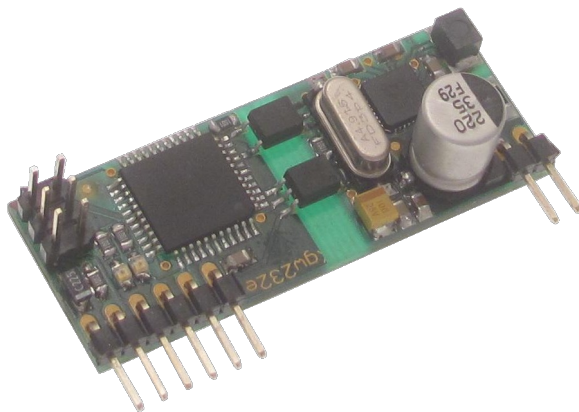


User manual

Document version 1.2 (for firmware version 2.1)

KNX232e / KNX232e1k



KNX232e is used for control
and reading conditions on KNX bus

Serial line with ASCII protocol

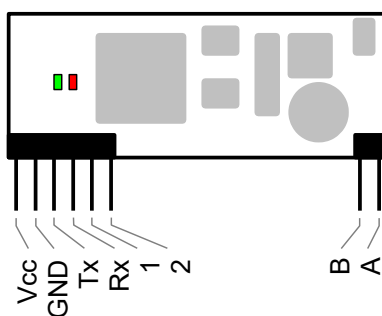
Communication signalization

Galvanic separation of KNX

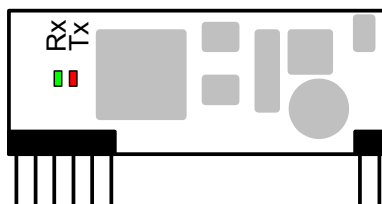
The KNX232e is a KNX communication module suitable for installation in third party devices. A serial line with the simple ASCII protocol described in this document is used to communicate with the module. Module KNX232e allows you to work with 250 KNX addresses and KNX232e1k version with 1000 addresses.

Technical specification		
Number of controlled KNX addresses KNX232e KNX232e1k	250 1000	
Supply voltage	3 - 5	V
consumption (Vcc)	5 (peak 8) @ 3,3V	mA
	8 (peak 17) @ 5V	
consumption (KNX)	4	mA
Galvanic separation	2	kV
Ambient working temperature	0 ÷ 50	°C
Storing temperature	-10 ÷ 70	°C
weight	10	g

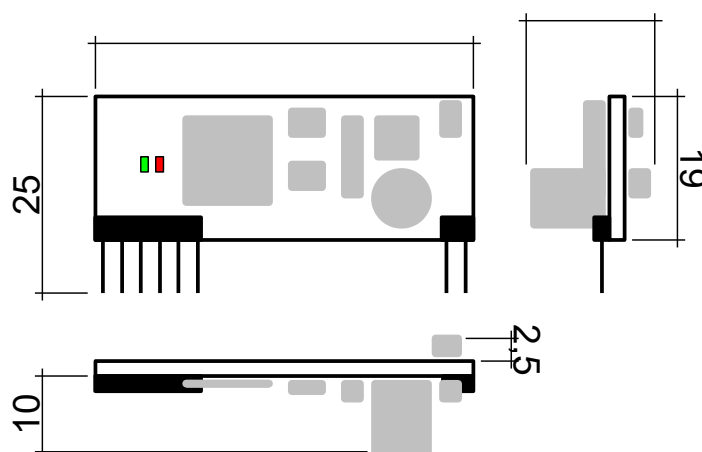
Terminals connection	
Vcc	Supply voltage
GND	Data and supply ground
Tx	Serial line data broadcast
Rx	Serial line data reception
1	signal TxLED
2	signal RxLED
A	KNX bus, conductor A
B	KNX bus, conductor B



Signalization	
Rx	RxLED – receiving message from KNX (green)
Tx	TxLED – sending message on KNX (red)



Dimensions (mm)



Protocol description

Data between external device and converter are send by simple protocol in ASCII format.

