Gateway MODBUS ⇨ PROFIBUS

for

UPC4

(Using UNIGATE® CL-ProfibusDPV1)

Operating Instructions

Supplier:

✉	ELTEK DEUTSCHLAND GmbH BU Industrial Schillerstraße 16 D-32052 Herford
☎	+ 49 (0) 5221 1708-210
FAX	+ 49 (0) 5221 1708-222
Email	Info.industrial@eltek.com
Internet	http://www.eltek.com

Revision history

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Revision	Description of change	Writer	Date
1.0	Translation of the german version “Eltek_UM_ProfiBus_Gateway_für_UPC4_D_R2.0.docx”	RTH	2013-05-27

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Gateway MODBUS ⇨ PROFIBUS, hardware and configuration

1 Technical description

This user manual is destined for UPC4 from software release **2.15** and higher. The UPC4 supports MODBUS RTU functionality as standard but simply has to be enabled to this protocol type by configuration using the configuration software MMT (Multi Management Tool), see section 3 "Preparative configuration at UPC4". To connect ProfiBus protocol to the UPC4 an external DIN gateway (UNIGATE® CL-PBDPV1) which converts MODBUS signals to ProfiBus signals is required.

NOTE: The gateway can be ordered by Eltek article code: **300-UP4-PRO.00**

Connect the ProfiBus-Gateway according to section 2 „Electrical connections" to the UPC4.
Operating voltage of the gateway is 24 VDC (admissible voltage range 10 to 33 VDC). Thus, it can be supplied combined with the UPC4 by the external power supply of the UPC4 (see figure 1 - "Electrical connections").

2 Electrical connections

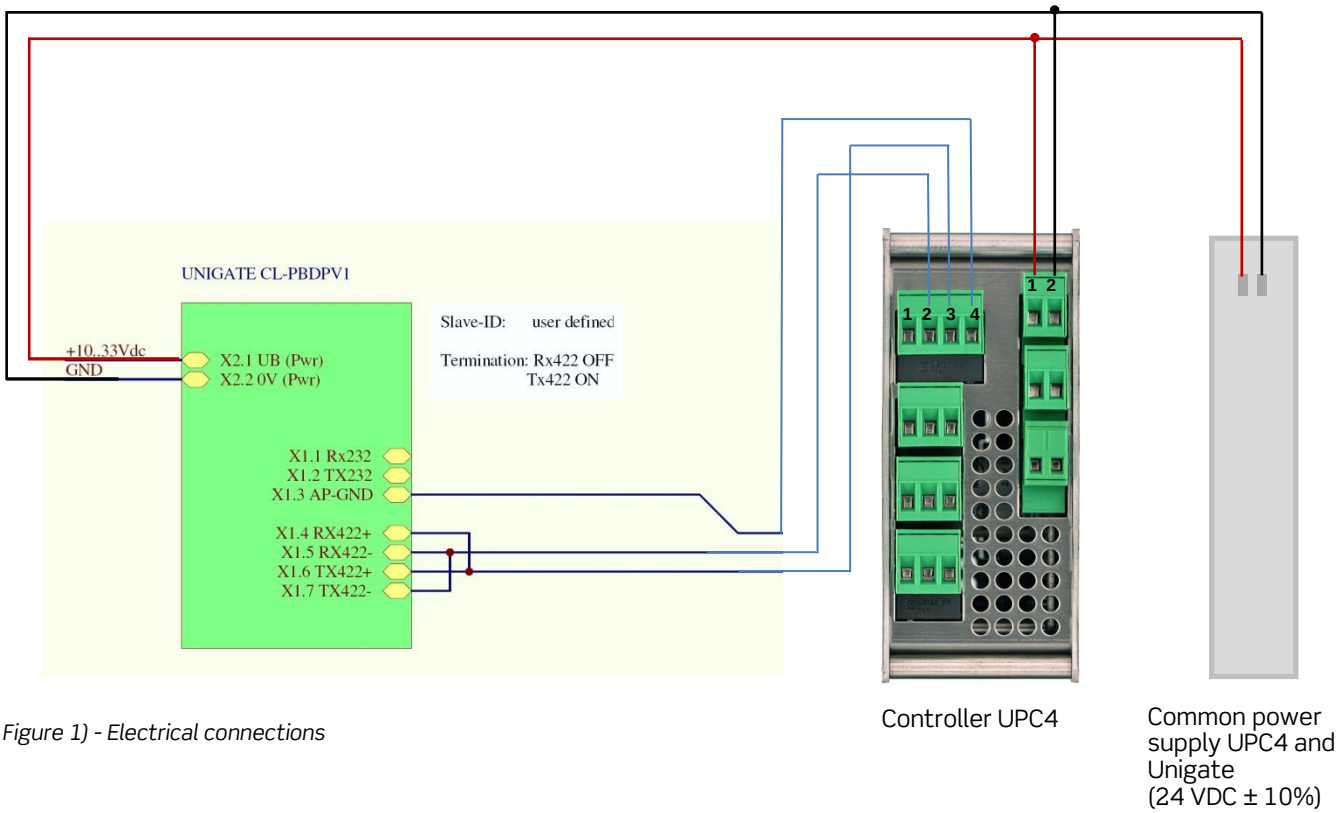

Figure 1) - Electrical connections

UPC4 side field bus connector, 4-pole	
Pin no.	**Function**
1	Corresponds to RS485 SHIELD (not connected to GND)
2	Corresponds to RS485 LINE A
3	Corresponds to RS485 LINE B
4	Corresponds to RS485 GND

NOTE: Using an appropriate cable the gateway can be connected to the RS485 female connector of the UPC4 alternatively.

