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command description XpressNet V3.6 with LAN/USB Interface 23151 Communication on the interfaces

XPressNet Version 3.6

Documentation Version 1.1 02/2012

0 changes

When	What	Where
February 2012	cross-reference corrected	1.2.3

1 General

This documentation contains the XpressNet command description for using the 23151 interface via the serial USB or LAN interface

1.1 USB interface

The USB interface creates a virtual COM port via the supplied driver, which is operated with the following parameters:

- Baud rate: always 57600 bits per second
- 8 data bits, 1 start bit, 1 stop bit, no parity bit
- no handshake

1.2 LAN interface

The interface is equipped with an Ethernet port for use in a network. It allows up to eight connections to other network devices at the same time.

1.2.1connection to a router

The connection is usually made via a router. If a WLAN-enabled router is used, the interface can be accessed via mobile, WLAN-enabled devices.

1.2.2Direct connection to a PC

Direct connection to a PC is also possible using a Xover LAN cable. In this case, the PC must be set to an IP address within the range of the interface, e.g. 192.168.0.201.

1.2.3IP addressing

The interface is set to a fixed IP address by default. This address is:**192.168.0.200**

From my own experience, I would like to point out that the router may need to be set to this address range in order to gain access to the interface. The interface can be set to operate with DHCP. Information on this can be found in the "Information on the LAN-USB Interface 23151" (on the CD included with the device or on the download page "http://www.lenz-elektronik.de/download.php") in the "Web Interface" section. For practical operation, we recommend using a fixed IP.

Subnet mask is 255.255.255.0 The
TCP port used is 5550.
Both the use of DHCP, the set IP and the subnet mask can be changed using the web interface integrated in the device.

1.3 Conventions

Every command sent to the interface must be preceded by the sequence 0xFF 0xFE. This sequence is not included in the calculation of the checksum.

As an example, to send the command "All on" to the interface, the following data must be transmitted:
0xFF 0xFE 0x21 0x81 0xA0

Each command to the interface is acknowledged with a response, this is either the general response
0xFF 0xFE 0x01 0x04 0x05
indicating that the command was successfully sent to the control center, or an error message, or the expected data.
Responses to a command are also always sent with the header 0xFF 0xFE.

Attention: In programming mode it may take up to a minute for a response.

As long as the interface has not acknowledged a command, no further command may be sent to the interface. A new command may only be sent after the timeout has expired (5 seconds in normal operation, 1.5 minutes in programming mode).

If a command has been sent to the interface and it has not yet sent back a response, the next response from the interface is always the command response. Broadcasts that arrive in the interface in the meantime are stored in the interface and only sent to the computer after the command response.

Broadcasts and unexpected messages have the header identifier 0xFF 0xFD in order to be able to clearly distinguish them from command responses.

1.4 Unsolicited information

Unsolicited information is always sent to one or all devices, including the PC, when system statuses need to be made known to all devices so that they can react correctly as quickly as possible. Unsolicited information is either sent as a broadcast if all slaves are to receive it, or formatted as a response if it only concerns a specific slave. It is always characteristic that a slave does not request this information (i.e. does not actually expect it), but still receives it at any time and must react correctly to inputs (locomotive driving commands), for example. Unsolicited information is:

broadcast "Everything On"	(to all participants)
broadcast "Alles Aus"	(to all participants)
Broadcast "All Locomotives Off"	(to all participants)

Broadcast “Programming mode” (to all participants)
Broadcast “Feedback” Broadcast (to all participants)
“Railcom info” Reply “Locomotive (to all participants)
occupied” (to the participant who has the locomotive straight
had access to)
Answer “Double traction occupied” (to the participant who
double traction was just in control)

The responses "Transmission error", "Central station busy", "Double traction error" and "Command not present" are not unsolicited information, as these responses can generally come in response to commands from a slave to the central station. They are therefore linked in time to the command to the central station, even if this does not normally result in a response.

1.5 Responses of the interface 23151

The commands that the PC sends to the control center via the 23151 interface are divided into two areas: firstly, commands that result in a direct response from the control center without processing other XpressNet devices (e.g. locomotive requests, but also broadcasts triggered by the PC!) and secondly, commands that do not result in a response from the control center (e.g. issuing a drive command). However, so that the PC program can assign sent and received data, a response is always sent back to the PC after a command is sent.

The following messages are sent by the interface 23151 as a response to the PC if no other control panel data is available (each in decimal representation):

Frame1	Frame2	header	message	X-Or	Meaning
255	254	01	01	00	The number of bytes specified in the header does not match the number of bytes received
255	254	01	02	03	Error between interface and control center (timeout during data transfer from the interface to the control center)
255	254	01	03	02	unknown error (central station addressed the interface with an acknowledgement request)
255	254	01	04	05	Order is sent to headquarters
255	253	01	05	04	Central unit no longer addresses the interface (x)
255	254	01	06	07	Buffer overflow in interface 23151
255	253	01	07	06	Central addresses the interface again (x)
255	254	01	08	09	Currently no commands can be sent to the control center
255	254	01	09	08	Error in the command parameters (e.g. locomotive address incorrect)
255	254	01	10	11	unknown error (Central did not provide the expected response)

This means:
255 / 254 / 01 / 01 / 00:
The first byte that the PC sends to the 23151 interface determines the number of bytes that will follow. If the PC does not send this number of bytes within a certain time, this message is sent when the timeout is reached. This message often occurs when transmission errors were previously detected.
255 / 254 / 01 / 02 / 03:
The response of the control unit to a command sent to it must also take place within a certain time, otherwise this message is sent to the PC. 255 / 254 / 01 / 03 / 02:

If an error occurs during data transmission to the central unit, the XpressNet device currently being used (Interface 23151) is addressed again and must then send an acknowledgement. The PC receives this information via this. If this occurs repeatedly, the cabling must first be checked. This message that the Interface 23151 has sent an acknowledgement to the central unit should not be confused with the "Transmission error" message, which is sent to the PC and is a response to a previous command.

255 / 254 / 01 / 04 / 05:
Is always sent to the PC when a command that the interface 23151 has sent to the control center has not resulted in a response (eg a locomotive drive command). This means that after sending a command, the control center has addressed the interface again. The message also comes as confirmation that the control center is addressing the interface 23151 again after this was not the case for a certain period of time (after a timeout during addressing). If a command that normally does not result in a control center response results in the response "transmission error", for example, then no command confirmation is sent by the interface 23151.
It should be noted that the PC program (or the 23151 interface) has no way of determining whether a command from the control center has already been placed on the track. The message "Command sent" simply means that the corresponding command was passed on to the control center. If the PC sends a command which results in a broadcast (e.g. "All On"), this is not confirmed with this message because this is a direct control center reaction from the point of view of the triggering device. Example: The PC sends "All On" to the control center, but the system cannot be switched on from the control center. From the point of view of the sending device (the PC), the command "All On" receives the response "All Off". For all other devices this broadcast comes unsolicited. The PC must also examine the content of this control center response in order to determine the success or failure of the sent command (e.g. "All On").
255 / 253 / 01 / 05 / 04:
The control center addresses connected devices at a specific time interval. If this does not happen, this message is sent to the PC. This message comes unsolicited.

255 / 254 / 01 / 06 / 07:
If too much data is sent to the interface without a separation frame (0xFF 0xFE), the input buffer overflows and this message is generated.
255 / 253 / 01 / 07 / 06:
The control panel addresses the interface 23151 again (for example after the programming mode). This message is usually the first message that the interface sends out. This message comes without being asked for.
255 / 254 / 01 / 08 / 09:
This error message is returned by the interface when an attempt is made to send a command while the interface is not addressed by the central unit (for example, while another handheld controller is in programming mode).
255 / 254 / 01 / 09 / 08:
If errors were made in the parameters, the interface 23151 responds with this command. For example, if a DTR greater than 99 was specified. The interface 23151 checks all commands for plausibility.
255 / 254 / 01 / 10 / 11:
If this error message is sent by the interface 23151, it can be assumed that the last command was not understood by the control unit. It is therefore recommended to repeat the last command.

1.6 Determine the version number of the interface 23151

Reading the version number of the Interface 23151 is an action that only takes place between the PC and the Interface 23151. However, the command structure and the associated Interface 23151 response still correspond to the format described in Chapter 2.

Command to read the version and code number:

	Frame1	Frame2	header byte	X-Or-Byte
Binary :	1111 1111	1111 1110	1111 0000	1111 0000
Hex :	0xFF	0xFE	0xF0	0xF0
Dec :	255	254	240	240

Response of interface 23151:

	Frame1	Frame2	header byte	data 1	Data 2	X-Or-Byte
Binary :	1111 1111	1111 1110	0000 0010	VVVV VVVV	CCCC CCCC	X-Or-Byte
Hex :	0xFF	0xFE	0x02	VV	CC	X-Or-Byte
Dec :	255	254	2	VV	CC	X-Or-Byte

Description:

VV indicates the version number of the interface 23151 in hexadecimal BCD representation.
CC indicates the code number of the interface 23151 in hexadecimal BCD representation.
Example:
Response = 0x02 0x30 0x01 0x33
Version number 3.0, code number 01

Special features:

This is the only command that the interface 23151 evaluates itself. Everything that does not correspond to this command is forwarded by the interface 23151 to the control center and its content is not checked.

1.7 Determine and change the device address of the 23151 interface

Reading the version number of the Interface 23151 is an action that only takes place between the PC and the Interface 23151. However, the command structure and the associated Interface 23151 response still correspond to the format described in Chapter 2.

Command to read the device address:

	Frame1	Frame2	header byte data 1	Data2	X-Or-Byte
Binary :	1111 1111	1111 1110	1111 0010	0000 0001	ADR	X-Or-Byte
Hex :	0xFF	0xFE	0xF2	0x01	ADR	X-Or-Byte
Dec :	255	254	242	1	ADR	X-Or-Byte

Response of interface 23151:

	Frame1	Frame2	header byte data 1	Data2	X-Or-Byte
Binary :	1111 1111	1111 1110	1111 0010	0000 0001	ADR	X-Or-Byte
Hex :	0xFF	0xFE	0xF2	0x01	ADR	X-Or-Byte
Dec :	255	254	242	1	ADR	X-Or-Byte

Description:

ADR specifies the XpressNet device address that the interface 23151 should use. The permitted range is between 1 and 31 dec. In the response from the interface 23151, the address to which the device was set can be found in data 2. Usually, the command and response are identical.

Special features:

If the device address is not specified in the range 1 to 31 in the command to the 23151 interface, the 23151 interface responds with its currently set address. This allows the address to be determined without changing it.

2 protocol extensions for operation with the LAN interface

2.1 Interface Status Command

So that the interface knows who to send broadcasts sent by the central station to, it stores information about the LAN devices connected to it. If the interface does not receive any information from a connected LAN device for a certain period of time (timeout), it assumes that the connection has been closed and it does not send any more broadcasts to this device. Each command resets this timeout. If a device wants to maintain the connection even when there are no commands to be sent, the timeout can be reset using the "Interface Status Command".

Command:

	Frame 1	Frame 2	header	Identification	X-OR
Binary	1111 1111	1111 1110	1111 0001	0000 0001	1111 0000
Hex	0xFF	0xFE	0xF1	0x01	0xF0
Dec	255	254	241	1	240

Response from the interface:

	Frame 1	Frame 2	header	Data 1	Data 2	X-OR
Binary	1111 1111	1111 1110	1111 0010	0000 0001	RRRR RRRA	X-OR
Hex	0xFF	0xFE	0xF2	0x01	Data	X-OR
Dec	255	254	242	1	Data	X-OR

Data2:
R: reserved (=0)
A: 1 = Interface receives data from the control center

2.2 XpressNet Version Command

This command can be used to query the supported XpressNet version.
Command:

	Frame 1	Frame 2	header	Identification	X-OR
Binary	1111 1111	1111 1110	1111 0001	0000 0010	1111 0011
Hex	0xFF	0xFE	0xF1	0x02	0xF3
Dec	255	254	241	2	243

Response from the interface:

	Frame 1	Frame 2	header	Data 1	Data 2	X-OR
Binary	1111 1111	1111 1110	1111 0010	0000 0010	VVVVVVVV	X-OR
Hex	0xFF	0xFE	0xF2	0x02	VV	X-OR
Dec	255	254	242	2	VV	X-OR

Data2:
V: the supported XpressNet version, BCD – encoded. Example: VV =
0x36 : Interface supports XpressNet version 3.6

2.3 Available Free Connections

This command can be used to determine how many free LAN connections are provided by the interface.

