COMMUNICATION PROTOCOL BETWEEN CHARGING MODULES AND MONITOR （THJS-TXXY-0060 V1.2）

1. Range

The protocol is applied to communication protocol between the main control board of the module type one double charge charger and charging modules.

2. Normative Files

The following documents are essential for the application of this file. All dated normative files, only dated versions are applied to this file. All undated normative files, the newest version (including all revising documents) are applied to this file.

GB/T 19596 EV Terms

GB/T 27930-2011 Communication Protocol between EV Offboard Conduction Type and battery management system

ISO 11898-1:2003 Road vehicle – Control area network (CAN) Part 1: Data link layer and physical signaling

SAE J1939-11:2006 Commercial vehicle control system LAN CAN communication protocol Part 11:Physical layer – 250K bits/s, twisted shielded pair.

SAE J1939-73:2006 Commercial vehicle control system LAN CAN communication protocol Part 21: Data link layer

SAE J1939-73:2006 Commercial vehicle control system LAN CAN communication protocol Part 73: Application Layer – Diagnostics

3. Terms and Definitions

GB/T 19596 Defined and the following terms and definitions apply to this file.

3.1 Frame

A series of data bits that form a complete message.

3.2 CAN data frame

The ordered bit domain required to form the CAN protocol for transferring data. Start from frame(SOF) and end of frame(EOF).

3.3 Messages

One or more “CAN data frames” with the same parameter group number.

3.4 Identifier

The identity part of the CAN arbitration domain.

3.5 Standard frame

CAN data frames defined in the bus using 11 bit identifiers.

3.6 Extended frame

CAN data frames defined in the bus using 29 bit identifiers.

3.7 Priority

In the identifiers, a three-bit field sets the arbitration priority of the transport process. The highest priority is 0, and the lowest priority is 7.

3.8 Parameter group (PG)

The collection of transporting parameters in a message. Parameter groups include: commands, data, request, response, and negative response and so on.

3.9 Parameter group number (PGN)

A 24-bit value used to uniquely identify a parameter group. PGN include: reservation bit, data page, PDU format domain (8 bits), group extension domain (8 bits).

3.10 Suspect parameter number (SPN)

The application layer describes the signal by parameters, and assigns a 19-bit value to each parameter.

3.11 Protocol data unit (PDU)

A specific CAN data frame format

3.12 Transport protocol

A part of the data link layer that provides a mechanism for transferring data to a PGN of 9 bytes or more.

3.13 Electronic control unit (ECU)

ECU, namely the on-board computer, consisting of microcomputer and peripheral circuit.

3.14 Diagnostic trouble code (DTC)

A 4-byte value for identifying fault type, associated failure mode, and occurrence times.

4, General Rules

4.1 The communication network between the main control and charging module adopts CAN communication protocol.

4.2 This standard data transmission adopts low-first send format.

5. Physical Layer

5.1 General Rules

The physical layer of this standard shall conform to the provisions in ISO 11898-1:2003 、 SAE J1939-11:2006. This communication shall adopt the isolated CAN interface. And communication rate adopts 125kbit/s.

6. Data Link Layer (DLL)

6.1 Frame Format

The device using this standard should use the 29-bit identifier of the CAN extension frame. The corresponding definition of each bit assignment should conform to the relevant provisions of 5.1 provision in SAE J1939-21:2006.

6.2 Protocol Data Unit (PDU)

Each CAN data frame contains a single PDU, as shown in sheet 1. PDU consists of seven parts, namely priority, reservation, data page, PDU format, specific PDU, source address and data domain.

Sheet 1 Protocol Data Unit(PDU)

P	R	DP	PF	PS	SA	DATA
3	1	1	8	8	8	0-64

Remark 1: P is priority: Set from the highest 0 to the lowest 7 .
Remark 2: R is reservation: Prepare for future development. This standard is 0.
Remark 3: DP i s d a t a p a g e: Used to select the auxiliary page described by the parameter group. This standard is 0.
Remark 4: PF is PDU format: Used to confirm PDU format and corresponding parameter group No of the data domain.
Remark 5: PS is specific PDU format: PS value depends on PDU format. Adopting PDU1 format in this standard, PS value is target address.
Remark 6: SA is source address: the source address that sends the message.

.3 Protocol Data Unit (PDU) Format

This standard adopts PDU1 format defined in 5.3 of SAE J1939-21:2006.

