

MODBUS RTU Protocol Description for Earthfault-Detection-Relay EOR-3D

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Distribution:

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1 Modbus Protocol

This document describes the characteristics of the MODBUS RTU communication protocol of EORD-3D device.

2 Modbus Protocol

EOR-3D devices can be connected to a Modbus Network in order to communicate MODBUS RTU protocol via RS232/RS485 and TCP/IP.

2.1 Technical characteristics of the MODBUS connection

2.1.1 Parameters of the MODBUS connection

The different parameters of the MODBUS connection are as follows:

- RS232 connection
- Isolated two-point RS485 connection (2kV 50Hz)
- MODBUS line protocol in RTU mode
- Communication speed can be configured

2.1.2 Transmission mode

Baud rate:

- 9600
- 19200
- 38400
- 57600
- 115200

Mode:

- 1 start / 8 bits / 1 stop: total 10 bits
 - 1 start / 8 bits / even parity / 1 stop: total 11 bits
 - 1 start / 8 bits / odd parity / 1 stop: total 11 bits
 - 1 start / 8 bits / none parity / 2 stop: total 11 bits
- > 1,5 Stopbits are not supported by the Modbus Slave

2.1.3 Address of the EOR-3D

The address of the EOR-3D on the same MODBUS network is situated between 1 and 247. The address 0 is reserved for the broadcast messages.

2.1.4 MODBUS functions of the EOR-3D

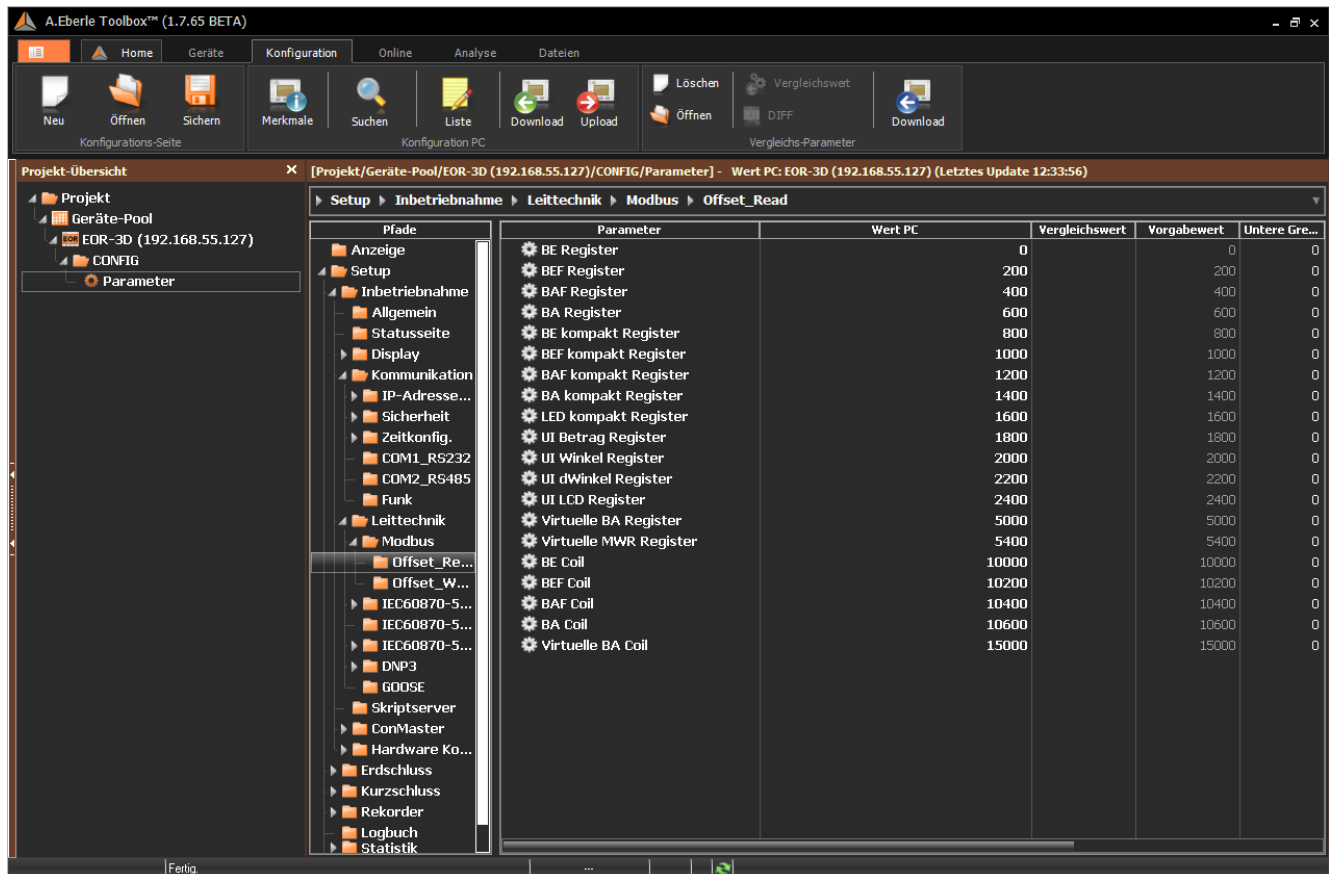
MODBUS functions implemented on the EOR-3D are:

- Function 01 (0x01): Read Coils
- Function 03 (0x03): Read Holding Registers
- Function 04 (0x04): Read Input Registers
- Function 05 (0x05): Write Coils
- Function 15 (0x0F): Write Multiple Coils
- Function 16 (0x10): Write Multiple Registers (Holding Registers)

3 EOR-3D Modbus Register Organisation

3.1 EOR-3D Modbus Register Organisation – Register offsets

Modbus register offsets can be change via EOR-3D Toolbox. Please take care when changing offsets, that there are no overlapping registers (look at the size of the register block).



Picture 1: Reaster offsets

3.2 EOR-3D Modbus Register Organisation

MODBUS Input Registers and Holding Registers are mapped at the same register addresses. So it is possible to Read Input and Holding Registers on the same registers.

To write of multiple registers is possible with function 0x10 (Function 16 (0x10): Write Multiple Registers)

--> Writing of “BE via LT” is possible, offset default 2600.

MODBUS Coils are mapped to Holding Registers where coils are possible. Coils are on a special addresses mapped if systems have problems with multiple register.

--> Offset of Coils start at 3000

To write coils function 0x05 (Function 5 (0x05): Write Coils) and 0x0F (Function 15 (0x0F): Write Multiple Coils) is included.

Information: BE
Default offset: 0

Address + Offset	Description	Type	Write	Name
0	BE_0 (BE1)	int16	false	BE_0
1	BE_1 (BE2)	int16	false	BE_1
2	BE_2 (BE3)	int16	false	BE_2
3	BE_3 (BE4)	int16	false	BE_3
4	BE_4 (BE5)	int16	false	BE_4
5	BE_5 (BE6)	int16	false	BE_5

BE can be also read as coils and also be read at other default offset 10000, please look at the coils part.