Command:

	Frame 1	Frame 2	header	Identification	X-OR
Binary	1111 1111	1111 1110	1111 0001	0000 0011	1111 0010
Hex	0xFF	0xFE	0xF1	0x03	0xF2
Dec	255	254	241	3	242

response from the interface

	Frame 1	Frame 2	header	Data 1	Data 2	X-OR
Binary	1111 1111	1111 1110	1111 0010	0000 0011	AAAAAAAAA	X-OR
Hex	0xFF	0xFE	0xF2	0x03	AA	X-OR
Dec	255	254	242	3	AA	X-OR

Data2:
A: Number of free connections in binary format.
Example:
AA = 0x06 means that the interface can provide an additional 6 LAN connections. Only the number of unused and free LAN connections is specified.

3 Data traffic central and PC

3.1 Central to PC

Command structure:

The control center sends data to the interface, which then immediately forwards it to the PC. The data may have been requested by the PC beforehand or it may have arisen due to changes in the system (unsolicited).
A header byte is sent, one to a maximum of 15 data bytes and an X-OR byte. The number of data bytes to follow is entered in the lower nibble of the header byte.

Agreements for the following command descriptions:

N = number of subsequent data bytes (binary and hexadecimal)
GA = device address

The command format is specified in binary, decimal and hexadecimal.

Not all control panels support all commands. This must be taken into account in a PC program to avoid endless loops (see also chapter 3.1.7, command not available).

3.1.1broadcast

The "Broadcast" call group gives the central unit the option of sending information to all slaves at the same time. This includes the PC. A broadcast is sent several times in succession to ensure that every participant can receive it. Some commands to the central unit trigger such a broadcast (e.g. "emergency stop"). A device that triggers a broadcast must ensure that no internal discrepancies arise if it receives this broadcast again immediately afterwards (e.g. if the central unit has been put into programming mode).

3.1.1.1BC "Alles An"

Format:

	Frame1	Frame2	header byte data 1		X-Or-Byte
Binary :	1111 1111	1111 1101	0110 0001	0000 0001	0110 0000
Hex :	0xFF	0xFD	0x61	0x01	0x60
Dec :	255	253	97	1	96

Description:

If the PC sends the command “All On” (see section Device to control center), the broadcast “All On” is sent to inform all participants. This broadcast then corresponds to the actual system status. If, for example, an emergency stop is pending, which is not

can be canceled and a bus participant sends “All On”, the broadcast “All Off” occurs!

Special features:

This call is sent without a request from an XpressNet device. It is unsolicited information.

3.1.1.2BC "Everything Off" (emergency stop)

Format:

	Frame1	Frame2	header byte data 1		X-Or-Byte
Binary :	1111 1111	1111 1101	0110 0001	0000 0000	0110 0001
Hex :	0xFF	0xFD	0x61	0x00	0x61
Dec :	255	253	97	0	97

Description:

The control center sends the information that the track voltage has been switched off and therefore no more switching or driving commands can be sent.

Special features:

This call is sent without a request from an XpressNet device. It is unsolicited information.

3.1.1.3BC "All locomotives off" (emergency stop)

Format:

	Frame1	Frame2	header byte data 1		X-Or-Byte
Binary :	1111 1111	1111 1101	1000 0001	0000 0000	0110 0001
Hex :	0xFF	0xFD	0x81	0x00	0x81
Dec :	255	253	129	0	129

Description:

The central unit sends the information that all locomotives on the track have been stopped by means of a broadcast (on the track side). The track voltage is still present so that switching commands can be sent, but no locomotives will be addressed until everything has been switched on again.

Special features:

This call is sent without a request from an XpressNet device. It is unsolicited information.

3.1.1.4BC "programming mode"

Format:

	Frame1	Frame2	header byte data 1		X-Or-Byte
Binary :	1111 1111	1111 1101	0110 0001	0000 0010	0110 0011
Hex :	0xFF	0xFD	0x61	0x02	0x63
Dec :	255	253	97	2	99

Description:

If this call is sent to all bus devices (including the PC), this is information that programming actions are now running. After this, no XpressNet device will be addressed except the one that triggered the programming action (eg by sending a programming read command to the control center). This means that if the PC has triggered programming mode, it can continue to communicate with the 23151 interface. If another device has triggered programming mode, no command can be sent to the 23151 interface. Programming mode can be cancelled again by the triggering device sending the "All On" command.

Special features:

This call is sent without a request from an XpressNet device. It is unsolicited information.

3.1.1.5BC "Feedback"

Format:

	Frame1	Frame2	header byte data 1	Data 2	Data 3	Data 4	etc.	X-Or-Byte
Binary :	1111 1111	1111 1101	0100 NNNN	ADR_1	DAT_1	ADR_2	DAT2	etc.	X-Or-Byte
Hex :	0xFF	0xFD	0x40 + N						X-Or-Byte
Dec :	255	253	64 + N						X-Or-Byte

Description:

With this call, the central unit informs all slaves that one or more feedback states have changed. The call is only sent if there are changes. At least one address state and a maximum of 7 states are transmitted in a broadcast (one data byte per address, a total of 15 bytes per call without header and X-Or byte). ADR_x and DAT_x have the format described under "Switching information". For example, to correctly display the state of a feedback module, a device must examine the entire content of the broadcast for the desired address.

Special features:

This call is sent without a request from an XpressNet device. It is unsolicited information.

3.1.2programming information

After a programming read command has been issued, the control unit is put into programming mode. With a subsequent result read command, the control unit responds with one of the responses described here. If the control unit is not in programming mode and a result read command has been sent by a slave, the control unit sends the response "Command not present".

3.1.2.1programming info "short circuit"

Format:

	Frame1	Frame2	header byte data 1		X-Or-Byte
Binary :	1111 1111	1111 1110	0110 0001	0001 0010	X-Or-Byte
Hex :	0xFF	0xFE	0x61	0x12	X-Or-Byte
Dec :	255	254	97	18	X-Or-Byte

Description:

A short circuit or too high a current occurred when reading or writing to a receiver on the programming connection of the control center. It can be assumed that a write command to a memory location on the receiver did not write to it or wrote to it incorrectly. Programming should then be aborted with an error message and if data from the receiver was used internally, this should be reset to its original value.

Special features:

No.

3.1.2.2programming info "Data not found"

Format:

	Frame1	Frame2	header byte data 1		X-Or-Byte
Binary :	1111 1111	1111 1110	0110 0001	0001 0011	X-Or-Byte
Hex :	0xFF	0xFE	0x61	0x13	X-Or-Byte
Dec :	255	254	97	19	X-Or-Byte

Description:

There is no receiver on the programming port of the control unit or the receiver is not responding to the control unit's reading attempt. Programming this receiver should be aborted or attempted again.

Special features:

No.

3.1.2.3Programming info "Central Busy"

Format:

	Frame1	Frame2	header byte data 1		X-Or-Byte
Binary :	1111 1111	1111 1110	0110 0001	0001 1111	X-Or-Byte
Hex :	0xFF	0xFE	0x61	0x1f	X-Or-Byte
Dec :	255	254	97	31	X-Or-Byte

Description:

This command is not used up to and including control panel version 3.0. **Special features:**

No.

3.1.2.4Programming info "Central Ready"

Format:

	Frame1	Frame2	header byte data 1		X-Or-Byte
Binary :	1111 1111	1111 1110	0110 0001	0001 0001	X-Or-Byte
Hex :	0xFF	0xFE	0x61	0x11	X-Or-Byte
Dec :	255	254	97	17	X-Or-Byte

Description:

This command is not used up to and including control panel version 3.0. **Special features:**

No.

3.1.2.5programming info "Data 3-byte format"

Format:

	Frame1	Frame2	header byte data 1	Data 2	Data 3	X-Or-Byte
Binary :	1111 1111	1111 1110	0110 0011	0001 0000	EEEE EEEE	DDDD DDDD	X-Or-Byte
Hex :	0xFF	0xFE	0x63	0x10	E	D	X-Or-Byte
Dec :	255	254	99	16	E	D	X-Or-Byte

Description:

This response is only given on request from the slave that put the central unit into programming mode. The EEPROM address (E) and the data read from it (D) are returned. This response is only given in register and page mode!

Special features:

The answer refers to programming actions in register and page mode. However, if a receiver was asked to read CVs and this answer was received, then the receiver cannot handle CV programming (old receiver). For further programming actions, you must now use write and read commands for register and page mode.

3.1.2.6 Programming info "Data 4-byte format" CV 1-255 and CV1024 (new from version 3.6; replaces the same command up to version 3)

Format:

	Frame1	Frame2	header byte data 1		Data 2	Data 3	X-Or-Byte
Binary :	1111 1111	1111 1110	0110 0011	0001 0100	CCCC CCCC	DDDD DDDD	X-Or-Byte
Hex :	0xFF	0xFE	0x63	0x14	C	DAT	X-Or-Byte
Dec :	255	254	99	20	C	DAT	X-Or-Byte

Description:

This response is only given on request from the slave that put the central unit into programming mode. The CV address (C) and the data read from it (D) are returned. This only applies to CV programming of receivers that support this mode.

Assignment value in C <=> CV – addresses:

C	CV
0	1024
1 ... 255	1 ... 255

Special features:

If a receiver is requested to read CVs and this response is received, everything is OK, because the receiver can handle it. However, this response does not necessarily have to be returned when a CV is requested. A device must take this into account and then program the receiver in register or page mode. See 3.1.2.5.

3.1.2.7Programming info "Data 4-byte format" CV256 to CV511 (new from version 3.6)

Format:

	Frame1	Frame2	header byte data 1		Data 2	Data 3	X-Or-Byte
Binary :	1111 1111	1111 1110	0110 0011	0001 0101	CCCC CCCC	DDDD DDDD	X-Or-Byte
Hex :	0xFF	0xFE	0x63	0x15	C	DAT	X-Or-Byte
Dec :	255	254	99	21	C	DAT	X-Or-Byte

Description:

This response is only given on request from the slave that put the central unit into programming mode. The CV address (C) and the data read from it (D) are returned. This only applies to CV programming of receivers that support this mode.

Assignment value in C <=> CV – addresses:

C	CV
0 ... 255	256 ... 511

Special features:

See 3.1.2.6.

3.1.2.8Programming info "Data 4-byte format" CV512 to CV767 (new from version 3.6)

Format:

	Frame1	Frame2	header byte data 1		Data 2	Data 3	X-Or-Byte
Binary :	1111 1111	1111 1110	0110 0011	0001 0110	CCCC CCCC	DDDD DDDD	X-Or-Byte
Hex :	0xFF	0xFE	0x63	0x16	C	DAT	X-Or-Byte
Dec :	255	254	99	22	C	DAT	X-Or-Byte

Description:

This response is only given on request from the slave that put the central unit into programming mode. The CV address (C) and the data read from it (D) are returned. This only applies to CV programming of receivers that support this mode.

Assignment value in C <=> CV – addresses:

C	CV
0 ... 255	512 ... 767

Special features:

See 3.1.2.6.

3.1.2.9Programming info "Data 4-byte format" CV768 to CV1023 (new from version 3.6)

Format:

	Frame1	Frame2	header byte data 1		Data 2	Data 3	X-Or-Byte
Binary :	1111 1111	1111 1110	0110 0011	0001 0111	CCCC CCCC	DDDD DDDD	X-Or-Byte
Hex :	0xFF	0xFE	0x63	0x17	C	DAT	X-Or-Byte
Dec :	255	254	99	23	C	DAT	X-Or-Byte

Description:

This response is only given on request from the slave that put the central unit into programming mode. The CV address (C) and the data read from it (D) are returned. This only applies to CV programming of receivers that support this mode.

