BMW I-bus

Information on instrument bus of BMW cars of series E38, E39 and E46. All information without guarantee and intended for private use!

New! About this theme can be written in the forum. For questions and problems I ask in the forum to seek help.

Software

I-bus analysis program (IBus Analyser 1.0.11)

Contents

ECUs in the vehicle series E39 (BMW 5 series)

On vehicles of model series E39 of the car manufacturer BMW used similar bus systems under other via the communication bus for networking the individual control units eigesetzt. The K-bus is a communication bus and belongs to the fieldbuses. A common application is the diagnostic communication in vehicles. The physical layer uses the K-Bus ISO 9141st It is a simple serial UART communication that can be used for s maximum data rate of 20 kbit /.

In this vehicle there are three major networks of ECUs. There are summarized respectively the control units performing similar tasks. Below certain control devices other small networks to connect the sensors and actuators to the control unit. An example is the automatic climate control. The associated adjusting elements of the air distribution flap are linked via the M-bus.

The controllers with security responsibilities are networked with others via CAN bus. Some of these are also (in addition eg for diagnostic purposes) connected via D-Bus or K-bus, but the CAN bus has priority. This engine and transmission control and ABS control not of disturbances on the D / K / I-buses are affected.

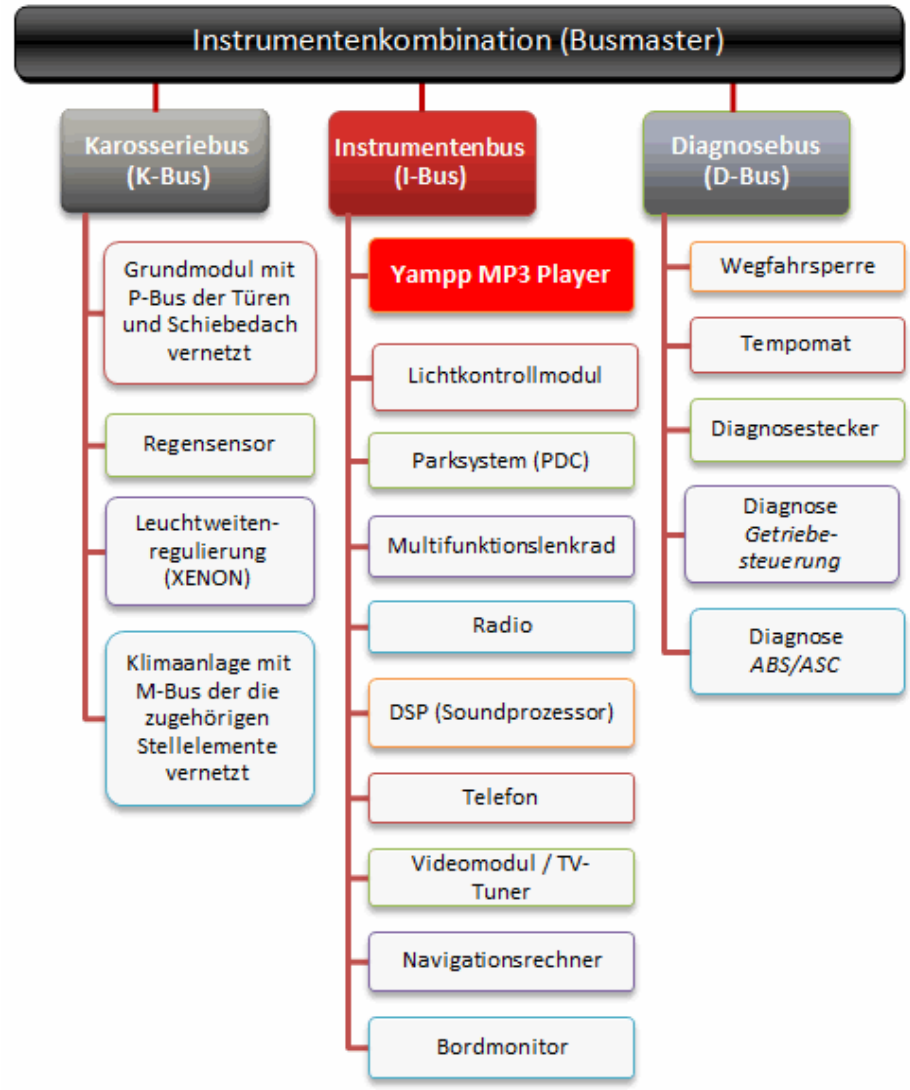


Fig ducation 1.1: Topology of ECU networks in the BMW E39

The graph shows the three networks with each clustered controllers. The MP3 player is coupled to the instrumentation and replace or emulate the CD changer. There are only shown the ECU the vehicle used in the project are installed.

Conversion of the I-bus (K-Bus ISO 9141) to RS232 standard

The bus operates at volume levels that are defined relative to the battery voltage (approximately 12 V) of the vehicle and for a logic 0 (low) and 0-30% for a logical 1 (high) 70 to 100% of the battery voltage, respectively.

