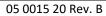


Revision-contract

Index	Modification	Date
Α	Init	09.05.19/ph
В	Register 0x0014, 0x002C: error corrections	12.03.20/qz

Changes concerning previous versions are marked

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EVCC2/3

API subset for external applications

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1 Basics

1.1 Common

This API specifies a subset of communication protocol of EVCC2/3, that enables a standard communication between external applications and charge controller:

- Setting of max charge current of outlet (Icmax)
- Reading status of outlet (A,B,C,F and E) and present current per phase
- Reading config of outlet and setting device-ID of outlet

1.2 Common settings

RS485-I/F	38400Bd, 8E1
MODBUS-type	MODBUS ASCII
Supported MODBUS-function	0x03 Read 16bit-registers
	0x10 Write 16bit-registers
Valid range of Device-ID	0x00 Broadcast
	0x010x10 Device-ID

1.3 Typical communication patterns

Read firmware revision of EVSE (device-ID 0x01)

SBC→pcba	:010300010002F9	
pcba→SBC >01030401011237AD		V1.2
		150215 & DCRCM attached
		Welding detection enabled
		cable

Read EV current (device-ID 0x01)[long]

SBC→pcba	:0103002E0005C9			
pcba→SBC	>01030A2EC3810A0064006400001F	C3 State C2 (I >1A)		
		810A $U_{CP} \le 10V$; $I_{cmax} = 16A$ (26.6%)		
		0064 I _{CT1} = 10A		
		0064 I _{CT2} = 10A		
		0000 I _{CT3} = 0A		

Read EV current (device-ID 0x01)[short]

SBC→pcba	:010300330003C6	
pcba→SBC	>0103063380C30A0A00EC	80 U _{CP} ≤ 10V
		C3 State C2 (I >1A)
		0A I _{CT1} = 10A
		0A I _{CT2} = 10A
		00 I _{CT3} = 0A

Set I_{cmax} of EVSE to 10A (device-ID 0x01)

SBC→pcba :0110001400010200A632		Duty cycle 16.6%
pcba→SBC >011000140001DA		OK
	>0190046B	Failed

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1.4 Frame settings

1.4.1 Reading

The answer to a reading-request includes the number of the register that the answer is concerning to. This information is fixed up in the final 8 bits of the register-bits.

Read one 16bit-register (R1)

	Request to device (e.g. register 0x0003) [4.9ms]		
byte	Value	Description	
2	0x01	Device ID	
3	0x03	Function code "read"	
45	0x0003	Starting address	
67	0x0001	Qty of registers	
8	0xF8	LRC	
		:010300030001F8 CRLF	

	Response of device (OK) [4.3ms]		
byte	Value	Description	
2	0x01	Device ID	
3	0x03	Function code "read"	
4	0x02	No of value bytes	
56	0x0327	Value of register 0x0003	
7	0xD0	LRC	
		>0103020327D0 CRLF	

Read two contiguous 16bit-register (R2)

	Request to device (e.g. register 0x0001) [4.9ms]		
byte	Value	Description	
2	0x01	Device ID	
3	0x03	Function code "read"	
45	0x0001	Starting address	
67	0x0002	Qty of registers	
8	0xF9	LRC	
		:010300010002F9 CRLF	

	Response of device (OK) [5.4ms]		
byte	Value	Description	
2	0x01	Device ID	
3	0x03	Function code "read"	
4	0x04	No of value bytes	
56	0x010F	Value of register 0x0001	
78	0x1509	Value of register 0x0002	
9	0xCA	LRC	
		>010304010F1509CA CRLF	

Read three contiguous 16bit-register (R3)

		Request to device (e.g. register 0x0033) [4.9ms]	
byte	Value	Description	
2	0x01	Device ID	
3	0x03	Function code "read"	
45	0x0033	Starting address	
67	0x0003	Qty of registers	
8	0xC6	LRC	
		:010300330003C6 CRLF	

	Response of device (OK) [6.6ms]		
	, , , , ,		
byte	Value	Description	
2	0x01	Device ID	
3	0x03	Function code "read"	
4	0x06	No of value bytes	
56	0x3300	Value of register 0x0033	
78	0xA164	Value of register 0x0034	
910	0x6464	Value of register 0x0035	
9	0xF6	LRC	
		>0103063300A1646464F6 CRLF	

Read five contiguous 16bit-register (R5)

		Request to device (e.g. register 0x0014)[4.9ms]
byte	Value	Description
2	0x01	Device ID
3	0x03	Function code "read"
45	0x0014	Starting address
67	0x0005	Qty of registers
8	0xE3	LRC
		:010300140005E3 CRLF