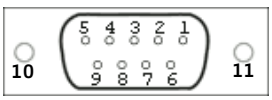

Figure 2) - RS485 female connector at UPC4

Pinning of RS485 female connector:

Pin no.	Function
8	Line A (D0)
3	Line B (D1)
5	Signal Common (GND)
10 + 11	SHIELD

3 Preparative configuration at UPC4

Initially, **Modbus** function has to be enabled at the UPC4. Connect the UPC4 using a Null Modem Cable (RS232) or a network cable (Ethernet; standard IP=192.168.0.123) to a PC or Laptop. Start the configuration software „MMT“ (Multi Management Tool). Choose menu item „Sercice/Enable“ **(1)**.
Scroll to item „Fieldbus“ **(2)** erscheint. Set „1“ **(3)** to enable Modbus functionality.

NOTE: Ignore function „2=Profibus n.a.“ because it is not available.

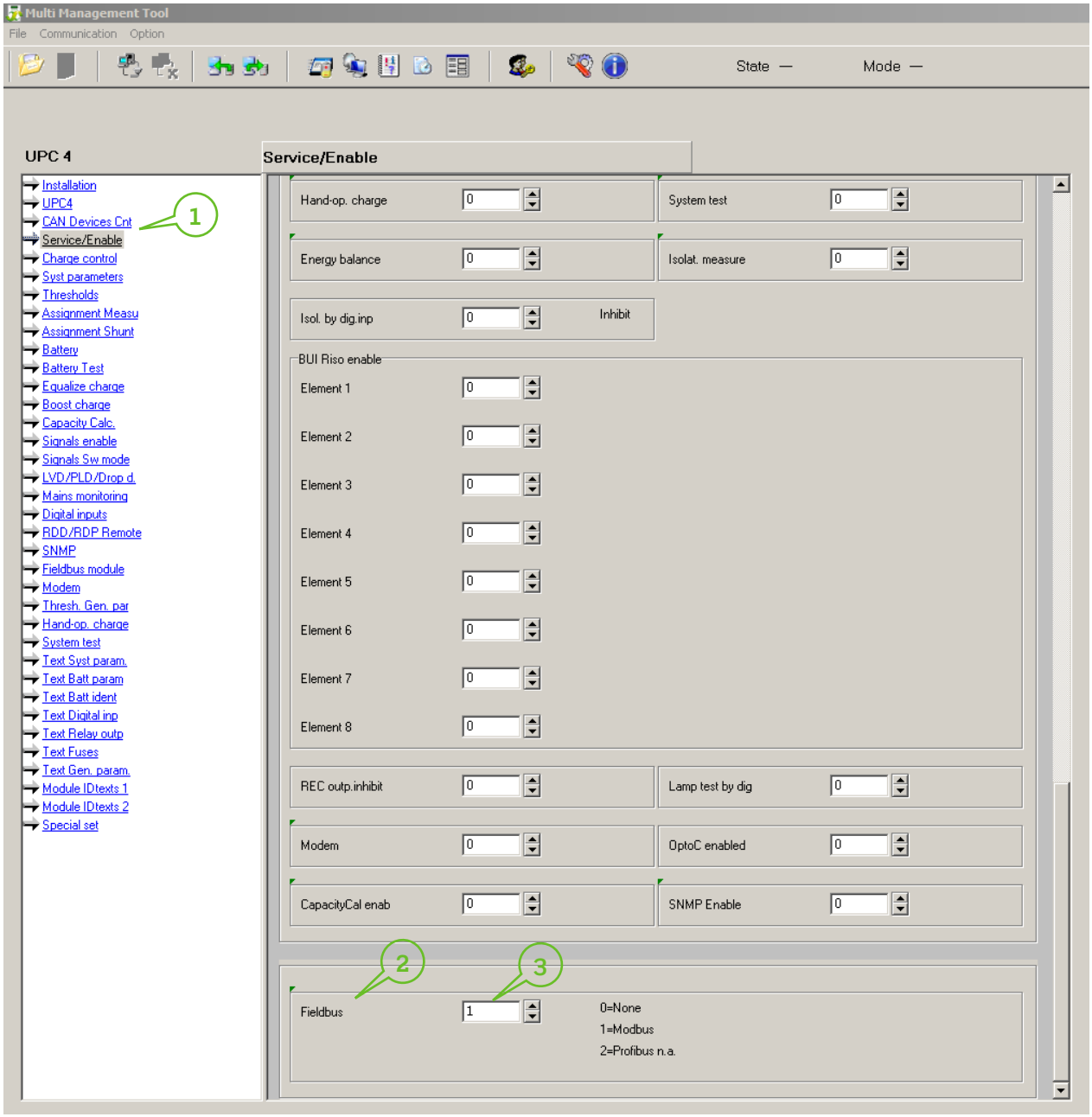

Figure 3) - Screenshot MMT „UPC4 Service/Enable“

4 Baud rate and parity (Modbus)

Next choose „Fieldbus module“ **(1)**.