Information: BEF
Default offset: 200

Address + Offset	Description	Type	Write	Name
200	BEF_0 (AUS)	int16	false	BEF_0
201	BEF_1 (Reboot E3D)	int16	false	BEF_1
202	BEF_2 (Aufz. starten)	int16	false	BEF_2
203	BEF_3 (Reset alles)	int16	false	BEF_3
204	BEF_4 (Reset LEDs)	int16	false	BEF_4
205	BEF_5 (Reset qu2)	int16	false	BEF_5
206	BEF_6 (Reset cos(phi))	int16	false	BEF_6
207	BEF_7 (Reset sin(phi))	int16	false	BEF_7
208	BEF_8 (Reset OV)	int16	false	BEF_8
209	BEF_9 (Reset Puls50)	int16	false	BEF_9
210	BEF_10 (Reset Kurzschluss)	int16	false	BEF_10
211	BEF_11 (Reset Statistik)	int16	false	BEF_11
212	BEF_12 (Reset FastPuls)	int16	false	BEF_12
213	BEF_13 (Reset Adm2)	int16	false	BEF_13
214	BEF_14 (BEF nicht zugewiesen)	int16	false	BEF_14
215	BEF_15 (BEF nicht zugewiesen)	int16	false	BEF_15

BEF can be also read as coils and also be read at other default offset 10200, please look at the coils part.

Information: BAF
Default offset: 400

Address + Offset	Description	Type	Write	Name
400	BAF_0 (AUS)	int16	false	AUS
401	BAF_1 (PROG)	int16	false	PROG
402	BAF_2 (Status)	int16	false	Status

403	BAF_3 (Störung)	int16	false	Störung
404	BAF_4 (U1_ok)	int16	false	U1_ok
405	BAF_5 (U2_ok)	int16	false	U2_ok
406	BAF_6 (U3_ok)	int16	false	U3_ok
407	BAF_7 (user_BAF1)	int16	false	user_BAF1
408	BAF_8 (user_BAF2)	int16	false	user_BAF2
409	BAF_9 (user_BAF3)	int16	false	user_BAF3
410	BAF_10 (user_BAF4)	int16	false	user_BAF4
411	BAF_11 (user_BAF5)	int16	false	user_BAF5
412	BAF_12 (user_BAF6)	int16	false	user_BAF6
413	BAF_13 (user_BAF7)	int16	false	user_BAF7
414	BAF_14 (user_BAF8)	int16	false	user_BAF8
415	BAF_15 (>Uerd)	int16	false	>Uerd
416	BAF_16 (>Uerd_delay)	int16	false	>Uerd_delay
417	BAF_17 (Uerd_L1)	int16	false	Uerd_L1
418	BAF_18 (Uerd_L2)	int16	false	Uerd_L2
419	BAF_19 (Uerd_L3)	int16	false	Uerd_L3
420	BAF_20 (Uerd_L1_d)	int16	false	Uerd_L1_d
421	BAF_21 (Uerd_L2_d)	int16	false	Uerd_L2_d
422	BAF_22 (Uerd_L3_d)	int16	false	Uerd_L3_d
423	BAF_23 (Sum_Uerd ->L)	int16	false	Sum_Uerd ->L
424	BAF_24 (Sum_Uerd ->S)	int16	false	Sum_Uerd ->S
425	BAF_25 (Prio_Uerd ->L)	int16	false	Prio_Uerd ->L
426	BAF_26 (Prio_Uerd ->S)	int16	false	Prio_Uerd ->S
427	BAF_27 (qu2 ->L)	int16	false	qu2 ->L
428	BAF_28 (qu2 ->S)	int16	false	qu2 ->S
429	BAF_29 (qu2_DE ->L)	int16	false	qu2_DE ->L
430	BAF_30 (qu2_DE ->S)	int16	false	qu2_DE ->S
431	BAF_31 (qui ->L)	int16	false	qui ->L
432	BAF_32 (qui ->S)	int16	false	qui ->S
433	BAF_33 (cos ->L)	int16	false	cos ->L
434	BAF_34 (cos ->S)	int16	false	cos ->S
435	BAF_35 (sin ->L)	int16	false	sin ->L
436	BAF_36 (sin ->S)	int16	false	sin ->S
437	BAF_37 (c_s ->L)	int16	false	c_s ->L
438	BAF_38 (c_s ->S)	int16	false	c_s ->S
439	BAF_39 (OV_250 ->L)	int16	false	OV_250 ->L
440	BAF_40 (OV_250 ->S)	int16	false	OV_250 ->S
441	BAF_41 (OV_fx1 ->L)	int16	false	OV_fx1 ->L

442	BAF_42 (OV_fx1 ->S)	int16	false	OV_fx1 ->S
443	BAF_43 (OV_fx2+ ->L)	int16	false	OV_fx2+ ->L
444	BAF_44 (OV_fx2+ ->S)	int16	false	OV_fx2+ ->S
445	BAF_45 (OV_fx2- ->L)	int16	false	OV_fx2- ->L
446	BAF_46 (OV_fx2- ->S)	int16	false	OV_fx2- ->S
447	BAF_47 (Puls_50)	int16	false	Puls_50
448	BAF_48 (Puls_50c)	int16	false	Puls_50c
449	BAF_49 (Puls_50c ->L)	int16	false	Puls_50c ->L
450	BAF_50 (Puls_50c ->S)	int16	false	Puls_50c ->S
451	BAF_51 (Puls50 LED)	int16	false	Puls50 LED
452	BAF_52 (Puls_HPCI_50)	int16	false	Puls_HPCI_50
453	BAF_53 (Puls_HPCI_50 ->L)	int16	false	Puls_HPCI_50 ->L
454	BAF_54 (Puls_HPCI_50 ->S)	int16	false	Puls_HPCI_50 ->S
455	BAF_55 (Puls_HPCI_fx)	int16	false	Puls_HPCI_fx
456	BAF_56 (>I)	int16	false	>I
457	BAF_57 (>I1)	int16	false	>I1
458	BAF_58 (>I2)	int16	false	>I2
459	BAF_59 (>I3)	int16	false	>I3
460	BAF_60 (>>I)	int16	false	>>I
461	BAF_61 (>>I1)	int16	false	>>I1
462	BAF_62 (>>I2)	int16	false	>>I2
463	BAF_63 (>>I3)	int16	false	>>I3
464	BAF_64 (>I ->)	int16	false	>I ->
465	BAF_65 (>I1 ->)	int16	false	>I1 ->
466	BAF_66 (>I2 ->)	int16	false	>I2 ->
467	BAF_67 (>I3 ->)	int16	false	>I3 ->
468	BAF_68 (>>I ->)	int16	false	>>I ->
469	BAF_69 (>>I1 ->)	int16	false	>>I1 ->
470	BAF_70 (>>I2 ->)	int16	false	>>I2 ->
471	BAF_71 (>>I3 ->)	int16	false	>>I3 ->
472	BAF_72 (>I ->S)	int16	false	>I ->S
473	BAF_73 (>I1 ->S)	int16	false	>I1 ->S
474	BAF_74 (>I2 ->S)	int16	false	>I2 ->S
475	BAF_75 (>I3 ->S)	int16	false	>I3 ->S
476	BAF_76 (>>I ->S)	int16	false	>>I ->S
477	BAF_77 (>>I1 ->S)	int16	false	>>I1 ->S
478	BAF_78 (>>I2 ->S)	int16	false	>>I2 ->S
479	BAF_79 (>>I3 ->S)	int16	false	>>I3 ->S
480	BAF_80 (>Ferro Res.)	int16	false	>Ferro Res.

BAF can be also read as coils and also be read at other default offset 10400, please look at the coils part.

