KBR Energy Management

Data point description for the Modbus protocol

4 quadrant controller

3D6...

4D6...

5D6...

multicomp

6D6-ESMSBSDS-1V1C6RO

Your partner for network analysis

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1 Supported Modbus commands

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0x2B	Read device identification

The **multicomp 4D6-ESBSDS-1V1C6RO** does not support broadcast commands. All described Modbus commands 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

Rule for byte sequence:
MSB before LSB

float:

Format	corresponds to 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 always amounts to 1 => it is not saved separately! S = sign for the mantissa: S = 1 ➢ negative number; S = 0 ➢ positive number
Exponent	8 bits (0-255); is saved relative to 127, i.e. the current value of the exponent is deduced by subtracting the number 127 from the value saved. Curr. exp. = saved value of exp. – 127 => Number range from 128 to -127!

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

The sequence of the float bytes on the bus can be reversed, where required, 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 illustration:
The sign bit is **1** => negative mantissa
The value of the exponent is **10000010** bin or **130** dec.
For the exponent, this means: 130 - 127 = **3**
The mantissa contains 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, you will obtain the following value: **1.10010000000000000000000**
Now, the mantissa must 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 appears in our illustration as:
1100.10000000000000000000
The number obtained corresponds to the binary floating-point number.
Binary points to the left of the decimal point yield values > 1.
In this example, **1100** bin yields the number **12** dec. $\{(1x2^3)+ (1x2^2)+ (1x2^1)+ (1x2^0)\}§^3$
Binary points to the right of the decimal point yield values < 1.
In this example, **.100**..... bin yields the number **0.5** dec. $\{(1x2^{-1})+ (0x2^{-2})+ (0x2^{-3})+ (0x2^{-4})\}§^3$
By adding the individual values, **12.5.** is obtained. Since the sign bit was set, the value is negative, meaning **-12.5**. The hexadecimal number **0xC1480000** therefore corresponds to **-12.5**.

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	25

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
- VZ=positive

01101010110101001111111 bin
Decimal point added to the first position of the mantissa
- **.** 01101010110101001111111

Leading 1 in front of decimal point
- **1.** 01101010110101001111111

Taking 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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Timestamp time_t (is transmitted as unsigned long)

The time stamp describes a point in time. The value is defined as follows:

Seconds since 1.1.1970 0°° hours (with respect to the appropriate time zone)

The values are transmitted over the bus as **unsigned long** (for byte sequence, see above). All values are to be interpreted as standard time (winter time), i.e. if you want to set the device clock in Germany to 11 o'clock in May, then the setting command via the bus must be done, by definition, with winter time 10 o'clock.

The following applies:

All time stamps which are transmitted via the bus are to be interpreted as standard (winter) time.

The device itself must be parametrized according to country-specific parameters.
Possible settings here:
e.g. in Germany -> daylight saving time from end of March to end of October
e.g. China -> daylight saving time not activated

3 Interface parameters

Setting options for Modbus RTU

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

Setting options for Modbus ASCII

Baud rate (Baud)	Parity	Data bits	Stop bits
4800,9600,19200	even,odd,none	7	2 for parity none 1 otherwise

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

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4 Device settings

Device settings are performed via the Modbus command 0x10 (write multiple registers) in accordance with table 1. These settings can also be read with the Modbus command 0x04.