6.4 Parameter Group Number (PGN)

The second byte of this standard PGN is PDU format (PF), and both high and low byte bits are 00H.

6.5 IP

The standard network address is used to ensure the uniqueness of information identifiers and the source of information. The assigned address is like Sheet 2.

Sheet 2 IP

Device	Address
Main control	0xA0
Charging module	1-240 (broadcast address is 0xff)

6.6 Information Type

The CAN bus technical specification supports five types of information, which are command, request, broadcast/response, validation, and group function. The specific definition should follow the rule of message type of 5.4 in SAE J1939-21:2006.

7. Application Layer

7.1 This standard application adopts the form of parameter and parameter group definition.

7.2 PGN is used to number the parameter group, and each node identified the content of the data packet according to PGN.

7.3 Adopting periodic and event-driven manner to send data.

7.4 When defining a new parameter group, try best to keep the parameters of the same function, the same or similar refresh frequency, and the parameters belonging to the same subsystem in the same parameter. At the same time, a new parameter group should not only make full use of 8 bytes data width, trying best to put the related parameters in the same group, but also consider the extendability, setting aside some parts of bytes or position, so as to modify in the future.

7.5 When you modify a defined parameter group, you should not modify the definition of a defined byte or bit. The newly added parameters should be related to the original parameters in the parameter group, and the irrelevant parameters should not be added to the defined PGN even if the number of PGN is expected to save.

7.6 In the process of data transmission, except the special instructions, all are 16 hexadecimal.

8. Message classification

8.1 Up-link data

Message Code	Message Description	PGN (Hex)	Priority	Data Length byte	Message Cycle ms	Source address-destination address
M_C_1	Charging module state	000100H	6	8	500+ Trigger	Charging module-master control
M_C_2	Specific module start &stop and over/under voltage setting confirmation	000200H	2	8	Trigger mode	Charging module-master control
M_C_3	AC information upload	000B00H	6	8	500	Charging module-master control
M_C_4	Extended state/ fault info upload	009100H	7	8	500+ Trigger	Charging module-master control

8.2 Down-link date

Broadcast mode:

Message mode	Message description	PGN(Hex)	Priority	Data length byte	Message cycle ms	Source address-destination address
C_M_1	Module start/stop	000300H	2	8	Trigger mode	Master control – Charging module
C_M_2	Module parameter setting	000400H	4	8	Trigger mode	Master control – Charging module
C_M_3	Timing command	000500H	6	8	5000 ms	Master control – Charging module
C_M_4	Input mode configuration	00AA00H	6	8	Trigger mode	Master control – Charging module
C_M_12	Address setting selection	009000H	7	8	Trigger mode	Master control – Charging module

To the specific module

Message mode	Message description	PGN(Hex)	Priority	Data length byte	Message cycle ms	Source address-destination address
C_M_23	Module address setting	000900H	6	8	Trigger mode	Master control – Charging module
C_M_24	Specific module start/stop & voltage current setting	000600H	2	8	Trigger mode	Master control – Charging module

9. Format and content of the message

9.1 Up-link data

9.1.1 Charging module state

Starting byte or bit	Length	Definition of SPN	Remarks
1	1 byte	Charging module state	0x00: normal OFF status 0x01: ON status 0x11: fault OFF status
2	2 bytes	Output voltage of charging module	0.1V/ bit, 0V offset, Data range: 0~1100 V
4	2 bytes	Output current of charging module	0.01 A/bit, 0A offset; Data range: 0~200A
6	2 bytes	Fault/alarm Bit = 0, normal Bit = 1, faulty	Bit0: Module input undervoltage Bit1: Module input phase loss Bit2: Module input overvoltage Bit3: Module output overvoltage Bit4: Module output overcurrent Bit5: Module temperature high Bit6: Module fan fault Bit7: Module hardware fault Bit8: Bus exception Bit9: SCI communication exception Bit10: Discharge fault Bit11: PFC shutdown due to exception Bit12: Output undervoltage warning Bit13: Output overvoltage warning Bit14: Power limit due to high

			temperature Bit15: Short circuit fault
8	1 byte	PFC fault Bit = 0, normal Bit = 1, faulty	Bit0: Input overcurrent fault Bit1: Mains frequency fault Bit2: Mains imbalance fault Bit3: DCTz fault Bit4: Address conflict Bit5: Bus bias Bit6: Phase exception fault Bit7: Bus overvoltage fault

Notes: 1. When any one of fault status Bit8-Bit13 occurs, in addition to that corresponding fault bits will be set, Bit7 will be also set.

