KBR
Energy Management

Data point description for the Modbus protocol

multicomp F144-3PH

System | English

25433_EDEBDA0284-2320-1_EN

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1. Supported Modbus commands

0x04	Read Input Registers
0x2B Read Device Identification	Read Device Identification

The multicomp 3F144 does not support broadcast commands. All Modbus commands described are device-specific commands.

2. Data formats

(unsigned) short: 0x1234

Address	+0	+1		
Contents	0x12	0x34		

Rule for byte sequence: MSB before LSB

(unsigned) long: 0x12345678

Address	+0	+1	+2	+3
Contents	0x12	0x34	0x56	0x78

float:

Format	Complies with the IEEE 754 standard
Representation	4 bytes
Accuracy	24 bits (➢ represent >7 decimal points)
Composition	24-bit mantissa; 8-bit exponent
Mantissa	24 bits (M) + 1 bit (S) The MSB of the mantissa is always 1 => it is not saved separately! S = sign of the mantissa: S = 1 ➢ negative number; S = 0 ➢ positive number
Exponent	8 bits (0-255); is saved relatively to 127, i.e. the current value of the exponent is calculated by subtracting the number 127 from the saved value. Curr. exp. = saved exp value. – 127 => range of numbers from 128 to -127!

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Example 1: -12.5 decimal = 0xC1480000 hex
M: 24 bit-mantissa
E: Exponent with offset of 127
S: Sign for mantissa (S=1 neg.; S=0 pos.)

Address	+0	+1	+2	+3
Format	SEEEEEEE	EMMMMMMM	MMMMMMMM	MMMMMMMM
Binary	1 1 0 0 0 0 0 1	0 1 0 0 1 0 0 0	0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0
Hex	C1	48	00	00

The byte sequence is defined as follows:
The byte with the "S sign bit" is transmitted over the bus as the first byte.

The sequence of the float bytes of the bus can be reversed, if necessary, using the device parameter 0xD02C (see table 1).

The register value 0xD02C in this case means:

- with 1 -> sign bit S in 1st byte (sequence according to definition)
- with 0 -> sign bit S in 4th byte (sequence reversed)

The following information can be derived from this:
The sign bit is 1 => negative mantissa
The value of the exponent amounts to 10000010 bin or 130 dec.
This results in an exponent value of: 130 - 127 = 3
The mantissa has the following value: 10010000000000000000000
The decimal point can be found at the left end of the mantissa, preceded by a 1. This position does not appear in the hexadecimal numeric notation. If you add 1 and set the decimal point at the beginning of the mantissa, the following value is obtained: 1.10010000000000000000000

Now, the mantissa needs to be adjusted to the exponent. A negative exponent shifts the decimal point to the left, a positive exponent shifts it to the right. Since the exponent is 3, this is represented as: 1100.10000000000000000000

The number obtained corresponds to the binary floating-point number.

Binary digits to the left of the decimal point result in values > 1. In this example, 1100 bin results in the number 12 dec. $\{(1x2^3) + (1x2^2) + (0x2^1) + (0x2^0)\}$

Binary digits to the right of the decimal point result in values < 1. In this example, .100..... bin yields the number 0.5 dec.

$\{(1x2^{-1})+ (0x2^{-2})+ (0x2^{-3})+ (0x2^{-4})\}$
By adding the individual values, 12.5 is obtained. As the sign bit was set, it is a negative value, -12.5.
The hexadecimal number 0xC1480000 thus corresponds to -12.5.

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Example 2: -12.55155 decimal = 0xC148D325 hex

Address	+0	+1	+2	+3
Format	SEEEEEEE	EMMMMMMM	MMMMMMMM	MMMMMMMM
Binary	1 1 0 0 0 0 0 1	0 1 0 0 1 0 0 0	1 1 0 1 0 0 1 1	0 0 1 0 0 1 0 1
Hex	C1	48	D3	2500

Example 3: 45.354 decimal = 0x42356A7F hex

Address	+0	+1	+2	+3
Format	SEEEEEEE	EMMMMMMM	MMMMMMMM	MMMMMMMM
Binary	0 1 0 0 0 0 1 0	0 0 1 1 0 1 0 1	0 1 1 0 1 0 1 0	0 1 1 1 1 1 1 1
Hex	42	35	6A	7F

Exponent: 10000100 bin = 132 dec.

