

KC-2S-U

Communication protocol



TECNOLOGIE DI COMUNICAZIONE E VISUALIZZAZIONE

AESYS S.p.A.
Via Artigiani, 41
24060 Brusaporto (BG) ITALY
Tel: +39 (0) 35 683000
Fax: +39 (0) 35 680030
www.aesys.it info@aesys.it

Versions

<u>Version</u>	<u>Date</u>	<u>Changes</u>
1.0.0	28/01/2016	<ul style="list-style-type: none">• First drawing. From KC2S proto 1.2.1 + proto 2.0.5.



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System structure

The system is composed by the Aesys central unit (KC630, KC640 or compatible, hereinafter KC) connected to a host device (hereinafter PC). More devices could be also connected on the same line (multipoint). KC is connected by another line to some other on-board devices such as signs (hereinafter DY_BUS).

Working principles

Each device has a unique address. The master equipment is PC and the slave is KC.

Serial communication parameters

On-board interface PC ↔ KC

Means: by cable

Serial type: RS485 (half duplex) / RS232 (full duplex) asynchronous

Baudrate: 9600 (default); Data bit: 8; Parity bit: N (none); Stop bit: 1

Communication protocol

General description

The messages interchanged between the devices that compose the system have the following structure:

STX <Address> <Command> <Data Length> <Data> ETX <Checksum>

where:

<Address>

Is the slave device involved in the information exchange (recipient for the call message and sender for the reply message).

- *Length*: 1 byte;
- *Values*: 'A' – 'Z'.

<Command>

Is the content of the message interchanged between the two devices.

- *Length*: 3 bytes;
- *Values*: between 0x41 and 0x5A;

<Data Length>

Is the length expressed in byte of the <Data> field, encoded in hexadecimal format.

- *Length*: 4 bytes;
- *Values*: between 0x30 and 0x39 or between 0x41 and 0x46 or "ZZZZ" in order not to effectuate controls;

<Data>

Are the information interchanged between the two devices. The content of the field depends on the type of the message.

- *Length*: variable (eventual 0, maximum 4096 useful byte – with DLE conversion the maximum characters number is 8192);
- *Values*: between 0x00 and 0xFF;
- *Note*: in order to represent the bytes with ASCII value 02h (STX), 03h (ETX), 10h (DLE) it is necessary use the DLE (10h) character followed by a character obtained adding the ASCII code of the character that has to be converted with value 40h (ex. STX becomes "DLE" + ("STX" + 40h) that is to say "DLE" + "B").

<Checksum>

Is the addition, module 65536, of all the characters that compose the message (STX, <Address>, <Command>, <Data Length>, <Data>, ETX). The value is obtained codifying in hexadecimal format the four semi-bytes that compose the checksum.

- *Length*: 4 bytes;
- *Values*: between 0x30 and 0x39 or between 0x41 and 0x46 or checksum "ZZZZ" in order not to effectuate controls.



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Commands

Call commands (Master → Slave)

COMMAND	DESCRIPTION	RECIPIENTS
CFK	Sending of configuration parameters to the on board central unit	KC
RCK	Request configuration	KC
POK	Status request (polling) to the on board central unit	KC
VER	Software/firmware version request	KC
VIS	Sending of message that has to be visualized	KC
CDE	Code description request	KC
VOC	Control annunciator	KC
SBR	Set displays' brightness	KC
SMS	Send "on the fly" message	KC
SPV	Set protocol version	KC
RPV	Require protocol version	KC
RES	Reset the CPU	KC
DUP	Data upload (for TRX files)	KC
TRI	Require info on installed TRX file	KC
TRS	Data uploading start	KC

Reply commands (Slave → Master)

COMMAND	DESCRIPTION	RECIPIENTS
ACK	Generic positive answer	PC
NAK	Negative answer for wrong checksum	PC
RRK	Answer to a configuration request	PC
RCD	Answer to a code description request	PC
RPK	Reply of the on board central unit to a status request	PC
RVE	Answer to a software/firmware version request	PC
RRP	Reply to a protocol version request	PC
RUP	Reply to a data upload command	PC
RTI	Reply to TRI	PC



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Commands interchange

For each command sent from the master, the slave can answer with the NAK command to indicate that the message was received with a wrong checksum and it was therefore rejected. For all the commands where a sending of the data to the master is not requested, the slave answer with the command ACK. An ACK command could be also answered if the checksum was correct, but the request cannot be corrected handled (see ACK command details). For the other commands, see the following table.