Make the adjustments as stated in the following:

- Set Slave address **(2)** to „1“.
- Set „parity“ **(3)** to „2“ (2=Even).
- Set „baudrate“ **(4)** to 19200.
- Set „mode“ **(5)** to „0“ (0=RTU).

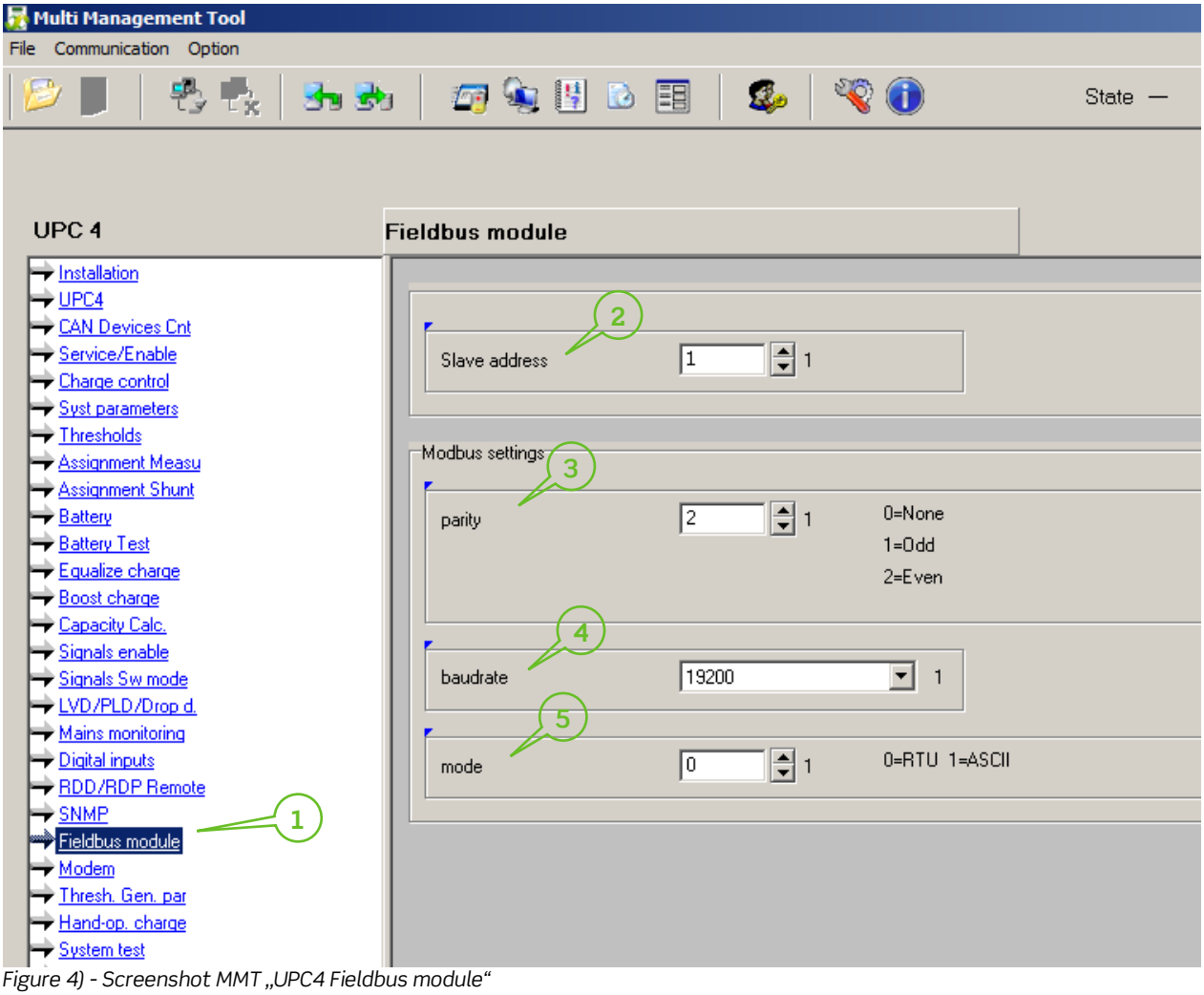

Figure 4) - Screenshot MMT „UPC4 Fieldbus module“

NOTE: For more information concerning the configuration software „MMT“ and DC controller „UPC4“ respectively please read the appropriate user manuals.