Table 1

Address	Words	Description	Value	Format
0xD002	2	Measuring voltage primary transformer	1-1000000	unsigned long
0xD004	2	Measuring voltage secondary transformer	1-600	unsigned long
0xD006	2	Primary transformer measurement current	1-1000000	unsigned long
0xD008	2	Secondary transformer measurement current	1 ->1A 5 ->5A	unsigned long
0xD00A	2	Frequency correction	0 automatic 1 50Hz fixed (currently not enabled) 2 60Hz fixed (currently not enabled)	unsigned long
0xD00C	2	Average current value, averaging time in min	0-255 (currently not used)	unsigned long
0xD00E	2	Attenuation voltage (0-9)	0-9	unsigned long
0xD010	2	Attenuation current (0-9)	0-9	unsigned long
0xD012	2	Primary transformer induced current	1-1000000	unsigned long
0xD014	2	Secondary transformer induced current	1 ->1A 5 ->5A	unsigned long
0xD016	2	Phase connected for voltage measurement	0:L1N; 1:L2N; 2:L3N; 3:L12; 4:L23, 5:L31	unsigned long
0xD018	2	Phase connected for current measurement	0:L1; 1:L2; 2:L3; 3:L1neg; 4:L2neg; 5: L3neg	unsigned long
0xD01A	2	0 daylight saving time not active 1 daylight saving time active	0,1	unsigned long
0xD01C	2	Switch from winter time → daylight saving time	1 – 12	unsigned long
0xD01E	2	Switch from daylight saving time → winter time	1 – 12	unsigned long
0xD020	2	Threshold value for voltage dip Uphn	new value	float
0xD022	2	Attenuation for missing compensation power	0-9	unsigned long
0xD024	2	Free	-	float
0xD026	2	Free	-	float
0xD028	2	Set time	Time as time stamp	unsigned long
0xD02A	2	Factor for default response times	Default setting 10 corresponds to factor 1.0 Factor 1.0 corresponds to >3.5 byte times Factor 2.0 corresponds to >7 byte times 0-255 meaning factors 0 to 25.5	unsigned long
0xD02C	2	Byte sequence for float on the Modbus	1 according to definition 0 reversed	unsigned long
0xD02E	2	Free	-	unsigned long
0xD030	2	Temperature limit [0.1 °C] that triggers the fan to run when exceeded	0 - 700	unsigned long

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0xD032	2	Temperature limit [0.1 °C] that triggers the alarm when exceeded	0 - 700	unsigned long
0xD034	2	Temperature limit [0.1 °C] that triggers the stages to switch off when exceeded	0 - 700	unsigned long
0xD036	2	Hysteresis [0.1 °C], fan	0 - 250	unsigned long
0xD038	2	Hysteresis [0.1 °C], alarm	0 - 250	unsigned long
0xD03A	2	Hysteresis [0.1 °C], Stage switch-off	0 - 250	unsigned long
0xD03C	2	Error message screen	-	unsigned long
0xD03E	2	Error response screen	-	unsigned long
0xD040	2	Target CosPhi	-1.0 - +1.0	float
0xD042	2	Target CosPhi in case of energy recovery	-1.0 - +1.0	float
0xD044	2	CosPhi limit for message "facility too small"	-1.0 - +1.0	float
0xD046	2	Limit for operating cycle message (for contactor stages)	0 - 100000	unsigned long
0xD048	2	Switching interval [ms]	0 – 10000	unsigned long
0xD04A	2	Delay time before contactor stages can be switched on [s]	0 – 1000	unsigned long
0xD04C	2	Time before message "facility too small" is displayed [s]	0 – 3000	unsigned long
0xD04E	2	Idle time after compensation [ms]	0 – 300000	unsigned long
0xD050	2	Percentage value of smallest available stage before connection	0 – 150	unsigned long
0xD052	2	Percentage value of smallest available stage before switch-off	0 – 150	unsigned long
0xD054	2	Error message relay	0: NO contact 1: NC contact	unsigned long
0xD056	2	Temperature evaluation	0: off 1: on	unsigned long
0xD058	2	Output index for following stage parameters	0 - 17	unsigned long
0xD05A	2	Type	0: stage; 1:thyro, 2:fan, 3:alarm output, 4:unused, 5:not available	unsigned long
0xD05C	2	Mode	0:Auto, 1:HAND_OFF, 2:HAND ON	unsigned long
0xD05E	2	Cabinet No.	0..5 (corresponds to No. 1..6)	unsigned long
0xD060	2	Reactor factor [0.1 %]	0..140	unsigned long
0xD062	2	Stage power [0.1 kvar]	0 - 100000	unsigned long
0xD064	2	Discharge time [s]	0..900	unsigned long
0xD066	2	Operating cycles	-1..100000 (-1: do not apply value)	long
0xD068	2	Operating hours	-1..100000 (-1: do not apply value)	long
0xD06A	2	Total Temperature switch-off	-1..100000 (-1: do not apply value)	long

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Example Modbus RTU

Request:
01 10 D0 01 00 02 04 00 00 01 90 AE 5A
in which

01	Device address
10	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	Write 2 registers
04	Write 4 bytes
00 00 01 90	Reset to value 400 (0x0190)
AE 5A	CRC code