Information: BA
Default offset: 600

Address + Offset	Description	Type	Write	Name
600	BA_0 (Rel_1 Function depends on assignment)	int16	false	BA_0
601	BA_1 (Rel_2 Function depends on assignment)	int16	false	BA_1
602	BA_2 (Rel_3 Function depends on assignment)	int16	false	BA_2
603	BA_3 (Rel_4 Function depends on assignment)	int16	false	BA_3
604	BA_4 (Rel_5 Function depends on assignment)	int16	false	BA_4
605	BA_5 (Rel_6 Function depends on assignment)	int16	false	BA_5
606	BA_6 (Rel_7 Function depends on assignment)	int16	false	BA_6
607	BA_7 (Rel_8 Function depends on assignment)	int16	false	BA_7

BA can be also read as coils and also be read at other default offset 10600, please look at the coils part.

Information: BE compact
Default offset: 800

Address + Offset	Description	Type	Write	Name
800	BE_compact_0 (BI as compact value)	int32	false	BE_compact_0

Information: BEF compact
Default offset: 1000

Address + Offset	Description	Type	Write	Name
1000	BEF_compact_0 (BIF as compact value)	int32	false	BEF_compact_0

Information: BAF compact
Default offset: 1200

Address + Offset	Description	Type	Write	Name
1200	BAF_0 (All BOFs and delayed BOFs => 8x uint32;)	int32	false	BAF_compact_0
1202	BAF_1 (All BOFs and delayed BOFs => 8x uint32;)	int32	false	BAF_compact_1
1204	BAF_2 (All BOFs and delayed BOFs => 8x uint32;)	int32	false	BAF_compact_2
1206	BAF_3 (All BOFs and delayed BOFs => 8x uint32;)	int32	false	BAF_compact_3
1208	BAF_4 (All BOFs and delayed BOFs => 8x uint32;)	int32	false	BAF_compact_4
1210	BAF_5 (All BOFs and delayed BOFs => 8x uint32;)	int32	false	BAF_compact_5
1212	BAF_6 (All BOFs and delayed BOFs => 8x uint32;)	int32	false	BAF_compact_6
1214	BAF_7 (All BOFs and delayed BOFs => 8x uint32;)	int32	false	BAF_compact_7

Information: BA compact
Default offset: 1400

Address + Offset	Description	Type	Write	Name
1400	BA_compact_0 (BO as compact value)	int32	false	BA_compact_0

Information: LED compact
Default offset: 1600

Address + Offset	Description	Type	Write	Name
1600	LED_compact_0 (LED as compact value)	int32	false	LED_compact_0

Information: UI Values from EOR3D process image
Default offset: 1800

Address + Offset	Description	Type	Write	Name
1800	UI_value_0 (Absolute value Uo in V (secondary))	float32	false	UI_value_0
1802	UI_value_1 (Absolute value U1 in V (secondary))	float32	false	UI_value_1
1804	UI_value_2 (Absolute value U2 in V (secondary))	float32	false	UI_value_2
1806	UI_value_3 (Absolute value U3 in V (secondary))	float32	false	UI_value_3
1808	UI_value_4 (Absolute value Io in mA (secondary))	float32	false	UI_value_4
1810	UI_value_5 (Absolute value I1 in mA (secondary))	float32	false	UI_value_5
1812	UI_value_6 (Absolute value I2 in mA (secondary))	float32	false	UI_value_6
1814	UI_value_7 (Absolute value I3 in mA (secondary))	float32	false	UI_value_7

Information: UI angle from EOR3D process image
Default offset: 2000

Address + Offset	Description	Type	Write	Name
2000	UI_angle_0 (Angle Uo in degree)	float32	false	UI_angle_0
2002	UI_angle_1 (Angle U1 in degree)	float32	false	UI_angle_1
2004	UI_angle_2 (Angle U2 in degree)	float32	false	UI_angle_2
2006	UI_angle_3 (Angle U3 in degree)	float32	false	UI_angle_3
2008	UI_angle_4 (Angle Io in degree)	float32	false	UI_angle_4
2010	UI_angle_5 (Angle I1 in degree)	float32	false	UI_angle_5
2012	UI_angle_6 (Angle I2 in degree)	float32	false	UI_angle_6
2014	UI_angle_7 (Angle I3 in degree)	float32	false	UI_angle_7

Information: UI d. angle from EOR3D process image
Default offset: 2200

Address + Offset	Description	Type	Write	Name
2200	UI_d_angle_0 (Angle (Uo_Io) in degree)	float32	false	UI_d_angle_0
2202	UI_d_angle_1 (Angle (U1_I1) in degree)	float32	false	UI_d_angle_1
2204	UI_d_angle_2 (Angle (U2_I2) in degree)	float32	false	UI_d_angle_2
2206	UI_d_angle_3 (Angle (U3_I3) in degree)	float32	false	UI_d_angle_3

Information: Values from EOR3D LCD Display
Default offset: 2400

Address + Offset	Description	Type	Write	Name
2400	Up_0 (Absolute value Uo in kV (primary))	float32	false	Up_0
2402	Up_1 (Absolute value U1 in kV (primary))	float32	false	Up_1
2404	Up_2 (Absolute value U2 in kV (primary))	float32	false	Up_2
2406	Up_3 (Absolute value U3 in kV (primary))	float32	false	Up_3
2408	Ip_0 (Absolute value Io in A (primary))	float32	false	Ip_0
2410	Ip_1 (Absolute value I1 in A (primary))	float32	false	Ip_1
2412	Ip_2 (Absolute value I2 in A (primary))	float32	false	Ip_2
2414	Ip_3 (Absolute value I3 in A (primary))	float32	false	Ip_3
2416	Us_0 (Absolute value Uo in V (secondary))	float32	false	Us_0
2418	Us_1 (Absolute value U1 in V (secondary))	float32	false	Us_1
2420	Us_2 (Absolute value U2 in V (secondary))	float32	false	Us_2
2422	Us_3 (Absolute value U3 in V (secondary))	float32	false	Us_3
2424	Is_0 (Absolute value Io in mA (secondary))	float32	false	Is_0
2426	Is_1 (Absolute value I1 in mA (secondary))	float32	false	Is_1
2428	Is_2 (Absolute value I2 in mA (secondary))	float32	false	Is_2
2430	Is_3 (Absolute value I3 in mA (secondary))	float32	false	Is_3
2432	U12p (Absolute value U12)	float32	false	U12p
2434	U12p_r (Real coefficient U12)	float32	false	U12p_r
2436	U12p_i (Imaginary coefficient U12)	float32	false	U12p_i
2438	wU12 (Angle U12)	float32	false	wU12
2440	Angle (Uo_Io) in degree (dw0)	float32	false	dw_0
2442	Angle (U1_I1) in degree (dw1)	float32	false	dw_1
2444	Angle (U2_I2) in degree (dw2)	float32	false	dw_2
2446	Angle (U3_I3) in degree (dw3)	float32	false	dw_3
2448	P_0 (Active power Zero sequence component Po in kW)	float32	false	P_0
2450	P_1 (Active power Phase_1 P1 in kW)	float32	false	P_1
2452	P_2 (Active power Phase_2 P2 in kW)	float32	false	P_2
2454	P_3 (Active power Phase_3 P3 in kW)	float32	false	P_3
2456	Q_0 (Reactive power Zero sequence component Qo in kVar)	float32	false	Q_0
2458	Q_1 (Reactive power Phase_1 Q1 in kVar)	float32	false	Q_1
2460	Q_2 (Reactive power Phase_2 Q2 in kVar)	float32	false	Q_2
2462	Q_3 (Reactive power Phase_3 Q3 in kVar)	float32	false	Q_3
2464	S_0 (Apparent power Zero sequence component So in kVA)	float32	false	S_0
2466	S_1 (Apparent power Phase_1 S1 in kVA)	float32	false	S_1