5 Overview Unigate (front view)

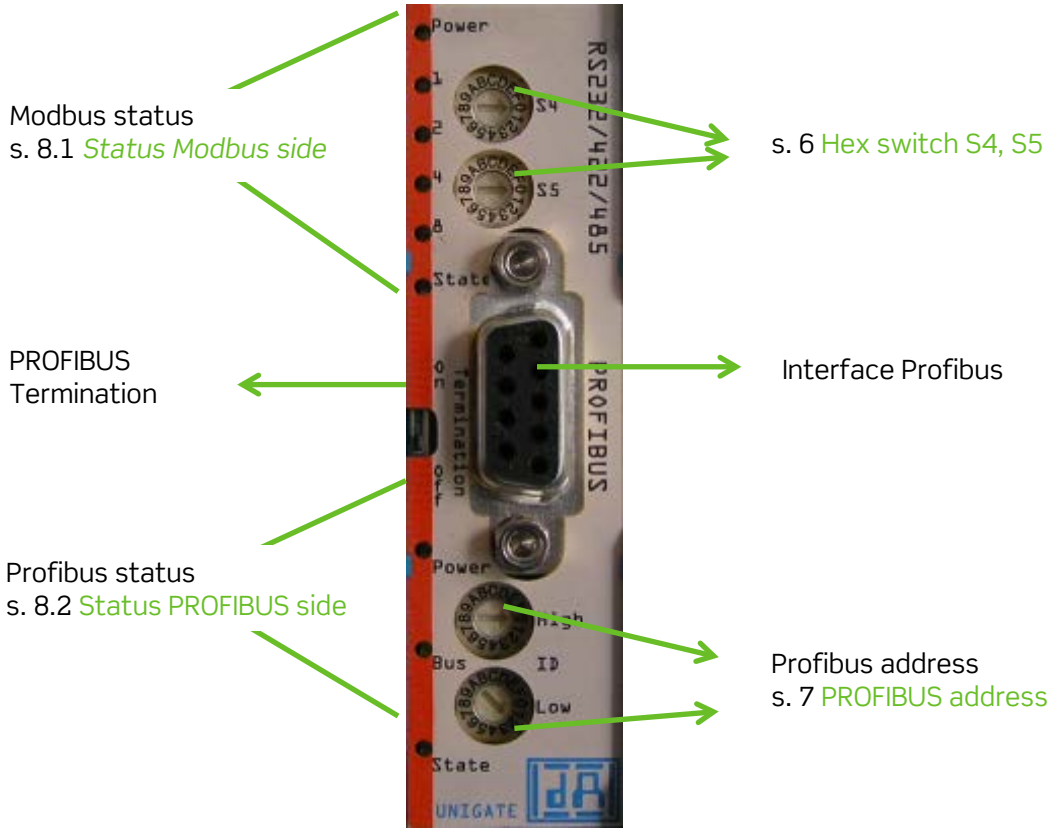

Figure 5) - Overview Unigate (front view)

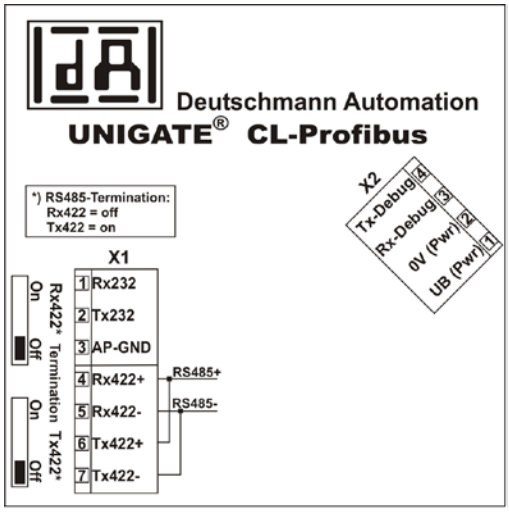

Figure 6) - Side view with label of connectors and termination

6 Hex switch S4, S5

The Hex switches S4, and S5 **must not** be switched to „EE" or "FF". Apart from that they can be switched in any way. We recommend switching them both to „0".

7 PROFIBUS address

PROFIBUS Slave-ID is to be choosen by both of the Hex switches. See section 5 Overview Unigate

Example: Hi=1 and Lo=2 >> in this case the PROFIBUS address is 0x12 (Hex) = 18 (dec)

8 LED status

8.1 Status Modbus side

Info:
The UPC4 permanently requests data by Modbus after the first successful PROFIBUS inquiry is occurred. Please first check PROFIBUS access and then Modbus status.

The LEDs at upper area (see section 5 Overview Unigate) indicate Modbus status.

	Power LED:	DC supply OK.
	LED 1	(s. below)
	LED 2	(s. below)
	LED 3	(s. below)
	LED 4	(s. below)
	Modbus state	Permanently flashing red or red/green status LED signals Modbus error, see error list below. Green LED permanently ON = Modbus communication with UPC4 OK.

Error list:

1. Only LED 2 flashes or is ON respectively:
   Timeout to UPC4. Check Modbus connection and settings at UPC4.

2. LED 1, 3, and 4 flash permanently:
   Break of Modbus communication. Check Modbus connection and settings at UPC4. Following restart Unigate (voltage).

8.2 Status PROFIBUS side

The LEDs at lower area (siehe section 5 Overview Unigate) indicate PROFIBUS status.

	Power LED:	DC voltage Profibus OK
	Bus (see below)	Profibus error
	State (see below)	Status of Profibus interface

LED "Bus"

This LED is directly triggered by Profibus ASIC. It signals, that Profibus is not at status "DATA EXCHANGE".

LED "(Bus) State"

LED green ON	Profibus at status "Data exchange"
Flashing green	Gateway waits for Profibus configuration data
Flashing red/green	Gateway waits for Profibus parameter data
LED red ON	General Profibus error

9 GSD file

Please use file "*UGIC3218.GSD*" with setting **244 Bytes (122 Words) Input** to configure the Profibus master.