2. When Bit2 and Bit7 faults among PFC faults occur, in addition to that corresponding fault bits will be set, Bit7 module hardware fault among the fault statuses will be also set.

Example of message:

Message information of No.1 module: shutdown due to fault, output voltage 0V, current 0A; the specific faults are bus bias, PFC exception, hardware fault.

0x1801A001	11	00 00	00 00	80 08	10
	Shutdown due to fault	Voltage 0V	Current 0A	Fault status 0x0880	Bus bias

PFC shutdown due to exception, hardware fault

9.1.2 Confirmation of start/stop and overvoltage/undervoltage settings of a specific module

Be sent when the module receives a specific module start/stop command.

Starting byte or bit	Length	Definition of SPN	Remarks
1	1 byte	Whether the command is received	0x00, not received 0x01, received
2	7 bytes	Standby	0x00

Example of message:

Message information of No.1 module:

0x0802A001 01 00 00 00 00 00 00 00

Command received

9.1.3 Uploading of AC information

Starting byte	Length	Definition of SPN	Remarks
1	2	A-phase voltage	
3	2	B-phase voltage	
5	2	C-phase voltage	
7	2	Ambient temperature	

Example of message:

Message information of No.1 module:

0x180BA001	E5 08	E9 08	D7 08	18 00
	A-phase 0x08E5	B-phase 0x08E9	C-phase 0x08D7	Ambient temperature 0x0018
	227.7 V	228.1 V	226.3 V	24℃

9.1.4 Uploading of extension status/fault information

Starting byte	Length	Definition of SPN	Remarks
1	2 bytes	Module state Bit = 0 No Bit = 1 Yes	Bit0: Current equalization Bit1: Mute Bit2: E2 Fault overflow Bit3: 0 -AC input source,1 -DC input source Bit4:0-E2 fault enabled, 1-E2 fault disabled Bit5:0- hot-plug disabled. 1-hot-plug enabled
3	2 bytes	Fault/warning Bit = 0 normal Bit = 1 faulty	Bit0: Pre-level wave stop Bit1: Hot-plug fault Bit2: CAN communication timeout Bit3: Reserved Bit4: Relay operation fault Bit5: Reserved Bit6: Internal element overtemperature Bit7: Air inlet overtemperature Bit8: Input power limit Bit9: Power limit due to overtemperature Bit10: Discharge changeover abnormal

5	4 bytes	Standby	Reserved

9.2 Down-link data

9.2.1 Module start/stop

Starting byte or bit	Length	Definition of SPN	Remarks
1	3 bytes	Module processing message flag	Bit0: Module with address of 1 0= Do not process the message of this frame. 1= Process the message of this frame. Bit1: Module with address of 2 0= Do not process the message of this frame. 1= Process the message of this frame. Bit2: Module with address of 3 0= Do not process the message of this frame. 1= Process the message of this frame. …
4	1 byte	Module start/stop	55H, stop AAH, start
5	1 byte	Module group number + address multiple	These upper 4 bits refer to the module group number: 0 indicates that the module group number is 1 by default These lower 4 bits refer to the address multiple: 1/time, data range: 0x00~0x09
6	3 bytes	Standby	0x00

Notes: 1. If the address multiple is 0, the message processing flag of the module indicates the address of the module from 1 to 24.

If the address multiple is 1, the message processing flag of the module indicates the address of the module from 25 to 48.

If the address multiple is 2, the message processing flag of the module indicates the address of the module from 49 to 72.

...

2.Address algorithm: Assuming that the actual address of the module is n, the address multiple is m, and the message processing flag of the module is k,

if((k &(1 << (n-m*24-1)))== (1 << (n-m*24-1))) //The address to be set is consistent with the actual address.

