2 THD%							x	x	x	x	
				Bit-3	I3 THD%							x	x	x	x	
04	44	Measurements Parameter 5				Data				0	x	x	x	x	x	
				Bit-0	MD I1						x	x	x	x	x	
				Bit-1	MD I2							x	x	x	x	
				Bit-2	MD I3							x	x	x	x	

Fct.	Add.	Contents	D Type	Ind	Values/Dependencies	Type	Min	Max	Step	Passcode	1W/1b	1W3/3b	1W4/4b	2W3/3u	3W4/4u
				Bit-3	MD St						x	x	x	x	x
				Bit-4	MD Pt1						x	x	x	x	x
				Bit-5	MD Pt2						x	x	x	x	x
				Bit-6	MD Qt1						x	x	x	x	x
				Bit-7	MD Qt2						x	x	x	x	x
				Bit-9	MD Since Last Reset						x	x	x	x	x

System data, not only read data

Fct.	Add.	Contents	D Type	Ind	Values/Dependencies	Type	Min	Max	Step	Passcode	1W/1b	1W3/3b	1W4/4b	2W3/3u	3W4/4u
16	0	User Password (L1, L2)	T_Str4	A…Z	Password to attempt user access level upgrade	Setting	41h	5Ah	1	0	x	x	x	x	x
16	2	Factory Password (FAC)	T_Str6	A…Z	Password to attempt factory access level upgrade	Setting	41h	5Ah	1	0	x	x	x	x	x
16	5	Lavel 1 - User password	T_Str4	A…Z		Setting	41h	5Ah	1	1	x	x	x	x	x
16	7	Lavel 2 - User password	T_Str4	A…Z		Setting	41h	5Ah	1	2	x	x	x	x	x
03, 06	9	Active Access Level	T1	0	Full protection	Setting	0	3	1	2	x	x	x	x	x
				1	Access up to level 1 user password	Data					x	x	x	x	x
				2	Access up to level 2 user password	Data					x	x	x	x	x
				3	Access up to level 2 (backup pass.)	Data					x	x	x	x	x
				4	Factory access level	Data					x	x	x	x	x
03, 06	10	Language	T1	0	English	Setting	0	3	1	2	x	x	x	x	x
				1	Français						x	x	x	x	x
				2	Deutsch						x	x	x	x	x
				3	Español						x	x	x	x	x
				4	Slovenian						x	x	x	x	x
				5	Russian						x	x	x	x	x
03, 06, 16	11	Description 1	T_Str20	Alfanum		Setting	20h	7Eh	1	2	x	x	x	x	x
03, 06, 16	21	Description 2	T_Str20	Alfanum		Setting	20h	7Eh	1	2	x	x	x	x	x

Fct.	Add.	Contents	D Type	Ind	Values/Dependencies	Type	Min	Max	Step	Passcode	1W/1b	1W3/3b	1W4/4b	2W3/3u	3W4/4u
		SYSTEM CONFIGURATION													
03, 06	32	LCD Contrast	T1			Setting	0	63	1	1	x	x	x	x	x
03, 06	33	LCD Back Light Intensity	T1			Setting	0	255	1	1	x	x	x	x	x
03, 06	34	LCD Back Light Time Off	T1		minutes (0=Always on)	Setting	0	59	1	1	x	x	x	x	x
03, 06, 16	35	Time and Date	T_Time		Current time and date	Setting				2	x	x	x	x	x
03, 06	39	Clock Synchronisation	T1	0	External synch. Disabled	Setting	0	7	1	2	x	x	x	x	x
				1	Sync. time to 30 s boundary										
				2	Sync. time to 1 min boundary										
				3	Sync. time to 5 min boundary										
				4	Sync. time to 10 min boundary										
				5	Sync. time to 15 min boundary										
				6	Sync. time to 30 min boundary										
				7	Sync. time to 60 min boundary										
03, 06	40	Pulse Length	T1		ms	Setting	2	510	2	2	x	x	x	x	x
03, 06	42	Connection Mode	T1	0	No mode	Setting	0	5	1	2					
				1	1b - Single Phase						x	x	x	x	x
				2	3b - 3 phase 3 wire balanced						x	x	x	x	x
				3	4b - 3 phase 4 wire balanced						x	x	x	x	x
				4	3u - 3 phase 3 wire unbalanced						x	x	x	x	x
				5	4u - 3 phase 4 wire unbalanced						x	x	x	x	x
03, 06	43	CT Secondary	T4		mA	Setting	?	?	?	2	x	x	x	x	x
03, 06	44	CT Primary	T4		A/10	Setting	?	?	?	2	x	x	x	x	x