2468	S_2 (Apparent power Phase_2 S2 in kVA)	float32	false	S_2
2470	S_3 (Apparent power Phase_3 S3 in kVA)	float32	false	S_3
2472	Pg (All Active power P1+P2+P3) in kW	float32	false	Pg
2474	Qg (All reactive power Q1+Q2+Q3) in kVar	float32	false	Qg
2476	Sg (All apparent power S1+S2+S3) in kVA	float32	false	Sg
2478	Cosphi	float32	false	cosphi
2480	Power frequency	float32	false	f_grid
2482	Uo Maximum value of magnitude	float32	false	Umax_0
2484	U1 Maximum value of magnitude	float32	false	Umax_1
2486	U2 Maximum value of magnitude	float32	false	Umax_2
2488	U3 Maximum value of magnitude	float32	false	Umax_3
2490	Uo Minimum value, that is greater than 0,5 * U_nenn	float32	false	Umin_0
2492	U1 Minimum value, that is greater than 0,5 * U_nenn	float32	false	Umin_1
2494	U2 Minimum value, that is greater than 0,5 * U_nenn	float32	false	Umin_2
2496	U3 Minimum value, that is greater than 0,5 * U_nenn	float32	false	Umin_3
2498	Uo Average of absolute values, magnitude	float32	false	Uav_0
2500	U1 Average of absolute values, magnitude	float32	false	Uav_1
2502	U2 Average of absolute values, magnitude	float32	false	Uav_2
2504	U3 Average of absolute values, magnitude	float32	false	Uav_3
2506	Io Maximum of magnitude	float32	false	Imax_0
2508	I1 Maximum of magnitude	float32	false	Imax_1
2510	I2 Maximum of magnitude	float32	false	Imax_2
2512	I3 Maximum of magnitude	float32	false	Imax_3
2514	Io Average of absolute values	float32	false	Iav_0
2516	I1 Average of absolute values	float32	false	Iav_1
2518	I2 Average of absolute values	float32	false	Iav_2
2520	I3 Average of absolute values	float32	false	Iav_3
2522	Po Positive maximum value, considered as a sink	float32	false	Pmax_0
2524	P1 Positive maximum value, considered as a sink	float32	false	Pmax_1
2526	P2 Positive maximum value, considered as a sink	float32	false	Pmax_2
2528	P3 Positive maximum value, considered as a sink	float32	false	Pmax_3
2530	Po Negative maximum value, considered as a source	float32	false	Pmin_0
2532	P1 Negative maximum value, considered as a source	float32	false	Pmin_1
2534	P2 Negative maximum value, considered as a source	float32	false	Pmin_2
2536	P3 Negative maximum value, considered as a source	float32	false	Pmin_3
2538	Po Average of all values summarized as abs values	float32	false	Pmin_0

2540	P1 Average of all values summarized as abs values	float32	false	Pmin_1
2542	P2 Average of all values summarized as abs values	float32	false	Pmin_2
2544	P3 Average of all values summarized as abs values	float32	false	Pmin_3
2546	Qo dto. P_max	float32	false	Qmax_0
2548	Q1 dto. P_max	float32	false	Qmax_1
2550	Q2 dto. P_max	float32	false	Qmax_2
2552	Q3 dto. P_max	float32	false	Qmax_3
2554	Qo dto. P_min)	float32	false	Qmin_0
2556	Q1 dto. P_min)	float32	false	Qmin_1
2558	Q2 dto. P_min	float32	false	Qmin_2
2560	Q2 dto. P_min	float32	false	Qmin_3
2562	Qo dto. P_ac	float32	false	Qav_0
2564	Q1 dto. P_ac	float32	false	Qav_1
2566	Q2 dto. P_ac	float32	false	Qav_2
2568	Q3 dto. P_ac	float32	false	Qav_3
2570	Maximum value of the total positive power as a sink	float32	false	P_max_all_0
2572	Minimum value of the total negative power, as source	float32	false	P_min_all_0
2574	Average value of the power flow, summarized over abs values	float32	false	P_av_all_0
2576	Maximum of reactive power, as consumer, i.e. inductive, sum of all phases	float32	false	Q_max_all_0
2578	Minimum of reactive power == maximum of reactive capacitive reactive power, sum of all phases	float32	false	Q_min_all_0
2580	Average value of all phases for the specified time interval, as absolute value	float32	false	Q_av_all_0
2582	Abs value of the apparent power	float32	false	S_max_all_0
2584	Average of S_max_all of the last specified period	float32	false	S_av_all_0
2586	U12 Maximum of line to line voltage, only the absolute value, without angle	float32	false	U_LL_max_0
2588	U23 Maximum of line to line voltage, only the absolute value, without angle	float32	false	U_LL_max_1
2590	U31 Maximum of line to line voltage, only the absolute value, without angle	float32	false	U_LL_max_2
2592	Number of events of qu2 method hits forwarddirected to feeder)	float32	false	EvCnt_Qu2Fw_0

Information: BE via LT (WRITE and READ)
Default offset: 2600

Address + Offset	Description	Type	Write	Name
2600	BE_LT_0 (AUS)	int16	true	BE_via_LT_0
2601	BE_LT_1 (Reboot E3D)	int16	true	BE_via_LT_1
2602	BE_LT_2 (Aufz. starten)	int16	true	BE_via_LT_2
2603	BE_LT_3 (Reset alles)	int16	true	BE_via_LT_3
2604	BE_LT_4 (Reset LEDs)	int16	true	BE_via_LT_4
2605	BE_LT_5 (Reset qu2)	int16	true	BE_via_LT_5
2606	BE_LT_6 (Reset cos(phi))	int16	true	BE_via_LT_6
2607	BE_LT_7 (Reset sin(phi))	int16	true	BE_via_LT_7
2608	BE_LT_8 (Reset OV)	int16	true	BE_via_LT_8
2609	BE_LT_9 (Reset Puls50)	int16	true	BE_via_LT_9
2610	BE_LT_10 (Reset Kurzschluss)	int16	true	BE_via_LT_10
2611	BE_LT_11 (Reset Statistik)	int16	true	BE_via_LT_11
2612	BE_LT_12 (Reset FastPuls)	int16	true	BE_via_LT_12
2613	BE_LT_13 (Reset Adm2)	int16	true	BE_via_LT_13
2614	BE_LT_14 (BEF nicht zugewiesen)	int16	true	BE_via_LT_14
2615	BE_LT_15 (BEF nicht zugewiesen)	int16	true	BE_via_LT_15

BE via LT can be also read and written as coils and also be read at other default offset 3800, please look at the coils part.

Information: TIME (WRITE and READ)
Default register offset: 2800

The register information format for time handling is from IEC 60870-5-104! For time handling 4 sequential registers are used.