- Exp.= 132-127=5

Mantissa: S=0

- Sign=positive

01101010110101001111111 bin

Decimal point added to the first position of the mantissa

- . 01101010110101001111111

Leading 1 in front of the decimal point

- 1. 01101010110101001111111

Taking the exponent into account (=5)

- 101101. 01011010100111111

to the left of the decimal point: 101101 bin = $2^5 + 2^3 + 2^2 + 2^0 = 45$ dec.

To the right of the decimal point: 01011010100111111 bin =

$2^{-2} + 2^{-4} + 2^{-5} + 2^{-7} + 2^{-9} + 2^{-12} + 2^{-13} + 2^{-14} + 2^{-15} + 2^{-16} + 2^{-17} + 2^{-18} = 0.3540001$ dec.

Final result: +45.03540001 dec.

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3. Interface parameters

Setting options for Modbus RTU

Baud rate (baud)	Parity	Data bits	Stop bits
4800,9600,19200, 38400	even, odd, none	8	2 for parity none otherwise 1

The maximum data length of a Modbus transmission is 256 bytes. This results in a user data length of 253 bytes.

The number of data bits and stop bits is defined in the Modbus definition. Baud rates of less than 4800 baud are possible by definition, but not implemented at present. The interface parameters can only be set on the device. (not via the bus).

4. Device settings

The settings are read with the 0x04 command (read input registers) as shown in Table 1. Writing is not possible at present.

Address	Words	Description	Value	Format
0xD002	2	Measuring voltage primary transformer (applies to all three phases)		unsigned long
0xD004	2	Measuring voltage secondary transformer (applies to all three phases)		unsigned long
0xD006	2	Measuring current primary transformer (applies to all three phases)		unsigned long
0xD008	2	Measuring current secondary transformer (applies to all three phases)		unsigned long
0xD00A	2	Frequency correction (0=auto // 1=50Hz // 2=60Hz)	0-2	unsigned long
0xD00C	2	Average current value, averaging time in min	1-15	unsigned long
0xD00E	2	Attenuation voltage	0-9	unsigned long
0xD010	2	Attenuation current	0-9	unsigned long
0xD012	2	Primary transformer induced current (not available)	---	unsigned long
0xD014	2	Secondary transformer induced current (not available)	---	unsigned long
0xD016	2	Connected phase voltage measurement (not available)	---	unsigned long
0xD018	2	Connected phase current measurement (0-120- 240)	0=0° // 1=120° // 2=240°	unsigned long

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Address	Words	Description	Value	Format
0xD01a	2	Daylight saving time (not available)		unsigned long
0xD01c	2	Switching standard time --> daylight saving time (not available)	---	unsigned long
0xD01e	2	Switching daylight saving time --> standard time (not available)	---	unsigned long
0xD020	2	Threshold value for voltage dip (not available)	---	float
0xD022	2	Attenuation for missing compensation power	0-9	unsigned long
0xD024	2	free	---	float
0xD026	2	free	---	float
0xD028	2	Time (not available)	---	unsigned long
0xD02a	2	Factor for default response times (not available)	---	unsigned long
0xD02c	2	Byte sequence for float on the Modbus (1=as defined // 0=reversed)	0-1	unsigned long
0xD02e	2	free	---	float
0xD030	2	Temperature [0.1 °C] that triggers the fan when the threshold is exceeded	0-700	unsigned long
0xD032	2	Temperature [0.1 °C] that triggers the alarm when exceeded (not available)	---	unsigned long
0xD034	2	Temperature [0.1 °C] that causes the stages to switch off when the threshold is exceeded	0-700	unsigned long
0xD036	2	Fan hysteresis (not in use)	---	unsigned long
0xD038	2	Alarm hysteresis (not in use)	---	unsigned long
0xD03A	2	Stage switch-off hysteresis (not in use)	---	unsigned long
0xD03C	2	Error message screen (not in use)	---	unsigned long
0xD03E	2	Message and relay screen (not in use)	---	unsigned long