The I bus is active low. The logical "1" is transmitted when the bus from the H level (idle status) is drawn for a short time at low level. The transmission is controlled by the bus speed, and the level. Low and high corresponds to 1 corresponds to 0, at a defined duration of one bit.

About special integrated circuits, the level of the I-bus can be adapted to the RS232 standard. The corresponding bus drivers are available from various manufacturers.

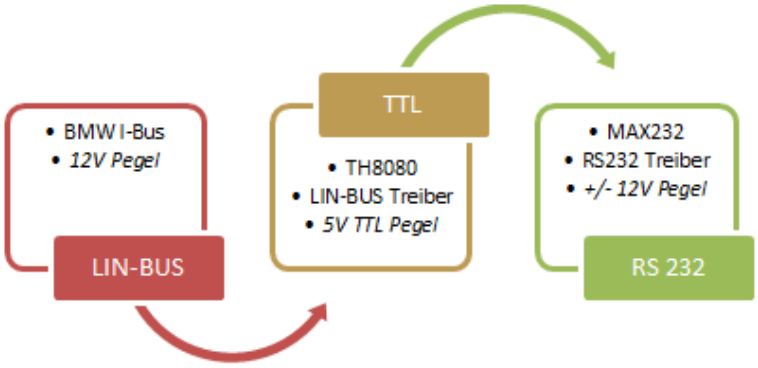
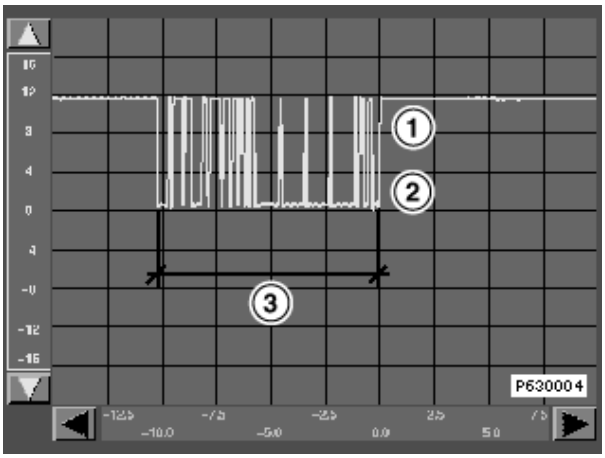


Figure 1.2: Level Adjustment

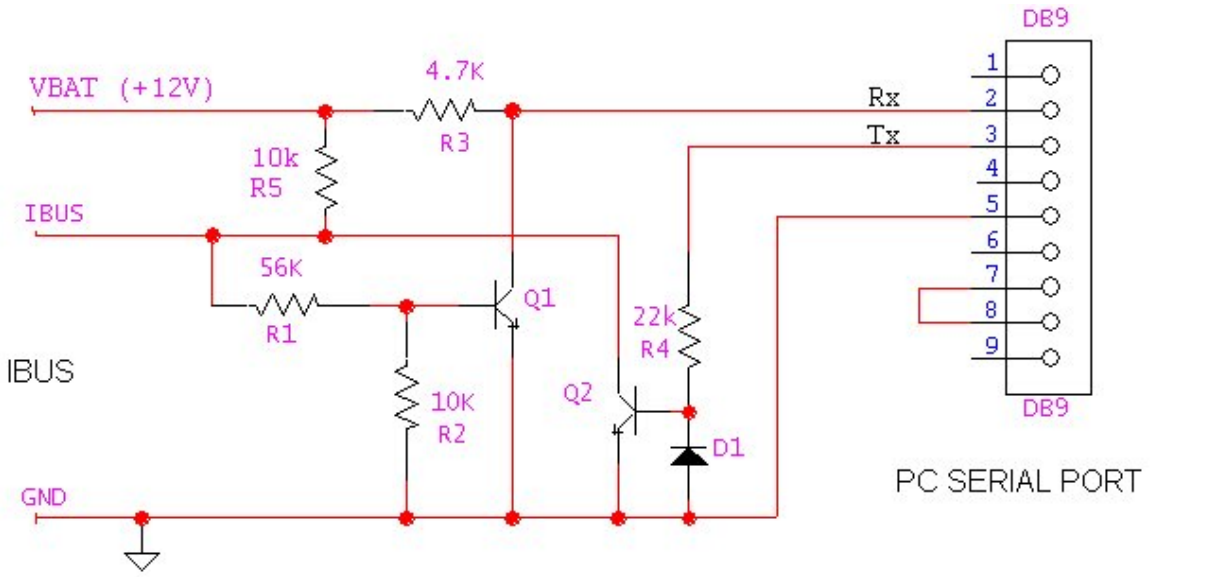
For this task, for example, the Melexis TH8080 LIN transceiver can be used. This IC provides a convenient and very stable solution to realize the necessary adjustment. The rescission of TTL to RS232 compatible level is handled by a standard MAX232 IC. The Melexis IC with only a few esternen components. The circuit design should not be a problem after reading the data sheet.