{Start/stop}else{addresses are not consistent}

Message issued by the upper computer: Control the start of modules No.1-24 and set the group number as 1

0x0803FFA0	FF FF FF	AA	00	00 00 00
	Address 0xFFFFFF No. 1-24	Start	Group number 1, multiple 1	

9.2.2 Module parameter setting

Starting byte or bit	Length	Definition of SPN	Remarks
1	3 bytes	Module processing message flag	Bit0: Module with address of 1 0= Do not process the message of this frame. 1= Process the message of this frame. Bit1: Module with address of 2 0= Do not process the message of this frame. 1= Process the message of this frame. Bit2: Module with address of 3 0= Do not process the message of this frame. 1= Process the message of this frame. …
4	1 byte	Module group number + address multiple	These upper 4 bits refer to the module group number:0 indicates that the module group number is 1 by default These lower 4 bits refer to the address multiple: 1/time, data range: 0x00~0x09
5	2 bytes	Charging voltage	0.1V/ bit, 0V offset,

			Data range: 0~750V
7	2 bytes	Charging current	0.01 A/bit, 0A offset;
			Data range: 0~500 A

Notes: 1. When the charging voltage issued by the monitor exceeds the maximum voltage that can be output by the module, the module will output the maximum voltage; when the charging voltage issued by the monitor is lower than the minimum voltage output by the module, the module will output the minimum voltage.

2.When the charging current issued by the monitor exceeds the maximum current that can be output by the module, the module will output the maximum current; when the charging current issued by the monitor is lower than the minimum current output by the module, the module will output the minimum current.

Example of message:

Message issued by the upper computer: Set the group number of modules No.1-24 as 1, output voltage 500V, output current 41A

0x1004FFA0	FF FF FF	00	88 13	04 10
	Address 0xFFFFFF	Group number 1, multiple 1	Voltage 0x1388	Current 0x1040
	1-24		500V	41A

9.2.3 Timing command

Starting byte or bit	Length	Definition of SPN	Remarks
1	8 bytes	Standby	0x00

Example of message:

The master control sends a timing command:

0x1805FFA0 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00

9.2.4 Start/stop of a specific module

Starting byte or bit	Length	Definition of SPN	Remarks
1	1 byte	Module start/stop	55H, stop AAH, start
2	1 byte	Charging mode (standby)	In the standby mode: 0x00
3	2 bytes	Charging	0.1V/ bit, 0V offset, data

		voltage	range: 0~1000V
5	2 bytes	Charging current	0.01 A/bit, 0A offset; Data range: 0~500 A
7	2 bytes	Standby	0x00

Example of message:

Message issued by the upper computer: Control the start of No.1 module, output voltage 500V, output current 41A

0x080601A0	AA	00	88 13	04 10	00 00
	Start		Voltage 0x1388	Current 0x1040	
			500V	**41A**	

9.2.5 Module address setting

Starting byte or bit	Length	Definition of SPN	Remarks
1	1 byte	New address of module	1/bit, data range 1~240
2	7 bytes	Standby	0x00

Notes: The module address setting will be stored in the EEPROM and will be stored on power failure

Message issued by the upper computer: set the address of all modules as 2

0x1809FFA0	02	00 00 00 00 00 00 00
	New address 2	

9.2.6 Selection of module address setting

Starting byte	Length	Definition of SPN	Remarks
1	1	Reserved	0: Automatic 1: Manual
2	7	Reserved	

Notes: 1. If the module address setting is selected as “Automatic”, it means that the address will be automatically assigned when the module is powered on; if the module address setting is selected as “Manual”, it means that the address will be set via the upper computer; the module is set as “Automatic” by default.

The module can only receive the module address setting selection command when it is powered off.

Message issued by the upper computer: set the address mode of all modules as “Manual”.

0x1C90FFA0	01	00 00 00 00 00 00 00
	Manual mode	

9.2.7 Input mode configuration

Start Byte	Length	SPN definition	Remark
1	1	Reserved	0:input DC mode 1:input AC mode
2	7	Reserved	

Remark: 1. The module can receive input mode configuration commands only when it is powered off.

