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Version-Historie:

Version	Datum	Autor	Änderungen/Bemerkungen
0.1 – 0.10	08.06.2011	Jürgen Mühl	Dokument angelegt
1.00	12.09.2011	Lars Kretschmer	Abstrahieren und Anpassung für Integratoren
1.01	23.09.2011	Jürgen Mühl	Ergänzungen zur Nachricht 0x120
1.02	28.11.2011	Henry Feddern	Translation

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1 Introduction

This document contains the protocol definition of the CAN-Interface for the communication of the fuel cell system (Nexa1200) with an external control unit. This document is seen as part of the “technical documentation” for the previously mentioned control unit and the Fuel Cell System Nexa1200.

2 Protocoldescription

2.1 General Information

The communication of the device is carried out through a CAN-Bus (Controller Area Network) with an advanced implementation of protocol, i.e. the useful information is directly embedded within the OSI-Layer 2 (data back-up layer). In order to denote the content of the messages an 11-Bit Identifier (Base Frame Format) is used. The Bus works with a speed of 500kBaund.

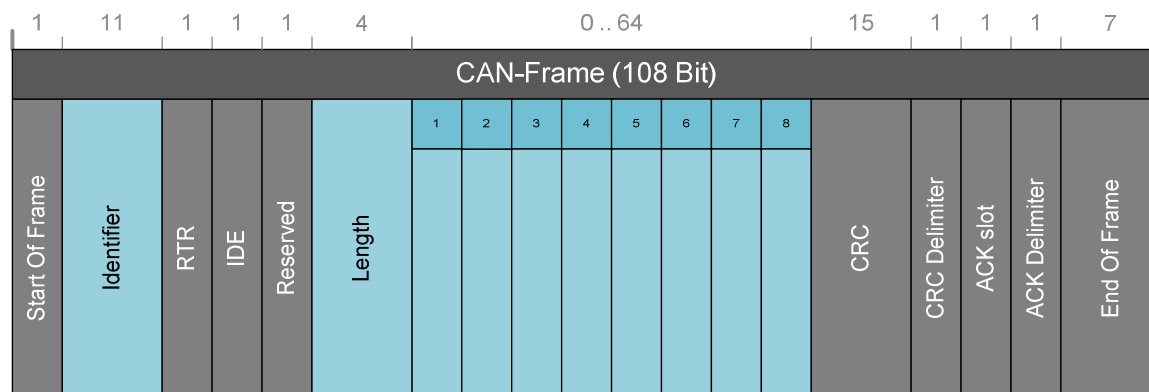


Image 1: CAN-Frame

This document concerns itself solely with the description of the content of a frame with the inscription of the corresponding Identifier and length (the colour highlighted elements in Illustration 1). The Identifier which is used for communication with the Fuel Cell System Nexa1200 can be extracted from the Tables 2-1 and Tab. 2-2. An exact description of the message contents can be found in Chapter

Identifier	Length	T	Content
0x010	8	1s	Version Number of the Firmware
0x100	6	25ms	Tension and Electrical Current of Stack. Electrical Current which is used by the System.
0x110	4	100ms	Temperature of the Stack, H ₂ -Concentration in the discharged Air und Warning Flag
0x120	variable	ACK	Response to 0x520 dependent on the Parameter Code in the 1. Byte
0x200	6	50ms	System temperature, system tension, ambient temperature, Fan control point and primary pressure
0x210	6	50ms	Valve positions and fan rotation speed, fan control point and primary pressure
0x300	7	-	Error-Flag (in the case of an error will only be transmitted once)
0x330	8	ACK / 25ms	Response to Req. 0x550. After a request several messages will be sent in intervals of 25ms in order to communicate the entire error memory. Additional support shall be provided by Heliocentris.

Tab. 2-1 CAN-Identifier, which is transmitted for the operation of the Fuel Cell System.

Identifier	Length	T	Content
0x500	2	acycl.	System Commands for the Operation of the Nexa1200 (Start, Stop, Fault Reset)
0x520	8	acycl.	Command for the read-out of the stack operating time
0x550	4	acycl.	Request to dispatch the Error-Log. Additional Support shall be provided by Heliocentris.

Tab. 2-2 CAN-Identifier, which is transmitted for the operation of the Fuel Cell System.

The following specified CAN ID's are reserved for further components of Heliocentris in the Controller and cannot be used in an integration with the Integrator.