Fct.	Add.	Contents	D Type	Ind	Values/Dependencies	Type	Min	Max	Step	Passcode	1W/1b	1W3/3b	1W4/4b	2W3/3u	3W4/4u
03, 06	45	VT Secondary	T4		mV	Setting	?	?	?	2	x	x	x	x	x
03, 06	46	VT Primary	T4		V/10	Setting	?	?	?	2	x	x	x	x	x
03, 06	47	Calibration current	T4		mA	Setting	?	?	?	4	x	x	x	x	x
03, 06	48	Calibration voltage	T4		mV	Setting	?	?	?	4	x	x	x	x	x
03, 06	49	Current input/output range	T16		% of input range for 100% output	Setting	10	100	0,01	2	x	x	x	x	x
03, 06	50	Voltage input/output range	T16		% of input range for 100% output	Setting	10	100	0,01	2	x	x	x	x	x
		SYSTEM COMMANDS													
6	51	Reset command register	T1	Bit-0	-	Setting	0	31	1	1	x	x	x	x	x
				Bit-1	Reset Demand						x	x	x	x	x
6	52	Operator Command Register	T1	1	Save Settings	Setting	1	2	1	2	x	x	x	x	x
				2	Abort Settings										
6	53	Capture Command Register	T1	1	Capture Measurements	Setting	1	1	1	0	x	x	x	x	x
		COMMUNICATION													
03, 06	54	Modbus Address	T1			Setting	1	247	1	2	x	x	x	x	x
03, 06	55	Baud Rate	T1	0	Baud rate 1200	Setting	0	7	1	2	x	x	x	x	x
				1	Baud rate 2400										
				2	Baud rate 4800										
				3	Baud rate 9600										
				4	Baud rate 19200										
				5	Baud rate 38400										

Fct.	Add.	Contents	D Type	Ind	Values/Dependencies	Type	Min	Max	Step	Passcode	1W/1b	1W3/3b	1W4/4b	2W3/3u	3W4/4u
				6	Baud rate 57600										
				7	Baud rate 115200										
03, 06	56	Stop Bit	T1	0	1 Stop bit	Setting	0	1	1	2	x	x	x	x	x
				1	2 Stop bits										
03, 06	57	Parity	T1	0	No parity	Setting	0	2	1	2	x	x	x	x	x
				1	Odd parity										
				2	Even parity										
03, 06	58	Data Bits	T1	0	8 bits	Setting	0	1	1	2	x	x	x	x	x
				1	7 bits										
		ANALOGUE OUTPUTS													
		Output 1									x	x	x	x	x
03, 06	59	Output 1 Type	T1	0	1 mA	Setting	0	5	1	2	x	x	x	x	x
				1	5 mA						x	x	x	x	x
				2	10 mA						x	x	x	x	x
				3	20 mA						x	x	x	x	x
				4	1 V						x	x	x	x	x
				5	10 V						x	x	x	x	x
03, 06	60	Output 1 Parameter	T1	0	No parameter	Setting	0	255	1	2	x	x	x	x	x
				1	Frequency						x	x	x	x	x
				2	Frequency 1										
				3	Frequency 2										
				4	Frequency 3										
				5	U1						x	x	x	x	x
				6	U2								U1		x
				7	U3								U1		x
				8	Uavg (phase to neutral)								U1		x