The upper computer send the message: set all module input as AC mode

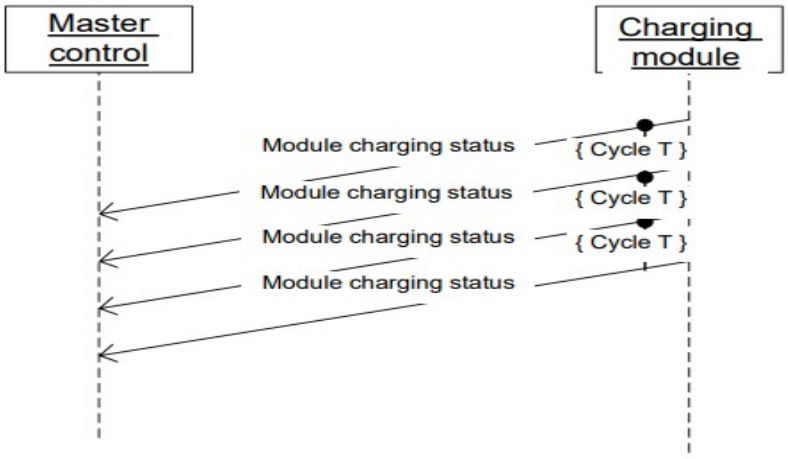
0x18AAFFA0 01 00 00 00 00 00 00 00

Input AC mode

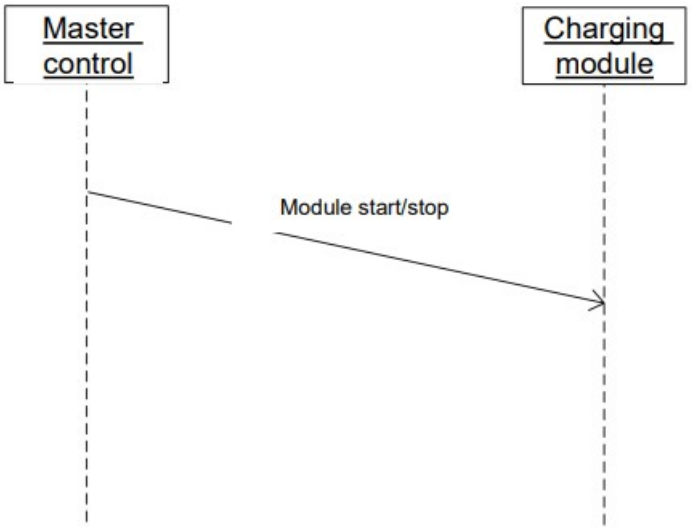
Appendix A

A.1 Data transmission process chart

A.1.1 Module state transmission process

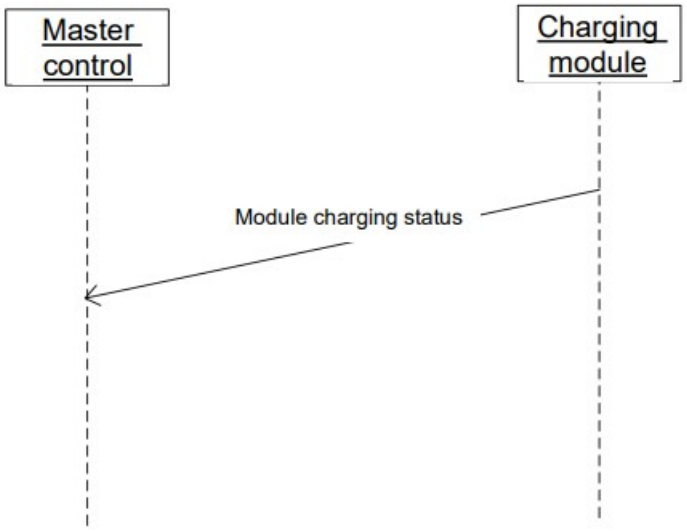


Periodical transmission by charging module

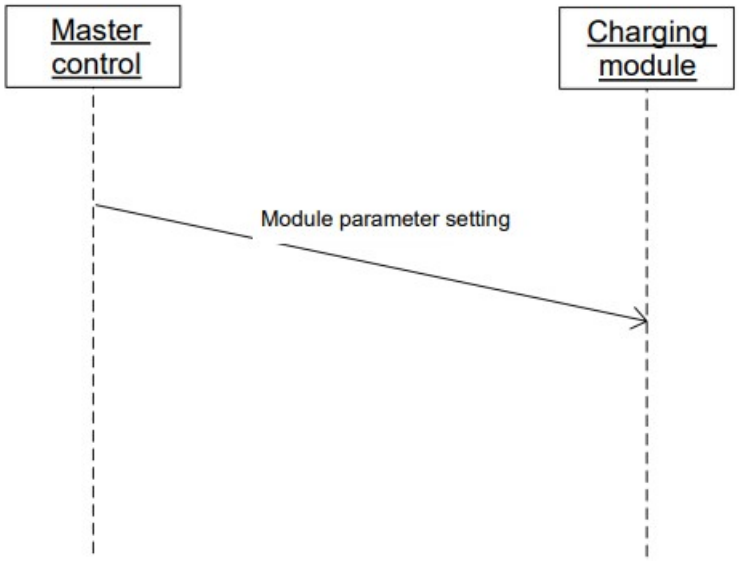


Automatically sent when the status of charging module is changed

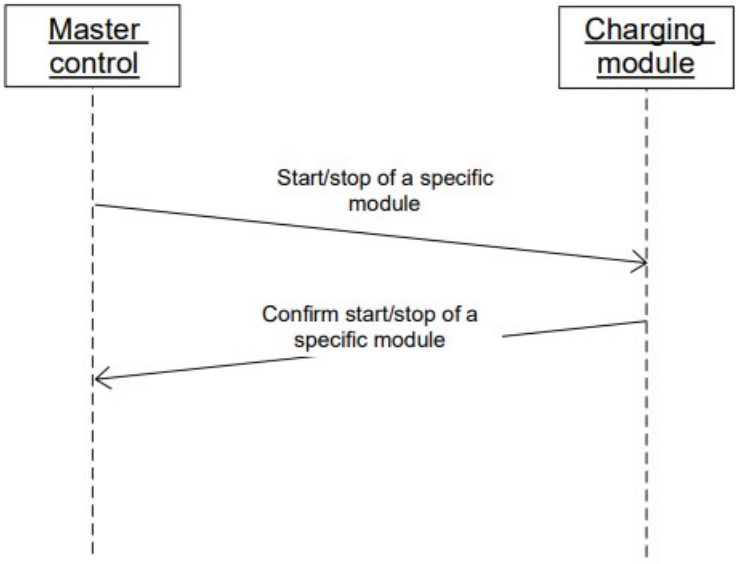
A.1.2 Module start/stop process (broadcast mode)



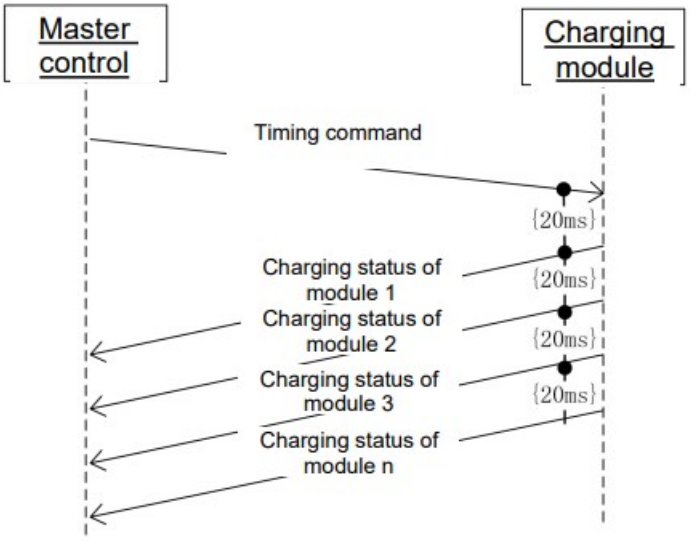
A.1.3 Module parameter setting process



A.1.4 Start/stop (address setting/overvoltage/undervoltage setting) process of a specific module



A.1.5 Timing command



A.2 Application case

A.2.1 Charging module state

Charging state sent by the charging module 1: (400V, 100A, no fault)

1801a001 0x01 0xa0 0x0f 0x10 0x27 0x00 0x00 0x00

A.2.2 Module start/stop

Master control: modules 1-3 start

0803ffa0 0x07 0x00 0x00 0xaa 0x00 0x00 0x00 0x00

A.2.3 Module parameter setting

Master control: Parameter setting of modules 1-3 (400V,100A, constant-voltage charging)

1004ffa0 0x07 0x00 0x00 0x00 0xa0 0x0f 0x10 0x27

A.2.4 Start/stop process of a specific module

Master control: start module 1

080601a0 0xaa 0x01 0xa0 0x0f 0x10 0x27 0x00 0x00

Confirm start/stop of charging module 1

0802a001 0x01 0x00 0x00 0x00 0x00 0x00 0x00 0x00

A.2.5 Timing command

The master control sends a timing command:

1805ffa0 0x00 0x00 0x00 0x00 0x00 0x00 0x00 0x00