Index	Signal	Setpoint
1	U high [V]	7 V ... Ubatt
2	U low [V]	0 V ... 2 V
3	Message time [ms]	5 ms ... 30 ms

Figure 1.3: oscillogram I / K-bus signals

Another way without specific IC is a level adjustment via the following simple transistor circuit. However, the circuit works tends to partially Übertragunsproblemen or transmission errors.



Minutes of the I-bus

In BMW vehicles, the protocol is about the individual control devices in the network communicate according to the following scheme built:

- Source ID
  identification of the subscriber wants to send a message to another bus devices
- length
  length of the entire message (without source ID and length specification itself)
- Target ID
  to identify the subscriber sent the message to the
- data
  payload of the message
- XOR CRC - Checksum
  The checksum is used to verify the message. The message recipient calculates the checksum and compares them with those contained in the message.

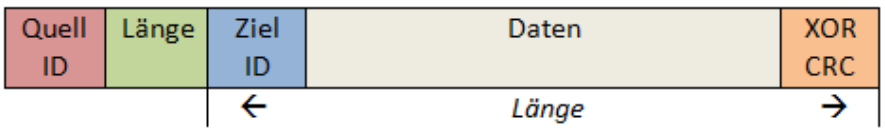


Figure 1.4: Structure of the message protocol

Each network (K-bus I-bus and D-Bus) transfers data at a baud rate of 9600 bits per second. The communication protocol is 8 data bits, 1 stop bit and even parity (even).

The implementation BMW sees as a bus master before the Instumentenkombination. Only if the IKE nothing sends itself may other bus, entertain '. This facilitates the integration of additional control devices such as MP3 players, and can shorten the reaction time, eg steering wheel buttons. On the I-bus (as well as the other bus systems) may occur as a tribute to the flexibility and high bus load collisions. Therefore, depending on the equipment used BMW

multiple buses.

- The following mechanisms are implemented for communication on the I-bus:
- the bus master (IKE) is a priority
- up to broadcasts each message (request) must be confirmed (response) (This is not true for all messages, then here I-Bus provides an appropriate coding ago)
- when the bus a defined period (eg 20-100ms after request after the timeout, eg 100-1000ms) has not been established, other participants may send a request
- does not wait for each bus the same time (this is not explicitly stated, but results from the signal propagation delays and timing differences in the control units)
- after a certain time of the transfer bus for other control devices must 'be opened
- Collision detection is to be used, in particular the echo should be checked.
- it is an address used arbitration: The station with the highest address receives the bus access when 2 or more participants simultaneously access the bus. This works as follows: During the transmission address is placed on the bus bit by bit, the state of the line is checked. Where a control device such as a 0 (high level) and the line is low, it must leave the bus (without disturbing the ongoing transmission of the other control units). In a tie, the next bit. Address binary 00100100 is higher than 00,100,011th
- Commands / messages are prioritized internally in the control unit. According to the priority a different interval between messages is (, message-dependent waiting time ') used: Prio 1 from 1.7ms, 2.3ms from 2 and 3 from 10ms. In collisions is a predefined conflict Wait 'used for control devices in the same domain (same position of the first recessive bits in the address) is different.
- should get no response to a request, it is repeated up to 5 times after every 300ms latency

Since the above-mentioned mechanisms to implement costly to sin enough in practice the following procedure to send messages from:

Before a message is sent must be maintained on the idle state of the bus. This is achieved when there is no data Trans Fehr for a certain time. The time is calculated from the data rate of the bus and the data frame of the serial connection of 10 bits / character. This data frame is specified in the bill already considered (0,104ms / * Bit 10Bit).

$$\frac{1\,Sekunde}{9600\,Bit} = 1{,}04\,ms \rightarrow 1{,}2\,ms\,(mit\,Sicherheitszuschlag)$$

So there must be at least 1.2 ms inactivity of the bus to wait before it can be assumed that no more bits sent more and thus the message of the currently active BEEN control unit has been completely sent. Thereafter, a message can be sent.

This system and this type of collision avoidance works in practice, with the proviso that all ECUs just stick to this software solution is very reliable. Actually, in this case, the waiting time of the idle bus is used to send over all other control devices. But this also means that important messages could be suppressed under some circumstances and actually avoid the other control devices collisions! Therefore, only a maximum of 1 bus device operates according to this "quick and dirty" method Solte be connected.

Addresses of the device in the I-bus

In the network, each node is identified by an ID (address), the length is a byte each.