Communication is Master – Slave type. Communication is initialized by question from external device and the converter is just answering. In the case of activation spontaneous data transfer regime, the converter sends received data (answers) also without request. In the case of inactive spontaneous data transfer regime are messages which comes from KNX bus and are addressed for external device saved in the converters buffer. External device reads them gradually from converter. Converters buffer can store up to 8 messages.

Data telegram structure

<STX>	Function code	data	checksum	<CR>
1 character (0x02)	2 ASCII characters (1 byte)	Length depending on message format	2 ASCII characters (1 byte)	1 character (0x0D)

All bytes except <STX> and <CR> (function code, data, checksum) are numbers written in the hex format (0x00 – 0xFF) in ASCII coding – up to two bytes which became the values only

„0“ – „9“ (0x30 – 0x39) or „A“ – „F“ (0x41 – 0x46)

Example: Function code 0x04 (question on received data from KNX bus) is written in two bytes „0“ – 0x30 and „4“ – 0x34.

Whole message for question on received data from KNX bus which is described below. <STX> 0x04 0xFB <CR> is send in 6 bytes (1B <STX>, 2B function code, 2B checksum and 1B <CR>). On the bus is therefore send 0x02, 0x30, 0x34, 0x46, 0x42, 0x0D.

Parameters of communication

Communication speed (user adjustable)	19200 bps
	38400 bps (factory setting)
Number of data bits	8
parity	even
Number of stop bits	1

Computation of checksum

In the checksum are counted all byte messages except STX and CR. Checksum is negation (negation of each bits) of function code and data sum.

Example: question on address 1/1/1

STX 0x0C 0x09 0x01 0xE9 CR

$0x0C + 0x09 + 0x01 = 0x16$

Negation 0x16 is final checksum, therefore 0xE9.

List of functions

Basic functions for communication with converter KNX232e.

Function code	description
0x01	Question about firmware version of converter
0x04	Question about received data from KNX bus
0x0B	Writing data on group address on KNX
0x0C	Question about group address on KNX

Configuration messages for setup of KNX232e converter. If the setup is done by *Configate.exe* there is no need to use the message.

Function code	description
0x40	Load of the listened addresses KNX232e converter
0x41	Setup of the listened addresses KNX232e converter
0x43	Deleting of the list of listened addresses
0x44	Load communication speed
0x45	Setup of the communication speed
0x46	Load of spontaneous data transfer regime
0x47	Setup of spontaneous data transfer regime
0x48	Load of the serial number
0x49	Load of the hardware version
0x4A	Load data format DPT/EIS
0x4B	Load data format DPT/EIS
0x4C	Retrieve the maximum number of KNX addresses
0x4E	Load the validity of the KNX addresses ordering (just for KNX232e1k)
0x70	Overwriting firmware regime
0x71	Overwriting firmware (only in overwriting firmware regime)
0x72	bootloader version (only in overwriting firmware regime)
0x73	Memory size (only in overwriting firmware regime)

Question about converters firmware version

Question	function code	0x01
	data	<i>unused</i>

Answer	function code	0x81
	data	converters firmware version – 2 byte Version is stated in the x.y format, where first byte represents x and second y.

Example	Question	<STX> 0x01 0xFE <CR>
	Reply	<STX> 0x81 0x01 0x15 0x68 <CR> Firmware version is 1.21 (0x01.0x15)

Question on received data from KNX bus

Question	function code	0x04
	data	<i>not used</i>

Reply	function code	0xFC
	data	Group address (2 byte) data – n byte (depending on data type on KNX)

If no new data from KNX bus was received the “data” entry is not used.

Example	Question	<STX> 0x04 0xFB <CR>
	Reply	<STX> 0xFC 0x09 0x01 0x07 0xF2 <CR> Data received from 1/1/1 address. Received byte 0x07. <STX> 0xFC 0x03 <CR> No new data from the KNX was received.