Assignment value in C <=> CV – addresses:

C	CV
0 ... 255	768 ... 1023

Special features:

See 3.1.2.6.

3.1.3software version central

Format:

	Frame1	Frame2	header byte	Data 1	Data 2	Data 3	X-Or-Byte
Binary :	1111 1111	1111 1110	0110 0011	0010 0001	OOOO UUUU	IIII IIII	X-Or-Byte
Hex :	0xFF	0xFE	0x63	0x21	O + U	ID	X-Or-Byte
Dec :	255	254	99	33	O + U	ID	X-Or-Byte

Description:

When you request the central software version, you will receive this answer. The version number is hexadecimal coded in upper (OOOO) and lower (UUUU) nibbles.
Example: Data 2 = 0011 0000 = 0x30 : Version 3.0.
In addition, the central unit ID is sent, which has the following meaning: ID =
0x00: LZ 100 – Central
ID = 0x01: LH 200 – Central
ID = 0x02: DPC – Central (Compact and Commander)

Special features:

No.

3.1.4Status Center

Format:

	Frame1	Frame2	header byte	Data 1	Data 2	X-Or-Byte
Binary :	1111 1111	1111 1110	0110 0010	0010 0010	SSSS SSSS	X-Or-Byte
Hex :	0xFF	0xFE	0x62	0x22	S	X-Or-Byte
Dec :	255	254	98	34	S	X-Or-Byte

Description:

When you request the central status, you get the status byte back. This byte is coded bit by bit as follows:

Bit 0: if 1, system in emergency stop
Bit 1: if 1, system in emergency off
Bit 2: Central start mode (0 = manual start, 1 = automatic start) Auto-start: All locomotives start immediately with their settings Manual start: All locomotives have speed 0 and functions off. If 1, then programming
Bit 3: mode is active
Bit 4: reserved
Bit 5: reserved
Bit 6: if 1, then cold start in the control center
Bit 7: if 1, then RAM check error in the control center

Special features:

Not all bits are present in all control centers. If bit 6 and bit 2 are set, the control center does not yet put any data onto the track. Track output only begins when a device sets the start mode to manual or automatic. Before this, the control center sends the "All on" broadcast. Not all control centers support different start modes. So if a device detects "cold start" and "start mode auto", it should only continue in its context (e.g. for controlling locomotives) when it has sent the desired start mode to the control center or an "All on" broadcast has been received. In this case, another XpressNet device has set the start mode. It is therefore sensible to first query the control center status after a device reset and then the locomotive data, etc.

3.1.5transmission error

Format:

	Frame1	Frame2	header byte	Data 1	X-Or-Byte
Binary :	1111 1111	1111 1110	0110 0001	1000 0000	1110 0001
Hex :	0xFF	0xFE	0x61	0x80	0xE1
Dec :	255	254	97	128	225

Description:

The control center sends the response “transmission error” to a device if, due to such an error, the X-Or byte does not work at the control center, ie the X-Or connection of all bytes including the X-Or byte does not become 0.

Special features:

A transmission error usually occurs when the X-Or byte was calculated incorrectly or the hardware handshake was not observed. The cause can also be a buffer overflow of the PC's UART hardware (this is not the send and receive FIFO set up by the driver software). A transmission error usually results in further error messages (PC interface timeout 23151). Even a command that normally does not result in a response and would be acknowledged with 255/254/01/04/05 can deliver this response instead.

3.1.6Busy Central

Format:

	Frame1	Frame2	header byte	Data 1	X-Or-Byte
Binary :	1111 1111	1111 1110	0110 0001	1000 0001	X-Or-Byte
Hex :	0xFF	0xFE	0x61	0x81	X-Or-Byte
Dec :	255	254	97	129	X-Or-Byte

Description:

The central unit sends a "Busy" response to a device when the command cannot be executed at the moment. This essentially means that the command cannot be placed on the track at the moment.

Special features:

The response "Busy" is sent to the PC when, for example, it tries to switch as many points as possible as quickly as possible without waiting to see whether the command has actually been accepted by the central unit. In order to be able to assign the response "Busy", a PC program should be based on the XpressNet process structure in order to be able to repeat the correct command in this situation.

3.1.7Command not available in control center

Format:

	Frame1	Frame2	header byte	data 1	X-Or-Byte
Binary :	1111 1111	1111 1110	0110 0001	1000 0010	X-Or-Byte
Hex :	0xFF	0xFE	0x61	0x82	X-Or-Byte
Dec :	255	254	97	130	X-Or-Byte

Description:

If a command was transmitted correctly but is not included in the command set of the control center, the control center sends this response back. The same applies if commands are not possible from the current context (reading the programming result without the control center being in programming mode).

Special features:

No.

3.1.8switching information

Format:

	Frame1	Frame2	header byte	Data 1	Data 2	X-Or-Byte
Binary :	1111 1111	1111 1110	0100 0010	AAAA AAAA	ITTN ZZZZ	X-Or-Byte
Hex :	0xFF	0xFE	0x42	ADR	ITNZ	X-Or-Byte
Dec :	255	254	66	ADR	ITNZ	X-Or-Byte

Description:

The headquarters sends as Answer on one Inquiry after switching /Feedback information this info. It can contain the status of feedback-capable or non-feedback-capable switches or the status of a feedback receiver. In detail, it means:

Data 1:	AAAA AAAA	For a switch, data 1 is the address of a switch divided by 4 from the value range 0..255. For control units of version 3.0 or earlier, data 1 has the value 0 to 63 = 6 bits. If ADR = 0x00, for example, you have information about switches 0, 1, 2 or 3, ie about switch group 0 (if the identification bits TT identify a switching receiver). For control units of version 3.0 or later, all 8 bits of data 1 are permitted as a group address. This means that 256*4=1024 switches can be queried and switched. For a feedback block, the address can be in the range 0..127 (7 bit address). This is the direct address of the block.
Data 2:	I	The address information is returned in this info as it was sent in the request for switching information from the control center. If the bit = 1, this means that the switching command is still being executed and the switch has not yet reached its end position. Not defined for Feedback blocks, since their inputs are always 0 or 1 and cannot assume an intermediate state. These two bits
Data 2:	TT	represent the identifier of the requested address. The following applies:
	TT = 0 0 :	Address is switching receiver without feedback
	TT = 0 1 :	Address is switching receiver with feedback
	TT = 1 0 :	Address is a feedback module
	TT = 1 1 :	reserved for future use
Data 2:	N	This is the identifier of which nibble of a switch or feedback module it is. N = 0 corresponds to the lower nibble, N = 1 corresponds to the upper nibble. For example, for switch group 0 this means

The lower nibble represents the state of switches 0 and 1 in the 4 status bits Z. The upper nibble represents the state of switches 2 and 3 in the 4 status bits Z.
For a feedback receiver, the lower nibble represents the state of the lower 4 inputs in the 4 status bits Z, the upper nibble represents the state of the upper 4 inputs in the 4 status bits Z. In order to capture all 8 inputs of a feedback module, a request must be sent to the lower nibble and a second request to the upper nibble of the feedback address.

Attention: The nibble bit is only correct if the switch has already been switched once!

Data 3: Z3 Z2 Z1 Z0

The following applies to the state of a switching receiver:

Z1 and Z0 represent the state of the first switch (e.g. switch no. 0 in switch group 0, nibble = 0) in the nibble,

Z3 and Z2 The state of the second switch in the nibble (e.g. switch no. 3 in switch group 0, nibble = 1).

Possible combinations:

Z1	Z0	(first switch in the nibble)
0	0	Switch has not been switched since the control center started or, in the case of switches with feedback capability, no input for the end position is connected.
0	1	The last switching command was “0”, the switch is on the left (this is of course only relative).
1	0	The last switching command was "1", the switch is in the other end position (e.g. right, relative).
1	1	Invalid combination if both limit switches of a switch with feedback capability are active. -> Wiring error?

The same applies to Z3 and Z2 (second switch in the nibble).
For a feedback receiver, the 4 bits Z3..Z0 represent the state of the 4 inputs of the requested nibble.

Special features:

No.

3.1.9 locomotive information

In response to a general locomotive request in the format for version 3.0 or higher (see section 3.2.25, page 46), one of the four responses described below can come. In contrast to earlier versions, the "busy" information is included here. This means that the responses described here do not come as unsolicited information. If a locomotive is taken over by another XpressNet device, this is now communicated via the unsolicited information "locomotive busy" (see 3.1.2). An additional identification byte is also inserted after the header byte, which is used to distinguish between the various commands from central unit version 3.0. The responses described here do not contain the address of the requested locomotive in order to avoid sending unnecessary redundant data over the XpressNet. However, the structure of the XpressNet results in the unique assignment of these responses, because they come directly from a previous request for locomotive data.

3.1.9.1 Locomotive information normal locomotive

This response is always sent if the requested locomotive is not in a multiple/double traction and is not the base address of a multiple traction.

Format:

	Frame1	Frame2	header byte identifier		Data 1	Data 2	Data 3	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0100	0000 BFFF	RVVV VVVV	000F FFFF	FFFF FFFF	X-Or-Byte
Hex :	0xFF	0xFE	0xE4	identifier	speed	F0	F1	X-Or-Byte
Dec :	255	254	228	identifier	speed	F0	F1	X-Or-Byte

Description:

Identifier: Bit3: B=0: Lok is free
B=1: Locomotive is called on another device (occupied)

:

Identifier: FFF Bit2 to Bit0: Identification of the number of speed steps:

Bit2	Bit1	Bit0	
0	0	0	14 gears
0	0	1	27 gears
0	1	0	28 gears
1	0	0	128 gears

Speed: Coding of speed and direction. R=1: forward, R=0: backward.

For 14 speed steps: Coding of bits 3,2,1,0 for the speed:

Bit3	Bit2	Bit1	Bit0	
0	0	0	0	gear 0
0	0	0	1	Locomotive-specific emergency stop. The locomotive stops immediately without the set delay.
0	0	1	0	gear level 1
.	.	.	.	.
1	1	1	1	gear level 14

With 27 gears: Coding of bits 4,3,2,1,0 : Note that bit 4 is the**LSB** the driving level.

Bit3	Bit2	Bit1	Bit0	Bit4 (!)	
0	0	0	0	0	gear 0
0	0	0	0	1	not used!
0	0	0	1	0	Locomotive-specific emergency stop. The locomotive stops without the set Delay immediately.
0	0	0	1	1	not used!
0	0	1	0	0	gear level 1
0	0	1	0	1	gear 2
0	0	1	1	0	gear 3
.	.	.	.	.	
1	1	1	1	0	gear level 27

With 28 speed steps: Coding of bits 4,3,2,1,0 for the speed: Man note that bit4 is the**LSB**the driving level.

Bit3	Bit2	Bit1	Bit0	Bit4 (!)	
0	0	0	0	0	gear 0
0	0	0	0	1	not used!
0	0	0	1	0	Locomotive-specific emergency stop. The locomotive stops without the set Delay immediately.
0	0	0	1	1	not used!
0	0	1	0	0	gear level 1
0	0	1	0	1	gear 2
0	0	1	1	0	gear 3
.	.	.	.	.	
1	1	1	1	0	gear level 27
1	1	1	1	1	gear level 28

With 128 gears:

Bit6	B5	B4	B3	B2	B1	B0	
0	0	0	0	0	0	0	gear 0
0	0	0	0	0	0	1	emergency stop
0	0	0	0	0	1	0	gear level 1
0	0	0	0	0	1	1	gear 2
.	.	.	.	.	.	.	.
1	1	1	1	1	1	1	gear level 126

F0: State of functions 0 to 4. 0 0 0 F0 F4 F3 F2 F1 State of functions
F1: 5 to 12 F12 F11 F10 F9 F8 F7 F6 F5 A 1 means that the function is on.

Special features:

No.