ID (Hex)	Name of the participant	Remark
00	General News (1)	
18	CD changer	Address of the MP3 player
30	SES (voice command)	
3B	Video module	
3F	DIS	external diagnosis system
43	Menu screen on-board monitor	
50	Steering wheel buttons	Left Side
60	PDC parking system	
68	Radio	
6A	DSP (sound processor)	
7F	GPS module	
80	Instrument cluster IKE	
A8	Unknown	
BB	TV module (in the video module)	
BF	Light control module LCM	
C0	Multi-information display MID	not installed
C8	Phone	
D0	Navigation data	
E7	Line of text in instrument cluster	
E8	Unknown	
ED	Memory Seats	

F0	Key-board monitor	
FF	General News (2)	

Communication of the control devices in the I-bus

The control devices within the network of instrumentation bus (I-bus) to communicate according to the protocol described in the chapter.

Certain control units form a composite in the bus. Here, a control unit takes over the role of "master" the other associated control devices form the "slaves". This is a logical assignment via the software of the control devices. The electrical topology of the I-bus connects as opposed to logical assignment of all control units together. Thus, all messages are sent over the bus at all control devices.

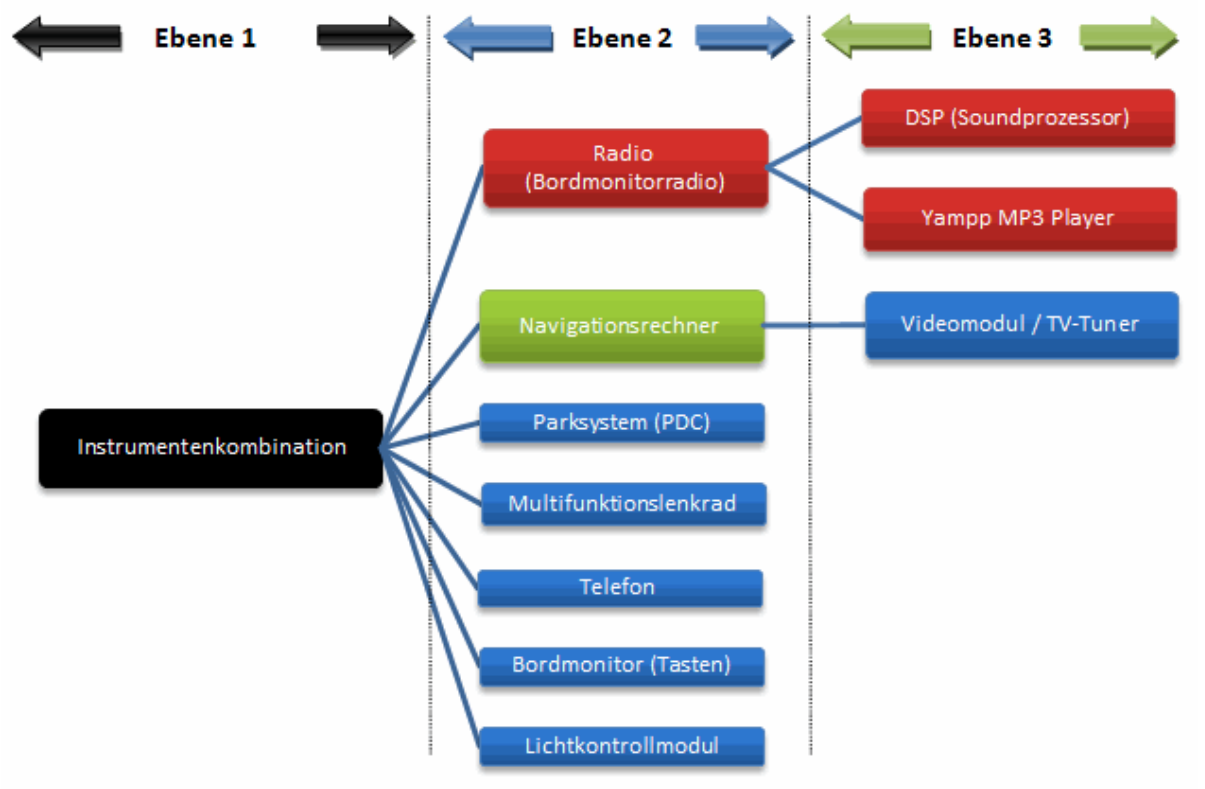


Figure 1.5: Block diagram of the logical assignment

Control devices are not part of the standard equipment of the vehicle and can be upgraded to be automatically detected on the bus. Detection occurs when in a certain time responding to a declaration addressed to the controller request, or the retrofit device has logged in with an initialization message. This also applies to the CD changer is emulated by the MP3 player. The radio asks for the ignition from the associated slaves (DSP / CD changer or MP3 player). At the request of the radio must be an answer. In addition, the device must periodically send a sign of life. If not, the device will be disabled until restart the vehicle. It is therefore important that the MP3 player responds reliably to requests.

The control of the CD changer is done regularly only by radio. If the CD mode is selected, the radio transmits to the CD changer a message to start playback. The CD changer sends a message back to the radio starts playing. All other commands such as CD changer etc. are received in the same way.