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Address	Words	Description	Value	Format
0xD040	2	Target CosPhi 1	-1.0 - +1.0	float
0xD042	2	Target CosPhi in case of energy recovery	-1.0 - +1.0	float
0xD044	2	Target CosPhi for message "Compensation unit too small"	-1.0 - +1.0	float
0xD046	2	Limit for operating cycle message	0-999999	unsigned long
0xD048	2	Switching interval [ms]	0-999990	unsigned long
0xD04A	2	Delay time before contactor stages can be switched on [s] (not in use)	---	unsigned long
0xD04C	2	Time before message "Compensation unit too small" is displayed [s]	0-9999	unsigned long
0xD04E	2	Idle time after compensation [ms]	0-999990	unsigned long
0xD050	2	Percentage of smallest available stage before activation	70-150	unsigned long
0xD052	2	Percentage of smallest available stage before stages can be switched off	70-150	unsigned long
0xD054	2	Alarm relay (not in use)	---	unsigned long
0xD056	2	Temperature evaluation	0 = off // 1 = on	unsigned long
		Stage parameters		
0xD058	2	Base index for the following stage parameters (addresses 0xD0B0 to 0xD06C)	0	unsigned long
0xD05A	2	Type (not in use)	---	unsigned long
0xD05C	2	Mode	0 = Off // 1 = Auto 2 = On	unsigned long
0xD05E	2	Cabinet number (not in use)	---	unsigned long
0xD060	2	Detuning factor (not in use)	---	unsigned long
0xD062	2	Stage power [0.1 kvar] (c = positive // i = negative)	c99999 – i99999	unsigned long
0xD064	2	Discharge time [ms]	0-99999	unsigned long

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Address	Words	Description	Value	Format
0xD066	2	Operating cycles	0-999999	unsigned long
0xD068	2	Operating hours	---	unsigned long
xD06A	2	Total temperature switch-offs (not in use)	---	long
0xD06C	2	Type of connection of the stage (bit coded, only 1 bit active) Bit0: Delta Bit3: L3N Bit6: L31 Bit1: L1N Bit4: L12 Bit2: L2N Bit5: L23		unsigned long
0xD06E		Base index…	1	unsigned long
		…		
0xD082		Type of connection…		unsigned long
0xD084		Base index…	2	unsigned long
		…		
0xD098		Type of connection…		unsigned long
0xD09A		Base index…	3	unsigned long
		…		
0xD0AE		Type of connection…		unsigned long
0xD0B0		Base index…	4	unsigned long
		…		
0xD0C4		Type of connection…		unsigned long

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Address	Words	Description	Value	Format
0xD0C6		Base index…	5	unsigned long
		…		
0xD0DA		Type of connection…		unsigned long
0xD0DC		Base index…	6	unsigned long
		…		
0xD0F0		Type of connection…		unsigned long
0xD0F2		Base index…	7	unsigned long
		…		
0xD106		Type of connection…		unsigned long
0xD108		Base index…	8	unsigned long
		…		
0xD11C		Type of connection…		unsigned long
0xD11E		Base index…	9	unsigned long
		…		
0xD132		Type of connection…		unsigned long
0xD134		Base index…	10	unsigned long
		…		
0xD148		Type of connection…		unsigned long

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Address	Words	Description	Value	Format
0xD14A		Base index…	11	unsigned long
		…		
0xD15E		Type of connection…		unsigned long
0xD160		Base index…	12	unsigned long
		…		
0xD174		Type of connection…		unsigned long
0xD176		Base index…	13	unsigned long
		…		
0xD18A		Type of connection…		unsigned long
0xD18C		Base index…	14	unsigned long
		…		
0xD1A0		Type of connection…		unsigned long
0xD1A2		Base index…	15	unsigned long
		…		
0xD1B6		Type of connection…		unsigned long
0xD1b8		Base index…	16	unsigned long
		…		
0xD1CC		Type of connection…		unsigned long