<u>Call command</u>	<u>Answer command</u>
POK	RPK (or ACK or NAK)
VER	RVE (or ACK or NAK)
CDE	RCD (or ACK or NAK)
RCK	RRK (or ACK or NAK)
RPV	RRP (or ACK or NAK)
DUP	RUP (or ACK or NAK)
TRI	RTI (or ACK or NAK)

Devices addressing

<u>Device name</u>	<u>Section/Type</u>	<u>Address</u>
KC	On board/Slave	"A" (0x41)
PC	On board/Master	"Z" (0x5A)

Commands details (<Data> field)

POK, VER, NAK, RCK, RPV, RES

These commands do not involve bytes for the data field.

SBR (set display brightness)

Field	Length (byte) and type	Range values
Display address	1 ascii	'@' - 'Z'
Brightness	1 binary	0 - 8 (0 = automatic brightness, 1 = minimum, 8 = maximum)

CDE (reply to a request code description)

Field	Length (byte) and type	Range values
Route index.	2 binary	The 2 byte value is in the MSB-LSB order. 0x0000 : return the actual route. 0x0001-N : return the route with selected index into the data base. If N is greater than the number of stored routes, the last one is returned.

RCD (reply to a request code description)

Field	Length (byte) and type	Range values
Route index.	2 binary	The 2 byte value is in the MSB-LSB order. 0x0000 : mean blank or no route in memory. 0x0001-N : Route index.
Actual external message code	10 alphanumeric ASCII	"???????????" in event of "on the fly" visualization, "#####@" if blank, or the code (numerical) at present



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		visualized
Code description	N Alphanumerical ASCII	Typically the description will be 27 chars long.

VOC (Control of vocal annunciator)

Field	Length (byte) and type	Range values
Announcement type.	1 ascii	<ul style="list-style-type: none">• 'E' Speak on channel 2 (external): "ROUTE" + the wave associated with the chosen code.• 'L' Speak on channel 1 (internal) the wave associated with the chosen code.• 'P' Speak on channel 1 (internal): "NEXT STOP" + the wave associated with the chosen code.• 'F' = Speak on channel 1 (internal): "STOP" + the wave associated with the chosen code.
Wave code.	4 ascii	"0000"-"9999" Fill un-used ascii with '0'.



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SMS (show "on the fly" message)

Field	Length (byte) and type	Range values
Message type	1 alphanumeric ASCII	'E' = external 'I' = internal
Free	1 binary	This field is actually not used
Text	variable binary	<u>External signs</u> Ascii text to be shown. The max field length is 200 chars. <u>Internal signs</u> Ascii text to be shown plus some control bytes (see following table). The max length of the text can vary between the different internal sign models. RG5M16144/D1K30B : max 100 chars.

Internal signs management.

Control byte	Meaning
<01>	End of fixed part (no scrolling). This field has also a "end of row" meaning in case of 2 line signs.
<0A>C	Select color. Possible values of C: '0' : Green '1' : Red '2' : Yellow This control byte will be ignored for monochromatic displays.
Scrolling	The scrolling will be automatically managed in function of the text length. For 2 line signs only the lower line can scroll.

External signs management.

Control byte	Meaning
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<0A>	End of the line
Scrolling	The scrolling will be automatically managed in function of the text length. For 2 line signs only the lower line can scroll.

ACK (Generic positive answer)

Field	Length (byte) and type	Range values
Control	1 binary	0 = OK 1 = not included command 2 = wrong syntax 3 = data field not valid 4 = wrong length 5 = unexpected command 6 = memorization error 7 = not present code 255 = generic error

RVE (Answer to a software/firmware version request)

Field	Length (byte) and type	Range values
Software/firmware code	variable alphanumeric ASCII	
Software/firmware description	variable alphanumeric ASCII	

DUP (Data uploading)

Field	Length (byte) and type	Range values
Packet number	2 binary	'0'-'65535'. The value is in the MSB-LSB order.
Data buffer	N binary	

RUP (Answer to a data uploading)

Field	Length (byte) and type	Range values
Uploading status	1 binary	0 : Ok, waiting for more data. 1 : Uploading finished OK. 255 : Wrong sequence. 254 : Error in data. 253 : Timeout (10 seconds).