Response:
01 10 D0 01 00 02 28 C8
in which

01	Device address
10	Command
D0 01	Write from register 0xD0002
00 02	2 words written
28 C8	CRC code

Example Modbus ASCII

Request:
3A 30 31 31 30 44 30 30 31 30 30 30 34 30 38 30 30 30 30 30 31 39 30 30 30 30 30 30 31 39 30 46 30 0D 0A
in which

3A	Start telex (colon)
30 31	Device address 0x01
31 30	Command 0x10
44 30 30 31	Set registers 0xD002 to 0xD005 (in accordance with the Modbus definition, the required address must be set to -1 in the request telex)
30 30 30 34	Set 4 registers (primary voltage transformer 2 words and secondary 2 words)
30 38	Write number of bytes (8 bytes)
30 30 30 30 30 31 39 30	Primary voltage transformer 0x190 corresponds to dec. 400 V
30 30 30 30 30 31 39 30	Secondary voltage transformer 0x190 corresponds to dec. 400 V
46 30	LRC code
0D 0A	Telex end (CR LF)

Response:
3A 30 31 31 30 44 30 30 31 30 30 30 34 31 41 0D 0A
in which

3A	Start telex (colon)
30 31	Device address 0x01
31 30	Command 0x10
44 30 30 31	Registers 0xD002 to 0xD005 set
30 30 30 34	4 data bytes written
30 30 30 30	No limit violated with address 4 to 13
	Last 6 bits in byte 00 are without meaning
31 41	LRC code
0D 0A	Telex end (CR LF)

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5 Commands

Commands can only be executed via the input 0x06 (write single register) in accordance with table 2.

Table 2

Address	Words	Description	Value	Format
0xF001	1	Device reset	42	unsigned short
0xF002	1	Reset all maximum values	0	unsigned short
0xF003	1	Reset all minimum values	0	unsigned short
0xF004	1	-	-	unsigned short
0xF005	1	-	-	unsigned short
0xF006	1	Delete error status	0	unsigned short
0xF007	1	-	-	unsigned short

Example Modbus RTU

Request:
01 06 F0 05 00 00 AA CB
in which

01	Device address
06	Command
F0 05	Register 0xF006 delete error status (in accordance with Modbus definition, the required address must be set to -1 in the request telex)
00 00	Value 0 (in accordance with definition table 2)
AA CB	CRC code

Response:
01 06 F0 05 00 00 AA CB
in which

01	Device address
06	Command
F0 05	Register 0xF006 delete error status (in accordance with Modbus definition, the required address must be set to -1 in the request telex)
00 00	Value 0 (in accordance with definition table 2)
AA CB	CRC code

Example Modbus ASCII

Request:
3A 30 31 30 36 46 30 30 31 30 30 30 30 30 38 0D 0A
in which

3A	Start telex (colon)
30 31	Device address 0x01
30 36	Command 0x06
46 30 30 31	Command 0xF002 reset all maximum values (in accordance with the Modbus definition, the required address must be set to -1 in the request telex)
30 30 30 30	Value 0 (in accordance with definition table 2)
30 38	LRC code
0D 0A	Telex end (CR LF)

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Response:
3A 30 31 30 36 46 30 30 31 30 30 30 30 30 38 0D 0A
in which

3A	Start telex (colon)
30 31	Device address 0x01
30 36	Command 0x06
46 30 30 31	Command 0xF002 reset all maximum values (in accordance with the Modbus definition, the required address must be set to -1 in the request telex)
30 30 30 30	Value 0 (in accordance with definition table 2)
30 38	LRC code
0D 0A	Telex end (CR LF)

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6 Limit violations

Limit violations are read via the command 0x02 (read discrete inputs) in accordance with table 3

Table 3

Address	Description of limit violations
0x0001	1st limit voltage PH-N
0x0002	1st limit voltage PH-PH
0x0003	1st limit voltage distortion factor
0x0004	1st limit voltage 3rd harmonic
0x0005	1st limit voltage 5th harmonic
0x0006	1st limit voltage 7th harmonic
0x0007	1st limit voltage 9th harmonic
0x0008	1st limit voltage 11th harmonic
0x0009	1st limit voltage 13th harmonic
0x000a	-
0x000b	-
0x000c	-
0x000d	-