Identifier	Length	T	Content
0x130	1 to 8	ACK	Answer to Request 0x560
0x220	1 to 8	ACK	Answer to Request 0x530
0x240	1 to 8	ACK	Answer to Request 0x540
0x310	1 to 8	ACK	Answer to Request 0x500
0x320	1 to 8	ACK	Answer to Request 0x510
0x700	1 to 8	-	Variable Content: Debug Information

Tab. 2-3 Reserved CAN-Identifier, which is transmitted for the operation of the Fuel Cell System.

Identifier	Length	T	Content
0x510	8	acycl.	Reserved
0x530	8	acycl.	Reserved
0x540	8	acycl.	Reserved
0x550	8	acycl.	Reserved
0x560	8	acycl.	Reserved

Tab. 2-4 Reserved CAN-Identifier, which is transmitted for the operation of the Fuel Cell System.

2.2 Message Definition

2.2.1 Incoming Messages

Description of messages which are sent from an external control unit to a Fuel Cell System (Nexa1200).

Identifier 0x500

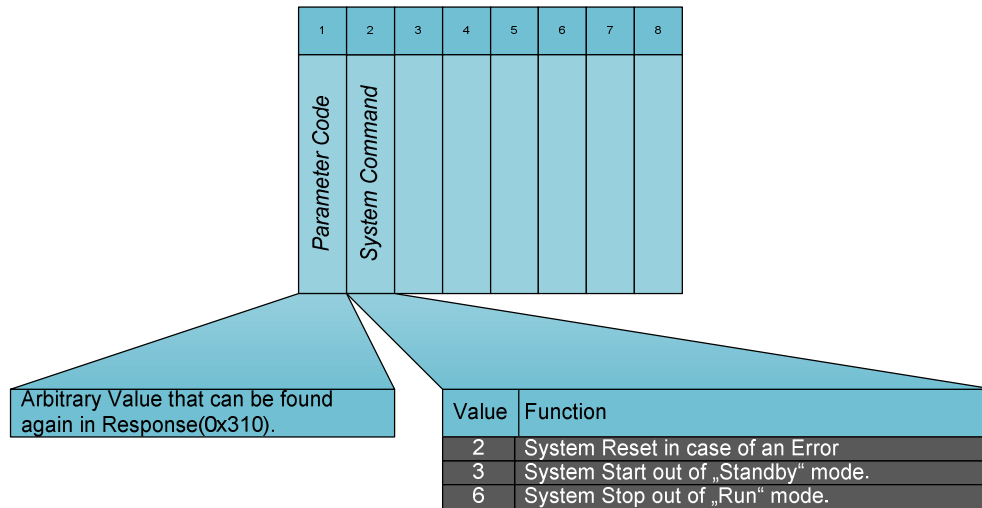


Image 2: Description of the Content of Frame 0x500

Identifier 0x520

The Frame with the Identifier 0x520 serves as a Request in order to read out the Stackhours, - minutes and seconds of the ID 0x120 from the Controller.

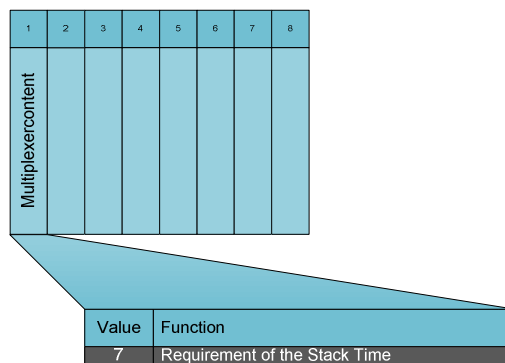


Image 3: Description of the Content of Frame 0x520

The Message with the ID 0x120 is always sent as a response to the message 0x520. Length and content of this message is variable and dependent on Byte0 –Multiplexer- of the Request (0x520). The Multiplexer from 0x520 can be found again in Byte0 of the response. Valid are values between 1 and 7, where as only the value 7 can be used for the Integrator.

Identifier 0x550

With the help of the Identifier 0x550, an external control unit requests the Error-Log of the Nexa1200. It is possible that several controlling units request for the Error-Log, or that during an existing transmission a new request is generated. In order to be able to guarantee an allocation of the transmitted data in accordance with a request, each request will be furnished with a randomly generated Request-ID, which can then be found again in the corresponding response sequence. The

Request-ID can thereby be displayed on a range of values between 1 and 255. Request-IDs of the value "0" will be ignored.