3.1.9.2Functional status F13 to F28 of the requested locomotive (from version 3.6)

	Frame1	Frame2	header byte identifier		Data 1	Data 2	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0011	0101 0010	FFFF FFFF	FFFF FFFF	X-Or-Byte
Hex :	0xFF	0xFE	0xE3	0x52			X-Or-Byte
Dec :	255	254	227	82			X-Or-Byte

Description:

Data1: Contains the state of functions 13 to 20. Fx=1 means function is switched on.
F2 = F20 F19 F18 F17 F16 F15 F14 F13

Data2: Contains the state of functions 21 to 28. Fx=1 means function is switched on.
F3 = F28 F27 F26 F25 F24 F23 F22 F21

Special features:

No.

3.1.9.3Locomotive information Locomotive is in a multiple traction

Format:

	Frame1	Frame2	header byte identifier		Data 1	Data 2	Data 3	Data 4	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0101	0001 BFFF	RVVV VVVV	000F FFFF	FFFF FFFF	MTR	X-Or-Byte
Hex :	0xFF	0xFE	0xE5	identifier	speed	F0	F1	MTR	X-Or-Byte
Dec :	255	254	229	identifier	speed	F0	F1	MTR	X-Or-Byte

Description:

Identifier: Bits 3 to 0 are coded as described in 3.1.9.1. The speed step number indicates the speed step number of the requested locomotive! This can be different from the speed step number of the multiple traction (MTR) in which the locomotive is located.

Speed: The speed byte is coded as described in 3.1.9.1. The speed indicates the speed of the requested locomotive! Coded as described in

F0, F1: 2.1.14.1.

MTR: This is the MTR base address of the requested locomotive.

Special features:

Locomotive driving commands must be sent to the base address, as not all control centers implement this. Function commands must be sent to the locomotive address itself.

3.1.9.4Locomotive information Locomotive address is the base address of a multiple traction

Format:

	Frame1	Frame2	header byte identifier		Data 1	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0010	0010 BFFF	RVVV VVVV	X-Or-Byte
Hex :	0xFF	0xFE	0xE2	identifier	speed	X-Or-Byte
Dec :	255	254	226	identifier	speed	X-Or-Byte

Description:

Identifier: Bits 3 to 0 are coded as described in 3.1.9.1. The speed step number indicates the speed step number of the multiple traction.

Speed: The speed byte is encoded as described in 3.1.9.1. The speed indicates the speed of the MTR.

Special features:

No function commands should be sent to the base address of an MTR.

3.1.9.5Locomotive information Locomotive is in a double traction

Format:

	Frame1	Frame2	Headerbyte	identifier	Data 1	Data 2	Data 3	Data 4	Data 5	X-Or-byte
Binary :	1111 1111	1111 1110	1110 0110	0110 BFFF	RVVV VVVV	000F FFFF	FFFF FFFF	Adr High	Adr Low	X-Or-Byte
Hex :	0xFF	0xFE	0xE6	identifier	speed	F0	F1	UH	AL	X-Or-Byte
Dec :	255	254	230	identifier	speed	F0	F1	UH	AL	X-Or-Byte

Description:

Identifier: Bits 3 to 0 are encoded as described in 3.1.9.1.

Speed: The speed byte is encoded as described in 3.1.9.1.

F0, F1: Coded as described in 3.1.9.1.

UH: High byte of the second locomotive address of the double traction.

AL: Low byte of the second locomotive address of the double traction

For locomotive addresses < 100 the following applies:

High byte of the locomotive address is 0x00 Low byte of the

locomotive address is 0x00 to 0x63 For locomotive addresses

from 100 to 9999 the following applies:

High byte of the locomotive address is: AH = (ADR&0xFF00)+0xC000

Low byte of the locomotive address is: AL = (ADR&0x00FF)

Special features:

This response only occurs if the locomotive was requested in the DTR with the “new” locomotive request command (see 3.2.27).

3.1.10 Locomotive occupied from central version 3.0

Format:

	Frame1	Frame2	header byte identifier		Data 1	Data 2	X-Or-Byte
Binary :	1111 1111	1111 1101	1110 0011	0100 0000	Address High	address Low	X-Or-Byte
Hex :	0xFF	0xFD	0xE3	0x40	UH	AL	X-Or-Byte
Dec :	255	253	227	64	UH	AL	X-Or-Byte

Description:

UH: High byte of the locomotive address.

AL: Low byte of the locomotive address.

For locomotive addresses < 100 the following applies:

High byte of the locomotive address is 0x00 Low byte of the

locomotive address is 0x00 to 0x63 For locomotive addresses

from 100 to 9999 the following applies:

High byte of the locomotive address is: AH = (ADR&0xFF00)+0xC000

Low byte of the locomotive address is: AL = (ADR&0x00FF)

Special features:

This information always comes unsolicited when another XpressNet device has taken over this locomotive.

3.1.11 Function status F0 to F12 of the requested locomotive

From version 3.0 of the LZ100 central unit, this stores additional information about a locomotive, whether its functions should be touch-sensitive or non-touch-sensitive. The track output for this does not change, however. XpressNet devices can, however, extend their functionality in the user interface so that, for example, an assigned function for sounds is only carried out as long as a button is pressed. The command is provided in the central unit so that this property is also retained when a locomotive is taken over.

can be used by another XpressNet device. The associated locomotive address is not sent because the correct assignment is determined by the immediately preceding query for the function status.

Format:

	Frame1	Frame2	header byte identifier	Data 1	Data 2	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0011	0101 0000	000S SSSS	SSSS SSSS	X-Or-Byte
Hex :	0xFF	0xFE	0xE3	0x50	S0	S1	X-Or-Byte
Dec :	255	254	227	80	S0	S1	X-Or-Byte

Description:

S0: Contains the status of functions 0 to 4. Sx=1 means function is momentary.
S0 = 0 0 0 S0 S4 S3 S2 S1

S1: Contains the status of functions 5 to 12. Sx=1 means function is momentary.
S1 = S12 S11 S10 S9 S8 S7 S6 S5

Special features:

No.

3.1.12 Function status F13 to F28 of the requested locomotive (from version 3.6)

	Frame1	Frame2	header byte identifier	Data 1	Data 2	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0100	0101 0001	SSSS SSSS	SSSS SSSS	X-Or-Byte
Hex :	0xFF	0xFE	0xE4	0x51			X-Or-Byte
Dec :	255	254	228	81			X-Or-Byte

Description:

Data1: Contains the status of functions 13 to 20. Sx=1 means function is momentary.
Bits:

7	6	5	4	3	2	1	0
F20	F19	F18	F17	F16	F15	F14	F13

Data2: Contains the status of functions 21 to 28. Sx=1 means function is tentative.
Bits:

7	6	5	4	3	2	1	0
F28	F27	F26	F25	F24	F23	F22	F21

Special features:

No.

3.1.13 locomotive information for address search queries

Format:

	Frame1	Frame2	header byte identifier		Data 1	Data 2	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0011	0011 KKKK	Address High	address Low	X-Or-Byte
Hex :	0xFF	0xFE	0xE3	0x30 + K	UH	AL	X-Or-Byte
Dec :	255	254	227	48 + K	UH	AL	X-Or-Byte

Description:

This response is sent when the XpressNet device has used one of the search queries from 3.2.30. This can be used, for example, to display a selection list of the desired locomotives in the device (next locomotive in a multiple traction, etc.).
The identifier contains the type of locomotive address, which is in Address High / Address Low.

Identifier: KKKK = 0: Normal locomotive in data 1/2 Double traction
KKKK = 1: locomotive in data 1/2 Multiple traction base
KKKK = 2: address in data 1/2 Member of a multiple traction
KKKK = 3: in data 1/2
KKKK = 4: No address found for search query. Data 1/2 = 0x00

AH/AL: The locomotive address is calculated as described in 3.1.10.

Special features:

No.

3.1.14 error messages

The connection arises from the previous command given to the control center, to which the error message refers.

Format:

	Frame1	Frame2	header byte identifier		X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0001	1000 FFFF	X-Or-Byte
Hex :	0xFF	0xFE	0xE1	0x80 + F	X-Or-Byte
Dec :	255	254	225	128 + F	X-Or-Byte

Description:

The 4 error bits are coded as follows:

FFFF = 0001: When assembling a multiple traction, a locomotive is not called up by the assembling device or locomotive 0 is selected.
FFFF = 0010: One of the locomotives of the multiple traction is called up on another device.
FFFF = 0011: One of the locomotives is already involved in another multiple traction or double traction.
FFFF = 0100: The speed of one of the locomotives in the multiple traction is not zero.

FFFF = 0101: The locomotive is not in multiple traction.
FFFF = 0110 The locomotive address is not a multiple traction base address. Deleting
FFFF = 0111: the locomotive is not possible
FFFF = 1000: The central stack is full

Special features:

No.

3.2 PC to central unit

Depending on the desired action, the control unit or the interface 23151 gives the PC the corresponding response.

3.2.1Everything On

Format:

	Frame1	Frame2	header byte	Data 1	X-Or-Byte
Binary :	1111 1111	1111 1110	0010 0001	1000 0001	1010 0000
Hex :	0xFF	0xFE	0x21	0x81	0xA0
Dec :	255	254	33	129	160

Description:

The command causes the control center to switch the voltage on the track back on if it was switched off and to start sending track commands again. This ends an emergency stop, an emergency off or programming operation on the programming track. After switching on successfully, the control center sends the broadcast "All On". See 2.1.4.1.

Special features:

No.

3.2.2All Off (emergency stop)

Format:

	Frame1	Frame2	header byte	Data 1	X-Or-Byte
Binary :	1111 1111	1111 1110	0010 0001	1000 0000	1010 0001
Hex :	0xFF	0xFE	0x21	0x80	0xA1
Dec :	255	254	33	128	161

Description:

The command causes the control center to switch off the voltage on the track. The control center then sends the broadcast “All Off” several times to all bus participants, including the person who gave this command.

Special features:

No.

3.2.3 Stop all locomotives (emergency stop)

Format:

	Frame1	Frame2	header byte	X-Or-Byte
Binary :	1111 1111	1111 1110	1000 0000	1000 0000
Hex :	0xFF	0xFE	0x80	0x80
Dec :	255	254	128	128

Description:

The command causes the central unit to immediately stop all locomotives on the track without their set delay. However, the voltage on the track remains switched on so that, for example, switches can still be switched.

Special features:

No.

3.2.4 Stopping a locomotive (emergency stop for a locomotive)

Format:

	Frame1	Frame2	header byte	data 1	Data 2	X-Or-Byte
Binary :	1111 1111	1111 1110	1001 0010	address High	address Low	X-Or-Byte
Hex :	0xFF	0xFE	0x92	UH	AL	X-Or-Byte
Dec :	255	254	146	UH	AL	X-Or-Byte

Description:

The command causes the central unit to immediately stop only the desired locomotive on the track without its set delay. The voltage on the track remains switched on so that, for example, switches can still be switched and all other locomotives continue to run normally.

Special features:

Locomotives 0 to 9999 can be stopped.
The locomotive address AH/AL is calculated as specified in 3.1.10.

3.2.5Read request programming 3-byte format (register mode)

Format:

	Frame1	Frame2	header byte data 1		Data 2	X-Or-Byte
Binary :	1111 1111	1111 1110	0010 0010	0001 0001	0000 RRRR	X-Or-Byte
Hex :	0xFF	0xFE	0x22	0x11	R	X-Or-Byte
Dec :	255	254	34	17	R	X-Or-Byte

Description:

The command causes the central unit to switch to programming mode and to read the receiver on the programming track in register mode. An attempt is made to read the register specified as 0000 RRRR. Registers 1..8 are permitted.

Special features:

The read request does not result in a response from the central unit! This must be requested explicitly with the "Request programming result" command. Only then can it be determined whether the read command was successful or not and whether the result is in the desired form (register mode).
After issuing a read command, the control unit sends the broadcast “programming mode” to all bus participants and only the device that triggered the programming mode can send further commands to the control unit.

3.2.6Read request programming 4-byte format (CV mode)

Format:

	Frame1	Frame2	header byte data 1		Data 2	X-Or-Byte
Binary :	1111 1111	1111 1110	0010 0010	0001 0101	CCCC CCCC	X-Or-Byte
Hex :	0xFF	0xFE	0x22	0x15	CV	X-Or-Byte
Dec :	255	254	34	21	CV	X-Or-Byte

Description:

The command causes the command station to switch to programming mode and read the receiver on the programming track in CV mode. An attempt is made to read the CV specified with CCCC CCCC.
The range is from 1 to 256, where CV256 is to be sent as 00.