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Address	Words	Description	Value	Format
0xD1CE	2	Base index for the following stage parameters (addresses 0xD0B0 to 0xD06C)	17	unsigned long
0xD1D0	2	Type (not in use)	---	unsigned long
0xD1D2	2	Mode	0 = Off // 1 = Auto 2 = On	unsigned long
0xD1D4	2	Cabinet number (not in use)	---	unsigned long
0xD1D6	2	Detuning factor (not in use)	---	unsigned long
0xD1D8	2	Stage power [0.1 kvar] (c = positive // i = negative)	c99999 – i99999	long
0xD1DA	2	Discharge time [ms]	0-99999	unsigned long
0xD1DC	2	Operating cycles	0-999999	unsigned long
0xD1DE	2	Operating hours	---	unsigned long
0xD1E0	2	Total temperature switch-offs (not in use)	---	long
0xD1E2	2	Type of connection of the stage (bit coded, only 1 bit active) Bit0: Delta Bit3: L3N Bit6: L31 Bit1: L1N Bit4: L12 Bit2: L2N Bit5: L23		unsigned long
0xD280	2	Methods of measurement	0 = 3ph // 1 = 1ph	unsigned long
0xD282	2	Zero-point creator	0 = no // 1 = yes	unsigned long
0xD284	2	Language (0 = 1st language // 1 = 2nd language)	0-1	unsigned long
0xD286	2	Temperature [0.1 °C] that causes the fan to switch off when the value falls below the threshold	0-700	unsigned long
0xD288	2	Temperature [0.1 °C] that triggers the stages when the value falls below the threshold	0-700	unsigned long

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Address	Words	Description	Value	Format
0xD28A	2	max. switching capacity per pulse [kvar] (at least the largest stage power of a delta stage or a combined delta stage)	xx-999999	unsigned long
0xD28C	2	Low load limit [A]	0.01-9999.99	float
0xD22E	2	Average current limit [A] incl.xI – L1	1.0-999999.0	float
0xD290	2	Average current limit [A] incl.xI – L2	1.0-999999.0	float
0xD292	2	Average current limit [A] incl.xI – L3	1.0-999999.0	float
0xD294	2	Average current limit [A] incl.xI – N	1.0-999999.0	float
0xD296	2	Overvoltage limit [%] (0% = off // 50% = 1.5*Uprim)	0-50%	unsigned long
0xD298	2	Voltage harmonics limit [%] (100% = programmed primary current)		unsigned long
0xD29A	2	Current harmonics limit [%] (100% = programmed primary current)		unsigned long
0cD29C	2	Target CosPhi 2	-1.0 - +1.0	float

Table 1

Example Modbus RTU
Request: 01 04 D0 01 00 02 18 CB
in which

01	Device address
04	Command
D0 01	Read from register 0xD002 "Measuring voltage primary transformer" (in accordance with the Modbus definition, the required address must be set to -1 in the request telex)
00 02	Read 2 registers, i.e. read 1 data point
18 CB	CRC code

Response:
01 04 04 00 00 01 90 FA 78
in which

01	Device address	
04	Command	
04	4 data bytes	
00 00 01 90	Primary transformer measuring voltage	400V
FA 78	CRC code	

4. Data points

Data points are read via the command 0x04 (Read Input Registers) in accordance with table 1.

Address	Words	Description	Unit	Format
0x0002	2	Voltage PH-N L1	V	float
0x0004	2	Voltage PH-N L2	V	float
0x0006	2	Voltage PH-N L3	V	float
0x0008	2	Voltage PH-PH L1-L2	V	float
0x000a	2	Voltage PH-PH L2-L3	V	float
0x000c	2	Voltage PH-PH L3-L1	V	float
0x000e	2	Current L1	A	float
0x0010	2	Current L2	A	float
0x0012	2	Current L3	A	float
0x0014	2	Current average value L1	A	float
0x0016	2	Current average value L2	A	float
0x0018	2	Current average value L3	A	float
0x001a	2	Apparent power L1	VA	float
0x001c	2	Apparent power L2	VA	float
0x001e	2	Apparent power L3	VA	float
0x0020	2	Active power L1	W	float
0x0022	2	Active power L2	W	float
0x0024	2	Active power L3	W	float
0x0026	2	Reactive power L1 – only fundamental component	var	float
0x0028	2	Reactive power L2 – only fundamental component	var	float
0x002a	2	Reactive power L3 – only fundamental component	var	float
0x002c	2	cos Phi L1		float
0x002e	2	cos Phi L2		float
0x0030	2	cos Phi L3		float
0x0032	2	Power factor L1		float
0x0034	2	Power factor L2		float
0x0036	2	Power factor L3		float
0x0038	2	Voltage distortion factor L1	%	float
0x003a	2	Voltage distortion factor L2	%	float
0x003c	2	Voltage distortion factor L3	%	float