Example Modbus RTU

Request:
01 02 00 00 00 07 79 CC
in which

01	Device address
02	Command
00 00	Address 1st limit U-PhN (in accordance with the Modbus definition, the required address must be set to -1 in the request telex)
00 07	Number of addresses to be evaluated (addresses 1 to 7)
79 CC	CRC code

Response:
01 02 01 07 E0 4A
in which

01	Device address
02	Command
01	Number of data bytes
07	1st limit U-PhN- violated 1st limit voltage PH-PH violated 1st limit voltage distortion factor violated 1st limit voltage 3rd harmonic not violated 1st limit voltage 5th harmonic not violated 1st limit voltage 6th harmonic violated 1st limit voltage 7th harmonic not violated Last bit in byte is without meaning
E0 4A	CRC code

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Example Modbus ASCII

Request:
3A 30 31 30 32 30 30 30 33 30 30 30 41 46 30 0D 0A
in which

3A	Start telex (colon)
30 31	Device address 0x01
30 32	Command 0x02
30 30 30 33	Address 1st limit voltage 3rd harmonic (in accordance with the Modbus definition, the required address must be set to -1 in the request telex)
30 30 30 41	Number of addresses to be evaluated 0x0A
46 30	LRC code
0D 0A	Telex end (CR LF)

Response:
3A 30 31 30 32 30 32 30 30 30 30 46 42 0D 0A
in which

3A	Start telex (colon)
30 31	Device address 0x01
30 32	Command
30 32	Number of data bytes 0x02
30 30 30 30	No limit violated with address 4 to 13
	Last 6 bits in byte 00 are without meaning
46 42	LRC code
0D 0A	Telex end (CR LF)

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7 Data points

Data points are read via the command 0x04 (read input registers) in accordance with table 4

Table 4

Address	Words	Description	Unit	Format
0x0002	2	Voltage PH-N	V	float
0x0004	2	Voltage PH-PH	V	float
0x0006	2	Current (main current)	A	float
0x0008	2	Induced current - not supported	A	float
0x000a	2	Apparent power	VA	float
0x000c	2	Active power	W	float
0x000e	2	Reactive power	var	float
0x0010	2	cos Phi		float
0x0012	2	Power factor		float
0x0014	2	Voltage distortion factor	%	float
0x0016	2	Voltage 3rd harmonic	%	float
0x0018	2	Voltage 5th harmonic	%	float
0x001a	2	Voltage 7th harmonic	%	float
0x001c	2	Voltage 9th harmonic	%	float
0x001e	2	Voltage 11th harmonic	%	float
0x0020	2	Voltage 13th harmonic	%	float
0x0022	2	Voltage 15th harmonic	%	float
0x0024	2	Voltage 17th harmonic	%	float
0x0026	2	Voltage 19th harmonic	%	float
0x0028	2	Total harmonic currents - not supported	A	float
0x002a	2	Current 3rd harmonic - not supported	A	float
0x002c	2	Current 5th harmonic - not supported	A	float
0x002e	2	Current 7th harmonic - not supported	A	float
0x0030	2	Current 9th harmonic - not supported	A	float
0x0032	2	Current 11th harmonic - not supported	A	float
0x0034	2	Current 13th harmonic - not supported	A	float
0x0036	2	Current 15th harmonic - not supported	A	float
0x0038	2	Current 17th harmonic - not supported	A	float
0x003a	2	Current 19th harmonic - not supported	A	float
0x003c	2	Mains frequency	Hz	float
0x003e	2	Missing compensation power	var	float
0x0040	2	Hooked up compensation power	var	float
0x0042	2	Current target Cos Phi	-	float
0x0044	2	Temperature value main unit	°C	float
0x0046	2	Temperature value module 1	°C	float
0x0048	2	Temperature value module 2	°C	float
0x004a	2	Temperature value module 3	°C	float
0x004c	2	Temperature value module 4	°C	float
0x004e	2	Temperature value module 5	°C	float
0x0050	2	Total compensation power	var	float
0x0052	2	Total active power	W	float
0x0054	2	Total reactive power	var	float
0x0056	2	Total apparent power	VA	float
0x0058	2	Total power factor - not supported		float
0x005a	2	Error status (=> see 9 error status description)		unsigned long
0x005c	2	Advanced error messages (=> see 9 error status description)		unsigned long
0x005e	2	Time		unsigned long
0x0060	2	Maximum: Voltage PH-N	V	float