Special features:

This command exists in addition to the command described in 3.2.7. If a control unit from version 3.6 is used, the command returns the value of CV1024 instead of CV256. We therefore recommend using the command described in**3.2.7**described command.

The read request does not result in a response from the control center! This must be explicitly requested with the command “Request programming result”. Only then can it be recognized

whether the read command was successful or not and whether the result is in the desired form (CV mode). If the receiver could not be read in CV mode, the central unit tries in register mode. If this reading action is successful, a result is available for collection in the central unit and the XpressNet device must check this result to see whether it is a CV or register result.

After issuing a read command, the control unit sends the broadcast “programming mode” to all bus participants and only the device that triggered the programming mode can send further commands to the control unit.

3.2.7 Read request programming 4-byte format (CV 1-255 and CV1024) (new from V3.6)

Format:

	Frame1	Frame2	header byte	Data 1	Data 2	X-Or-Byte
Binary :	1111 1111	1111 1110	0010 0010	0001 1000	CCCC CCCC	X-Or-Byte
Hex :	0xFF	0xFE	0x22	0x18	CV	X-Or-Byte
Dec :	255	254	34	24	CV	X-Or-Byte

Description:

The command causes the command station to switch to programming mode and read the receiver on the programming track in CV mode. An attempt is made to read the CV specified with CCCC CCCC.

Assignment value in "Data 2" <=> CV – addresses:

Data 2	CV
0	1024
1 ... 255	1 ... 255

Special features:

This command should always be used on a control panel from version 3.6 onwards; further special features apply as described under 3.2.6.

3.2.8 Read request programming 4-byte format (CV 256-511) (new from V3.6)

Format:

	Frame1	Frame2	header byte	Data 1	Data 2	X-Or-Byte
Binary :	1111 1111	1111 1110	0010 0010	0001 1001	CCCC CCCC	X-Or-Byte
Hex :	0xFF	0xFE	0x22	0x19	CV	X-Or-Byte
Dec :	255	254	34	25	CV	X-Or-Byte

Description:

The command causes the command station to switch to programming mode and read the receiver on the programming track in CV mode. An attempt is made to read the CV specified with CCCC CCCC.

Assignment value in "Data 2" <=> CV – addresses:

Data 2	CV
0 ... 255	256 ... 511

Special features:

As described in 3.2.6.

3.2.9 Read request programming 4-byte format (CV 512-767) (new from V3.6)

Format:

	Frame1	Frame2	header byte	Data 1	Data 2	X-Or-Byte
Binary :	1111 1111	1111 1110	0010 0010	0001 1010	CCCC CCCC	X-Or-Byte
Hex :	0xFF	0xFE	0x22	0x1A	CV	X-Or-Byte
Dec :	255	254	34	26	CV	X-Or-Byte

Description:

The command causes the command station to switch to programming mode and read the receiver on the programming track in CV mode. An attempt is made to read the CV specified with CCCC CCCC.

Assignment value in "Data 2" <=> CV – addresses:

Data 2	CV
0 ... 255	512 ... 767

Special features:

As described in 3.2.6.

3.2.10 Read request programming 4-byte format (CV 768-1023) (new from V3.6)

Format:

	Frame1	Frame2	header byte	Data 1	Data 2	X-Or-Byte
Binary :	1111 1111	1111 1110	0010 0010	0001 1011	CCCC CCCC	X-Or-Byte
Hex :	0xFF	0xFE	0x22	0x1B	CV	X-Or-Byte
Dec :	255	254	34	27	CV	X-Or-Byte

Description:

The command causes the command station to switch to programming mode and read the receiver on the programming track in CV mode. An attempt is made to read the CV specified with CCCC CCCC.

Assignment value in "Data 2" <=> CV – addresses:

Data 2	CV
0 ... 255	768 ... 1023

Special features:

As described in 3.2.6.

3.2.11 Read request programming 3-byte format (page mode)

Format:

	Frame1	Frame2	header byte data 1		Data 2	X-Or-Byte
Binary :	1111 1111	1111 1110	0010 0010	0001 0100	CCCC CCCC	X-Or-Byte
Hex :	0xFF	0xFE	0x22	0x14	CV	X-Or-Byte
Dec :	255	254	34	20	CV	X-Or-Byte

Description:

The command causes the central unit to switch to programming mode and read the receiver on the programming track in page mode. An attempt is made to read the CV specified with CCCC CCCC. The central unit converts the page information to registers (on the track side) and attempts to read the receiver in register mode.

The range is from 1 to 256, where CV256 is to be sent as 00.

Special features:

The read request does not result in a response from the central unit! This must be explicitly requested using the "Request programming result" command. Only then can it be determined whether the read command was successful or not and whether the result is in the desired form (page mode). If a read action is successful, a result is available for collection in the central unit and the XpressNet device must examine this result for its content.
After issuing a read command, the control unit sends the broadcast “programming mode” to all bus participants and only the device that triggered the programming mode can send further commands to the control unit.

3.2.12 Request programming result

Format:

	Frame1	Frame2	header byte	Data 1	X-Or-Byte
Binary :	1111 1111	1111 1110	0010 0001	0001 0000	0011 0001
Hex :	0xFF	0xFE	0x21	0x10	0x31
Dec :	255	254	33	16	49

Description:

The command causes the control unit to send the result of a previous reading action to the XpressNet device. The response is one of the options described in 3.1.2.

Special features:

No.

3.2.13 Write command programming 3-byte format (register mode)

Format:

	Frame1	Frame2	header byte data 1		Data 2	Data 3	X-Or-Byte
Binary :	1111 1111	1111 1110	0010 0011	0001 0010	0000 RRRR	Data	X-Or-Byte
Hex :	0xFF	0xFE	0x23	0x12	R	Data	X-Or-Byte
Dec :	255	254	35	18	R	Data	X-Or-Byte

Description:

The command causes the central unit to switch to programming mode and write the receiver on the programming track in register mode. An attempt is made to write the value in data 3 to the register address in data 2.

The range is registers 1 to 8.

Special features:

Before using a write command, the central unit should be put into programming mode by a read command. There is no control on the part of the XpressNet device as to whether the receiver has understood the programming sequence, except by reading it out again.

3.2.14 Write command programming 4-byte format (CV mode, CV1-256)

Format:

	Frame1	Frame2	header byte data 1		Data 2	Data 3	X-Or-Byte
Binary :	1111 1111	1111 1110	0010 0011	0001 0110	CCCC CCCC	Data	X-Or-Byte
Hex :	0xFF	0xFE	0x23	0x16	CV	Data	X-Or-Byte
Dec :	255	254	35	22	CV	Data	X-Or-Byte

Description:

The command causes the central unit to switch to programming mode and write the receiver, which is on the programming track, in CV mode.

an attempt is made to write the value in data 3 to the CV address in data 2.

The range is CV 1 to 255.

Special features:

This command exists in addition to the command described in 3.2.15. If a control unit from version 3.6 is used, CV1024 is written instead of CV256. We therefore recommend using the command described in 3.2.15.
Before using a write command, the central unit should be put into programming mode using a read command and checked to see whether the receiver can be programmed in CV mode. There is no way for the XpressNet device to check whether the receiver has understood the programming sequence, except by reading it out again.

3.2.15 Write command programming 4-byte format (CV mode, CV 1-255 and CV1024) (new from version 3.6)

Format:

	Frame1	Frame2	header byte data 1		Data 2	Data 3	X-Or-Byte
Binary :	1111 1111	1111 1110	0010 0011	0001 1100	CCCC CCCC	Data	X-Or-Byte
Hex :	0xFF	0xFE	0x23	0x1C	CV	Data	X-Or-Byte
Dec :	255	254	35	28	CV	Data	X-Or-Byte

Description:

The command causes the central unit to switch to programming mode and write the receiver on the programming track in CV mode. An attempt is made to write the value in data 3 to the CV address in data 2.

Assignment value in "Data 2" <=> CV – addresses:

Data 2	CV
0	1024
1 ... 255	1 ... 255

Special features:

Before using a write command, the central unit should be put into programming mode using a read command and checked to see whether the receiver can be programmed in CV mode. There is no way for the XpressNet device to check whether the receiver has understood the programming sequence, except by reading it out again.

3.2.16 Write command programming 4-byte format (CV mode, CV 256-511) (new from version 3.6)

Format:

	Frame1	Frame2	header byte data 1		Data 2	Data 3	X-Or-Byte
Binary :	1111 1111	1111 1110	0010 0011	0001 1101	CCCC CCCC	Data	X-Or-Byte
Hex :	0xFF	0xFE	0x23	0x1D	CV	Data	X-Or-Byte
Dec :	255	254	35	29	CV	Data	X-Or-Byte

Description:

The command causes the central unit to switch to programming mode and write the receiver on the programming track in CV mode. An attempt is made to write the value in data 3 to the CV address in data 2.

Assignment value in "Data 2" <=> CV – addresses:

Data 2	CV
0 ... 255	256 ... 511

Special features:

as 3.2.15.

3.2.17 Write command programming 4-byte format (CV mode, CV 512-767) (new from version 3.6)

Format:

	Frame1	Frame2	header byte data 1		Data 2	Data 3	X-Or-Byte
Binary :	1111 1111	1111 1110	0010 0011	0001 1110	CCCC CCCC	Data	X-Or-Byte
Hex :	0xFF	0xFE	0x23	0x1E	CV	Data	X-Or-Byte
Dec :	255	254	35	30	CV	Data	X-Or-Byte

Description:

The command causes the central unit to switch to programming mode and write the receiver on the programming track in CV mode. An attempt is made to write the value in data 3 to the CV address in data 2.

Assignment value in "Data 2" <=> CV – addresses:

Data 2	CV
0 ... 255	512 ... 767

Special features:

as 3.2.15.

3.2.18 Write command programming 4-byte format (CV mode, CV 768-1023) (new from version 3.6)

Format:

	Frame1	Frame2	header byte data 1		Data 2	Data 3	X-Or-Byte
Binary :	1111 1111	1111 1110	0010 0011	0001 1111	CCCC CCCC	Data	X-Or-Byte
Hex :	0xFF	0xFE	0x23	0x1F	CV	Data	X-Or-Byte
Dec :	255	254	35	31	CV	Data	X-Or-Byte

Description:

The command causes the central unit to switch to programming mode and write the receiver on the programming track in CV mode. An attempt is made to write the value in data 3 to the CV address in data 2.

Assignment value in "Data 2" <=> CV – addresses:

Data 2	CV
0 ... 255	768 ... 1023

Special features:

as 3.2.15.

3.2.19 Write command programming 3-byte format (page mode)

Format:

	Frame1	Frame2	header byte data 1		Data 2	Data 3	X-Or-Byte
Binary :	1111 1111	1111 1110	0010 0011	0001 0111	CCCC CCCC	Data	X-Or-Byte
Hex :	0xFF	0xFE	0x23	0x17	CV	Data	X-Or-Byte
Dec :	255	254	35	23	CV	Data	X-Or-Byte

Description:

The command causes the central unit to switch to programming mode and write the receiver on the programming track in page mode. An attempt is made to write the value in data 3 to the CV address in data 2, whereby the central unit converts the CV to the page to be used and programs the receiver in register mode.

The range is CV 1 to 256, where CV256 must be sent as 0x00.

Special features:

Before using a write command, the central unit should be put into programming mode using a read command and checked to see whether the receiver can be programmed in page mode. There is no way for the XpressNet device to check whether the receiver has understood the programming sequence, except by reading it out again.

3.2.20 Request software version of the control unit

Format:

	Frame1	Frame2	header byte data 1		X-Or-Byte
Binary :	1111 1111	1111 1110	0010 0001	0010 0001	0000 0000
Hex :	0xFF	0xFE	0x21	0x21	0x00
Dec :	255	254	33	33	0

Description:

This command causes the control panel to communicate its software version to the XpressNet device. Depending on the control panel version, the responses are possible as described in 3.1.3.