Fct.	Add.	Contents	D Type	Ind	Values/Dependencies	Type	Min	Max	Step	Passcode	1W/1b	1W3/3b	1W4/4b	2W3/3u	3W4/4u
				10	j23 (angle between U2 and U3)								120		x
				11	j31 (angle between U3 and U1)								120		x
				12	U12							x	1)	x	x
				13	U23							x	1)	x	x
				14	U31							x	1)	x	x
				15	Uavg (phase to phase)							x	1)	x	x
				16	I1						x	x	x	x	x
				17	I2							I1	I1	X	x
				18	I3							I1	I1	x	x
				19	IN							0	0	0	x
				20	IE (? error)										
				21	Iavg							I1	I1	X	x
				22	S I							2)	2)	X	x
				23	Active Power Total (Pt)							x	3)	x	x
				24	Active Power Phase L1 (P1)						x		x		x
				25	Active Power Phase L2 (P2)								P1		x
				26	Active Power Phase L3 (P3)								P1		x
				27	Reactive Power Total (Qt)							x	3)	x	x
				28	Reactive Power Phase L1 (Q1)						x		x		x
				29	Reactive Power Phase L2 (Q2)								Q1		x
				30	Reactive Power Phase L3 (Q3)								Q1		x
				31	Apparent Power Total (St)							x	3)	x	x
				32	Apparent Power Phase L1 (S1)						x		x		x
				33	Apparent Power Phase L2 (S2)								S1		x
				34	Apparent Power Phase L3 (S3)								S1		x
				35	Power Factor Total (PFt)							x	PF1	x	x
				36	Power Factor Phase 1 (PF1)						x		x		x
				37	Power Factor Phase 2 (PF2)								PF1		x
				38	Power Factor Phase 3 (PF3)								PF1		x
				39	Power Angle Total (atan2(Pt,Qt))							x	PF1	x	x
				40	j1 (angle between U1 and I1)						x		x		x

Fct.	Add.	Contents	D Type	Ind	Values/Dependencies	Type	Min	Max	Step	Passcode	1W/1b	1W3/3b	1W4/4b	2W3/3u	3W4/4u
				41	j2 (angle between U2 and I2)								j1		x
				42	j3 (angle between U3 and I3)								j1		x
				43	Internal Temperature										
				44	U1 THD%						x		x		x
				45	U2 THD%								U1		x
				46	U3 THD%								U1		x
				47	U12 THD%							x	U1	x	x
				48	U23 THD%							x	U1	x	x
				49	U31 THD%							x	U1	x	x
				50	I1 THD%						x	x	x	x	x
				51	I2 THD%							I1	I1	X	x
				52	I3 THD%							I1	I1	x	x
					DYNAMIC DEMAND VALUES										
				53	I1						x	x	x	x	x
				54	I2							I1	I1	X	x
				55	I3							I1	I1	x	x
				56	Apparent Power Total (St)						x	x	x	x	x
				57	Active Power Total (Pt) - (positive)						x	x	x	x	x
				58	Active Power Total (Pt) - (negative)						x	x	x	x	x
				59	Reactive Power Total (Qt) - L						x	x	x	x	x
				60	Reactive Power Total (Qt) - C						x	x	x	x	x
					MAX DEMAND SINCE LAST RESET										
				61	I1						x	x	x	x	x
				62	I2							I1	I1	X	x
				63	I3							I1	I1	x	x
				64	Apparent Power Total (St)						x	x	x	x	x
				65	Active Power Total (Pt) - (positive)						x	x	x	x	x
				66	Active Power Total (Pt) - (negative)						x	x	x	x	x
				67	Reactive Power Total (Qt) - L						x	x	x	x	x
				68	Reactive Power Total (Qt) - C						x	x	x	x	x