0x0062	2	Maximum: Voltage PH-PH	V	float
0x0064	2	Maximum: Current (main current)	A	float
0x0066	2	Maximum: Induced current - not supported	A	float
0x0068	2	Maximum: Apparent power	VA	float
0x006a	2	Maximum: Active power	W	float
0x006c	2	Maximum: Reactive power	var	float
0x006e	2	Maximum: cos Phi		float
0x0070	2	Maximum: Power factor		float
0x0072	2	Maximum: Voltage distortion factor	%	float
0x0074	2	Maximum: Voltage 3rd harmonic	%	float
0x0076	2	Maximum: Voltage 5th harmonic	%	float
0x0078	2	Maximum: Voltage 7th harmonic	%	float
0x007a	2	Maximum: Voltage 9th harmonic	%	float
0x007c	2	Maximum: Voltage 11th harmonic	%	float
0x007e	2	Maximum: Voltage 13th harmonic	%	float
0x0080	2	Maximum: Voltage 15th harmonic	%	float
0x0082	2	Maximum: Voltage 17th harmonic	%	float
0x0084	2	Maximum: Voltage 19th harmonic	%	float
0x0086	2	Maximum: Total harmonic currents - not supported	A	float
0x0088	2	Maximum: Current 3rd harmonic - not supported	A	float
0x008a	2	Maximum: Current 5th harmonic - not supported	A	float
0x008c	2	Maximum: Current 7th harmonic - not supported	A	float
0x008e	2	Maximum: Current 9th harmonic - not supported	A	float
0x0090	2	Maximum: Current 11th harmonic - not supported	A	float
0x0092	2	Maximum: Current 13th harmonic - not supported	A	float
0x0094	2	Maximum: Current 15th harmonic - not supported	A	float
0x0096	2	Maximum: Current 17th harmonic - not supported	A	float
0x0098	2	Maximum: Current 19th harmonic - not supported	A	float
0x009a	2	Maximum: Mains frequency	Hz	float
0x009c	2	Maximum: Missing compensation power	var	float
0x009e	2	Maximum: Hooked up compensation power	var	float
0x00a0	2	Maximum: Current target Cos Phi - not supported	-	float
0x00a2	2	Maximum: Temperature value main unit	°C	float
0x00a4	2	Maximum: Temperature value module 1	°C	float
0x00a6	2	Maximum: Temperature value module 2	°C	float
0x00a8	2	Maximum: Temperature value module 3	°C	float
0x00aa	2	Maximum: Temperature value module 4	°C	float
0x00ac	2	Maximum: Temperature value module 5	°C	float
0x00ae	2	Minimum: Voltage PH-N	V	float
0x00b0	2	Minimum: Voltage PH-PH	V	float
0x00b2	2	Minimum: Current (main current)	A	float
0x00b4	2	Minimum: Induced current - not supported	A	float
0x00b6	2	Minimum: Apparent power	VA	float
0x00b8	2	Minimum: Active power	W	float
0x00ba	2	Minimum: Reactive power	var	float
0x00bc	2	Minimum: Cos Phi		float
0x00be	2	Minimum: Power factor		float
0x00c0	2	Minimum: Mains frequency	Hz	float
0x00c2	2	Minimum: Missing compensation power	var	float
0x00c4	2	Minimum: Hooked up compensation power	var	float
0x00c6	2	Minimum: Current target Cos Phi - not supported	-	float
0x00c8	2	Minimum: Temperature value main unit	°C	float
0x00ca	2	Minimum: Temperature value module 1	°C	float
0x00cc	2	Minimum: Temperature value module 2	°C	float
0x00ce	2	Minimum: Temperature value module 3	°C	float