Please download the file at: www.deutschmann.de/support/; choose there „Fieldbus"/"Device description files"/"GSD file UNIGATE-CL-PB".

10 Data at Profibus

NOTE: The UPC4 invariably gets measuring values over CAN bus from external CAN devices.
NOTE: Hi-Byte always is transmitted first.

We recommend: always evaluate Word 122 (monitoring of Modbus communication OK), see below.

Word	Type	Unit	Description
1	unsigned	YYYY	RTC year, 4 digits
2	unsigned	MM	RTC month
3	unsigned	DD	RTC day
4	unsigned	hh	RTC hour
5	unsigned	mm	RTC minute
6	unsigned	ss	RTC second
7	signed	[1/10V]	Vbatt1 voltage battery 1
8	signed	[1/10V]	Vbatt2 voltage battery 2
9	signed	[1/10V]	Vbatt3 voltage battery 3
10	signed	[1/10V]	Vbatt4 voltage battery 4
11	signed	[1/10V]	Vbatt5 voltage battery 5
12	signed	[1/10V]	Vbatt6 voltage battery 6
13	signed	[1/10V]	Vbatt7 voltage battery 7
14	signed	[1/10A]	Ibatt1 current battery 1
15	signed	[1/10A]	Ibatt2 current battery 2
16	signed	[1/10A]	Ibatt3 current battery 3
17	signed	[1/10A]	Ibatt4 current battery 4
18	signed	[1/10A]	Ibatt5 current battery 5
19	signed	[1/10A]	Ibatt6 current battery 6
20	signed	[1/10A]	Ibatt7 current battery 7
21	signed	[1/10V]	Vbatt1/2 tap voltage battery 1
22	signed	[1/10V]	Vbatt2/2 tap voltage battery 2
23	signed	[1/10V]	Vbatt3/2 tap voltage battery 3
24	signed	[1/10V]	Vbatt4/2 tap voltage battery 4
25	signed	[1/10V]	Vbatt5/2 tap voltage battery 5
26	signed	[1/10V]	Vbatt6/2 tap voltage battery 6
27	signed	[1/10V]	Vbatt7/2 tap voltage battery 7
28	signed	[1/10°C]	Tbatt1 temperature battery 1
29	signed	[1/10°C]	Tbatt2 temperature battery 2
30	signed	[1/10°C]	Tbatt3 temperature battery 3
31	signed	[1/10°C]	Tbatt4 temperature battery 4
32	signed	[1/10°C]	Tbatt5 temperature battery 5
33	signed	[1/10°C]	Tbatt6 temperature battery 6
34	signed	[1/10°C]	Tbatt7 temperature battery 7
35	signed	[1/10V]	Vload system load voltage
36	signed	[1/10A]	Iload system load current
37	unsigned	[kOhm]	Riso insulation resistor
38	signed	[1/10A]	Isum_batt sum battery current
39	signed	[1/10A]	Isum_rectifier sum rectifier current
40	signed	[1/10A]	Isum_dcdc sum DC/DC current
41	signed	[1/10A]	Iload_calculated calculated load current (Isum_rec-Isum_batt)
42	signed	[1/10V]	Vgeneral_E1 general voltage E1
43	signed	[1/10V]	Vgeneral_E2 general voltage E2
44	signed	[1/10V]	Vgeneral_E3 general voltage E3
45	signed	[1/10V]	Vgeneral_E4 general voltage E4
46	signed	[1/10A]	Igen_E1 general current E1
47	signed	[1/10°C]	Tgen_E1 general temperature E1
48	signed	[1/10V~]	Vl1 mains voltage phase 1 (ext. MMB)
49	signed	[1/10V~]	Vl2 mains voltage phase 2 (ext. MMB)
50	signed	[1/10V~]	Vl3 mains voltage phase 3 (ext. MMB)
51	signed	[1/10A~]	Il1 mains current phase 1 (ext. MMB)
52	signed	[1/10A~]	Il2 mains current phase 2 (ext. MMB)
53	signed	[1/10A~]	Il3 mains current phase 3 (ext. MMB)
54	signed	[1/100Hz]	Fl1 mains frequency phase 1 (ext. MMB)
55	signed	[1/100Hz]	Fl2 mains frequency phase 2 (ext. MMB)
56	signed	[1/100Hz]	Fl3 mains frequency phase 3 (ext. MMB)