The keys on the on-board monitor and the buttons on the multifunction steering wheel when pressed send a message that the code for the button and the kind of push (short press, long press and release the button) contains.

Figure 1.6: On-board monitor (Displaying Data MP3) with active radio display

The on-board monitor consists of the on-board monitor buttons to send the broadcast address 48 hex and 49 hex key codes. In addition, a TFT display and the tape drive in the enclosure of the monitor. The TFT display is powered directly from the navigation computer with an RGB video signal and thus serves only as a monitor. The control of the Kassentenlaufwerks is relaisiert via the I-bus (the on-board monitor). The audio cable with the drive is connected directly to the radio

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Codes of Bormonitortasten (address 0F)

Messages to the radio ADDRESS 68 HEX

Message format:

<0F 04 68 > <keycode> <XOR>

Button	Pressure <1s	Pressure> 1s	Pressure from	Button	Pressure Short	Print long	Button from
<>	48 14	48 54	48 94	Eject	48 24	48 64	48 A4
1	48 11	48 51	48 91	2	48 01	48 41	48 81
3	48 12	48 52	48 92	4	48 02	48 42	48 82
5	48 13	48 53	48 93	6	48 03	48 43	48 83
TP	48 32	48 72	48 B2	RDS	48 22	48 62	48 A2
FM	48 31	48 71	48 B1	AM	48 21	48 61	48 A1
Info	48 07 *	48 47 *	48 87 *	MODE	48 23	48 63	48 A3
TONE	48 04	48 44	48 84	SELECT	48 20	48 60	48 A0
<	48 10	48 50	48 90	>	48 00	48	48 80

(Title back)				**(Track up)**		40	
(Radio menu)	48 30	48 70	48 B0	* Message to "FF" instead of radio "68"			

News on navigation computer: 3B HEX ADDRESS

Message format:

<0F 04 3B > <knob code> <XOR>

48 05 printing 48 45 Pressure> 1s 48 85 pressure

49 0 **n** Turn left 49 8 **n** Turn right

n *between 1 and 9. The value varies depending on the rotational speed.*

General information: ADDRESS FF HEX

Message format:

<04 0F FF > <keycode> <XOR>

Press the 'Phone'

48 08 printing 48 48 Pressure> 1s 48 88 pressure

Press the 'auxiliary heating / Clock'

48 07 printing 48 47 Pressure> 1s 48 87 pressure

Press the 'MENU'

48 34 printing 48 74 Pressure> 1s 48 B4 pressure

Key codes of the steering wheel buttons (address 50)

Figure 1.7: steering wheel buttons

Messages to the radio ADDRESS 68 HEX

Message format:

<50 04 68 > <keycode> <XOR>

Press the "-" (Volume +)

32 10

Press the "+" (Volume + -)

32 11

">" Button (next track)

3B 01 pressure 3B 21 pressure

"<" Button (previous track)

3B 08 pressure 3B 28 pressure

News on Phone: ADDRESS C8 HEX

Message format:

<50 04 C8 > <keycode> <XOR>

Press the 'Select'

3B 80 pressure 3B 90 Pressure> 1s 3B A0 pressure

Press "R / T "

3B 40 pressure

News for voice control (SES / ULF): ADDRESS B0 HEX

The activation of the SES geschiet by holding the 'Select' button

<50 04 B0 > 3B 80 5F

Remark: Mj.1999 we SES detected automatically when MFL and given the above code when holding the handset button. The older MFL can not do this! Thus can not be activated directly with these SES.

Visualization of messages in the instrument cluster

The text line of the instrument cluster can be described via the I-bus. You may already displayed messages, on-board computer, for example, to hide it. It is displayed after transmission of the message for about 10s. After this time, the screen returns to the previously displayed text or shuts down when it was the previous state of the display.

Figure 1.8: The figure shows the instrument cluster. It is the name of the currently playing artist appears in the text line.

Describe the text line in the instrument cluster: ADDRESS 80 HEX

Message format:

<68 17 80 > 23 62 30 <option> <text in ASCII Hex> <XOR>

Note: It is always all of the characters, the "old" characters that are sent displayed in the text line otherwise are not overwritten. Thus, the message length is always "17H".

The message can be displayed with the following options:

35 00 normal display

37 01 See text between two red Files

37 03 See text between two red flashing Files

37 04 View Gong and text between two red flashing Files

37 05 View Gong and Text

37 08 Gong I (without displaying a message)

37 10 Gong II (without displaying a message)

Visualization of messages in the on-board monitor

The image output of the navigation computer is done on the TFT display of the on-board monitor. The navigation computer-generated image information can not be changed or only with great effort. It is possible in principle other video signals displayed on the onboard monitor by the video signals are switched to an external source. However, here's a video switcher is either necessary or the video signal should be fed via the input of the reversing camera in the video module. The latter would have a poor image quality as a result of the camera input is only compatible with composite video signals according to the NTSC video standard. Furthermore, the generation of the corresponding video signal would involve a disproportionate effort.