Structure and uploading of TRX file

The file with extension TRX created by the VerbaBUS or VerbaPLUS softwares contains all the information that have to be visualized on the on board signs and some settings for the KC central unit. The file is composed by different sections that can be uploaded separately and can contain messages for external signs, messages for internal signs and inversions. Each one of the 3 possible sections start with the sequence of characters <0x06><0x5A>C. C is a character that identify the type of the following section:

- 'P' : data for external signs
- 'M' : messages for internal signs
- 'I' : inversions

Each section finish with the end character <0x10>.

In the following table there is an example of a TRX file.



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LINE	COMMENT
;VerbaTX V3.0	Comment line 1
;TxParam->9600,N,8,2	Comment line 2
;RxChars->3,	Comment line 3
<06h>ZP	External signs section data header
.....	External signs data lines
<10h>	External signs section data end.
<06h>ZM	Internal sign section data header
.....	Internal sign data lines
<10h>	Internal sign section data end.

To upload a certain section simply send all the bytes from the header <0x06>Z to the ending <0x10> using the DUP command. The packet number field must always start from 0 for the first data packet of the section and must be increased of one unit for each of the following one. The size of each packets must be at maximum equal to 8K bytes. The answer command RUP inform the board computer of how the uploading sequence is proceeding. A correct uploading sequence will receive back a 0 code for each packet from the first to the (last -1) and a 1 code for the last packet to identify that data was successfully uploaded.

2 steps uploading of TRX file

With 2 steps uploading the new TRX file can be transmitted maintaining the old file until the new one is all correctly received.

The transmission of the file must be done again with the DUP command, but must be preceded by the TRS command. The TRI command let check which TRX file is actually installed into the unit.

TRS (Data uploading start)

Field	Length (byte) and type	Range values
New file length	4 binary	The value is in the MSB-LSB order.
New file checksum	2 binary	The value is in the MSB-LSB order. The checksum is a 2 byte unsigned short (0-65535) calculated as simple sum of every byte in the file to be transmitted.
New file name	N ASCII + 1 binary	The new file name must be \0 terminated. The max length is 16 chars (terminator excluded)

RTI (Reply to TRI command)

Field	Length (byte) and type	Range values
Actual file length	4 binary	The value is in the MSB-LSB order.
Actual file checksum	2 binary	The value is in the MSB-LSB order.



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		The checksum is a 2 byte unsigned short (0-65535) calculated as simple sum of every byte in the file to be transmitted.
Actual file status	1 Binary	0: no file present 1: file installation pending 2: TRX correctly installed 3: Error installing the TRX file.
Actual file name	N ASCII + 1 binary	The new file name must be \0 terminated. The max length is 16 chars (terminator excluded)

Differences between protocol ver.1 and ver.2

SPV (set KC-2S protocol)

Field	Length (byte) and type	Range values
Major version	1 binary	Set 2 for this protocol
Minor version	1 binary	Set 0 for this protocol
Release	1 binary	Set 1 for this protocol
Serial baud rate	1 binary	0 = 9600 1 = 19200 2 = 38400 255 = Don't change BR

NOTES

- Protocol version 1 is active as default setting.
- sending the CFK / VIS commands following version 1 or version 2 specification will result in an automatic switch from version 1 and 2 of the protocol (even without sending the SPV command).

RRP (Reply to a require KC-2S protocol version)

Field	Length (byte) and type	Range values
Major version	1 binary	
Minor version	1 binary	
Release	1 binary	



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CFK Version 1 (Sending of configuration parameters to the on board central unit)

Field	Length (byte) and type	Range values
Date and time	6 binary	Date and time valid in dmyhns format (d=day, m=month, y=year-2000, h=hour, m=minutes, s=seconds)