If the spontaneous transmission mode is turned on, Question is not sent, but Answer with the 0xFC function code is sent automatically when bus data is received.

Writing the data on group address on KNX

Command	function code	0x0B
	data	Group address (2 byte) sending priority (1 byte) 0x0C – lowest priority 0x08 – alarm functions 0x04 – high priority 0x00 – system functions <i>data (n byte) length according to data type on KNX</i>

Reply	Function code	0x8B
	data	error code – 1 byte 0 – sent data 1 – group address is not in the list of listened addresses 2 – sent data but not confirmed 3 – sending data error

Example	Question	<STX> 0x0B 0x09 0x01 0x0C 0x07 0xD7 <CR>
	Answer	<STX> 0x8B 0x00 0x74 <CR> To address 1/1/1 data 0x07 written.

Question on group address on KNX

Question	function code	0x0C
	data	Group address (2 byte)

Reply	Function code	0x8C
	data	error code – 1 byte 0 – sent data 1 – group address is not in the list of listened addresses 2 – sent data but not confirmed 3 – sending data error

Example	Question	<STX> 0x0C 0x09 0x01 0xE9 <CR>
	Answer	<STX> 0x8C 0x00 0x73 <CR> Question to Group address 1/1/1 sent.

Setting of listened group addresses list

The message is used to configure the KNXnet converter. One message can set one listened group address. The addresses must be entered from the smallest to the largest into the memory. If configuration is made by *Configate.exe*, you do not need to use the message.

Command	function code	0x41
	data	Position of the item in the memory of the KNXnet converter (2 byte) 0-249 – list of listened group addresses 65535 (0xFFFF) physical address of KNXnet converter KNX address (2 byte) group or physical address 0xFFFF means in the case of a group address that this memory position will not be used (will delete the item) Data type (1 byte) group address format (1=DPT1 atd.) In the case of physical address 0 can be set.

Reply	function code	0xC1
	data	position of the item in the memory of the KNXnet converter (2 byte) 0-249 – list of listened group addresses 65535 (0xFFFF) physical address of KNXnet converter KNX address (2 byte) group or physical address Data type (1 byte) group address format (1=DPT1/EIS1 etc.) 0 means that this position is unused
	Error code	1 – item position in the converters memory is out of range (1byte)

Example	Question	<STX> 0x41 0x00 0x00 0x09 0x03 0x01 0xB1 <CR> Save group address 1/1/3 (0x09,0x03) with type DPT1 (0x01) in the first position of memory (0x00,0x00).
	Reply	<STX> 0xC1 0x00 0x00 0x09 0x03 0x01 0x31 <CR> In the first position of memory(0x00,0x00) is saved group address 1/1/3 (0x09,0x03) with type DPT1 (0x01).
		<STX> 0xC1 0x01 0x3D <CR> item position in the converters memory is out of range

Retrieve the list of listened addresses

The message is used to configure the KNXnet converter. One message can retrieve one listened group address. If configuration is made by *Configate.exe*, you do not need to use the message.

Question	function code	0x40
	data	Position of the item in the memory of the KNXnet converter (2 byte) 0-249 – list of listened group addresses 65535 (0xFFFF) physical address of KNXnet converter KNXnet

Reply	function code	0xC0
	data	position of the item in the memory of the KNXnet converter (2 byte) 0-249 – list of listened group addresses 65535 (0xFFFF) physical address of KNXnet converter KNX address (2 byte) group or physical address 0xFFFF in the case of group address means that this memory item is unused Data type group address format (1=DPT1/EIS1 etc.)
	Error code	1 – item position in the converters memory is out of range (1byte)

Example	Question	<STX> 0x40 0x00 0x00 0xBF <CR> Question to group address which is first in the first item of the converters memory
	Reply	<STX> 0xC0 0x00 0x00 0x09 0x03 0x01 0x32 <CR> In the first memory item is saved group address 1/1/3 (0x09,0x03) with type DPT1 (0x01).