Fct.	Add.	Contents	D Type	Ind	Values/Dependencies	Type	Min	Max	Step	Passcode	1W/1b	1W3/3b	1W4/4b	2W3/3u	3W4/4u
					EXTENDED POWER FACTOR										
				69	CAP/IND P. F. Total (PFt)							x	EPF 1	x	x
				70	CAP/IND P. F. Phase 1 (PF1)						x		x		x
				71	CAP/IND P. F. Phase 2 (PF2)								EPF 1		x
				72	CAP/IND P. F. Phase 3 (PF3)								EPF 1		x
					Directional Currents (=Ix * sign(Px))										
				73	Directional Iavg							x	I1	x	x
				74	Directional I1						x		x		x
				75	Directional I2								I1		x
				76	Directional I3								I1		x
					CALIBRATION SETTINGS										
!				253	Min (Neg.) Call. Point						x	x	x	x	x
!				254	Max (Pos.) Call. Point						x	x	x	x	x
!				255	Centre Call. Point						x	x	x	x	x
03, 06	61	Output 1 Function Type	T1	0	linear	Setting	0	1	1	2	x	x	x	x	x
				1	quadratic						x	x	x	x	x
03, 06	62	Output 1 Number of Breakpoints	T1			Setting	0	6	1	2	x	x	x	x	x
03, 06	63	Output 1 Lower X Point (X0)	T17		% of parameter value	Setting	-300	300	0,01	2	x	x	x	x	x
03, 06	64	Output 1 Lower Y Point (Y0)	T17		% of output type	Setting	-120	120	0,01	2	x	x	x	x	x
03, 06	65	Output 1 X Breakpoint 1 (X1)	T17		% of parameter value	Setting	-300	300	0,01	2	x	x	x	x	x
03, 06	66	Output 1 Y Breakpoint 1 (Y1)	T17		% of output type	Setting	-120	120	0,01	2	x	x	x	x	x
03, 06	67	Output 1 X Breakpoint 2 (X2)	T17		% of parameter value	Setting	-300	300	0,01	2	x	x	x	x	x
03, 06	68	Output 1 Y Breakpoint 2 (Y2)	T17		% of output type	Setting	-120	120	0,01	2	x	x	x	x	x

Fct.	Add.	Contents	D Type	Ind	Values/Dependencies	Type	Min	Max	Step	Passcode	1W/1b	1W3/3b	1W4/4b	2W3/3u	3W4/4u
03, 06	69	Output 1 X Breakpoint 3 (X3)	T17		% of parameter value	Setting	-300	300	0,01	2	x	x	x	x	x
03, 06	70	Output 1 Y Breakpoint 3 (Y3)	T17		% of output type	Setting	-120	120	0,01	2	x	x	x	x	x
03, 06	71	Output 1 X Breakpoint 4 (X4)	T17		% of parameter value	Setting	-300	300	0,01	2	x	x	x	x	x
03, 06	72	Output 1 Y Breakpoint 4 (Y4)	T17		% of output type	Setting	-120	120	0,01	2	x	x	x	x	x
03, 06	73	Output 1 X Breakpoint 5 (X5)	T17		% of parameter value	Setting	-300	300	0,01	2	x	x	x	x	x
03, 06	74	Output 1 Y Breakpoint 5 (Y5)	T17		% of output type	Setting	-120	120	0,01	2	x	x	x	x	x
03, 06	75	Output 1 X Breakpoint 6 (X6)	T17		% of parameter value	Setting	-300	300	0,01	2	x	x	x	x	x
03, 06	76	Output 1 Y Breakpoint 6 (Y6)	T17		% of output type	Setting	-120	120	0,01	2	x	x	x	x	x
	77	Reserved													
		Output 2													
03, 06	79	Output 2 Type	T1		See Output 1	Setting	0	5	1	2	x	x	x	x	x
03, 06	80	Output 2 Parameter	T1		See Output 1	Setting	0	255	1	2	x	x	x	x	x
03, 06	81	Output 2 Function Type	T1		See Output 1	Setting	0	1	1	2	x	x	x	x	x
03, 06	82	Output 2 Number of Breakpoints	T1			Setting	0	6	1	2	x	x	x	x	x
03, 06	83	Output 2 Lower X Point (X0)	T17		% of parameter value	Setting	-300	300	0,01	2	x	x	x	x	x
03, 06	84	Output 2 Lower Y Point (Y0)	T17		% of output type	Setting	-120	120	0,01	2	x	x	x	x	x
03, 06	85	Output 2 X Breakpoint 1 (X1)	T17		% of parameter value	Setting	-300	300	0,01	2	x	x	x	x	x
03, 06	86	Output 2 Y Breakpoint 1 (Y1)	T17		% of output type	Setting	-120	120	0,01	2	x	x	x	x	x