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0x00d0	2	Minimum: Temperature value module 4	°C	float
0x00d2	2	Minimum: Temperature value module 5	°C	float
0x00d4	2	Maximum date: Voltage PH-N		unsigned long
0x00d6	2	Maximum date: Voltage PH-PH		unsigned long
0x00d8	2	Maximum date: Current (main current)		unsigned long
0x00da	2	Maximum date: Induced current - not supported		unsigned long
0x00dc	2	Maximum date: Apparent power		unsigned long
0x00de	2	Maximum date: Active power		unsigned long
0x00e0	2	Maximum date: Reactive power		unsigned long
0x00e2	2	Maximum date: Cos Phi		unsigned long
0x00e4	2	Maximum date: Power factor		unsigned long
0x00e6	2	Maximum date: Voltage distortion factor		unsigned long
0x00e8	2	Maximum date: Voltage 3rd harmonic		unsigned long
0x00ea	2	Maximum date: Voltage 5th harmonic		unsigned long
0x00ec	2	Maximum date: Voltage 7th harmonic		unsigned long
0x00ee	2	Maximum date: Voltage 9th harmonic		unsigned long
0x00f0	2	Maximum date: Voltage 11th harmonic		unsigned long
0x00f2	2	Maximum date: Voltage 13th harmonic		unsigned long
0x00f4	2	Maximum date: Voltage 15th harmonic		unsigned long
0x00f6	2	Maximum date: Voltage 17th harmonic		unsigned long
0x00f8	2	Maximum date: Voltage 19th harmonic		unsigned long
0x00fa	2	Maximum date: Total harmonic currents - not supported		unsigned long
0x00fc	2	Maximum date: Current 3rd harmonic - not supported		unsigned long
0x00fe	2	Maximum date: Current 5th harmonic - not supported		unsigned long
0x0100	2	Maximum date: Current 7th harmonic - not supported		unsigned long
0x0102	2	Maximum date: Current 9th harmonic - not supported		unsigned long
0x0104	2	Maximum date: Current 11th harmonic - not supported		unsigned long
0x0106	2	Maximum date: Current 13th harmonic - not supported		unsigned long
0x0108	2	Maximum date: Current 15th harmonic - not supported		unsigned long
0x010a	2	Maximum date: Current 17th harmonic - not supported		unsigned long
0x010c	2	Maximum date: Current 19th harmonic - not supported		unsigned long
0x010e	2	Maximum date: Mains frequency		unsigned long
0x0110	2	Maximum date: Missing compensation power		unsigned long
0x0112	2	Maximum date: Hooked up compensation power		unsigned long
0x0114	2	Maximum date: Current target Cos Phi - not supported		unsigned long
0x0116	2	Maximum date: Temperature value main unit		unsigned long
0x0118	2	Maximum date: Temperature value module 1		unsigned long
0x011a	2	Maximum date: Temperature value module 2		unsigned long
0x011c	2	Maximum date: Temperature value module 3		unsigned long
0x011e	2	Maximum date: Temperature value module 4		unsigned long
0x0120	2	Maximum date: Temperature value module 5		unsigned long
0x0122	2	Minimum date: Voltage PH-N		unsigned long
0x0124	2	Minimum date: Voltage PH-PH		unsigned long
0x0126	2	Minimum date: Current (main current)		unsigned long
0x0128	2	Minimum date: Induced current (only for Comfort device)		unsigned long
0x012a	2	Minimum date: Apparent power		unsigned long
0x012c	2	Minimum date: Active power		unsigned long
0x012e	2	Minimum date: Reactive power		unsigned long
0x0130	2	Minimum date: cos Phi		unsigned long
0x0132	2	Minimum date: Power factor		unsigned long
0x0134	2	Minimum date: Mains frequency		unsigned long
0x0136	2	Minimum date: Missing compensation power		unsigned long
0x0138	2	Minimum date: Hooked up compensation power		unsigned long
0x013a	2	Minimum date: Current target Cos Phi - not supported		unsigned long
0x013c	2	Minimum date: Temperature value main unit		unsigned long

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0x013e	2	Minimum date: Temperature value module 1		unsigned long
0x0140	2	Minimum date: Temperature value module 2		unsigned long
0x0142	2	Minimum date: Temperature value module 3		unsigned long
0x0144	2	Minimum date: Temperature value module 4		unsigned long
0x0146	2	Minimum date: Temperature value module 5		unsigned long
0x0148	2			