	Response of device (OK) [8.9ms]		
byte	Value	Description	
2	0x01	Device ID	
3	0x03	Function code "read"	
4	0x0A	No of value bytes (10)	
56	0x1400	Value of register 0x0014	
78	0x0249	Value of register 0x0015	
910	0x0AFA	Value of register 0x0016	
1112	0x0200	Value of register 0x0017	
1314	0x01FF	Value of register 0x0018	
15	0x8D	LRC	
		>01030A140002490AFA020001FF8D CRLF	



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Read eight contiguous 16bit-register (R8)

nead eight contiguous robit register (No)		
		Request to device (e.g. register 0x0014)[4.9ms]
byte	Value	Description
2	0x01	Device ID
3	0x03	Function code "read"
45	0x0050	Starting address
67	0x0008	Qty of registers
8	0xA4	LRC
		:010300500008A4 CRLF

		Response of device (OK) [12.6ms]
byte	Value	Description
2	0x01	Device ID
3	0x03	Function code "read"
4	0x10	No of value bytes (16)
56	0x5000	Value of register 0x0050
78	0x3257	Value of register 0x0051
910	0x3232	Value of register 0x0052
1112	0x7879	Value of register 0x0053
1314	0x3031	Value of register 0x0054
1516	0x3233	Value of register 0x0055
1718	0x3435	Value of register 0x0056
1920	0x3637	Value of register 0x0057
21	0x22	LRC
		>0103105000325732327879303132333435363722 CRLF
		(Serial number: 2W22xy01234567)

1.4.2 Writing

Write 16bit value to one 16bit-register

		Request to device (e.g. register 0x0013) [6.6ms]
byte	Value	Description
2	0x01	Device ID
3	0x10	Function code "write"
45	0x0013	Starting address
67	0x0001	Qty of registers
8	0x02	No of value bytes
910	0x010B	Value for register 0x0013
11	0xCD	LRC
		:01100013000102010BCD CRLF

		Response of device (OK)(except BC) [4.9ms]
byte	Value	Description
2	0x01	Device ID
3	0x10	Function code "write"
45	0x0013	Starting address
67	0x0001	Qty of registers
8	0xD8	LRC
		>011000130001D8 CRLF

1.4.3 Error-handling

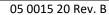
Example:

	•	Response of device (FAILURE))(except BC)[3.2ms]
byte	Value	Description
2	0x01	Device ID
3	0x90	Function code "error"
4	0x04	Exception code "Writing registers failed"
5	0x6B	LRC
		>0190046B <crlf></crlf>

No response is returned, if

- device receives a request, but detects a communication error (parity, LRC, CRC, ...)
- function code is neither 0x03 (read) nor 0x10 (write)
- write-request does not access a valid register for writing
- \bullet qty of registers of a write-request does not meet requirements of accessed register
- number of value-bytes write-request does not meet qty of registers
- read-request does not access a valid register for reading

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2 Protocol

0x0001 - Read device-ID and firmware-revision

Function Read device-ID, firmware-revision and config

 $\begin{array}{lll} \text{Type} & \text{R2} \\ 1^{\text{st}} \, \text{Register} & \text{0x0001} \\ \text{Last register} & \text{0x0002} \\ \text{Broadcast supported} & \text{Yes} \end{array}$

Remarks Each outlet is identified by its individual device-ID

Register-Bit	Value	Description
3124	0x01	Register which the answer is referring to
2322		Hardware:
	00	pcba: 141215
	01	pcba: 160307
	10	pcba: 170725
	11	not used
2116	0x010x10	device-ID (default: 0x01)
1512		Major revision
118		Minor revision
7	1	Reading of coding resistor at socket-input CS for rated current I _{CS} of adapter enabled
6	1	Upstream-timeout enabled
5	1	Internal phase-current meter enabled
4	1	Internal RDC-MD enabled
3	1	Socket enabled
2	1	Welding detection (contactor) enabled
10	00	No function
	01	Must be closed for transition B1->B2
	10	Closed: Outlet enabled
	11	Invalid

0x0003 - Read MODBUS settings

Function Read MODBUS-setting

 Type
 R1

 1st Register
 0x0003

 Last register
 0x0003

 Broadcast supported
 no

Remarks

Register-Bit	Value	Description
158	0x03	Register which the answer is referring to
76	00	1 stop bit (default)
	11	2 stop bit
54	00	No parity
	01	Parity odd
	10	Parity even (default)
	11	Invalid
30	0000	(reserved)
	0101	9600 Bd
	0110	19200 Bd
	0111	38400 Bd (default)
	1000	57600 Bd
	others	Invalid