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
Request-ID	Command HB	Command LB	Frame #	Sequence #
ID, which can be found again in the Response. Values between 1-255 are permitted. The message with the Request-ID "0" will be ignored.	Commands 0 .. 3 0 .. Request Initialization (Command to Dispatch a Error-Frame.) 1 .. Resend all (Break off the dispatch sequence with the stated Request-ID and start from the beginning.) 2 .. Resend Frame (Renewed Dispatch of Frames from Byte 4 with the Request-ID from Byte 1.) 3 .. Resend Sequence (Renewed Dispatch of the Sequence Number from Byte 5 of the Frame out of Byte 4 with the Request from Byte 1.)		# 0..N States the Frame that has to be sent by a Frame-Resend-Command.	# 0..N States the Sequence Number that has to be send by a Resend-Sequence-Command.

Tab. 2-5 Description of the data structure of Frame 0x550

! CAUTION! In Version v1.0.5 of the Operational Software of the Fuel Cell System the parallel processing of several connections is not yet supported.

2.2.2 Outgoing Messages

Description of Messages, which are sent from a Fuel Cell System (Nexa1200) to an external control unit.

Identifier 0x100

Das Frame mit dem Identifier 0x100 wird zyklisch alle 25ms gesendet.

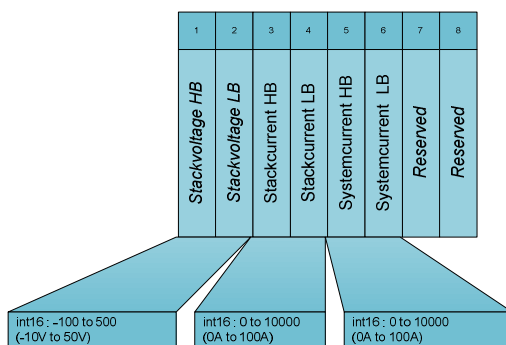


Image 4: Description of the Content of Frame 0x100

Identifier 0x110

The Frame with the Identifier 0x110 is sent cyclically every 100ms.

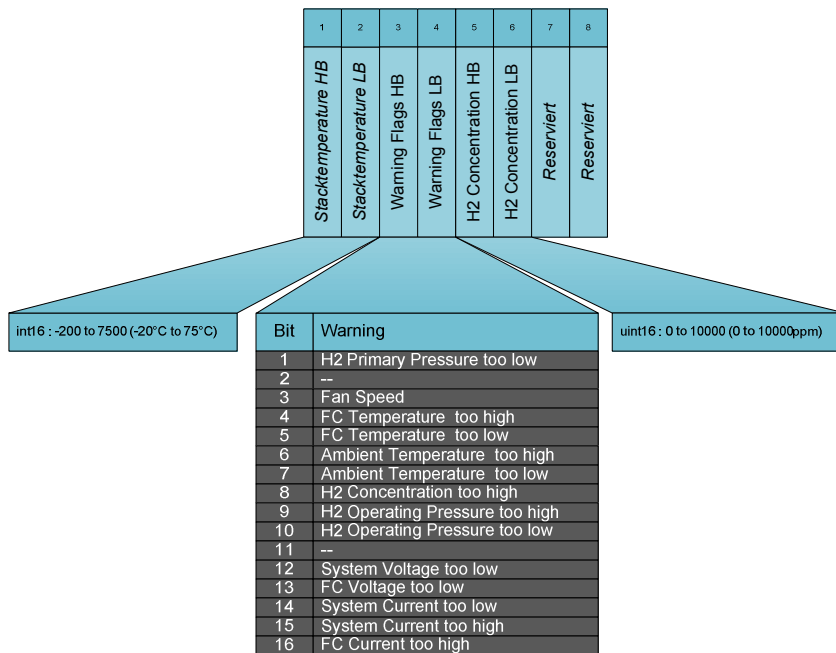


Image 5: Description of the Content of Frame 0x110

Identifier 0x120

The Frame with the Identifier 0x120 is sent on Request the ID 0x520.