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Address	Words	Description	Unit	Format
0x003e	2	Voltage 3rd harmonic L1	%	float
0x0040	2	Voltage 3rd harmonic L2	%	float
0x0042	2	Voltage 3rd harmonic L3	%	float
0x0044	2	Voltage 5th harmonic L1	%	float
0x0046	2	Voltage 5th harmonic L2	%	float
0x0048	2	Voltage 5th harmonic L3	%	float
0x004a	2	Voltage 7th harmonic L1	%	float
0x004c	2	Voltage 7th harmonic L2	%	float
0x004e	2	Voltage 7th harmonic L3	%	float
0x0050	2	Voltage 9th harmonic L1	%	float
0x0052	2	Voltage 9th harmonic L2	%	float
0x0054	2	Voltage 9th harmonic L3	%	float
0x0056	2	Voltage 11th harmonic L1	%	float
0x0058	2	Voltage 11th harmonic L2	%	float
0x005a	2	Voltage 11th harmonic L3	%	float
0x005c	2	Voltage 13th harmonic L1	%	float
0x005e	2	Voltage 13th harmonic L2	%	float
0x0060	2	Voltage 13th harmonic L3	%	float
0x0062	2	Voltage 15th harmonic L1	%	float
0x0064	2	Voltage 15th harmonic L2	%	float
0x0066	2	Voltage 15th harmonic L3	%	float
0x0068	2	Voltage 17th harmonic L1	%	float
0x006a	2	Voltage 17th harmonic L2	%	float
0x006c	2	Voltage 17th harmonic L3	%	float
0x006e	2	Voltage 19th harmonic L1	%	float
0x0070	2	Voltage 19th harmonic L2	%	float
0x0072	2	Voltage 19th harmonic L3	%	float
0x0074	2	Total harmonic currents L1	A	float
0x0076	2	Total harmonic currents L2	A	float
0x0078	2	Total harmonic currents L3	A	float
0x007a	2	Current 3rd harmonic L1	A	float
0x007c	2	Current 3rd harmonic L2	A	float
0x007e	2	Current 3rd harmonic L3	A	float

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Address	Words	Description	Unit	Format
0x0080	2	Current 5th harmonic L1	A	float
0x0082	2	Current 5th harmonic L2	A	float
0x0084	2	Current 5th harmonic L3	A	float
0x0086	2	Current 7th harmonic L1	A	float
0x0088	2	Current 7th harmonic L2	A	float
0x008a	2	Current 7th harmonic L3	A	float
0x008c	2	Current 9th harmonic L1	A	float
0x008e	2	Current 9th harmonic L2	A	float
0x0090	2	Current 9th harmonic L3	A	float
0x0092	2	Current 11th harmonic L1	A	float
0x0094	2	Current 11th harmonic L2	A	float
0x0096	2	Current 11th harmonic L3	A	float
0x0098	2	Current 13th harmonic L1	A	float
0x009a	2	Current 13th harmonic L2	A	float
0x009c	2	Current 13th harmonic L3	A	float
0x009e	2	Current 15th harmonic L1	A	float
0x00a0	2	Current 15th harmonic L2	A	float
0x00a2	2	Current 15th harmonic L3	A	float
0x00a4	2	Current 17th harmonic L1	A	float
0x00a6	2	Current 17th harmonic L2	A	float
0x00a8	2	Current 17th harmonic L3	A	float
0x00aa	2	Current 19th harmonic L1	A	float
0x00ac	2	Current 19th harmonic L2	A	float
0x00ae	2	Current 19th harmonic L2	A	float
0x00b0	2	Network frequency	Hz	float
0x00b2	2	Neutral conductor current	A	float
0x00b4	2	Average value neutral conductor current	A	float
0x00b6	2	Total active power - collective Active power	W	float
0x00b8	2	Total reactive power – sum of the fundamental reactive power	var	float
0x00ba	2	Total apparent power - collective Apparent power	VA	float
0x00bc	2	Power factor		float