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0x0005 – Modify state

Function Modify state of outlet

Type W1

1st Register 0x0005

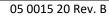
Last register 0x0005

Broadcast supported yes

Remarks 0xE0E0 and 0xE2E2 are used normally

Register-Bit	Value	Description
150	0x3838	Load Imbalance Detection (20A) enabled (E2 required)
	0x5A5A	Reset
	0xA1A1	Jump to state A1 (E0 or E2 required)
	0xE0E0	Jump to state E0
	0xE2E2	Jump to state E2 (A1 or E0 required)
	0xF1F1	Jump to state F1 (RCD is tripped, if configured)
	others	Must not be used

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0x0006- Read system-flags

Function Read system-flags

Type R2
1st Register 0x0006
Last register 0x0007
Broadcast supported no

Remarks

Register-Bit	Value	Description
3124	0x06	Register which the answer is referring to
2316		Pointer of state-machine
15	0	Upstream-Timeout triggers F14 instead of F4
	1	Upstream-Timeout triggers F4 instead of F14
14	0	B1->B2 enabled after power-cycle
	1	B1->B2 disabled after power-cycle
1312	00	Use default limits for CP detection and timing
	10	Use China limits for CP detection and timing
	01	(reserved)
	11	(reserved)
1110		(reserved)
9	0	Upstream communication established
	1	Upstream communication lost (BC6); timeout may trigger F4/F14
8	0	No load imbalance detected
	1	Load imbalance detected (BC3)
7	0	Onboard temperature less of equal 60°C
	1	Onboard temperature 60°C < T < 80°C (BC5)
6	0	Internal phase current metering available
	1	Internal phase current metering available failed (BC4)
5	0	E0->A1 enabled
	1	E0->A1 disabled
4	0	B1->B2 enabled
	1	B1->B2 disabled
3	0	A1->B1 enabled
	1	A1->B1 disabled
20	000	EV Current ≤ 100 % I _c
	001	100% I _c < EV Current ≤ 105% I _c
	101	105% I _c < EV Current ≤ 110% I _c (failure aft. 1000s; not for China)
	011	110% I _c < EV Current ≤ 120% I _c (failure aft. 100s; China: 5s)
	111	EV Current > 120 % Ic (failure aft. 10s; China: 5s)

0x0014- Set I_{cmax}

Function Set I_{cmax}
Type W1
1st Register 0x0014
Last register 0x0014
Broadcast supported yes
Remarks ./.

Register-Bit	Value	Description
150	0x00500x03E8	Duty cycle I _{cmax} [%]*10 (8100%)

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0x002C - Set device-ID

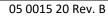
Function Set device-ID, Upstream-Timeout and transition B1->B2 after power-cycle

Type W1
1st Register 0x002C
Last register 0x002C
Broadcast supported yes

Remarks Outlet must be in state E2

Register-Bit	Value	Description
1514	00	No change
	01	Upstream-Timeout and failure F4 are disabled
	10	Upstream-Timeout and failure F4 are enabled
	11	No change
1312	00	No change
	01	Outlet enters B2 after power-cycle, if EV connected
	10	Outlet stops in B1 after power-cycle, if EV connected. Enable required
	11	No change
118	0000	(reserved)
70	0x010x10	Device-ID

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0x002E - Read current (full)

Function Read state, digital inputs, max charge current I_C and current of each phase (resolution 0.1A)

 $\begin{array}{lll} \text{Type} & \text{R5} \\ 1^{\text{st}} \, \text{Register} & \text{0x002E} \\ \text{Last register} & \text{0x0032} \\ \text{Broadcast supported} & \text{no} \end{array}$

Remarks

Register-Bit	Value	Description
7972	0x2E	Register which the answer is referring to
7164	0x	State of EVSE
63	0	U _{CP} > 10V (no EV connected, not valid in state Ex and Fx)
	1	$U_{CP} \le 10V$ (EV connected, not valid in state Ex and Fx)
62	0	Duty cycle is not reduced due to BC3-BC6
	1	Duty cycle reduced due to BC3-BC6
61	0	EN2 open
	1	EN2 closed
60	0	EN1 open
	1	EN1 closed
5948	0x0000x3E8	Duty cycle I _c [%]*10 (0100%)
4732	0x00000x0320	I _{ct1} [0,1A] (080A)
	0x03E8	Phase current meter not available or state A
3116	0x00000x0320	I _{ct2} [0,1A] (080A)
	0x03E8	Phase current meter not available or state A
150	0x00000x0320	I _{ct3} [0,1A] (080A)
	0x03E8	Phase current meter not available or state A