The project will take the same route to the radio used to display information. In "Radio Display Mode" of the navigation system individual areas of the displayed image can be described via the I-bus from the radio. The vehicle used for the project navigation computer 4th generation (MK4) is installed. This provides the so-called "split-screen" mode. This display mode navigation data is displayed on the right side of the page. On the left side of the screen, either the road map, trip computer or the radio screen can be displayed. The display of the phone's menus and settings are always displayed in full screen mode. It is also possible everything in full screen mode display when a corresponding adjustment is made. The display of the MP3 player is but optimized for the "split-screen" mode as this provides a better representation because the writable fields lie to each other.

Figure 1.9: Comparison of "split-screen" mode (left) and full screen (right)

In the pictures, the radio display is in the CD changer mode to see. All writable via the bus fields are described with text. It should be noted that the order of the fields is different in both modes.

Me The contents of the fields in force unless they are overwritten or the mode (here the CD changer mode) is exited. This is true for each character of a text field . For example, if the current value is 8 characters during the new value to be displayed consists of 5 characters, the difference must be filled with spaces. The number of displayed characters is different depending on the field. This behavior can own texts be used to write in the boxes.

The opportunity offers itself for this behavior is the fields after the radio messages sent to the navigation computer and thus described the text fields overwritten with data from the MP3 player. Thus own data can be displayed on the onboard monitor.

The messages to the navigation computer are the radio with the address 68 hex sent. The writable part (left in the "split-screen") is subdivided into 6 text boxes track and index range.

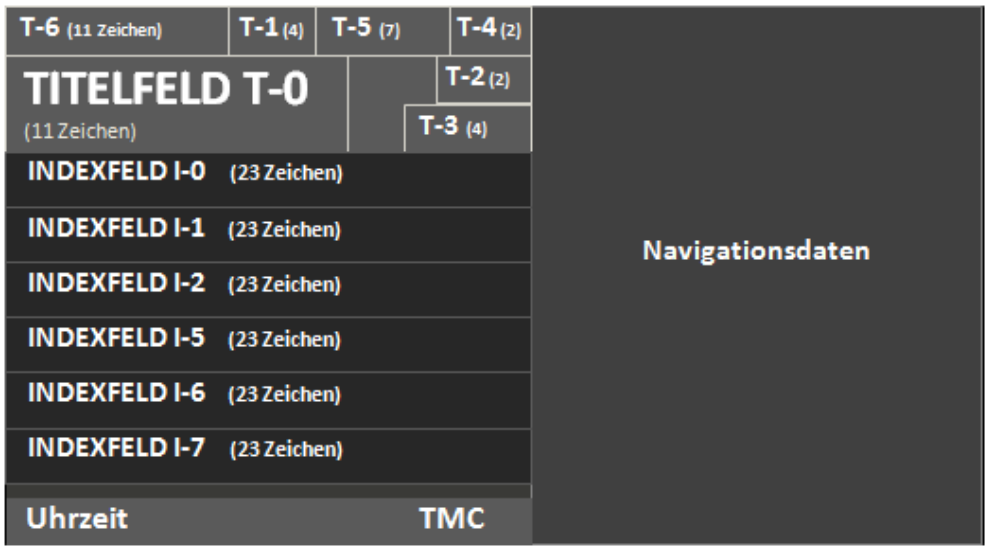

Figure 1.10: Writable text fields in the radio display mode of the on-board monitor

Describe the text boxes on the radio navigation system or CD changer mode: ADDRESS 3B HEX

Message format for the Title field 0

<68 3B length> 23 62 30 <text in ASCII Hex> <XOR>

Message for title fields T-1 to T-6 format

<68 Length 3B> A5 62 01 <index the text field> <text in ASCII Hex> <XOR>

Index is 01 to 06 for the title Fields 1 to 6

Message for index fields I 0 to I-5 (format **MK2** navigation system)

<68 Length 3B> A5 62 00 <index the text field> <text in ASCII Hex> <XOR>

Message for index fields I 0 to I-5 (format **MK3 MK4 and** navigation system with split screen software)

<68 3B length> 21 60 00 <index the text field> <text in ASCII Hex> <XOR>

Field	Index	Field	Index
0	40	**5**	45
1	41	**6**	46
2	42	**7**	47/07
(3)	(43)	**(8)**	(48)
(4)	(44)	**(9)**	(49)

Values in brackets are only relevant in full screen mode

To refresh the index fields following message must be sent to:

<68 06 3B> A5 60 01 00 91

Outlined in the mode (radio → CD changer) appropriate feedback can be output via the selecting of the index fields with the knob of the on-board monitor. This feedback will be sent to the address of the radio. As with the original CD changer in the index fields the 6 CDs are displayed as menu it is possible with the above function to select them on the knob. This functionality can be used to control a dynamic menu. However, it was omitted in this project to this function. The main reason for this is the limited space in the program memory of the microcontroller used . (→ see Section 4.2.3)

Message Format (feedback on selection of index fields)

<3B 06 68> 23 62 30 <index the text field> <XOR>

Index	Pressure	Pressure from	Index	Pressure	Pressure from
0	00	40	**5**	05	45
1	01 (CD 1)	41	**6**	06 (CD 4)	46
2	02 (CD 2)	42	**7**	07 (CD 5)	47
3	03 (CD 3)	43	**8**	08 (CD 6)	48
4	04	44	**9**	09	49

When selecting the index fields 1-6 calls the radio in response to a message to the address of the CD changer CD change. This question must be answered accordingly.