Example Modbus RTU

Request:
01 04 00 01 00 32 20 1F
in which

01	Device address
04	Command
00 01	Read "voltage PH-N" from register 0x0112 (in accordance with the Modbus definition, the required address must be set to -1 in the request telex)
00 32	Read 50 registers, i.e. read 25 data points
20 1F	CRC code

Response:
01 04 64 43 04 97 8E 43 65 A7 F6 42 49 75 6A 00 00 00 00 45 CF DC 77 45 B2 ED 46 C5 B4 9B 24 BF 5C 93 C9 3F 5C 64 E8 3D 83 5F 79 3C B9 BD FA 3C A2 AE D2 3C A2 AF 06 3C B3 A8 D4 3C B9 BD FA 3C B9 BD FA 3C A2 AF 06 3C A2 AF 06 3C B9 BD FA 3F B0 B1 A8 3E EA DA 1B 3E E4 E3 72 3E E6 B5 02 3E D7 FF D7 3E CB 68 75 0C CD
in which

01	Device address	
04	Command	
64	100 data bytes	
43 04 97 8E	Voltage PH-N	132.59 V
43 65 A7 F6	Voltage PH-PH	229.65 V
42 49 75 6A	Current (main current)	50.36 A
00 00 00 00	Induced current (only for Comfort device)	0.0 A
45 CF DC 77	Apparent power - not supported	6651.55 VA
45 B2 ED 46	Active power - not supported	5725.65 W
C5 B4 9B 24	Reactive power - not supported	-5779.39 var (cap.)
BF 5C 93 C9	Cos Phi	-0.86 (cap.)
3F 5C 64 E8	Power factor	0.86
3D 83 5F 79	Voltage distortion factor	0.06 %
3C B9 BD FA	Voltage 3rd harmonic	0.02 %
3C A2 AE D2	Voltage 5th harmonic	0.019 %
3C A2 AF 06	Voltage 7th harmonic	0.019 %
3C B3 A8 D4	Voltage 9th harmonic	0.021 %
3C B9 BD FA	Voltage 11th harmonic	0.022 %
3C B9 BD FA	Voltage 13th harmonic	0.022 %
3C A2 AF 06	Voltage 15th harmonic	0.019 %
3C A2 AF 06	Voltage 17th harmonic	0.019 %
3C B9 BD FA	Voltage 19th harmonic	0.022 %
3F B0 B1 A8	Total harmonic currents	1.380 A
3E EA DA 1B	Current 3rd harmonic	0.458 A
3E E4 E3 72	Current 5th harmonic	0.447 A
3E E6 B5 02	Current 7th harmonic	0.450 A
3E D7 FF D7	Current 9th harmonic	0.421 A
3E CB 68 75	Current 11th harmonic	0.397 A
0C CD	CRC code	

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Example Modbus ASCII

Request:
3A 30 31 30 34 30 30 39 35 30 30 30 32 36 34 0D 0A
in which

3A	Start telex (colon)
30 31	Device address 0x01
30 34	Command 0x40
30 30 39 35	Read from register 0x0095 (in accordance with the Modbus definition, the required address must be set to -1 in the request telex)
30 30 30 32	Read 2 registers, i.e. read 1 measured value (maximum: Voltage 7th harmonic L3)
36 34	LRC code
0D 0A	Telex end (CR LF)

Response:
3A 30 31 30 34 30 34 34 32 38 34 34 32 39 34 35 42 0D 0A
in which

3A	Start telex (colon)
30 31	Device address 0x01
30 34	Command 0x40
30 34	4 data bytes
34 32 38 34 34 32 39 34	Maximum: Mains frequency: 66.13 Hz
35 42	LRC code
0D 0A	Telex end (CR LF)

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8 Device information

The device information is read via the command 0x2B (read device identification)

Information about manufacturer, device code and device version is gathered in the process.
The device supplies the "basic device identification". The "regular device identification" and "extended device identification" are optional in accordance with the Modbus definition.
They are not used by the **multicomp 4D6-ESBSDS-1V1C6RO**.