Fct.	Add.	Contents	D Type	Ind	Values/Dependencies	Type	Min	Max	Step	Passcode	1W/1b	1W3/3b	1W4/4b	2W3/3u	3W4/4u
03, 06	87	Output 2 X Breakpoint 2 (X2)	T17		% of parameter value	Setting	-300	300	0,01	2	x	x	x	x	x
03, 06	88	Output 2 Y Breakpoint 2 (Y2)	T17		% of output type	Setting	-120	120	0,01	2	x	x	x	x	x
03, 06	89	Output 2 X Breakpoint 3 (X3)	T17		% of parameter value	Setting	-300	300	0,01	2	x	x	x	x	x
03, 06	90	Output 2 Y Breakpoint 3 (Y3)	T17		% of output type	Setting	-120	120	0,01	2	x	x	x	x	x
03, 06	91	Output 2 X Breakpoint 4 (X4)	T17		% of parameter value	Setting	-300	300	0,01	2	x	x	x	x	x
03, 06	92	Output 2 Y Breakpoint 4 (Y4)	T17		% of output type	Setting	-120	120	0,01	2	x	x	x	x	x
03, 06	93	Output 2 X Breakpoint 5 (X5)	T17		% of parameter value	Setting	-300	300	0,01	2	x	x	x	x	x
03, 06	94	Output 2 Y Breakpoint 5 (Y5)	T17		% of output type	Setting	-120	120	0,01	2	x	x	x	x	x
03, 06	95	Output 2 X Breakpoint 6 (X6)	T17		% of parameter value	Setting	-300	300	0,01	2	x	x	x	x	x
03, 06	96	Output 2 Y Breakpoint 6 (Y6)	T17		% of output type	Setting	-120	120	0,01	2	x	x	x	x	x
	97	Reserved													
		Output 3													
03, 06	99	Output 3 Type	T1		See Output 1	Setting	0	5	1	2	x	x	x	x	x
03, 06	100	Output 3 Parameter	T1		See Output 1	Setting	0	255	1	2	x	x	x	x	x
03, 06	101	Output 3 Function Type	T1		See Output 1	Setting	0	1	1	2	x	x	x	x	x
03, 06	102	Output 3 Number of Breakpoints	T1			Setting	0	6	1	2	x	x	x	x	x
03, 06	103	Output 3 Lower X Point (X0)	T17		% of parameter value	Setting	-300	300	0,01	2	x	x	x	x	x
03, 06	104	Output 3 Lower Y Point (Y0)	T17		% of output type	Setting	-120	120	0,01	2	x	x	x	x	x
03, 06	105	Output 3 X Breakpoint 1 (X1)	T17		% of parameter value	Setting	-300	300	0,01	2	x	x	x	x	x

Fct.	Add.	Contents	D Type	Ind	Values/Dependencies	Type	Min	Max	Step	Passcode	1W/1b	1W3/3b	1W4/4b	2W3/3u	3W4/4u
03, 06	106	Output 3 Y Breakpoint 1 (Y1)	T17		% of output type	Setting	-120	120	0,01	2	x	x	x	x	x
03, 06	107	Output 3 X Breakpoint 2 (X2)	T17		% of parameter value	Setting	-300	300	0,01	2	x	x	x	x	x
03, 06	108	Output 3 Y Breakpoint 2 (Y2)	T17		% of output type	Setting	-120	120	0,01	2	x	x	x	x	x
03, 06	109	Output 3 X Breakpoint 3 (X3)	T17		% of parameter value	Setting	-300	300	0,01	2	x	x	x	x	x
03, 06	110	Output 3 Y Breakpoint 3 (Y3)	T17		% of output type	Setting	-120	120	0,01	2	x	x	x	x	x
03, 06	111	Output 3 X Breakpoint 4 (X4)	T17		% of parameter value	Setting	-300	300	0,01	2	x	x	x	x	x
03, 06	112	Output 3 Y Breakpoint 4 (Y4)	T17		% of output type	Setting	-120	120	0,01	2	x	x	x	x	x
03, 06	113	Output 3 X Breakpoint 5 (X5)	T17		% of parameter value	Setting	-300	300	0,01	2	x	x	x	x	x
03, 06	114	Output 3 Y Breakpoint 5 (Y5)	T17		% of output type	Setting	-120	120	0,01	2	x	x	x	x	x
03, 06	115	Output 3 X Breakpoint 6 (X6)	T17		% of parameter value	Setting	-300	300	0,01	2	x	x	x	x	x
03, 06	116	Output 3 Y Breakpoint 6 (Y6)	T17		% of output type	Setting	-120	120	0,01	2	x	x	x	x	x
	117	Reserved													
		DEMAND CALCULATIONS													
03, 06	122	Time constant	T1		minutes (0=disabled)	Setting	0	255	1	2	x	x	x	x	x
03, 06	123	Number of sliding windows	T1		0=thermal	Setting	0	15	1	2	x	x	x	x	x
	124	Reserved													
		MEASUREMENTS CONTROL													
03, 06	126	Average interval	T1	3	8 periods (0.16s @50Hz)	Setting	3	8	1	2					
				4	16 periods (0.32s @50Hz)										