Word	Type	Unit	Description
57	16 bit	bool	Alarm global bits 0..15 (by enabling filter), see below
58	16 bit	bool	Alarm global bits16..31(ditto)
59	16 bit	bool	Alarm global bits32..47 (ditto)
60	16 bit	bool	Alarm global bits48..63 (ditto)
61	16 bit	bool	Alarm global bits64..79 (ditto)
62	16 bit	bool	Alarm global bits80..95 (ditto)
63	16 bit	bool	Alarm DC system bits 0..15 (ditto)
64	16 bit	bool	Alarm DC system bits16..31 (ditto)
65	16 bit	bool	Alarm DC system bits32..47 (ditto)
66	16 bit	bool	Alarm DC system bits48..63 (ditto)
67	16 bit	bool	Alarm DC system bits64..79 (dito)
68	16 bit	bool	Alarm DC system bits80..95 (ditto)
69	16 bit	bool	Alarm DC system bits96..111 (ditto)
70	16 bit	bool	Alarm DC system bits112..127 (ditto)
71	16 bit	bool	Alarm battery Bits0..7 B1 Bits0..7 B2 (ditto)
72	16 bit	bool	Alarm battery Bits0..7 B3 Bits0..7 B4 (ditto)
73	16 bit	bool	Alarm battery Bits0..7 B5 Bits0..7 B6 (ditto)
74	16 bit	bool	Alarm battery Bits0..7 B7 Bits0..7 B8 (ditto)
75	16 bit	bool	Status list LEDs: Bit 0: error list; Bit 1: History list; Bit 2: Modem/Traps; Bit3..7: not used; Bit 8: LED OK; Bit 9: LED1 RD; Bit10: LED2 RD; Bit11: LED3 RD; Bit12: LED4 RD; Bit13: LED5 RD; Bit14: LED6 RD; Bit15: not used
76	16 bit	bool	Status list Relays: Bit 0: Rel1.1; Bit 1: Rel2.1; Bit 2: Rel3.1; Bit 3: Rel4.1; Bit 4: Rel5.1; Bit 5: Rel6.1; Bit 6/7: not used; Bit 8: Rel1.2; Bit 9: Rel2.2; Bit10: Rel3.2; Bit11: Rel4.2; Bit12: Rel5.2; Bit13: Rel6.2; Bit14/15: not used
77	unsigned	[1/10A]	Irec1 output current rectifier 1
78	unsigned	[1/10A]	Irec2 output current rectifier 2
79	unsigned	[1/10A]	Irec3 output current rectifier 3
80	unsigned	[1/10A]	Irec4 output current rectifier 4
81	unsigned	[1/10A]	Irec5 output current rectifier 5
82	unsigned	[1/10A]	Irec6 output current rectifier 6
83	unsigned	[1/10A]	Irec7 output current rectifier 7
84	unsigned	[1/10A]	Irec8 output current rectifier 8
85	unsigned	[1/10A]	Irec9 output current rectifier 9
86	unsigned	[1/10A]	Irec10 output current rectifier 10
87	unsigned	[1/10A]	Irec11 output current rectifier 11
88	unsigned	[1/10A]	Irec12 output current rectifier 12
89	unsigned	[1/10A]	Irec13 output current rectifier 13
90	unsigned	[1/10A]	Irec14 output current rectifier 14
91	unsigned	[1/10A]	Irec15 output current rectifier 15
92	unsigned	[1/10A]	Irec16 output current rectifier 16
93	16 bit	bool	Alarm bit0..15: rectifier 1..16; 1=Alarm
94	16 bit	bool	CAN_contact bit0..15: rectifier 1..16; 1=contact
95	unsigned	[1/10V]	Vdcdc1 DCDC output voltage 1
96	unsigned	[1/10V]	Vdcdc2 DCDC output voltage 2
97	unsigned	[1/10V]	Vdcdc3 DCDC output voltage 3
98	unsigned	[1/10V]	Vdcdc4 DCDC output voltage 4
99	unsigned	[1/10V]	Vdcdc5 DCDC output voltage 5
100	unsigned	[1/10V]	Vdcdc6 DCDC output voltage 6
101	16 bit	bool	Alarm bit0..15: DCDC 1..16; 1=Alarm
102	16 bit	bool	CAN_contact bit0..15: DCDC 1..16; 1=contact
103	unsigned	[1/10A]	Iinv1 inverter output current 1
104	unsigned	[1/10A]	Iinv2 inverter output current 2
105	unsigned	[1/10A]	Iinv3 inverter output current 3
106	unsigned	[1/10A]	Iinv4 inverter output current 4
107	unsigned	[1/10A]	Iinv5 inverter output current 5
108	unsigned	[1/10A]	Iinv6 inverter output current 6
109	unsigned	[1/10A]	Iinv7 inverter output current 7
110	unsigned	[1/10A]	Iinv8 inverter output current 8
111	16 bit	bool	Alarm bit0..15:inverter 1..16; 1=Alarm
112	16 bit	bool	CAN_contact bit0..15: inverter 1..16; 1=contact

Word	Type	Unit	Description
113	unsigned	[Vac]	Bypass switch STS, mains voltage
114	unsigned	[Vac]	Bypass switch STS, inverter voltage
115	unsigned	[1/10A]	Bypass switch STS, output current
116	unsigned	[1/10V]	Bypass switch STS, battery voltage
117	unsigned	[1/10Hz]	Bypass switch STS, mains frequency
118	unsigned	[1/10Hz]	Bypass switch STS, inverter frequency
119	unsigned	[1/10°C]	Bypass switch STS, temperature
120	16 Bit	bool	Bypass switch STS, status bit0..15 (see below)
121	16 Bit	bool	Fuse Monitoring Board FMB bits0..15
122	--	--	ErrorByte (Low-Byte) 0=OKAY 2=connection error