Example Modbus RTU

Request:
01 2B 0E 01 00 70 77
in which

01	Device address
2B	Command
0E	MEI type in accordance with Modbus definition always 0x0E
01	Device ID code for "basic device identification" (see Modbus definition)
00	Object ID -> in our example manufacturer, 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 14 4D 55 4C 54 49 43 4F 4D 50 20 33 20 2D 20 42 61 73 69 63 20 02 09 20 32 2E 30 30 64 30 30 34 7E CE
in 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	Length of the text of the ID 00
4B 42 52 20 47 6D 62 48	"KBR GmbH"
01	Object ID 01
14	Length of the text of the ID 01
4D 55 4C 54 49 43 4F 4D 50 20 33 20 2D 20 42 61 73 69 63 20	"multicomp 4D6-ESBSDS-1V1C6RO"
02	Object ID 02
09	Length of the text of ID 02
20 32 2E 30 30 64 30 30 34	"2.00r004"
7E CE	CRC code

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Example Modbus ASCII

Request:
3A 30 31 32 42 30 45 30 31 30 32 43 33 0D 0A
in which

3A	Start telex (colon)
30 31	Device address 0x01
32 42	Command 0x2B
30 45	MEI type in accordance with Modbus definition always 0x0E
30 31	Device ID code for "basic device identification" (see Modbus definition)
30 32	Object ID -> in out example read 02 version and release
43 33	LRC code
0D 0A	Telex end (CR LF)

Response:
3A 30 31 32 42 30 45 30 31 30 31 30 30 30 32 30 31 30 32 30 39 32 30 33 32
32 45 33 30 33 30 36 34 33 30 33 30 33 34 44 45 0D 0A
in which

3A	Start telex (colon)
30 31	Device address 0x01
32 42	Command
30 45	MEI type (see Modbus definition)
30 31	"basic identification" (see Modbus definition)
30 31	"conformity level" (see Modbus definition)
30 30	No further information follows (no additional telex required)
30 32	Next object ID
30 31	Number of objects
30 32	Object ID 02
30 39	Length of the text of ID 02
32 30 33 32 32 45 33 30 33 30 36 34 33 30 33 30 33 34	"2.00r004"
44 45	LRC code
0D 0A	Telex end (CR LF)

9 Error state description

The error state (data point 0x0056) is bit-encoded and structured as follows:

Bit	Explanation
0	Operating cycles of a stage above limiting value (contactor stage)
1	Phase angle deviation
2	Current direction (k and l of the current transformer were swapped)
3	Facility too small (FTS)
4	Battery voltage critical
5	Parameter error (default value replaces incorrect value)
6	At least one input is overloaded
7	Advanced error messages (error state is reset automatically)
8	Mains failure has occurred
9	A limit has been violated
10	Counter pulse missing -> not set
11	External synchronous pulse missing -> not set
12	Reset has been performed
13	DCF synchronous (1 = no, 0 = yes) -> not set
14	Error message
15	Not assigned

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The advanced error messages (data point 0x0058) are bit-encoded and structured as follows:

Bit	Error No.	Explanation
0	E17	No measuring circuit voltage (measuring circuit voltage below limit value)
1	E18	Phase error
2	E19	Programming error (no stage power programmed)
3	E20	Facility too small (FTS)
4	E21	Limit violated
5	E22	Limit violated, stage switch-off active
6	E23	Stage switch-off temperature reached on at least one temperature sensor
7	E24	Overtemperature or short circuit on any temperature sensors
8	E25	No measured current
9	E26	Capacitor current too high
10	E27	No induced current
11	E28	Capacitance loss
12	E29	Contactor defective
13	E30	Stage locked due to induced current error
14	E31	Reserve
15	E32	Reserve
16	E33	Relay module basic device cannot be reached
17	E34	Relay module 1 cannot be reached
18	E35	Relay module 2 cannot be reached
19	E36	Relay module 3 cannot be reached
20	E37	Temperature module cannot be reached
21	E38	Temperature module1 cannot be reached
22	E39	Temperature module 2 cannot be reached
23	E40	Temperature module 3 cannot be reached
24	E41	Temperature module 4 cannot be reached
25	E42	Temperature module 5 cannot be reached
26	E43	Induced current module 1 cannot be reached
27	E44	Induced current module 2 cannot be reached
28	E45	Induced current module 3 cannot be reached
29	E46	Induced current module 4 cannot be reached
30	E47	Induced current module 5 cannot be reached
31	E48	Induced current module 6 cannot be reached

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Korrekturen:
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