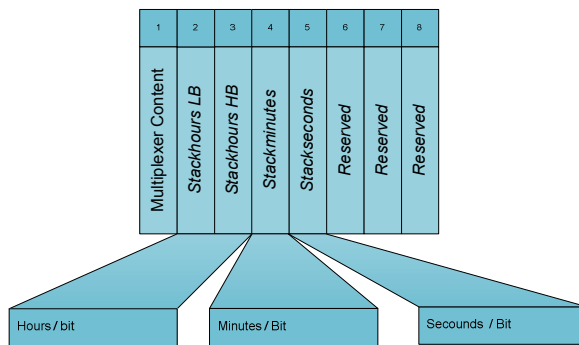


Image 6: Description of the Content of Frame 0x120

The Message with the ID 0x120 will always be sent in response to the Message 0x520. Length and Content of this Message is variable and dependent on Byte0 –Multiplexer- of the Request (0x520). The Multiplexer from 0x520 can also be found in the Byte0 of the Response. Valid are values between 1 and 7, where as the Integrator can only use the Value 7.

Byte0 Multiplexer	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
1	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
2	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
3	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
4	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved

Byte0 Multiplexer	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
5	reserved	reserved	reserved	reserved	reserved	reserved	reserved
6	reserved	reserved	reserved	reserved	reserved	reserved	reserved
7	Stackhours (HB)	Stackhours (LB)	Stack-minutes	Stack-seconds	-	-	-

Tab. 2-6 Description of the Content of Frame 0x120

Identifier 0x200

The Frame with the Identifier 0x200 is sent cyclically every 50ms.

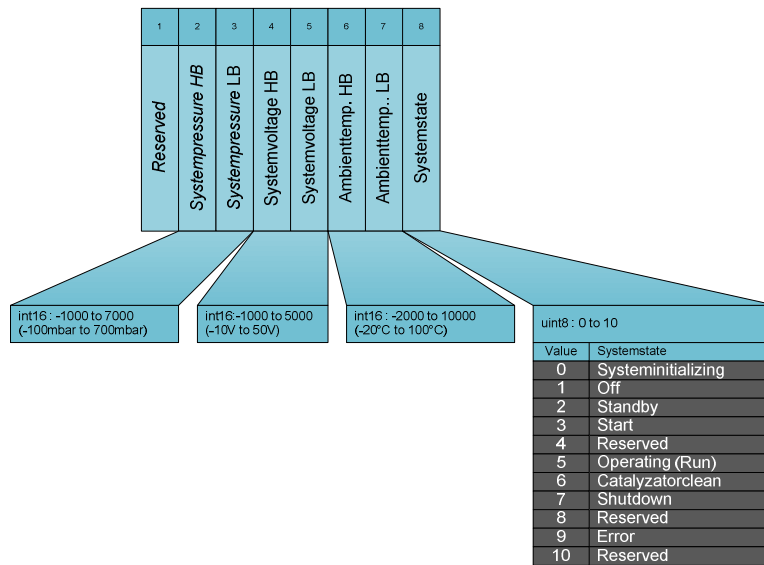


Image 7: Description of the Content of Frame 0x200

Identifier 0x210

The Frame with the Identifier 0x210 is sent cyclically every 50ms.

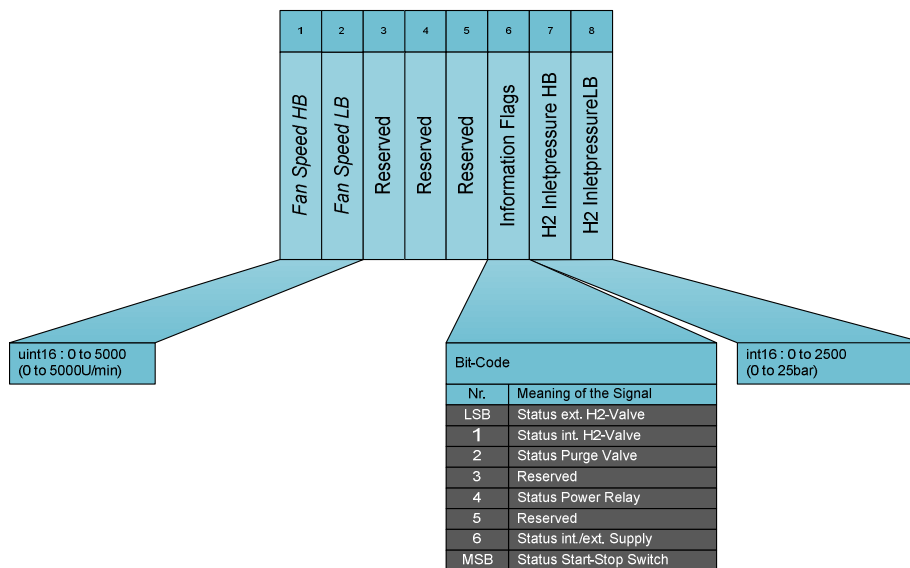


Image 8: Description of the Content of Frame 0x210

Identifier 0x300

The Frame with the Identifier 0x300 contains the Error Messages and is sent once when an error appears.