Communication with the CD changer

The CD changer communicates mainly with the radio. After activation of the I-bus, this happens when you open the vehicle, the CD changer began to make known to the system with a sign-on message. Solely by this news, the CD changer mode is enabled but not on the radio. This only happens when the CD changer immediately responds to the following request of the radio. The radio repeats this request in a cycle of about 10 seconds. At least two-thirds of these questions will be answered if this is not carried out, the CD changer mode deactivated. In a single-wire bus as the bus I can when another control device on the bus sends data be delays sell your own message. In addition, the news is not always excluded are received in error. The answers to the questions of radio must be answered reliably in the later emulation for the above reasons.

News from the CD changer: ADDRESS 18 HEX

Format of the login message: FF HEX ADDRESS

< 18 04 FF > 02 01 E0

Format of the response on the radio request: FF HEX ADDRESS

< 18 04 FF > 02 00 E1

Messages to the radio ADDRESS 68 HEX

< 18 0A 68 > 39 00 02 00 3F 00 dd tt <XOR> CD and title status if CD changer does not play

< 18 0A 68 > 39 00 09 00 3F 00 dd tt <XOR> CD and title status when the CD changer is playing

< 18 0A 68 > 39 02 09 00 3F 00 dd tt <XOR> Start playback of the title

< 18 0A 68 > 39 03 09 00 3F 00 dd tt <XOR> CD status scan forward

< 18 0A 68 > 39 04 09 00 3F 00 dd tt <XOR> CD status scan backwards

< 18 0A 68 > 39 07 09 00 3F 00 dd tt <XOR> Ending

< 18 0A 68 > 39 08 09 00 3F 00 dd tt <XOR> CD Exchange

- dd is the CD number (01-06).

- tt is the title number

Z4 / X3 monitor control

Messages to the monitor: Address BF Hex

Wake system

<80 04 BF> 11 01 2B

TFT switch on / extend monitor

<3B 06 F0> 4F 11 11 81 03

Sign of life (every 8-10 seconds must be sent to the monitor)

<3B 04 46> 01 00 78

Control of the 16: 9 widescreen board monitor

News of changing the display mode in the on-board monitor: F0 hex address (sender ED Hex)

<ED 05 F0> 4F 11 <option> <XOR>

Options

31 Set 16: 9 / Zoom 60Hz (Navianzeige)
32 Set 16: 9 / Zoom 50Hz (TV mode)

11 Set 16: 9 60Hz (Navianzeige) 12 Set 16: 9 50Hz (TV mode)

01 Set 4: 3 60Hz (Navianzeige) 02 Set 4: 3 50Hz (TV mode)

Control of the body electronics

Messages to the control units for the E39 series: address 00 hex (transmitter 3F hex / DIS)

<3F 05 00> 0C 00 44 <XOR> window driver side rear close
<3F 05 00> 0C 00 45 <XOR> window driver side rear open
<3F 05 00> 0C 00 46 <XOR> window passenger side rear close
<3F 05 00> 0C 00 47 <XOR> window passenger side opening rear
<3F 05 00> 0C 00 65 <XOR> open all windows
<3F 05 00> 0C 00 66 <XOR> sunroof open
<3F 05 00> 0C 00 0B <XOR> openable Central / close
<3F 05 00> 0C 00 40 <XOR> trunk open
<3F 05 00> 0C 00 00 <XOR> driver seat forward move
<3F 05 00> 0C 00 01 <XOR> move the driver seat backwards
<3F 06 00> 0C 01 31 01 <XOR> mirror driver side fold
<3F 06 00> 0C 01 30 01 <XOR> mirror driver side show
<3F 06 00> 0C 02 31 01 <XOR> mirror passenger side fold
<3F 06 00> 0C 02 30 01 < XOR> Expand mirror passenger side

Other I-bus codes (telephone, LCM, light, IKE, On board computer, navigation, cassette deck)