Address + Offset	Description	Type	Write	Name
2800	Time_1 (Milliseconds)	int16	true	Time_1
2801	Time_2 (Minutes and hours)	int16	true	Time_2
2802	Time_3 (Day/day of week/month)	int16	true	Time_3
2803	Time_4 (Year)	int16	true	Time_4

Register information format - Time_1 (Milliseconds) 2800:

Bit	15	14	13	12	11	10	9	8
	Milliseconds							
Bit	7	6	5	4	3	2	1	0
	Milliseconds							

Milliseconds: 0-59999ms

Register information format - Time_2 (Minutes and hours) 2801

Bit	15	14	13	12	11	10	9	8
	SU	RES2			Hours			
Bit	7	6	5	4	3	2	1	0
	IV	RES1	Minutes					

Minutes: 0-59 min

Hours: 0-23 hours

SU: 1 = Summer Time / 0 = Normal Time

IV:

RES1/2:

0 = valid / 1 = invalid time tag

reserved

Register information format - Time_3 (Day/day of week/month) 2802

Bit	15	14	13	12	11	10	9	8
	RES3				Month			
Bit	7	6	5	4	3	2	1	0
	Day of week			Day month				

Day month: 1-31 days

Month: 1-12 month

Day of week: 1-7 day

RES3: reserved

Register information format - Time_4 (Year) 2803

Bit	15	14	13	12	11	10	9	8
	RES5							
Bit	7	6	5	4	3	2	1	0
	RES4 Year							

Year: 0-127 years (0 = 2000 / 1 = 2001 / 2 = 2002 / ...)

Information: Values from EOR3D LCD Display 2

Default offset: 4000

Address + Offset	Description	Type	Write	Name
4000	U23p (Absolute value U23)	float32	false	U23p
4002	U23p_r (Real coefficient U23)	float32	false	U23p_r
4004	U23p_i (Imaginary coefficient U23)	float32	false	U23p_i
4006	wU23 (Angle U23)	float32	false	wU23
4008	U31p (Absolute value U31)	float32	false	U31p
4010	U31p_r (Real coefficient U31)	float32	false	U31p_r
4012	U31p_i (Imaginary coefficient U31)	float32	false	U31p_i
4014	wU31 (Angle U31)	float32	false	wU31
4016	Shortcircuit current L1	float32	false	I_SC_0
4018	Shortcircuit current L2	float32	false	I_SC_1
4020	Shortcircuit current L3	float32	false	I_SC_2
4022	Maximum short circuit current	float32	false	I_SC_3

3.2.1 EOR-3D Modbus Coils Organisation

Coils are shown as shadow of the Bit 0 from the corresponding registers above. This coils here have a special address space, they can also been read from the addresses above. BE via LT can also been written at the register offset above.

Information: COIL BE

Default offset: 3000

Address + Offset	Description	Type	Write	Name
3000	BE_0 (BE1)	coil	false	BE_0
3001	BE_1 (BE2)	coil	false	BE_1
3002	BE_2 (BE3)	coil	false	BE_2
3003	BE_3 (BE4)	coil	false	BE_3
3004	BE_4 (BE5)	coil	false	BE_4
3005	BE_5 (BE6)	coil	false	BE_5

Information: COIL BEF

Default offset: 3200

Address + Offset	Description	Type	Write	Name
------------------	-------------	------	-------	------

3200	BEF_0 (AUS)	coil	false	BEF_0
3201	BEF_1 (Reboot E3D)	coil	false	BEF_1
3202	BEF_2 (Aufz. starten)	coil	false	BEF_2
3203	BEF_3 (Reset alles)	coil	false	BEF_3
3204	BEF_4 (Reset LEDs)	coil	false	BEF_4
3205	BEF_5 (Reset qu2)	coil	false	BEF_5
3206	BEF_6 (Reset cos(phi))	coil	false	BEF_6
3207	BEF_7 (Reset sin(phi))	coil	false	BEF_7
3208	BEF_8 (Reset OV)	coil	false	BEF_8
3209	BEF_9 (Reset Puls50)	coil	false	BEF_9
3210	BEF_10 (Reset Kurzschluss)	coil	false	BEF_10
3211	BEF_11 (Reset Statistik)	coil	false	BEF_11
3212	BEF_12 (Reset FastPuls)	coil	false	BEF_12
3213	BEF_13 (Reset Adm2)	coil	false	BEF_13
3214	BEF_14 (BEF nicht zugewiesen)	coil	false	BEF_14
3215	BEF_15 (BEF nicht zugewiesen)	coil	false	BEF_15

Information: BAF

Default offset: 3400

Address + Offset	Description	Type	Write	Name
3400	BAF_0 (AUS)	coil	false	AUS
3401	BAF_1 (PROG)	coil	false	PROG
3402	BAF_2 (Status)	coil	false	Status
3403	BAF_3 (Störung)	coil	false	Störung
3404	BAF_4 (U1_ok)	coil	false	U1_ok
3405	BAF_5 (U2_ok)	coil	false	U2_ok
3406	BAF_6 (U3_ok)	coil	false	U3_ok
3407	BAF_7 (user_BAF1)	coil	false	user_BAF1
3408	BAF_8 (user_BAF2)	coil	false	user_BAF2
3409	BAF_9 (user_BAF3)	coil	false	user_BAF3
3410	BAF_10 (user_BAF4)	coil	false	user_BAF4
3411	BAF_11 (user_BAF5)	coil	false	user_BAF5
3412	BAF_12 (user_BAF6)	coil	false	user_BAF6
3413	BAF_13 (user_BAF7)	coil	false	user_BAF7
3414	BAF_14 (user_BAF8)	coil	false	user_BAF8
3415	BAF_15 (>Uerd)	coil	false	>Uerd
3416	BAF_16 (>Uerd_delay)	coil	false	>Uerd_delay
3417	BAF_17 (Uerd_L1)	coil	false	Uerd_L1
3418	BAF_18 (Uerd_L2)	coil	false	Uerd_L2
3419	BAF_19 (Uerd_L3)	coil	false	Uerd_L3

3420	BAF_20 (Uerd_L1_d)	coil	false	Uerd_L1_d
3421	BAF_21 (Uerd_L2_d)	coil	false	Uerd_L2_d
3422	BAF_22 (Uerd_L3_d)	coil	false	Uerd_L3_d
3423	BAF_23 (Sum_Uerd ->L)	coil	false	Sum_Uerd ->L
3424	BAF_24 (Sum_Uerd ->S)	coil	false	Sum_Uerd ->S
3425	BAF_25 (Prio_Uerd ->L)	coil	false	Prio_Uerd ->L
3426	BAF_26 (Prio_Uerd ->S)	coil	false	Prio_Uerd ->S
3427	BAF_27 (qu2 ->L)	coil	false	qu2 ->L
3428	BAF_28 (qu2 ->S)	coil	false	qu2 ->S
3429	BAF_29 (qu2_DE ->L)	coil	false	qu2_DE ->L
3430	BAF_30 (qu2_DE ->S)	coil	false	qu2_DE ->S
3431	BAF_31 (qui ->L)	coil	false	qui ->L
3432	BAF_32 (qui ->S)	coil	false	qui ->S
3433	BAF_33 (cos ->L)	coil	false	cos ->L
3434	BAF_34 (cos ->S)	coil	false	cos ->S
3435	BAF_35 (sin ->L)	coil	false	sin ->L
3436	BAF_36 (sin ->S)	coil	false	sin ->S
3437	BAF_37 (c_s ->L)	coil	false	c_s ->L
3438	BAF_38 (c_s ->S)	coil	false	c_s ->S
3439	BAF_39 (OV_250 ->L)	coil	false	OV_250 ->L
3440	BAF_40 (OV_250 ->S)	coil	false	OV_250 ->S
3441	BAF_41 (OV_fx1 ->L)	coil	false	OV_fx1 ->L
3442	BAF_42 (OV_fx1 ->S)	coil	false	OV_fx1 ->S
3443	BAF_43 (OV_fx2+ ->L)	coil	false	OV_fx2+ ->L
3444	BAF_44 (OV_fx2+ ->S)	coil	false	OV_fx2+ ->S
3445	BAF_45 (OV_fx2- ->L)	coil	false	OV_fx2- ->L
3446	BAF_46 (OV_fx2- ->S)	coil	false	OV_fx2- ->S
3447	BAF_47 (Puls_50)	coil	false	Puls_50
3448	BAF_48 (Puls_50c)	coil	false	Puls_50c
3449	BAF_49 (Puls_50c ->L)	coil	false	Puls_50c ->L
3450	BAF_50 (Puls_50c ->S)	coil	false	Puls_50c ->S
3451	BAF_51 (Puls50 LED)	coil	false	Puls50 LED
3452	BAF_52 (Puls_HPCI_50)	coil	false	Puls_HPCI_50
3453	BAF_53 (Puls_HPCI_50 ->L)	coil	false	Puls_HPCI_50 ->L
3454	BAF_54 (Puls_HPCI_50 ->S)	coil	false	Puls_HPCI_50 ->S
3455	BAF_55 (Puls_HPCI_fx)	coil	false	Puls_HPCI_fx
3456	BAF_56 (>I)	coil	false	>I
3457	BAF_57 (>I1)	coil	false	>I1
3458	BAF_58 (>I2)	coil	false	>I2