Special features:

No.

3.2.21 Request status of the headquarters

Format:

	Frame1	Frame2	header byte	Data 1	X-Or-Byte
Binary :	1111 1111	1111 1110	0010 0001	0010 0100	0000 0101
Hex :	0xFF	0xFE	0x21	0x24	0x05
Dec :	255	254	33	36	5

Description:

The request for the central status results in the response described in 3.1.4.

Special features:

No.

3.2.22 Set central start mode

Format:

	Frame1	Frame2	header byte	Data 1	Data 2	X-Or-Byte
Binary :	1111 1111	1111 1110	0010 0010	0010 0010	0000 0M00	X-Or-Byte
Hex :	0xFF	0xFE	0x22	0x22	M	X-Or-Byte
Dec :	255	254	34	34	M	X-Or-Byte

Description:

Sets the start mode of the central unit after reset. M=0: Manual start of all locomotives, M=1: Automatic start of all locomotives with the last speed and function settings.

Special features:

Not all control panels support this command.

3.2.23 Request switching information

Format:

	Frame1	Frame2	header byte	Data 1	Data 2	X-Or-Byte
Binary :	1111 1111	1111 1110	0100 0010	AAAA AAAA	1000 000N	X-Or-Byte
Hex :	0xFF	0xFE	0x42	address	0x80 + N	X-Or-Byte
Dec :	255	254	66	address	128 + N	X-Or-Byte

Description:

Based on this command, the control unit sends the response described in 3.1.8.

Address: For a switching receiver, this is the address of the desired switching output (=switch group) divided by 4. This gives the address a range of 0 to 63 = 6 bits for all versions below 3.0.

As of version 3.0, all 8 bits are permitted for the switch group. This results in a range of 256 (0..255) switch groups. This means that 1024 switches can be switched, whereby switches no. 1..512 can provide feedback, but switches no. 513 to 1024 cannot. For a feedback module, the address is in the range 0 to 127 (=7 bits) and directly indicates the desired module.

N: Identification of the desired nibble. N=0 is the lower nibble, N=1 is the upper nibble.
For switching receivers, a switch group contains 4 switches and the lower nibble designates switches 0 and 1 of the switch group and the upper nibble designates switches no. 2 and 3 of the switch group.

For a feedback block, the lower nibble indicates the state of the first 4 inputs of the feedback block and the upper nibble indicates the state of the upper 4 inputs.

Special features:

Example 1: Switch range 0..255, the state of switch no. 21 is desired. Address: 21 mod 4 = 5, i.e. switch 21 is in switch group 5
Switch group 5 contains switches 20, 21, 22, 23. This means that the nibble bit is 0 (lower nibble).

Example 2: Switch range 0..1023, the state of switch no. 620 is desired. Address: 623 mod 4 = 155, i.e. switch 623 is in switch group 155. Switches 620, 621, 622, 623 are in switch group 155. The nibble bit is therefore 1 (upper nibble).

3.2.24switching command

Format:

	Frame1	Frame2	header byte	Data 1	Data 2	X-Or-Byte
Binary :	1111 1111	1111 1110	0101 0010	AAAA AAAA	1000 DBBD	X-Or-Byte
Hex :	0xFF	0xFE	0x52	address	0x80 + DBBD	X-Or-Byte
Dec :	255	254	82	address	128 + DBBD	X-Or-Byte

Description:

Switching commands can only be given to switching receivers. The address is therefore the switch number / 4 (= switch group). All that remains is to define the offset in the switch group in order to precisely define the desired switch, as well as to select which of the two outputs of this switch is desired and whether this output is to be activated or deactivated. This is done using the 4 bits D1 B1 B0 D2 in data 2.

B1 B0: These are the two LSBs of the switch address that were omitted when dividing by 4.

D1: D1 = 0 means deactivate output. D1 = 1 means activate output.

D2: D2 = 0 means output 1 of the switch is selected. D2 = 1 means output 2 of the switch is selected.

Special features:

For control units with versions lower than 3.0, a range of 0..63 is defined for the switch group. This means that the group address is 6 bits long. From version 3.0 onwards, groups up to 255 can also be used. See also 3.2.23.

3.2.25Request locomotive information

Format:

	Frame1	Frame2	header byte identifier		Data 1	Data 2	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0011	0000 0000	Address High	address Low	X-Or-Byte
Hex :	0xFF	0xFE	0xE3	0x00	UH	AL	X-Or-Byte
Dec :	255	254	227	0	UH	AL	X-Or-Byte

Description:

Locomotives 0 to 9999 can be requested.
The locomotive address AH/AL is calculated as specified in 3.1.10.
The possible answers are described in 3.1.9.

Special features:

No.

3.2.25.1 Request functional status

Format:

	Frame1	Frame2	header byte identifier		Data 1	Data 2	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0011	0000 0111	Address High	address Low	X-Or-Byte
Hex :	0xFF	0xFE	0xE3	0x07	UH	AL	X-Or-Byte
Dec :	255	254	227	7	UH	AL	X-Or-Byte

Description:

Gets the functional status F0 to F12 as momentary or non-momentary.
The locomotives 0 to 9999 can be requested.
The locomotive address AH/AL is calculated as specified in 3.1.10.
The possible answers are described in 3.1.11.

Special features:

No.

3.2.25.2 Request function status F13 – F28 (new from central version 3.6)

Format:

	Frame1	Frame2	header byte identifier		Data 1	Data 2	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0011	0000 1000	Address High	address Low	X-Or-Byte
Hex :	0xFF	0xFE	0xE3	0x08	UH	AL	X-Or-Byte
Dec :	255	254	227	8	UH	AL	X-Or-Byte

Description:

Gets the function status F13 to F28 as momentary or non-momentary.
The locomotives 0 to 9999 can be requested.
The locomotive address AH/AL is calculated as specified in 3.1.10.
The possible answers are described in 3.1.12.

Special features:

No.

3.2.25.3 Request functional status F13 – F28 (new from central control unit version 3.6)

Format:

	Frame1	Frame2	header byte identifier		Data 1	Data 2	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0011	0000 1001	Address High	address Low	X-Or-Byte
Hex :	0xFF	0xFE	0xE3	0x09	UH	AL	X-Or-Byte
Dec :	255	254	227	9	UH	AL	X-Or-Byte

Description:

Gets the functional status of functions F13 to F28.
Locomotives 0 to 9999 can be queried.
The locomotive address AH/AL is calculated as specified in 3.1.10.
The possible answers are described in 3.1.9.2.

Special features:

No.

3.2.26 control the locomotive

3.2.26.1 driving commands

The driving command for a locomotive is divided into 4 different options, which are assigned to the speed levels 14, 27, 28 and 128. This is achieved by the different identifiers. The speed itself is coded for 14, 27 and 28 speed levels as described under 3.1.9.1 "Locomotive information for normal locomotives". The speed for 128 speed levels as described under 3.1.9.1.

Driving command 14 speed levels:

Format:

	Frame1	Frame2	header byte	identifier	Data 1	Data 2	Data 3	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0100	0001 0000	address High	address Low	R000 VVVV	X-Or-Byte
Hex :	0xFF	0xFE	0xE4	0x10	UH	AL	RV	X-Or-Byte
Dec :	255	254	228	16	UH	AL	RV	X-Or-Byte

Driving command 27 speed levels:

Format:

	Frame1	Frame2	header byte	identifier	Data 1	Data 2	Data 3	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0100	0001 0001	address High	address Low	R00V VVVV	X-Or-Byte
Hex :	0xFF	0xFE	0xE4	0x11	UH	AL	RV	X-Or-Byte
Dec :	255	254	228	17	UH	AL	RV	X-Or-Byte

Driving command 28 speed levels:

Format:

	Frame1	Frame2	header byte	identifier	Data 1	Data 2	Data 3	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0100	0001 0010	address High	address Low	R00V VVVV	X-Or-Byte
Hex :	0xFF	0xFE	0xE4	0x12	UH	AL	RV	X-Or-Byte
Dec :	255	254	228	18	UH	AL	RV	X-Or-Byte

Driving command 128 speed steps:

Format:

	Frame1	Frame2	header byte	identifier	Data 1	Data 2	Data 3	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0100	0001 0011	address High	address Low	RVVV VVVV	X-Or-Byte
Hex :	0xFF	0xFE	0xE4	0x13	UH	AL	RV	X-Or-Byte
Dec :	255	254	228	19	UH	AL	RV	X-Or-Byte

Description:

The travel command for version 3 control units only contains the speed and direction information. The functions are set separately.
Locomotives 0 to 9999 can be controlled.
The locomotive address AH/AL is calculated as specified in 3.1.10.

Special features:

No.

3.2.26.2 Function commands from central version 3.0 / version 3.6

The function commands for a locomotive are divided into 3 different options, which are assigned to the functions of group 1 (F0..F4), group 2 (F5..F8), group 3 (F9..F12), group 4 (F13...F20) (from V3.6) and group 5 (F21...F28) (from V3.6). This is achieved by the different identifiers.

Function command group 1:

Format:

	Frame1	Frame2	header byte	identifier	Data 1	Data 2	Data 3	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0100	0010 0000	address High	address Low	000F FFFF	X-Or-Byte
Hex :	0xFF	0xFE	0xE4	0x20	UH	AL	Group 1	X-Or-Byte
Dec :	255	254	228	32	UH	AL	Group 1	X-Or-Byte

The following applies to the functions:

Data 3: 0 0 0 F0 F4 F3 F2 F1 If Fx=1, the function is on, otherwise off.

Function command group 2:

Format:

	Frame1	Frame2	header byte	identifier	Data 1	Data 2	Data 3	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0100	0010 0001	address High	address Low	0000 FFFF	X-Or-Byte
Hex :	0xFF	0xFE	0xE4	0x21	UH	AL	Group 2	X-Or-Byte
Dec :	255	254	228	33	UH	AL	Group 2	X-Or-Byte

The following applies to the functions:

Data 3: 0 0 0 0 F8 F7 F6 F5 If Fx=1, the function is on, otherwise off.

Function command group 3:

Format:

	Frame1	Frame2	header byte	identifier	Data 1	Data 2	Data 3	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0100	0010 0010	address High	address Low	0000 FFFF	X-Or-Byte
Hex :	0xFF	0xFE	0xE4	0x22	UH	AL	Group 3	X-Or-Byte
Dec :	255	254	228	34	UH	AL	Group 3	X-Or-Byte

The following applies to the functions:

Data 3: 0 0 0 0 F12 F11 F10 F9 If Fx=1, the function is on, otherwise off.

Function command group 4 (new from version 3.6):

Format:

	Frame1	Frame2	header byte	identifier	Data 1	Data 2	Data 3	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0100	0010 0011	address High	address Low	0000 FFFF	X-Or-Byte
Hex :	0xFF	0xFE	0xE4	0x23	UH	AL	Group 4	X-Or-Byte
Dec :	255	254	228	35	UH	AL	Group 4	X-Or-Byte

The following applies to the functions:

Data 3: F20 F19 F18 F17 F16 F15 F14 F13 If Fx=1, the function is on, otherwise off..

Function command group 5 (new from version 3.6):

Format:

	Frame1	Frame2	header byte identifier		Data 1	Data 2	Data 3	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0100	0010 1000	address High	address Low	0000 FFFF	X-Or-Byte
Hex :	0xFF	0xFE	0xE4	0x28	UH	AL	Group 5	X-Or-Byte
Dec :	255	254	228	40	UH	AL	Group 5	X-Or-Byte

The following applies to the functions:

Data 3: F28 F27 F26 F25 F24 F23 F22 F21 If Fx=1, the function is on, otherwise off..

Description:

The following applies to the

functions: Group 1: 0 0 0 F0 F4 F3 F2 F1 0 0 If Fx=1, the function is on, otherwise off.

Group 2: 0 0 F8 F7 F6 F5 0 0 0 0

Group 3: F12 F11 F10 F9

The locomotives 0 to 9999 can be addressed.
The locomotive address AH/AL is calculated as specified in 3.1.10.

Special features:

No.