STS state:
Bit 0 error source1 (priority source)
Bit 1 error source2 (spare source)
Bit 2 synchronisation error
Bit 3 Inverter error
Bit 4 temperature heatsink high
Bit 5 output current high
Bit 6 DC voltage low
Bit 7 DC voltage high
Bit 8 DC voltage low warning
Bit 9 DC voltage high warning
Bit10 _not used
Bit11 _ not used
Bit12 0=INV priority 1=mains priority
Bit13 switch state_relays2: 0=inactive 1=active
Bit14 1=load on_INV 0=load on mains
Bit15 collective alarm

10.1 ALARMS

Global bits 0..91	
Bit no.	**Signal**
000	"Dig. input 1[1]"
001	"Dig. input. 1[2]"
002	"Dig. input 1[3]"
003	"Dig. input 1[4]"
004	"Dig. input 1[5]"
005	"Dig. input 1[6]"
006	"Dig. input 1[7]"
007	"Dig. input 1[8]"
008	"Dig. input 2[1]"
009	"Dig. input 2[2]"
010	"Dig. input 2[3]"
011	"Dig. input 2[4]"
012	"Dig. input 2[5]"
013	"Dig. input 2[6]"
014	"Dig. input 2[7]"
015	"Dig. input 2[8]"
016	"V1 <> Vmin/max1"
017	"V2 <> Vmin/max2"
018	"V3 <> Vmin/max3"
019	"V4 <> Vmin/max4"
020	"V5 <> Vmin/max5"
021	"V6 <> Vmin/max6"
022	"I1 <> Imin/max1"
023	"I2 <> Imin/max2"
024	"I3 <> Imin/max3"
025	"I4 <> Imin/max4"
026	"I5 <> Imin/max5"
027	"I6 <> Imin/max6"
028	"T1 <> Tmin/max1"
029	"T2 <> Tmin/max2"
030	"T3 <> Tmin/max3"
031	"T4 <> Tmin/max4"
032	"T5 <> Tmin/max5"
033	"T6 <> Tmin/max6"
034	"R1 <> Rmin/max1"
035	"R2 <> Rmin/max2"
036	"R3 <> Rmin/max3"
037	"R4 <> Rmin/max4"
038	"R5 <> Rmin/max5"
039	"R6 <> Rmin/max6"
040	"Relay1.Q"
041	"Relay1.Q'"
042	"Relay2.Q"
043	"Relay2.Q'"
044	"Relay3.Q"
045	"Relay3.Q'"
046	"Relay4.Q"
047	"Relay4.Q'"
048	"LVD active"
049	"PLD1 active"
050	"PLD2 active"
051	"Tsensor limit"
052	"Fanrack: Error"
053	" Fanrack: No CAN"
054	"BUI: Errorr"
055	"BUI: No CAN"
056	"_not used"
057	"_not used"
058	"MMB: Error"
059	"MMB: No CAN"
060	"BMB: Error"
061	"BMB: No CAN"

062	"DIB:Error"
063	"DIB: No CAN"
064	"RLB: Error"
065	"RLB: No CAN"
066	"FMB: Error"
067	"FMB: No CAN"
068	"UMB: Error"
069	"UMB: No CAN"
070	"UMA: Error"
071	"UMA: No CAN"
072	"RDX: Error"
073	"RDX: No CAN"
074	"RDP:Error"
075	"RDP: No CAN"
076	"1.L1 V<>Vmin,max"
077	"1.L2 V<>Vmin,max"
078	"1.L3 V<>Vmin,max"
079	"2.L1 V<>Vmin,max"
080	"2.L2 V<>Vmin,max"
081	"2.L3 V<>Vmin,max"
082	"error bool seq."
083	"combined error 1"
084	"ombined error 2"
085	"ombined error 3"
086	"ombined error 4"
087	"ombined error 5"
088	"UPC Supply 1 Err"
089	"UPC Supply 2 Err"
090	"UPC Supply 3 Err"
091	"Output inhibit"

DC system1 bits 0..56	
Bit no.	**Signal**
000	"Vload < Vmin"
001	" Vload > Vmax"
002	" Vload < Vmin_INV"
003	"Vload< Vmin_DCC"
004	"REC#1Error"
005	"REC#1 No CAN"
006	"REC#1 Redundancy"
007	"REC#1 Load"
008	"REC#1 Load dist."
009	"REC#2 Error"
010	"REC#2 No CAN"
011	"REC#2 Redundancy"
012	"REC#2 Load"
013	"REC#2 Load dist."
014	"Lim Load current"
015	"DCC Error"
016	"DCC No CAN"
017	"DCC Redundancy"
018	"INV Error"
019	"INV No CAN"
020	"INV Redundancy"
021	"STS: Error"
022	"STS: No CAN"
023	"STS Err sorce 1"
024	"STS Err sorce 2"
025	"STS Sync error"
026	"STS Inverter error"
027	"STS T. heat sink"
028	"STS Current high"
029	"STS DC volt. low"
030	"STS DC volt. high"
031	"STS DC v. low Wa"
032	"STS DC v. high Wa"
033	"STS Mains prior."
034	"STS Relay active"
035	"STS Load on INV"
036	"STS Coll. alarm"
037	"_STS not used"
038	"_STS not used"
039	"Equalize charge"
040	"Equal. ch. Timeout"
041	"Boost charge"
042	"Boost ch. Timeout"
043	"Fan (boost chge)"
044	"Standard charge"
045	"Insulation err P"
046	"Insulation err M"
047	"Isol meas. runs"
048	"Battery test"
049	"Battery test err"
050	"Drop diode 1"
051	"Drop diode 2"
052	"Difference Ah"
053	"Capacity low A"
054	"Capacity low B"
055	"Tsensor lim Batt"
056	"diesel operation"