Delete of the listened addresses list

The message is used to delete the configuration of the KNXnet converter. All the listened addresses are deleted by the message. Deletion can take up to 1.5 seconds.

Question	function code	0x43
	data	<i>not used</i>

Reply	function code	0xC3
	data	<i>not used</i>

Example	Command	<STX> 0x43 0xBC <CR>
	Reply	<STX> 0xC3 0x3C <CR>

Retrieve of the communication speed

Message serves for retrieve of the serial line communication speed.

Question	Function code	0x44
	data	<i>Not used</i>

Reply	Function code	0xC4
	data	Communication speed (1 byte) 1 – 19200bps 2 – 38400bps

Example	Question	<STX> 0x44 0xBB <CR>
	Answer	<STX> 0xC4 0x01 0x3A <CR> Communication speed of serial line is 19200bps.

Communication speed setup

The message serves to change the serial line communication speed.

Command	Function code	0x45
	data	Communication speed (1 byte) 1 – 19200bps 2 – 38400bps

Reply	Function code	0xC5
	data	Communication speed (1 byte) 1 – 19200bps 2 – 38400bps

Example	Question	<STX> 0x45 0x01 0xB9 <CR>
	Answer	<STX> 0xC5 0x01 0x39 <CR> Receive command to change speed to 19200bps. The answer is sent at the original communication speed. The communication speed setting is valid even when the power is turned off.

Setting spontaneous data transfer mode

The message is used to enable or disable the spontaneous data transfer mode. If the mode is inactive, data received from the KNX bus are stored in the buffer, and the master system retrieves it using the "KNX Received Data" message (function code 0x04). When the mode is active, messages received on the KNX bus are sent spontaneously to the serial line. When the mode is activated, the contents of the message stacker are cleared.

Command	function code	0x47
	data	spontaneous transfer (1 byte) 0 – off 1 – on

Reply	function code	0xC7
	data	spontaneous transfer (1 byte) 0 – off 1 – on

Example	Command	<STX> 0x47 0x01 0xB7 <CR>
	Reply	<STX> 0xC7 0x01 0x37 <CR> Spontaneous data transfer mode is on.

Read of spontaneous data transfer mode

The message is used to read the state of spontaneous data transfer mode.

Question	function code	0x46
	data	<i>not used</i>

Reply	function code	0xC6
	data	spontaneous transfer (1 byte) 0 – off 1 – on

Example	Question	<STX> 0x46 0xB9 <CR>
	Reply	<STX> 0xC6 0x01 0x38 <CR> Spontaneous data transfer mode is on.

Read of the serial number

The message is used to read the serial number of the KNXnet converter.

Question	function code	0x48
	data	<i>not used</i>

Reply	function code	0xC8
	data	Serial number (2 byte)

Example	Question	<STX> 0x48 0xB7 <CR>
	Reply	<STX> 0xC8 0x01 0x01 0x35 <CR> serial number 0x0101 = 257.

Read of HW version

The message is used to read hardware version of the converter KNXnet.

Question	function code	0x49
	data	<i>not used</i>

Reply	function code	0xC9
	data	hw version (2 byte) Version is stated in the x.y format, where first byte represents x and second y.

Example	Question	<STX> 0x49 0xB6 <CR>
	Reply	<STX> 0xC9 0x00 0x01 0x35 <CR> HW version is 0.1

Read of data format DPT/EIS

The message is used to read used data format for addresses stored in list of listened addresses.

Question	function code	0x4A
	data	<i>not used</i>

Reply	function code	0xCA
	data	Data format (1 byte) 0 – DPT 1 – EIS

Example	Question	<STX> 0x4A 0xB5 <CR>
	Reply	<STX> 0xCA 0x00 0x35 <CR> DPT data type is used.

Setting data format DPT/EIS

The message is used to set the used data format for the addresses stored in the listened addresses list.

The message is used to enable or disable the spontaneous data transfer mode.