3.2.26.3 set function status

3.2.26.4 Set function status from central version 3.0 / version 3.6

The LZ100 central unit from version 3.0 saves the status of its functions as touch-sensitive or non-touch-sensitive for each locomotive address. XpressNet devices can query this status and design their user interface accordingly. This functionality is primarily intended for sounds.
As with the functions, Group 1, Group 2 and Group 3 are distinguished by the identifier.
In version 3.6, group 4 (F13...20) and group 5 (F21...F28) have been added.

Set function status group 1:

Format:

	Frame1	Frame2	header byte	identifier	Data 1	Data 2	Data 3	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0100	0010 0100	address High	address Low	000S SSSS	X-Or-Byte
Hex :	0xFF	0xFE	0xE4	0x24	UH	AL	Group 1	X-Or-Byte
Dec :	255	254	228	36	UH	AL	Group 1	X-Or-Byte

The following applies to the functions:

Data 3: 0 0 0 S0 S4 S3 S2 S1 not. If Sx=1, the function is tentative, otherwise

Set function status group 2:

Format:

	Frame1	Frame2	header byte	identifier	Data 1	Data 2	Data 3	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0100	0010 0101	address High	address Low	0000 SSSS	X-Or-Byte
Hex :	0xFF	0xFE	0xE4	0x25	UH	AL	Group 2	X-Or-Byte
Dec :	255	254	228	37	UH	AL	Group 2	X-Or-Byte

The following applies to the functions:

Data 3: 0 0 0 0 S8 S7 S6 S5 not. If Sx=1, the function is tentative, otherwise

Set function status group 3:

Format:

	Frame1	Frame2	header byte	identifier	Data 1	Data 2	Data 3	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0100	0010 0110	address High	address Low	0000 SSSS	X-Or-Byte
Hex :	0xFF	0xFE	0xE4	0x26	UH	AL	Group 3	X-Or-Byte
Dec :	255	254	228	38	UH	AL	Group 3	X-Or-Byte

The following applies to the functions:

Data 3: 0 0 0 0 S12 S11 S10 S9 not. If Sx=1, the function is tentative, otherwise

Set function status group 4 (from version 3.6):

Format:

	Frame1	Frame2	header byte	identifier	Data 1	Data 2	Data 3	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0100	0010 0111	address High	address Low	0000 SSSS	X-Or-Byte
Hex :	0xFF	0xFE	0xE4	0x27	UH	AL	Group 4	X-Or-Byte
Dec :	255	254	228	39	UH	AL	Group 4	X-Or-Byte

The following applies to the functions:

Data 3: S20 S19 S18 S17 S16 S15 S14 S13 If Sx=1, the function tentative, otherwise not.

Set function status group 5 (from version 3.6):

Format:

	Frame1	Frame2	header byte identifier		Data 1	Data 2	Data 3	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0100	0010 1100	address High	address Low	0000 SSSS	X-Or-Byte
Hex :	0xFF	0xFE	0xE4	0x2C	UH	AL	Group 5	X-Or-Byte
Dec :	255	254	228	44	UH	AL	Group 5	X-Or-Byte

The following applies to the functions:

Data 3: S20 S19 S18 S17 S16 S15 S14 S13 If Sx=1, the function tentative, otherwise not.

3.2.26.5 Set function refresh mode from central version 3.6

Function refresh means the cyclical repetition of function data on the track. From central control unit version 3.6 onwards, it is possible to set which function data is refreshed. The factory setting is to refresh functions 0 to 8.

Format:

	Frame1	Frame2	header byte identifier		Data 1	Data 2	Data 3	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0101	0010 1111	address High	address Low	refresh mode	X-Or-Byte
Hex :	0xFF	0xFE	0xE5	0x2F	UH	AL	RF	X-Or-Byte
Dec :	255	254	228	47	UH	AL	RF	X-Or-Byte

For data 3 (refresh mode) the following applies:

Value	Refresh for
0	F0 ... F4
1	F0 ... F8
3	F0 ... F12
7	F0 ... F20
0xF	F0 ... F28

Description:

The following applies to the functions: Group 1: 0 0 0 S0 S4 S3 S2 S1 If Sx=1, the function is tentative, otherwise not.
Group 2: 0 0 0 0 S8 S7 S6 S5 0 0 0
Group 3: 0 S12 S11 S10 S9

The locomotives 0 to 9999 can be addressed.
The locomotive address AH/AL is calculated as specified in 3.1.10.

Special features:

No.

3.2.27double traction

3.2.27.1 Install double traction

Format:

	Frame1	Frame2	header byte identifier		Data 1	Data 2	Data 3	Data 4	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0101	0100 0011	Adr High 1	Adr Low 1	Adr. High 2	Adr Low 2	X-Or-Byte
Hex :	0xFF	0xFE	0xE5	0x43	AH1	AL1	AH 2	AL 2	X-Or-Byte
Dec :	255	254	229	67	AH1	AL1	AH 2	AL 2	X-Or-Byte

Description:

The locomotives in data 1/2 and data 3/4 are combined in the control center to form a double traction, which means that a drive command to one of the locomotives is also sent to the other by the control center.
The locomotive addresses AH/AL are calculated as specified in 3.1.10.
If the installation fails, the control unit sends one of the error messages described under 3.1.14.

Special features:

The command replaces the old double traction commands, the in later Central versions are no longer supported.

3.2.27.2 eliminate double traction

Format:

	Frame1	Frame2	header byte identifier		Data 1	Data 2	Data 3	Data 4	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0101	0100 0011	Adr High 1	Adr Low 1	0000 0000	0000 0000	X-Or-Byte
Hex :	0xFF	0xFE	0xE5	0x43	AH1	AL1	0x00	0x00	X-Or-Byte
Dec :	255	254	229	67	AH1	AL1	0x00	0x00	X-Or-Byte

Description:

The locomotive in data 1/2 is removed from the double traction in which it is integrated. This also removes the double traction in the control center.
The command station can recognize that this is a DTR resolution by the second locomotive address, which is 0 in this case.
The locomotive address AH/AL is calculated as specified under 2.1.15.
If the resolution fails, the control center sends one of the error messages described under 3.1.14.

Special features:

no

3.2.28Programming on Main

Programming on Main means that CVs of a receiver can be changed while the locomotive is on the normal track. A programming track is not necessary in this case. However, the address of a receiver cannot be changed with this, as this must be used in the programming command.
Control panels that do not support Programming on Main send “Command not present” to the XpressNet device.
In contrast to programming on the programming track, CVs 1..1024 are possible here, but XpressNet devices should not allow CVs that result in an address change, because then a receiver would no longer be able to listen to data packets sent later if it evaluates the transmission (which is not allowed).

3.2.28.1 Writing Programming on Main Byte

Format:

	Frame1	Frame2	Header Byte	Identifier	Data 1	Data 2	Data 3	Data 4	Data 5	X-Or-byte
Binary:	1111 1111	1111 1110	1110 0110	0011 0000	address High	address Low	1110 11CC	CCCC CCCC	DDDD DDDD	X-Or-byte
Hex :	0xFF	0xFE	0xE6	0x30	UH	AL	0xEC + C	CV	D	X-Or-byte
Dec :	255	254	230	48	UH	AL	236 + C	CV	D	X-Or-byte

Description:

Data 1 and Data 2 specify the locomotive address from 1..9999 to which the byte programming refers.
The locomotive address AH/AL is calculated as specified in 3.1.10.
Since CVs from 0..1023 are possible (=10 bits), the upper 2 bits (MSB s) are written to data 3. The rest of the CV address (the 8 LSBs) are in data 4. The value of this CV to be programmed is in data 5.
The CV address is sent as it appears on the track, i.e. decremented by one.

Special features:

No CVs should be used that refer to recipient addresses.

3.2.28.2 Programming on Main Byte reading (from version 3.6)

Format:

	Frame1	Frame2	Header Byte	Identifier	Data 1	Data 2	Data 3	Data 4	Data 5	X-Or-Byte
Binary:	1111 1111	1111 1110	1110 0110	0011 0000	address High	address Low	1110 01CC	CCCC CCCC	DDDD DDDD	X-Or-Byte
Hex :	0xFF	0xFE	0xE6	0x30	UH	AL	0xEA + C	CV	D	X-Or-Byte
Dec :	255	254	230	48	UH	AL	234 + C	CV	D	X-Or-Byte

Description:

Data 1 and Data 2 specify the locomotive address from 1..9999 to which the byte programming refers.
The locomotive address AH/AL is calculated as specified in 3.1.10.
Since CVs from 0..1023 are possible (=10 bits), the upper 2 bits (MSB s) are written to data 3. The rest of the CV address (the 8 LSBs) are in data 4. The value of this CV to be programmed is in data 5.
The CV address is sent as it appears on the track, i.e. decremented by one.

Special features:

No CVs should be used that refer to recipient addresses.

3.2.28.3 Writing Programming on Main Bit

Format:

	Frame1	Frame2	Header Byte	Identifier	Data 1	Data 2	Data 3	Data 4	Data 5	X-Or-byte
Binary:	1111 1111	1111 1110	1110 0110	0011 0000	address High	address Low	1110 10CC	CCCC CCCC	1111 WBBB	X-Or-Byte
Hex :	0xFF	0xFE	0xE6	0x30	UH	AL	0xE8 + C	CV	WB	X-Or-Byte
Dec :	255	254	230	48	UH	AL	232 + C	CV	WB	X-Or-Byte

Description:

Data 1 and Data 2 specify the locomotive address from 1..9999 to which the bit programming refers.
The locomotive address AH/AL is calculated as specified in 3.1.10.
Since CV ś from 0..1023 are possible (=10 bits), the upper 2 bits (MSB s) are written to data 3. The rest of the CV address (the 8 LSBs) are in data 4. The bit value to be programmed is in data 5 and is calculated as follows:
W is the bit value 0 or 1.
The bits B2, B1, B0 indicate the position of the bit in the CV (bit position 0 to bit position 7).
The CV address is sent as it appears on the track, i.e. decremented by one.

Special features:

No CVs should be used that refer to recipient addresses.

3.2.29multiple tractions

3.2.29.1 Add a locomotive to a multiple traction or create an MTR

A locomotive can be added to a multiple traction train (MTR) if it is not already included in any other MTR. If this locomotive is the first locomotive, an MTR is automatically created.
In addition, the insertion direction can be defined so that a locomotive can sit the "wrong" way around in an MTR but still travel in the correct direction. This is decided by a bit in the identifier (R).

Format:

	Frame1	Frame2	header byte identifier e		Data 1	Data 2	Data 3	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0100	0100 000R	address High	Address Low	MTR	X-Or-Byte
Hex :	0xFF	0xFE	0xE4	0x40 + R	UH	AL	MTR	X-Or-Byte
Dec :	255	254	228	64 + R	UH	AL	MTR	X-Or-Byte

Description:

R: R = 0 means that the locomotive is not inserted inverted into the MTR. This means that the

MTR moves forward, the locomotive also moves forward.

R =1 means that the direction of travel of the locomotive is inverted.

Data 1 and data 2 specify the locomotive address from 1..9999 that is to be inserted into the MTR. The locomotive address AH/AL is calculated as specified in 3.1.10.

MTR: This is the MTR base address in the range 1 to 99.

Special features:

By definition, a locomotive cannot be inserted into a multiple traction that has the same address.

3.2.29.2 Remove locomotive from a multiple traction or delete MTR

A locomotive can be removed from an MTR if it is a member of this MTR. When the last locomotive from an MTR is removed, the MTR is also deleted from the central station.

Format:

	Frame1	Frame2	header byte identifier e		Data 1	Data 2	Data 3	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0100	0100 0010	address High	Address Low	MTR	X-Or-Byte
Hex :	0xFF	0xFE	0xE4	0x42	UH	AL	MTR	X-Or-Byte
Dec :	255	254	228	66	UH	AL	MTR	X-Or-Byte

Description:

Data 1 and Data 2 specify the locomotive address from 1..9999 that is to be removed from the MTR.
The locomotive address AH/AL is calculated as specified in 3.1.10.
MTR: This is the base address or MTR address in the range 1 to 99 under which the

Multiple traction can be used. **Special**

features:

No.