3459	BAF_59 (>I3)	coil	false	>I3
3460	BAF_60 (>>I)	coil	false	>>I
3461	BAF_61 (>>I1)	coil	false	>>I1
3462	BAF_62 (>>I2)	coil	false	>>I2
3463	BAF_63 (>>I3)	coil	false	>>I3
3464	BAF_64 (>I ->)	coil	false	>I ->
3465	BAF_65 (>I1 ->)	coil	false	>I1 ->
3466	BAF_66 (>I2 ->)	coil	false	>I2 ->
3467	BAF_67 (>I3 ->)	coil	false	>I3 ->
3468	BAF_68 (>>I ->)	coil	false	>>I ->
3469	BAF_69 (>>I1 ->)	coil	false	>>I1 ->
3470	BAF_70 (>>I2 ->)	coil	false	>>I2 ->
3471	BAF_71 (>>I3 ->)	coil	false	>>I3 ->
3472	BAF_72 (>I ->S)	coil	false	>I ->S
3473	BAF_73 (>I1 ->S)	coil	false	>I1 ->S
3474	BAF_74 (>I2 ->S)	coil	false	>I2 ->S
3475	BAF_75 (>I3 ->S)	coil	false	>I3 ->S
3476	BAF_76 (>>I ->S)	coil	false	>>I ->S
3477	BAF_77 (>>I1 ->S)	coil	false	>>I1 ->S
3478	BAF_78 (>>I2 ->S)	coil	false	>>I2 ->S
3479	BAF_79 (>>I3 ->S)	coil	false	>>I3 ->S
3480	BAF_80 (>Ferro Res.)	coil	false	>Ferro Res.

Information: COIL BA

Default offset: 3600

Address + Offset	Description	Type	Write	Name
3600	BA_0 (Rel_1 Function depends on assignment)	coil	false	BA_0
3601	BA_1 (Rel_2 Function depends on assignment)	coil	false	BA_1
3602	BA_2 (Rel_3 Function depends on assignment)	coil	false	BA_2
3603	BA_3 (Rel_4 Function depends on assignment)	coil	false	BA_3
3604	BA_4 (Rel_5 Function depends on assignment)	coil	false	BA_4
3605	BA_5 (Rel_6 Function depends on assignment)	coil	false	BA_5
3606	BA_6 (Rel_7 Function depends on assignment)	coil	false	BA_6
3607	BA_7 (Rel_8 Function depends on assignment)	coil	false	BA_7

Information: COIL BE via LT (WRITE and READ)

Default offset: 3800

Address + Offset	Description	Type	Write	Name
3800	BE_LT_0 (AUS)	coil	true	BE_via_LT_0
3801	BE_LT_1 (Reboot E3D)	coil	true	BE_via_LT_1

3802	BE_LT_2 (Aufz. starten)	coil	true	BE_via_LT_2
3803	BE_LT_3 (Reset alles)	coil	true	BE_via_LT_3
3804	BE_LT_4 (Reset LEDs)	coil	true	BE_via_LT_4
3805	BE_LT_5 (Reset qu2)	coil	true	BE_via_LT_5
3806	BE_LT_6 (Reset cos(phi))	coil	true	BE_via_LT_6
3807	BE_LT_7 (Reset sin(phi))	coil	true	BE_via_LT_7
3808	BE_LT_8 (Reset OV)	coil	true	BE_via_LT_8
3809	BE_LT_9 (Reset Puls50)	coil	true	BE_via_LT_9
3810	BE_LT_10 (Reset Kurzschluss)	coil	true	BE_via_LT_10
3811	BE_LT_11 (Reset Statistik)	coil	true	BE_via_LT_11
3812	BE_LT_12 (Reset FastPuls)	coil	true	BE_via_LT_12
3813	BE_LT_13 (Reset Adm2)	coil	true	BE_via_LT_13
3814	BE_LT_14 (BEF nicht zugewiesen)	coil	true	BE_via_LT_14
3815	BE_LT_15 (BEF nicht zugewiesen)	coil	true	BE_via_LT_15

3.2.2 EOR-3D Modbus virtual Variables (vBA, vMWR, vBE, vMWW, vBAcoil, vBEcoil)

The EOR3D has multiple 96 variables, which can be used for a protocol converter with other SCADA Protocols or EOR3D connection master system with LUA.

Information: vBA

Default offset: 5000

Address + Offset	Description	Type	Write	Name
5000	vBA_0	int16	false	vBA_0
5001	vBA_1	int16	false	vBA_1
.	.	.	.	
.	.	.	.	
5094	vBA_94	int16	false	vBA_94
5095	vBA_95	int16	false	vBA_95

Information: vBA coil

Default offset: 15000

- Like vBA but on offset 15000 as coil

Information: vMWR

Default offset: 5400

Address + Offset	Description	Type	Write	Name
5400	vMWR_0	float32	false	vMWR_0
5402	vMWR_1	float32	false	vMWR_1
.	.	.	.	
.	.	.	.	
5588	vMWR_94	float32	false	vMWR_94
5590	vMWR_95	float32	false	vMWR_95

Information: vBE
Default offset: 6000

Address + Offset	Description	Type	Write	Name
6000	vBE_0	int16	true	vBE_0
6001	vBE_1	int16	true	vBE_1
.	.	.	.	
.	.	.	.	
6094	vBE_94	int16	true	vBE_94
6095	vBE_95	int16	true	vBE_95

Information: vBE coil
Default offset: 16000
- Like vBE but on offset 16000 as coil
Information: vMWW
Default offset: 6400

Address + Offset	Description	Type	Write	Name
6400	vMWW_0	float32	true	vMWW_0
6402	vMWW_1	float32	true	vMWW_1
.	.	.	.	
.	.	.	.	
6588	vMWW_94	float32	true	vMWW_94
6590	vMWW_95	float32	true	vMWW_95

4 EOR-3D Toolbox Modbus Configuration

Please keep in mind after changing Modbus Parameters, the Applications have to be **started new or a change from 0 to 1 of the Modbus active flag** has to happen! So the Modbus Slave gets it's new configuration.