Command	function code	0x4B
	data	Data format (1 byte) 0 – DPT 1 – EIS

Reply	function code	0xCB
	data	Data format (1 byte) 0 – DPT 1 – EIS

Example	Command	<STX> 0x4B 0x00 0xB4 <CR>
	Reply	<STX> 0xCB 0x00 0x34 <CR> The spontaneous data transfer mode is on.

Retrieve the maximum number of addresses on KNX

The message is used to retrieve the maximum number of controlled addresses on the KNX. KNX232e has 250 addresses, KNX232e1k has 1000 addresses.

Question	function code	0x4C
	data	<i>not used</i>

Reply	function code	0xCC
	data	Maximum number of controlled addresses on KNX (2 byte)

Example	Question	<STX> 0x4C 0xB3 <CR>
	Reply	<STX> 0xCC 0x03 0xE8 0x48 <CR> Maximum number 0x03E8 = 1000 KNX addresses

Retrieving the validity of the KNX addresses ordering

The message is used to read if the data is properly sorted. For KNXnet it is necessary to write individual KNX addresses from the lowest to the highest. If settings are made by Configate.exe, the addresses are automatically sorted before uploading. For KNX232e (which allows to control only 250 addresses) it is not necessary.

Command	function code	0x4E
	data	<i>not used</i>

Reply	function code	0xCE
	data	Information about the validity of the ordered KNX addresses(1 byte) 0 – Unsorted data. Some addresses might be ignored in KNX232e1k. 1 – The data is sorted correctly.

Example	Command	<STX> 0x4E 0xB1 <CR>
	Reply	<STX> 0xCE 0x01 0x30 <CR> The data is sorted correctly.

Firmware overwrite regime

The message switches the unit to firmware update mode. After switching, you need to wait 100ms before the firmware overwriting mode initializes. If overwriting does not begin within 2s, the unit automatically switches back to the standard function.

Command	function code	0x70
	data	<i>not used</i>

Reply	function code	0xF0
	data	<i>not used</i>

Example	Question	<STX> 0x70 0x8F <CR>
	Reply	<STX> 0xF0 0x0F <CR> Firmware overwriting mode is on.

Firmware overwrite

After switching to firmware overwrite mode, individual lines are sent in the Intel HEX format. The initial character ":" and the Intel HEX checksum are not sent (last 2 characters). After complete upload, the new firmware is started automatically (firmware overwrite mode).

Command	function code	0x71
	data	Intel HEX file line without and initial character ":" and checksum.

Reply	function code	0xF1
	data	Data (1 byte) 0 – Data received 1 – Maximum message length exceeded 2 – Command is out of memory length 3 – Error writing to memory

Example	Command	<STX> 0x71 0x04 0x00 0x00 0x00 0x00 0xF8 0x94 0xFF 0xCF 0x30 <CR>
	Reply	<STX> 0xF1 0x00 0x0E <CR> Line „:04000000F894FFCF“ Intel HEX file successfully written.

Note: For the first line of the HEX file a 4s timeout is required. For other lines 100ms is sufficient.

Bootloader version

Inquiry on the firmware version of the program in the unit. Available only in firmware overwrite mode.

Question	function code	0x72
	data	<i>not used</i>

Reply	function code	0xF2
	data	Bootloader version (2 byte) Version is stated in the x.y format, where first byte represents x and second y.

Example	Question	<STX> 0x72 0x8D <CR>
	Reply	<STX> 0xF2 0x00 0x01 0x0C <CR> Bootloader version is 0.1

Memory size

Question on the memory size for firmware upload. The return value indicates the number of 128B blocks. Available only in firmware overwrite mode.

Question	function code	0x73
	data	<i>not used</i>

Reply	function code	0xF3
	data	Memory size (2 byte)

Example	Question	<STX> 0x73 0x8C <CR>
	Reply	<STX> 0xF3 0x00 0xDE 0x2E <CR> Memory for firmware is $222 \cdot 128 = 28416B$