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Address	Words	Description	Unit	Format
0x0328	2	collective Total reactive power, sum of single-phase measurement	var	float
0x0322	2	Total reactive power L1	var	float
0x0324	2	Total reactive power L2	var	float
0x0326	2	Total reactive power L3	var	float
0x032a	2	Missing compensation power L1	var	float
0x032c	2	Missing compensation power L2	var	float
0x032e	2	Missing compensation power L3	var	float
0x0330	2	Total missing compensation power	var	float
0x0332	2	Temperature	°C	float
	2			float
0x0334	2	Relay states (20 bit: bit 0 = stage 1 - bit 17 = stage 18 // bit 18 = error message// Bit 19 = fan)	bitwise	unsigned long
0x0336	2	Messages (bit coded)		unsigned long
0x0338	2	Error state (bit coded)		unsigned long
0x033A	2	Error messages (bit coded)		unsigned long

Table 2

Messages: (display)
Bit 00 set: No stage power
Bit 01 set: No measuring current
Bit 02 set: No measuring voltage
Bit 03 set: Light load operation

Error state: (display)
Bit 00 set: Power failure has occurred
Bit 01 set: Reset has been performed
Bit 02 set: System temperature switch-off
Bit 03 set: Voltage harmonics limit reached
Bit 04 set: Current harmonics limit reached
Bit 05 set: Operating cycle limit reached
Bit 06 set: Overvoltage limit reached
Bit 07 set: Current average limit reached (L1 or L2 or L3)
Bit 08 set: PFC too small

Error messages: (relay set)
Bit 00 set: No stage power
Bit 01 set: Power failure has occurred
Bit 02 set: Reset has been performed
Bit 03 set: System temperature switch-off
Bit 04 set: No measuring current
Bit 05 set: No measuring voltage
Bit 06 set: Light load operation
Bit 07 set: Voltage harmonics limit reached
Bit 08 set: Current harmonics limit reached
Bit 09 set: Operating cycle limit reached
Bit 10 set: Overvoltage limit reached
Bit 11 set: Current average limit reached (L1 or L2 or L3)
Bit 12 set: PFC too small

Example Modbus RTU
Request:
01 04 00 1F 00 0C 80 0B

01	Device address
04	Command
00 1F	Read active power L1 from register 0x0020 (in accordance with the Modbus definition, the required address must be set to -1 in the request telex)
00 0C	Read 12 registers, i.e. read 6 data points
80 0B	CRC code

Response:
01 04 18 48 44 02 45 48 43 BF 8A 48 42 E9 0A 47 DA C0 73 47 DC 86 B2 47 DC 61 9B CA 9E
in which

01	Device address	
04	Command	
04	100 data bytes	
48 44 02 45	Active power L1	200710 W
48 43 BF 8A	Active power L2	200446 W
48 42 E9 0A	Active power L3	199588 W
47 DA C0 73	Reactive power L1 – basic power only	112000 var
47DC 86 B2	Reactive power L1 – basic power only	112909 var
47 DC 61 9B	Reactive power L1 – basic power only	112835 var
CA 9E	CRC code	

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6. Device information

The device information is read via the command 0x2B (Read Device Identification).

Information about the manufacturer, device code and device version is read in the process. The device supplies the "Basic Device Identification". "Regular" and "Extended Device Identification" are optional according to the Modbus definition. They are not used in the Multimess Comfort.

Example Modbus RTU

Request: 01 2B 0E 01 00 70 77

01	Device address
2B	Command
0E	MEI type according to the Modbus definition always 0x0E
01	Device ID code for "Basic Device Identification" (see Modbus definition)
00	Object ID -> in our example manufacturer name, product name and version
70 77	CRC code

Response: 01 2B 0E 01 01 00 00 03 00 08 4B 42 52 20 47 6D 62 48 01 12 6D 75 6C 74 69 63 6F 6D 70 20 46 31 34 34 2D 33 50 48 02 09 20 32 2E 30 30 72 30 30 37 D3 E4in which

01	Device address
2B	Command
0E	MEI type (see Modbus definition)
01	"Basic identification" (see Modbus definition)
01	"Conformity level" (see Modbus definition)
00	No further information follows (no additional telex required)
00	Next object ID
03	Number of objects
00	Object ID 00
08	Text length of ID 00
4B 42 52 20 47 6D 62 48	"KBR GmbH"
01	Object ID 01
12	Text length of ID 01
6D 75 6C 74 69 63 6F 6D 70 20 46 31 34 34 2D 33 50 48	"multicomp F144-3PH"
02	Object ID 02
09	Text length of ID 02
20 32 2E 30 30 72 30 30 37	„2.00r007"
D3 E4	CRC code

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