0x0033 - Read current amps

Function Read state and current of each phase (1A)

Type R3
1st Register 0x0033
Last register 0x0035
Broadcast supported no

Remarks

Register-Bit	Value	Description
4740	0x33	Register which the answer is referring to
39	0	$U_{CP} > 10V$ (no EV connected, not valid in state Ex and Fx)
	1	$U_{CP} \le 10V$ (EV connected, not valid in state Ex and Fx)
3832	0x00	
3124	0x	State of EVSE
2316	0x000x50	I _{ct1} [A] (080A)
	0x64	Phase current meter not available or state A
158	0x000x50	I _{ct2} [A] (080A)
	0x64	Phase current meter not available or state A
70	0x000x50	I _{ct3} [A] (080A)
	0x64	Phase current meter not available or state A

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3 Annex

3.1 Abbreviations

Sorted alphabetically

Joi tea dipila	o caroan y
ADC	Analog-to-Digital Converter
BC	Error-reaction, that is just possible in state B or C => no own state
bd	Baud = Unit to the symbol-transmission-rate per second (1 symbol in ASCII = 2 hexadecimal numbers)
CP	Control Pilot (EV-Information)
CS	Control Signal (Cable-Information)
RDC-MD	Residual Direct Current Monitoring Device
EV	Electrical vehicle
EVCC	Electric Vehicle Charge Control (quite often used as a synonym to pcba)
EVSE	The whole charching-system
HMI	Human-Machine Interface
LCM	Load current measurement = METER, Measures the load current of each phase and compares it with present Ic using pcba 150212, In
	case of lost communication with pcba 150212 I _{cmax} is limited to 10A
LID	Load Imbalance Detection
LM	Load current management
LRC	Longitudinal Redundancy Check
pcba	priced circuit board assembly
PWM	Pulse-width modulation
SBC	Connected single board computer, which is used for communicating with the pcba throughout upstream communication
TP	Testing points on pcba 160307 (rests of the third switch)
UID	Unique Identifier
WD	Welding detection

3.2 PWM duty cycle provided by EV supply equipment

Maximum current I_{av}	Nominal control pilot duty cycle D _N	Description
$I_{av} = 0 A$	D _N = 0 %	Continuous -12 V, EV supply equipment not available; state F
	D _N = 100 %	No current available – state x1 (see Table A.5)
Maximum current is indicated via digital communication	D _N = 5 %	A duty cycle of 5 % indicates that digital communication is required and shall be established between the EV supply equipment and EV before enabling energy supply.
		If digital communication cannot be established, the EV supply equipment shall:
		• stay in 5 % duty cycle or
		• change to x1 (100 % duty cycle) for at least 3 s
		or
		• change to x1 (100 % duty cycle) for at least 3 s
		and then change to a duty cycle between 10 % and 96 %.
6 A ≤ I _{av} ≤ 51 A	$D_{N} = I_{av} / 0.6 A$	10 %≤ D _N ≤ 85 %
51 A < I _{av} ≤ 80 A	$D_{N} = (I_{av} / 2.5 \text{ A} + 64)$	85 %< D _N ≤ 96 %

(Source: IEC 61851-1_Ed 3_2017.pdf)

3.3 Definition of current

 $I_{rated} \hspace{1.5cm} \textbf{Rated current of outlet}$

l_{default} Max. charging current due to rated current of outlet, wiring of installation etc.

 I_{default} is internally limited to I_{rated}

Max. charging current, that can be provided to this outlet due to external control etc.

If I_{cmax} is not modified externally, than $I_{cmax} = I_{default}$

 I_{cmax} is internally limited to $I_{default}$, except for setting 100%, that indicates "no current allowed" to EV

I_{cs} Outlet with socket: Rated current of charging adapter

Outlet with cable: $I_{cs} = I_{default}$

Ic Max. current, that EV may take

 I_c is internally limited to I_{cmax} or I_{cs} or other internal values (e.g. due to error conditions), whichever is lower

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3.4 Definition of states

State	Description
A1	Waiting for EV
B1	EV is asking for charging
B2	EV has the permission to charge
C2	EV is charged
C3	C2, reduced current (error F16, F17)
C4	C2, reduced current (imbalance F15)
EO	Outlet disabled
E1	Production test
E2	EVCC setup mode
E3	Bus idle

F1 Unintended closed contact (Welding)

F2 Internal error

F3 DC residual current detected
 F4 Upstream communication timeout
 F5 Lock of socket failed

F6 CS out of range
F7 State D requested by EV
F8 CP out of range
F9 Overcurrent detected
F10 Temperature outside limits
F11 Unintended opened contact

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