3.2.30address search commands

Due to the introduction of multiple traction and extended stack handling in the control centers, it has become necessary for XpressNet devices to also search for locomotive addresses in order to achieve a comfortable user interface.

3.2.30.1 Address request member of a multiple traction

The distinction between forward and backward search is made via the identifier.

Format:

	Frame1	Frame2	header byte identifier e		Data 1	Data 2	Data 3	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0100	0000 00RR	MTR	address High	Address Low	X-Or-Byte
Hex :	0xFF	0xFE	0xE4	0x01 + R	MTR	UH	AL	X-Or-Byte
Dec :	255	254	228	1 + R	MTR	UH	AL	X-Or-Byte

Description:

In order to have quick access to the locomotives in an MTR, e.g. to be able to switch functions, the central unit supplies the next address that follows the requested one (forward search) or precedes it (backward search) based on this request.
For central units version 3.x only the forward search is defined.
Identifier = 0x01: (RR=01) means forward search

Identifier = 0x02: (RR=10) means reverse search
Data 1 specifies the MTR base address in the range 1..99 to which the search refers.

Data 2 and data 3 specify the locomotive address from 1..9999 for which the following or previous address is to be searched.
The locomotive address AH/AL is calculated as specified in 3.1.10.
MTR: This is the base address or MTR address in the range 1 to 99 under which the multiple traction can be driven.
The result of the search is sent to the device in the response as described in 3.1.13.

Special features:

No.

3.2.30.2 Address request multiple traction

The distinction between forward and backward search is made via the identifier.

Format:

	Frame1	Frame2	header byte identifier e		Data 1	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0010	0000 0RRR	MTR	X-Or-Byte
Hex :	0xFF	0xFE	0xE2	0x03 + R	MTR	X-Or-Byte
Dec :	255	254	226	3 + R	MTR	X-Or-Byte

Description:

This command causes the central unit to send the XpressNet device the next base address of an MTR that follows (forward search) or precedes (backward search) the requested MTR.
For central units version 3.x only the forward search is defined.
Identifier = 0x03: (RRR=011) means forward search
Identifier = 0x04: (RRR=100) means backward search
MTR: This is the base address or MTR address in the range 1 to 99 under which the multiple traction can be driven.
The result of the search is sent to the device in the response as described in 3.1.13.

Special features:

No.

3.2.30.3 Address request locomotive in central stack

The distinction between forward and backward search is made via the identifier.

Format:

	Frame1	Frame2	header byte identifier e		Data 1	Data 2	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0011	0000 01RR	address High	Address Low	X-Or-Byte
Hex :	0xFF	0xFE	0xE3	0x05 + R	UH	AL	X-Or-Byte
Dec :	255	254	227	5 + R	UH	AL	X-Or-Byte

Description:

The locomotive address that is stored in the central unit stack behind (forward search) or in front of the locomotive address (backward search) in data 1/2 is sent to the XpressNet device. For central units version 3.x, only the forward search is defined.
Identifier = 0x05: (RR=01) means forward search
Identifier = 0x06: (RR=10) means backward search
Data 1 and data 2 specify the locomotive address from 0..9999 for which the following or previous address is to be searched. The locomotive address AH/AL is calculated as specified in 3.1.10.
The result of the search is sent to the device in the response as described in 3.1.13.

Special features:

No.

3.2.31 Delete locomotive from central stack

Format:

	Frame1	Frame2	header byte identifier e		Data 1	Data 2	X-Or-Byte
Binary :	1111 1111	1111 1110	1110 0011	0100 0100	address High	Address Low	X-Or-Byte
Hex :	0xFF	0xFE	0xE3	0x44	UH	AL	X-Or-Byte
Dec :	255	254	227	68	UH	AL	X-Or-Byte

Description:

Data 1 and Data 2 specify the locomotive address from 1..9999, which is to be deleted in the central stack.
The locomotive address AH/AL is calculated as specified in 3.1.10.

Special features:

The problem that the central stack is full occurs especially in centrals with low hardware equipment, which then cannot process all locomotives ever called up with all

can store data. The central stack is used to send the data from these locomotives to the track.
The XpressNet device that deleted the locomotive in the stack should ensure that it can continue working with another locomotive so that the deletion is successful. Otherwise, the locomotive that was just deleted would be added again immediately.

4 Command overview central unit to PC

The exact meaning of the respective data bytes is described in the corresponding chapters. N in the header byte indicates the number of the following data bytes.

command	Frame1	Frame2	header	Data1	Data2	data3	data4	data5	data6	data7
BC Alles An	0xFF	0xFD	0x61	0x01	0x60					
BC Alles Aus	0xFF	0xFD	0x61	0x00	0x61					
BC All Locomotives Off	0xFF	0xFD	0x81	0x00	0x81					
BC programming mode	0xFF	0xFD	0x61	0x02	0x63					
BC feedback	0xFF	0xFD	0x40 + N	ADR_1	DAT_1	ADR_2	DAT2	etc.	etc.	X-Or
P-Info short circuit	0xFF	0xFE	0x61	0x12	X-Or					
P-Info No data	0xFF	0xFE	0x61	0x13	X-Or					
P-Info Busy	0xFF	0xFE	0x61	0x1f	X-Or					
P-Info ready	0xFF	0xFE	0x61	0x11	X-Or					
P-Info data 3 bytes	0xFF	0xFE	0x63	0x10	EE	DAT	X-Or			
P-Info CV1-255 and 1024	0xFF	0xFE	0x63	0x14	CV	DAT	X-Or			
P-Info CV256 - 511	0xFF	0xFE	0x63	0x15	CV	DAT	X-Or			
P-Info CV512 - 767	0xFF	0xFE	0x63	0x16	CV	DAT	X-Or			
P-Info CV768 - 1023	0xFF	0xFE	0x63	0x17	CV	DAT	X-Or			
software version	0xFF	0xFE	0x63	0x21	DAT1	DAT2	X-Or			
Status Center	0xFF	0xFE	0x62	0x22	DAT	X-Or				
transmission error	0xFF	0xFE	0x61	0x80	X-Or					
Busy Central	0xFF	0xFE	0x61	0x81	X-Or					
Command not available	0xFF	0xFE	0x61	0x82	X-Or					
switching information	0xFF	0xFE	0x42	ADR	DAT	X-Or				
Normal locomotive information	0xFF	0xFE	0xE4	identifier	speed	FKT0	FKT1	X-Or		
F-state F13 ... F28	0xFF	0xFE	0xE3	0x52	F 13-20	F 21-28	X-Or			
MTR member	0xFF	0xFE	0xE5	identifier	speed	FKT0	FKT1	MTR	X-Or	
MTR base address	0xFF	0xFE	0xE2	identifier	speed	X-Or				
Locomotive is in DTR	0xFF	0xFE	0xE6	identifier	speed	FKT0	FKT1	ADR High	ADR Low	X-Or
locomotive occupied	0xFF	0xFD	0xE3	0x40	ADR High	ADR Low	X-Or			
functional status	0xFF	0xFE	0xE3	0x50	STAT 0	STAT 1	X-Or			
F-status F13 to 28	0xFF	0xFE	0xE4	0x51	STAT 2	STAT 3	X-Or			
locomotive search result	0xFF	0xFE	0xE3	0x30 + K	ADR High	ADR Low	X-Or			
DTR error	0xFF	0xFE	0x61	0x80 + F	X-Or					
Error message	0xFF	0xFE	0xE1	0x80 + F	X-Or					

5 Command overview PC to control center

The meaning of the respective data bytes is described in the corresponding chapters.

command	Frame1	Frame2	header	Kennung	Data1	Data2	data3	data4	data5	data6
Everything On	0xFF	0xFE	0x21	0x81	0xA0					
Everything's Over	0xFF	0xFE	0x21	0x80	0xA1					
Stop all locomotives	0xFF	0xFE	0x80	0x80						
Stopping a locomotive	0xFF	0xFE	0x92	ADR High	ADR Low	X-Or				
Prog.-Reading Register	0xFF	0xFE	0x22	0x11	REG	X-Or				
Prog.-Reading CV	0xFF	0xFE	0x22	0x15	CV	X-Or				
Prog.-Read CV1-255; 1024	0xFF	0xFE	0x22	0x18	CV low	X-Or				
Prog.-Read CV256-511	0xFF	0xFE	0x22	0x19	CV low	X-Or				
Prog.-Reading CV512-767	0xFF	0xFE	0x22	0x1A	CV low	X-Or				
Prog.-Reading CV768-1023	0xFF	0xFE	0x22	0x1B	CV low	X-Or				
Prog.-Reading Paging	0xFF	0xFE	0x22	0x14	CV	X-Or				
Request program result	0xFF	0xFE	0x21	0x10	0x31					
Prog.-Schreiben Register	0xFF	0xFE	0x23	0x12	REG	DAT	X-Or			
Prog.-Letter CV	0xFF	0xFE	0x23	0x16	CV	DAT	X-Or			
Prog.-Schr. CV1-255; 1024	0xFF	0xFE	0x23	0x1C	CV low	DAT	X-Or			
program script CV256-511	0xFF	0xFE	0x23	0x1D	CV low	DAT	X-Or			
program code CV512-767	0xFF	0xFE	0x23	0x1E	CV low	DAT	X-Or			
program script CV768-1023	0xFF	0xFE	0x23	0x1F	CV low	DAT	X-Or			
Programming Paging	0xFF	0xFE	0x23	0x17	CV	DAT	X-Or			
Request software version	0xFF	0xFE	0x21	0x21	0x00					
Request Status Headquarters	0xFF	0xFE	0x21	0x24	0x05					
Request switching information	0xFF	0xFE	0x42	ADR	Nibble	X-Or				
switching command	0xFF	0xFE	0x52	ADR	DAT	X-Or				
Request locomotive data	0xFF	0xFE	0xE3	0x00	ADR High	ADR Low	X-Or			
Request Fkt status	0xFF	0xFE	0xE3	0x07	ADR High	ADR Low	X-Or			
Fkt-Status anf. F13-F28	0xFF	0xFE	0xE3	0x08	ADR High	ADR Low	X-Or			
Fkt-Status anf. F13-F28	0xFF	0xFE	0xE3	0x09	ADR High	ADR Low	X-Or			
locomotive driving command	0xFF	0xFE	0xE4	identifier	ADR High	ADR Low	speed	X-Or		
Lok function command	0xFF	0xFE	0xE4	identifier	ADR High	ADR Low	group	X-Or		
set function status	0xFF	0xFE	0xE4	identifier	ADR High	ADR Low	group	X-Or		
Set Func.refresh mode	0xFF	0xFE	0xE5	0x2F	ADR High	ADR Low	mode	X-Or		
set function status	0xFF	0xFE	0xE4	identifier	ADR High	ADR Low	group	X-Or		
DTR commands	0xFF	0xFE	0xE5	0x43	ADR1 H	ADR1 L	ADR2 H	ADR2 L	X-Or	
Write Prog. on Main Byte	0xFF	0xFE	0xE6	0x30	ADR High	ADR Low	0xEC + C	CV	DAT	X-Or
Prog. on Main Byte read	0xFF	0xFE	0xE6	0x30	ADR High	ADR Low	0xEA + C	CV	DAT	X-Or
Prog. on Main Bit	0xFF	0xFE	0xE6	0x30	ADR High	ADR Low	0xE8 + C	CV	DAT	X-Or
Add locomotive to MTR	0xFF	0xFE	0xE4	0x40 + R	ADR High	ADR Low	MTR	X-Or		
Remove locomotive from MTR	0xFF	0xFE	0xE4	0x42	ADR High	ADR Low	MTR	X-Or		
Address search Lok in Mtr	0xFF	0xFE	0xE4	0x01 + R	MTR	ADR High	ADR Low	X-Or		

Address Search MTR	0xFF	0xFE	0xE2	0x03 + R	MTR	X-Or				
Stack Search Lok	0xFF	0xFE	0xE3	0x05 + R	ADR High	ADR Low	X-Or			
Delete locomotive from stack	0xFF	0xFE	0xE3	0x44	ADR High	ADR Low	X-Or			