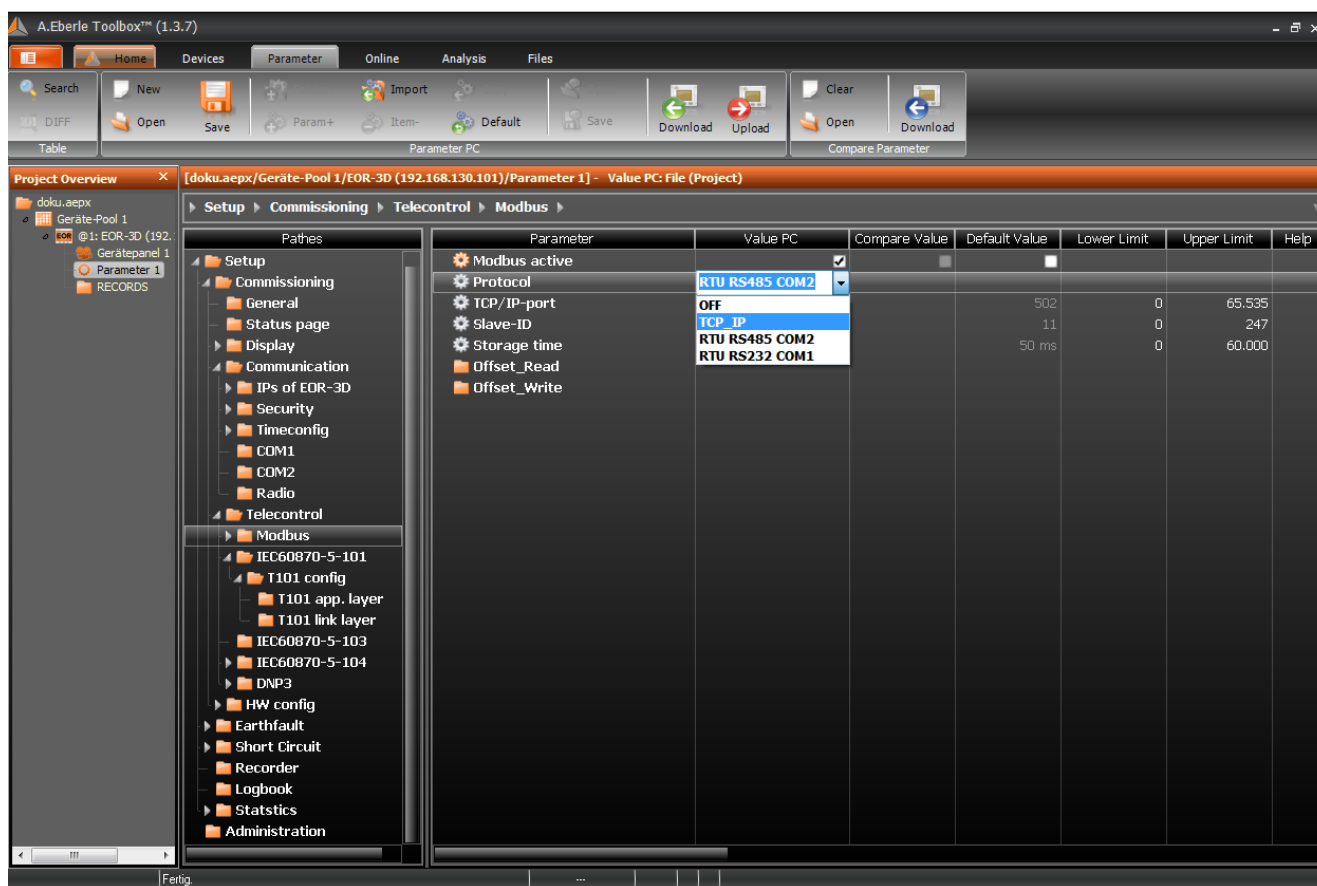
The pictures can look different to your version of the EOR-3D Toolbox. It can also be that some things in the EOR-3D Toolbox is added or removed and not shown in the pictures.

4.1 Modbus – Global Modbus Parameters

- Modbus active (disable - all data 0 / enable update data)
 --> **On a changed from 0 to 1 the Modbus slave gets it new configuration.**
- Protocol (disabled / TCP/IP / COM2 RS485 / COM1 RS232)
- Modbus port (Port TCP/IP)
- Slave ID (ID for RS485 Modbus network, is also to be set on RS232 mode)
 --> **Please set the correct Slave ID also on a RS232 Master !!!**
- Modbus Storage Time (Time in ms)
 --> **The Storage Time defines the time after a read from the device when Modbus Data does not get updated!**
 --> **Only the measured values are possible to be used with Storage Time! (UI value, UI angle and UI d. angle). All other values are normally updated on a read of the register !**
 --> **Please take care of the register offset for UI value, UI angel and UI d. angle. The Modbus slave checks the offset of UI value [0] and uses the Storage Time for 600 registers after UI value [0] offset!**

4.2 EOR-3D TCP/IP Configuration for Modbus

To change to Modbus TCP/IP please set the Protocol to TCP_IP and change the port what you want to use. Only one TCP/IP connection is allowed.



Picture 2: Toolbox TCP/IP

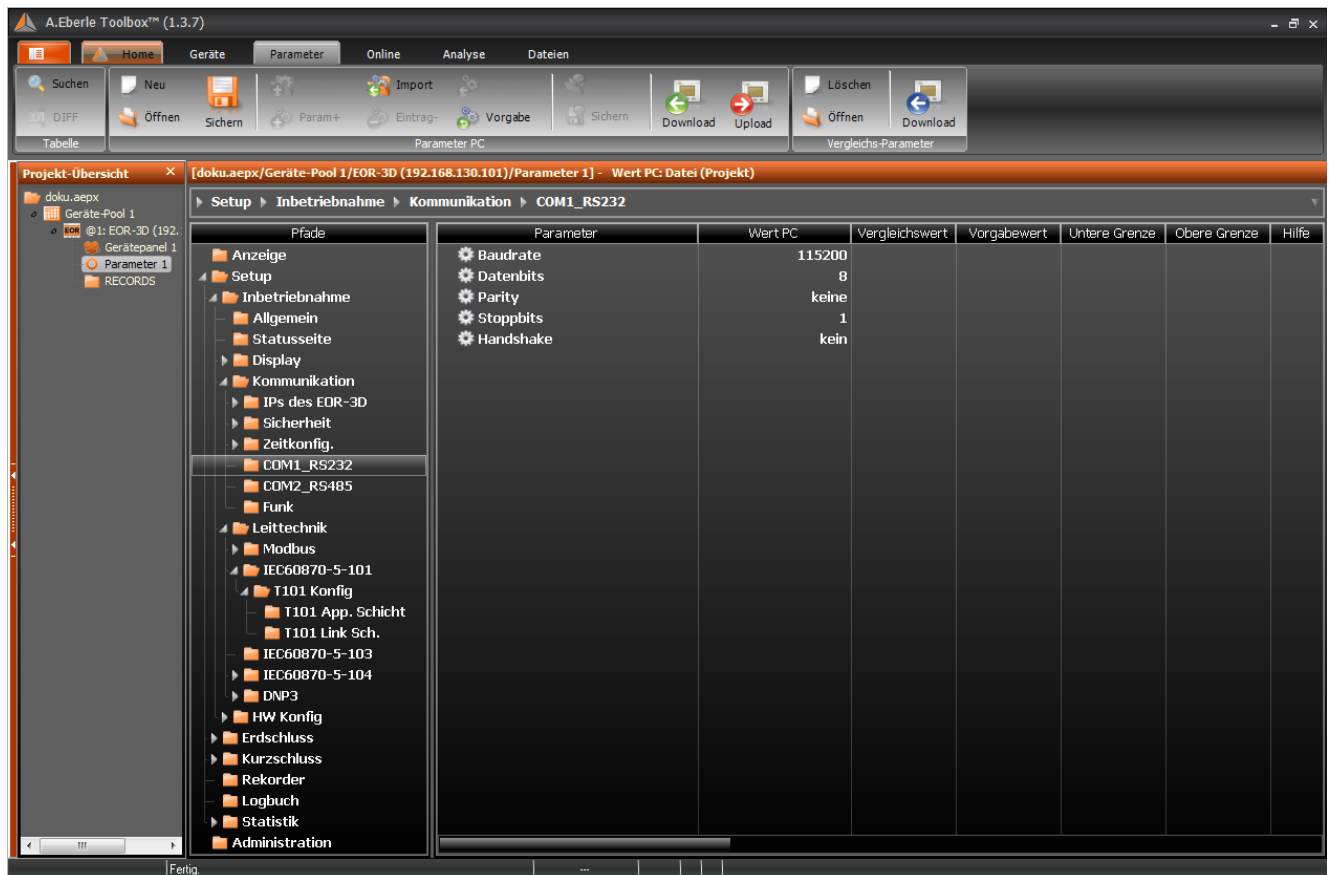
4.3 EOR-3D Serial Configuration for Modbus