CFK Version 2

Field	Length (byte) and type	Range values
Date and time	6 binary	Date and time valid in dmyhns format (d=day, m=month, y=year-2000, h=hour, m=minutes, s=seconds)
Internal sign type	1 binary	0: none 1: RG5M144x16 (fw DDBUS16144T) 2: display graphic 7x96 (fw DSBUS07096TSAS) 3: DDBUS1X16T (1 row 16 chars) 4: DDBUS1X20T (1 row 20 chars) 5: DDBUS2X24T (2 rows 24 chars) 10 : TFT indirizzo K 11 : TFT doppio, indirizzi K e X. 255 : leave actual setting
Enable / disable dash sign	1 binary	0 : disable 1 : enable 255 : leave actual setting
Enable / disable automatic vocal annunciator management	1 binary	0 : disable 1 : enable standard speaker 2 : enable TTS speaker 255 : leave actual setting
Enable / disable manual set of vocal annunciator volume.	1 binary	0 : disable 1 : enable 255 : leave actual setting
Enable / disable route + destination (dynamic route management)	1 binary	0 : disable 1 : enable 255 : leave actual setting
Language	1 binary	0 : Italian 1 : English 2 : Spanish 3 : French 4 : German 5 : Portuguese 255 : leave actual setting
Password	2 binary	The 2 byte value is in the MSB-LSB order. 0 - 9999 : set the password 65535 : leave actual setting
Vocal annunciator volume	1 binary	1 - 31 : valid volume range 255 : leave actual setting

RRK (Reply to a request configuration parameters to the on board central unit)

The RRK fields are the same of CFK Version 2 command.

VIS Version 1 (Sending of message that has to be visualized)

Field	Length (byte) and type	Range values
Message type	1 alphanumeric ASCII	'E' = external 'I' = internal
Other parameters	4 binary	Not used. Available for future expansions.
Message code	10 alphanumeric ASCII	"@@@@@@@@@" (always valid) to blank the signs, or the code (numerical) that has to be visualized ("0000000000" - "9999999999")

VIS Version 2

Field	Length (byte) and type	Range values
Message type	1 alphanumeric ASCII	'E' = external 'I' = internal 'B' = inversion. In this case the following message code will be ignored. 'D' = driver ID (the ID length is MAX 9 ascii and depends on KC set up. Used only if dash sign is present. 'R' = dynamic route text (3 ascii). Used only on "route + destination" systems.
Message code	10 alphanumeric ASCII	The less significative ascii will be considered if the codes are less than 10 ascii long. Fill un-used ascii with '0'. "@@@@@@@@@" : blank the signs.

RPK Version 1(Reply of the on board central unit to a status request)

Field	Length (byte) and type	Range values
Date and time	6 binary	Date and time valid in dmyhns format (y=year-2000)
State	1	Generally 0.



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	binary	<i>Setted Bit7</i> = shows that the unit has restarted from the last received command; <i>Setted Bit6</i> = shows that the unit doesn't have data.
External message code	10 alphanumerical ASCII	"?????????" in event of ASCII visualization, or the code (numerical) at present visualized
Internal message code	10 alphanumerical ASCII	"?????????" in event of ASCII visualization, or the code (numerical) at present visualized
Number of displays DY_BUS (NRD)	1 binary	0 - 5
Displays brightness	NRD byte binary	0 - 8 (0 = automatic brightness, 1 = minimum, 8 = maximum)
Displays parameters	NRD*4 bytes binary	0 - 255 (specified from Aesys on ground of the equipment; the first byte of each display shows the address in a range included between 'A' and 'Z' and it refers to the serial KC ↔ DY_BUS, for example AxxxxBxxxxCxxxxDxxxx)
Displays status	NRD byte binary	0 = OK 1 = Error

RPK Version 2

Field	Length (byte) and type	Range values
Date and time	6 binary	Date and time valid in dmyhns format (y=year-2000)
State	1 binary	Generally 0. <i>Setted Bit7</i> = shows that the unit has restarted from the last received command; <i>Setted Bit6</i> = shows that the unit doesn't have data.
External message code	10 alphanumerical ASCII	"?????????" in event of "on the fly" visualization, "#####@" if blank, or the code (numerical) at present visualized
Internal message code	10 alphanumerical ASCII	"#####@" if blank or the code (numerical) at present visualized.
Driver ID	9 alphanumerical ASCII	Filled with '0' if the ID length is less than 9 ascii.
Route	3 alphanumerical ASCII	"???" if system different from "route + destination".
Number of devices (displays, annunciator)	1	



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etc.) on the line DY_DEV (NRD)	binary	
Displays parameters	NRD*2 bytes binary	The first byte of each device shows the address (in a range included between 'A' to 'Z' for the signs and '_' for the vocal annunciator) . The address refers to the serial KC ↔ DY_BUS. The second byte is the device status: 0 = OK ; 1 = ERROR. For example A0B0C0D1.