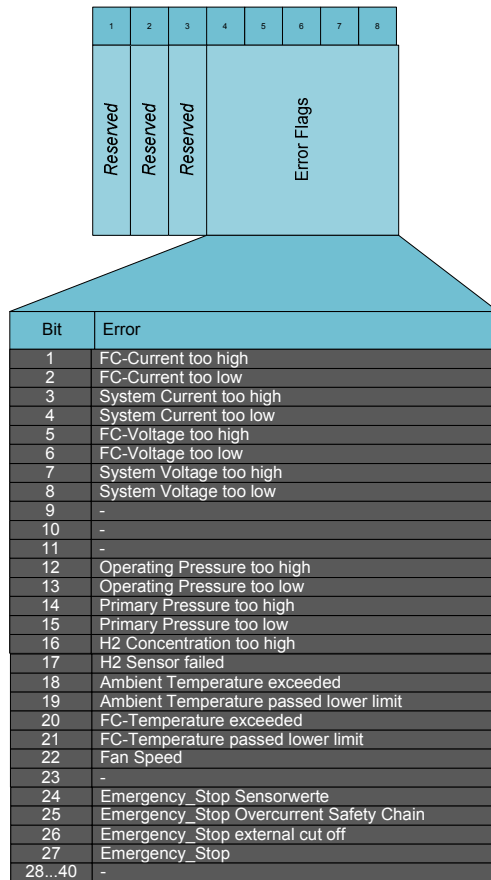


Image 9: Description of the Content of Frame 0x300

Identifier 0x330

The Frame with the Identifier 0x330 is sent after a Request (0x550) every 25ms, until the entire Error Log is transmitted.

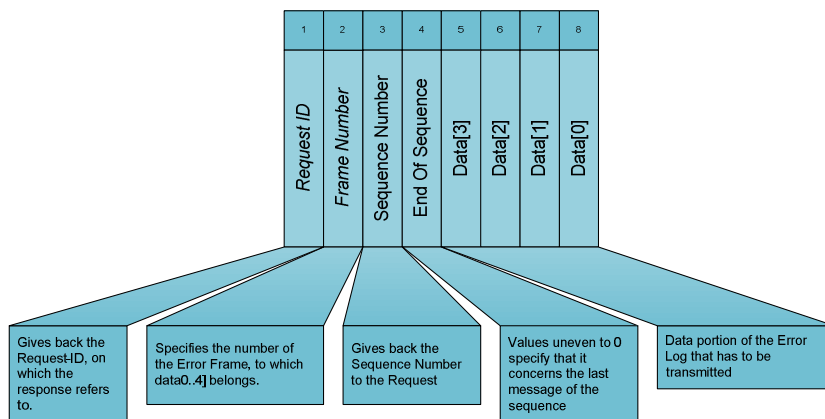


Image 10: Description of the Content of Frame 0x330

The portion of data that begins with Data[0], is written linearly into memory. The process of writing ends when the „End Of Sequence“-Byte is uneven to 0. [Image 11](#) gives an overview of how received data should be organised in memory. How the data should be interpreted, can be learnt from the document „TU_Betriebsführung-v103_H60-0082_Nexa1200_10_3510.pdf“ in the Chapter „Error Logging“.

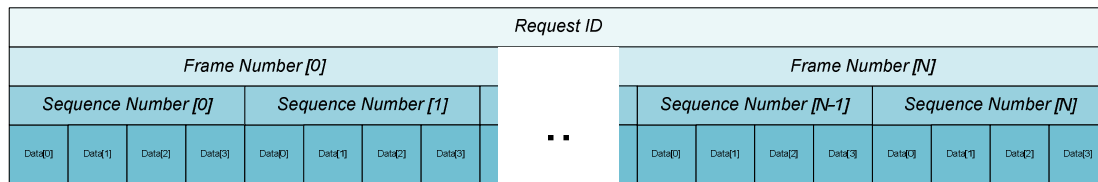


Image 11: Description how the received data of the Error-Log should be organized in memory.

The enumeration of the “Sequence Number” begins in each frame at 0. In order to identify a certain data package, a “Frame Number” and “Sequence Number” are also needed.