4.3.1 COM1 – RS232 Device

Following parameters have to be set to configure the serial port:

- Baudrate
- Databits (has to be 8)
- Parity (N,E,O)
- Stopbits (depends on Parity – 1,2)
- Handshake (has to be none)

To change to Modbus RTU on RS232 COM1 please set the Protocol to RTU RS232. Set also the SLAVE ID, this is necessary because RS232 and RS485 work in the same way. Normal on a RS232 connection SLAVE ID is not necessary but here we have to set it. Don't forget to set the SLAVE ID also on the Modbus Master!



Picture 3: Toolbox RS232

4.3.2 COM2 – RS485 Device

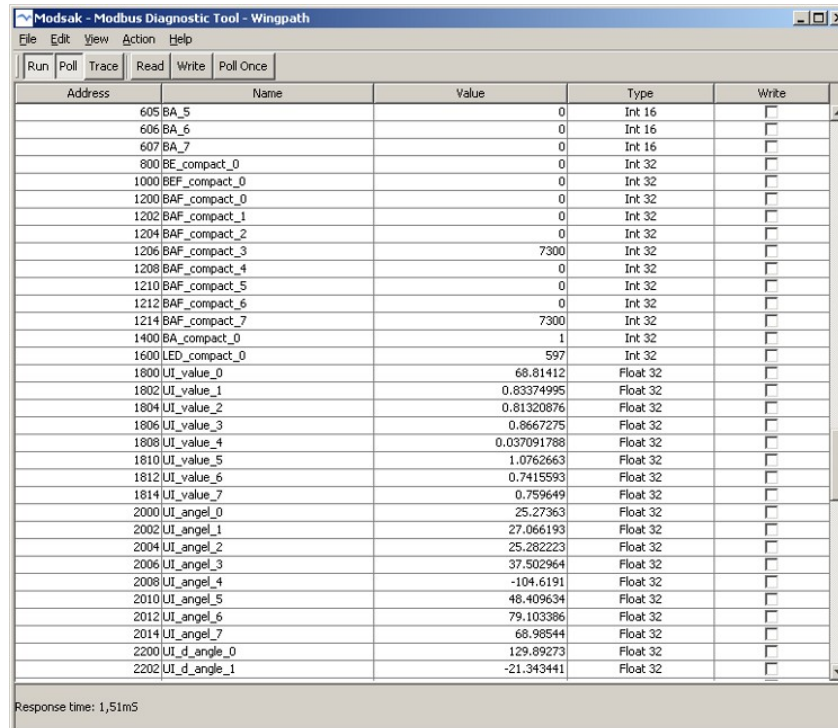
Following parameters have to be set to configure the serial port:

- Baudrate
- Databits (has to be 8)
- Parity (N,E,O)
- Stopbits (depends on Parity – 1,2)
- Handshake (has to be none)

To change to Modbus RTU on RS485 COM2 please set the Protocol to RTU RS485. Set also the SLAVE ID! Don't forget to set the SLAVE ID on the Modbus Master!

5 EOR-3D Example Modbus Communication with Modsak

A example configuration as file for RS232 and TCP/IP of the Modsak debugging tool can be provided.



Address	Name	Value	Type	Write
605	BA_5	0	Int 16	<input type="checkbox"/>
606	BA_6	0	Int 16	<input type="checkbox"/>
607	BA_7	0	Int 16	<input type="checkbox"/>
800	BE_compact_0	0	Int 32	<input type="checkbox"/>
1000	BEF_compact_0	0	Int 32	<input type="checkbox"/>
1200	BAF_compact_0	0	Int 32	<input type="checkbox"/>
1202	BAF_compact_1	0	Int 32	<input type="checkbox"/>
1204	BAF_compact_2	0	Int 32	<input type="checkbox"/>
1206	BAF_compact_3	7300	Int 32	<input type="checkbox"/>
1208	BAF_compact_4	0	Int 32	<input type="checkbox"/>
1210	BAF_compact_5	0	Int 32	<input type="checkbox"/>
1212	BAF_compact_6	0	Int 32	<input type="checkbox"/>
1214	BAF_compact_7	7300	Int 32	<input type="checkbox"/>
1400	BA_compact_0	1	Int 32	<input type="checkbox"/>
1600	LED_compact_0	597	Int 32	<input type="checkbox"/>
1800	UI_value_0	68.81412	Float 32	<input type="checkbox"/>
1802	UI_value_1	0.83374995	Float 32	<input type="checkbox"/>
1804	UI_value_2	0.81320876	Float 32	<input type="checkbox"/>
1806	UI_value_3	0.8667275	Float 32	<input type="checkbox"/>
1808	UI_value_4	0.037091788	Float 32	<input type="checkbox"/>
1810	UI_value_5	1.0762663	Float 32	<input type="checkbox"/>
1812	UI_value_6	0.7415593	Float 32	<input type="checkbox"/>
1814	UI_value_7	0.759649	Float 32	<input type="checkbox"/>
2000	UI_angle_0	25.27363	Float 32	<input type="checkbox"/>
2002	UI_angle_1	27.066193	Float 32	<input type="checkbox"/>
2004	UI_angle_2	25.282223	Float 32	<input type="checkbox"/>
2006	UI_angle_3	37.502964	Float 32	<input type="checkbox"/>
2008	UI_angle_4	-104.6191	Float 32	<input type="checkbox"/>
2010	UI_angle_5	48.409634	Float 32	<input type="checkbox"/>
2012	UI_angle_6	79.103386	Float 32	<input type="checkbox"/>
2014	UI_angle_7	68.98544	Float 32	<input type="checkbox"/>
2200	UI_d_angle_0	129.89273	Float 32	<input type="checkbox"/>
2202	UI_d_angle_1	-21.343441	Float 32	<input type="checkbox"/>

Response time: 1,51mS

Picture 4: Modsak example

6 BI (Binary Input) – Hardware differences

BE3 to BE6 is only available on EOR-3D compact Hardware Version!