Source	Target	Message Name	Message (HEX)	Example	Remark
???	**LCM**	Inserted key	44 05 74 04 xx bf chk		xx is the key number
???	**LCM**	Extracted key	44 05 74 00 ff bf chk		Message comes when the key is removed
ALL	**LCM**	Lighting control	00 04 76 xx bf chk	xx is a bit mask, as follows 7 6 5 4 3 2 1 0	Bit 1 = warning lights, bit 2 = low beam, bit 3 = Fade. The bits may be combined. eg low beam and warning lights = 0 0 0 0 0 1 1 0 = $ 06 (hex)
BMB	**RAD**	Cartridge error	f0 05 68 4b 06 f0 chk		Error cassette drive
BMB	**RAD**	Play Tray 2	f0 05 68 4b 06 12 chk		Play cassette Page 1 (response from cassette drive around the radio in cassette mode switch)
BMB	**RAD**	Play Tray 2	f0 05 68 4b 06 11 chk		Play cassette side (to switch response from the tape drive to the radio in cassette mode) 2
BMB	**RAD**	No cassette	f0 04 68 4b 05 chk		Response from the tape drive that no cartridge is inserted. (After ejecting the cassette or the switch on cassette)
BMB	**RAD**	Kassettenlaufwerk-fast forward	f0 05 68 4b 06 51 chk		Response from the tape drive during fast forward.
BMB	**RAD**	Kassettenlaufwerk-rewind	f0 05 68 4b 06 61 chk		Response from the tape drive during fast forward.
BMB	**RAD**	Dolby	f0 05 68 b4 06 xx chk		xx = 81 = Dolby off, xx = 82 = Dolby B, Dolby C = xx = 84
IKE	**OBC**	Output from the timer	80 0e 0e e7 24 00 xx xx xx xx xx xx xx xx xx chk		Output of the timer as plain text. xx is the text.
IKE	**OBC**	Output of the stopwatch	80 0e e7 1a 24 00 xx xx xx xx xx xx xx xx xx chk		Output of the stopwatch is sent only if the stopwatch has previously requested and started xx is the time in plain text (xx is the text)
IKE	**LCM**	Speed and RPM	80 05 BF 18 xx yy chk		xx speed / yy speed 2/100. Message is repeated every 2 seconds.
LCM	**IKE**	Request Mileage	BF 03 80 16 2A	The miles are in bytes 5-7 coded (eg A0 D0 01); calculation as follows: km = Byte7 * 65536 + Byte6 * 256 + Byte 5	Without the requirement of this distance display the message rarely (every few minutes)
MID	**OBC**	Phone LED	c8 04 e7 2b xx chk	xx is a bitmask 7 6 5 4 3 2 1 0	Bit 0 = red, Bit 1 = red + flashing, bit 2 = orange, bit 3 = orange + flash, bit 4 = green, bit 5 = green + flash
NAV	**IKE**	Stop Timer	3b 05 80 41 08 0e chk		Stop the timer.
NAV	**IKE**	Request Timer	3b 05 80 41 01 1a chk		Stopwatch / timer status is calling when the timer is running.
NAV	**IKE**	Auxiliary heating	3b 04 80 41 xx chk		Heater control: xx = 11 = OFF, xx = 12 = ON
NAV	**IKE**	Delete average.	3b 05 80 41 0a 10		Set average speed to 0.

			chk		
NAV	**IKE**	Delete meter	3b 05 80 41 xx 10 chk	xx = 04 meter 1 to 0 \ xx = 05 meter 2 to 0	Meter set to 0.
NAV	**IKE**	Distance from the target	3b 06 80 40 07 00 xx chk	3b 06 80 40 07 00 45 chk - Set distance to 69km	Carrying the distance to the target in the on-board computer (for calculation of the arrival time). xx is the distance
NAV	**IKE**	Set speed limit	3b 06 80 40 09 00 xx chk	3b 06 80 40 09 00 32 chk speed limit = 50 km / h	Set speed limit and activate it. xx is speed.
NAV	**IKE**	Set speed limit on the speedometer.	3b 05 80 41 09 20 chk		Set speed limit on the current gefarene and activate the limit.
NAV	**IKE**	Set speed limit from	3b 05 80 41 09 08 chk		Set of speed limit. The preset speed is stored.
NAV	**IKE**	Start the timer	3b 05 80 41 04 0e chk		Start the stopwatch / timer.
TEL	**MFL**	Phone status	C8 04 50 2C chk xx / xx is a bitmask as follows 7 6 5 4 3 2 1 0	Not installed Bit 6 = 0 Telefonadaper, 1 = Telefonadaper installed Example 1: C8 E7 04 2C 10 17 See 5 byte hex 10 binary is 0001 0000, this means: Hands-free off \, telephone away from	Bit 0 0 = speakerphone off, 1 = handsfree, Bit1 0 = Phone Menu on-board monitor or MID / 1 = active call, Bit 2 1 = incoming call, Bit 3 1 = phone screen locked Bit 4 0 = phone off / 1 = phone, bit 5 0 = inactive phone / 1 = active phone

(Chk - XOR checksum)

New! About this theme can be written in the forum. For questions and problems I ask in the forum to seek help.