Fct.	Add.	Contents	D Type	Ind	Values/Dependencies	Type	Min	Max	Step	Passcode	1W/1b	1W3/3b	1W4/4b	2W3/3u	3W4/4u
				5	32 periods (0.64s @50Hz)										
				6	64 periods (1.28s @50Hz) default										
				7	128 periods (2.56s @50Hz)										
				8	256 periods (5.12s @50Hz)										
03, 06	127	Starting total current for PFt & Pat (4)	T1		3277 for 20mA	Setting	0	6554	1	2					
03, 06	128	Starting current for all powers	T1		327 for 2mA	Setting	0	3279	1	2					
		ANALOGUE OUTPUT 4													
03, 06	159	Output 4 Type	T1		See Output 1	Setting	0	5	1	2	x	x	x	x	x
03, 06	160	Output 4 Parameter	T1		See Output 1	Setting	0	255	1	2	x	x	x	x	x
03, 06	161	Output 4 Function Type	T1		See Output 1	Setting	0	1	1	2	x	x	x	x	x
03, 06	162	Output 4 Number of Breakpoints	T1			Setting	0	6	1	2	x	x	x	x	x
03, 06	163	Output 4 Lower X Point (X0)	T17		% of parameter value	Setting	-300	300	0,01	2	x	x	x	x	x
03, 06	164	Output 4 Lower Y Point (Y0)	T17		% of output type	Setting	-120	120	0,01	2	x	x	x	x	x
03, 06	165	Output 4 X Breakpoint 1 (X1)	T17		% of parameter value	Setting	-300	300	0,01	2	x	x	x	x	x
03, 06	166	Output 4 Y Breakpoint 1 (Y1)	T17		% of output type	Setting	-120	120	0,01	2	x	x	x	x	x
03, 06	167	Output 4 X Breakpoint 2 (X2)	T17		% of parameter value	Setting	-300	300	0,01	2	x	x	x	x	x
03, 06	168	Output 4 Y Breakpoint 2 (Y2)	T17		% of output type	Setting	-120	120	0,01	2	x	x	x	x	x
03, 06	169	Output 4 X Breakpoint 3 (X3)	T17		% of parameter value	Setting	-300	300	0,01	2	x	x	x	x	x

Fct.	Add.	Contents	D Type	Ind	Values/Dependencies	Type	Min	Max	Step	Passcode	1W/1b	1W3/3b	1W4/4b	2W3/3u	3W4/4u
03, 06	170	Output 4 Y Breakpoint 3 (Y3)	T17		% of output type	Setting	-120	120	0,01	2	x	x	x	x	x
03, 06	171	Output 4 X Breakpoint 4 (X4)	T17		% of parameter value	Setting	-300	300	0,01	2	x	x	x	x	x
03, 06	172	Output 4 Y Breakpoint 4 (Y4)	T17		% of output type	Setting	-120	120	0,01	2	x	x	x	x	x
03, 06	173	Output 4 X Breakpoint 5 (X5)	T17		% of parameter value	Setting	-300	300	0,01	2	x	x	x	x	x
03, 06	174	Output 4 Y Breakpoint 5 (Y5)	T17		% of output type	Setting	-120	120	0,01	2	x	x	x	x	x
03, 06	175	Output 4 X Breakpoint 6 (X6)	T17		% of parameter value	Setting	-300	300	0,01	2	x	x	x	x	x
03, 06	176	Output 4 Y Breakpoint 6 (Y6)	T17		% of output type	Setting	-120	120	0,01	2	x	x	x	x	x

Notes:

1) U1*sqr(3)
2) 3*I1
3) 3*P1 or 3*Q1 or 3*S1
4) If It<R40128, analogue output PFt=1, CAP/IND PFt=1, Pat=0