DC system2 bits 57..113	
Bit no.	**Signal**
057	"Vload < Vmin"
058	" Vload > Vmax"
059	" Vload < Vmin_INV"
060	"Vload< Vmin_DCC"
061	"REC#1Error"
062	"REC#1 No CAN"
063	"REC#1 Redundancy"
064	"REC#1 Load"
065	"REC#1 Load dist."
066	"REC#2 Error"
067	"REC#2 No CAN"
068	"REC#2 Redundancy"
069	"REC#2 Load"
070	"REC#2 Load dist."
071	"Lim Load current"
072	"DCC Error"
073	"DCC No CAN"
074	"DCC Redundancy"
075	"INV Error"
076	"INV No CAN"
077	"INV Redundancy"
078	"STS: Error"
079	"STS: No CAN"
080	"STS Err sorce 1"
081	"STS Err sorce 2"
082	"STS Sync error"
083	"STS Inverter error"
084	"STS T. heat sink"
085	"STS Current high"
086	"STS DC volt. low"
087	"STS DC volt. high"
088	"STS DC v. low Wa"
089	"STS DC v. high Wa"
090	"STS Mains prior."
091	"STS Relay active"
092	"STS Load on INV"
093	"STS Coll. alarm"
094	"_STS not used"
095	"_STS not used"
096	"Equalize charge"
097	"Equal. ch. Timeout"
098	"Boost charge"
099	"Boost ch. Timeout"
100	"Fan (boost chge)"
101	"Standard charge"
102	"Insulation err P"
103	"Insulation err M"
104	"Isol meas. runs"
105	"Battery test"
106	"Battery test err"
107	"Drop diode 1"
108	"Drop diode 2"
109	"Difference Ah"
110	"Capacity low A"
111	"Capacity low B"
112	"Tsensor lim Batt"
113	"diesel operation"

Battery1 bits 0..7	
Bit no.	**Signal**
000	"Vbatt < Vmin(B1)"
001	"Vbatt > Vmax(B1)"
002	"Vbat < Vwarn(B1)"
003	"Vbat > VmaxR(B1)"
004	"T > Tmax(B1)"
005	"Asymmetrical(B1)"
006	"Fuse open(B1)"
007	"Battery oper(B1)"

Battery2 bits 8..15	
000	"Vbatt < Vmin(B2)"
001	"Vbatt > Vmax(B2)"
002	"Vbat < Vwarn(B2)"
003	"Vbat > VmaxR(B2)"
004	"T > Tmax(B2)"
005	"Asymmetrical(B2)"
006	"Fuse open(B2)"
007	"Battery oper(B2)"

Battery3 bits 16..23	
000	"Vbatt < Vmin(B3)"
001	"Vbatt > Vmax(B3)"
002	"Vbat < Vwarn(B3)"
003	"Vbat > VmaxR(B3)"
004	"T > Tmax(B3)"
005	"Asymmetrical(B3)"
006	"Fuse open(B3)"
007	"Battery oper(B3)"

Battery4 bits 24..31	
000	"Vbatt < Vmin(B4)"
001	"Vbatt > Vmax(B4)"
002	"Vbat < Vwarn(B4)"
003	"Vbat > VmaxR(B4)"
004	"T > Tmax(B4)"
005	"Asymmetrical(B4)"
006	"Fuse open(B4)"
007	"Battery oper(B4)"

Battery5 bits 32..39	
000	"Vbatt < Vmin(B5)"
001	"Vbatt > Vmax(B5)"
002	"Vbat < Vwarn(B5)"
003	"Vbat > VmaxR(B5)"
004	"T > Tmax(B5)"
005	"Asymmetrical(B5)"
006	"Fuse open(B5)"
007	"Battery oper(B5)"

Battery6 bits 40..47	
000	"Vbatt < Vmin(B6)"
001	"Vbatt > Vmax(B6)"
002	"Vbat < Vwarn(B6)"
003	"Vbat > VmaxR(B6)"
004	"T > Tmax(B6)"
005	"Asymmetrical(B6)"
006	"Fuse open(B6)"
007	"Battery oper(B6)"

Battery7 bits 48..55	
000	"Vbatt < Vmin(B7)"
001	"Vbatt > Vmax(B7)"
002	"Vbat < Vwarn(B7)"
003	"Vbat > VmaxR(B7)"
004	"T > Tmax(B7)"
005	"Asymmetrical(B7)"
006	"Fuse open(B7)"
007	"Battery oper(B7)"

Kontakt:

	ELTEK DEUTSCHLAND GmbH BU Industrial Schillerstraße 16 D-32052 Herford
☎	+ 49 (0) 5221 1708-210
FAX	+ 49 (0) 5221 1708-222
Email	Info.industrial@eltek.com
Internet	http://www.eltek.com