



# 720-VBS data output specification

Draft proposal of protocol and structure

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# DOCUMENT CHANGE HISTORY

VERSION	CHANGES	DATE	RELEASED BY
1.0	Initial draft release.	22/07/2010	Bradley Boxall
1.1	Added configurable header and footer	20/09/2010	Bradley Boxall
1.3	Added input data for override and shutdown	21/09/2010	Bradley Boxall
1.4	Added ACK/NAK system and inputs for time setting and override	29/09/2010	Bradley Boxall
1.5	Added details of command strings	02/10/2010	Bradley Boxall
1.6	Changed time set/get to simpler format	09/11/2010	Bradley Boxall
1.7	Added calibration date request	16/11/2010	Bradley Boxall

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# PRODUCT SPECIFICATION

## 1 PREAMBLE

The purpose of this document is to define the event data for the 720-VBS. The data will be sent out of the 4 wire port on the VBS for use by 3<sup>rd</sup> party telematics systems. The specification will detail both physical data as well as the packet structure used.

## 2 PHYSICAL LAYER SPECIFICATION

### 2.1 Mechanical specification

The 4 wires used for this interface are located at the front panel of the 720-101 (and future variants of the VBS). Figure 1 shows the location of the port.

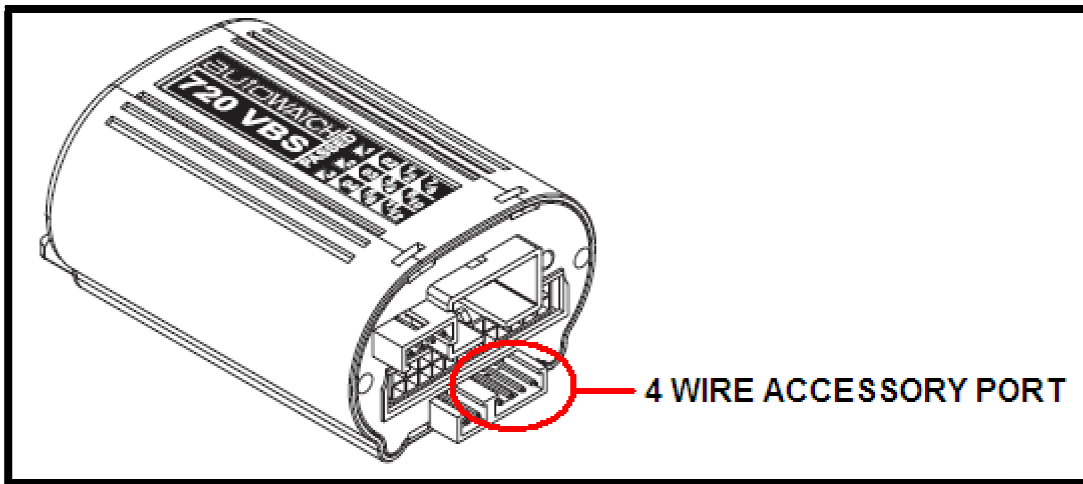


Figure 1: VBS ACCESSORY PORT LOCATION

### 2.2 Electrical specification

#### 2.2.1 Pin configuration

The accessory port has the following physical specifications.

Table 1: Pin configuration

PIN 1	Serial data output		
PIN 2	Serial data input		
PIN 3	3V output (Used for voltage level reference and low power accessories only)		
PIN 4	Common		

Table 2: Electrical specifications

Voltage level input high minimum	>2.4 VDC		
Voltage level input low	< 0.45 VDC		
Voltage level output high	> 2.5 VDC		
Voltage level output low	< 0.4 VDC		

3V output maximum current	25 mA
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### 2.2.2 Serial specification

The serial port is set up in the following configuration.

Table 3: Serial specification

Baud rate	Configurable (56000 default)
Number of bits	8
Number of stop bits	1
Number of start bits	1
Parity	None
Flow control	None

### 2.3 Baud rate configuration

The baud rate is configurable using the PC configuration software. Table 4 shows the possible configurations of the baud rate. The default baud rate is set to 56000 to allow for use of the 873.

Table 4: Baud rate configuration

Baud rate (bits per second)	Error (%)
9600	-0.08
14400	-0.08
19200	0.16
28800	-0.08
38400	0.16
56000 (default)	0.6
57600	0.64
115200	-0.79

## 3 DATA PROTOCOL SPECIFICATION

### 3.1 Packet structure

The data will be in ASCII text with a preamble for automatic baud rate detection, start of packet header, a payload and a CRC followed by the end of packet delimiter.

Table 5: Packet structure

Preamble	Start of packet	Payload	CRC	End of packet
0 to 5 bytes	6 bytes	6+12+2+4+6 = 30 bytes	2 bytes	0 to 5 bytes

#### 3.1.1 Preamble

At the start of the packet a preamble will be sent, this preamble is configurable using the PC configuration software provided for this. It is possible to have no preamble or up to 5 bytes, the default configuration is 2 bytes of 0xAA.

#### 3.1.2 Header

The start of packet will be a 6 byte sequence of ASCII"720VBS". This will indicate the type of system sending the data.



### 3.1.3 Payload

The payload will be split into 5 parts.

Table 6: Packet payload breakdown

Payload data segment	Number of bytes
VBS serial number	6
Time and date of event	12
Event number	2
Alcohol value associated to the event	4
TAB serial number associated with the event	6

#### 3.1.3.1 VBS serial number

The serial number of the VBS.

#### 3.1.3.2 Time and date stamp

This will be the time and date that the event occurred, this is the VBS time and unless correctly configured for the country in use the time may not be correct.

#### 3.1.3.3 Event number

All events are defined in Table 7 this will be a two byte section that will indicate the event that has taken place.

#### 3.1.3.4 Alcohol value associated with an event

Should the event be a sample, be it pass or fail, the alcohol value will be send in this four byte section. The four bytes correspond to µg/l alcohol value, for conversion to mg/l the decimal point must be inserted after the first number. For example, if the four bytes are 1234 this corresponds to a breath alcohol value of 1.234 mg/l.

Should there be no alcohol value associated with an event, such as an ignition event, or no alcohol was detected, then these bytes will all be zero (ASCII zero).

#### 3.1.3.5 TAB serial number

Should a TAB be connected to the VBS when an event occurs, these six bytes will contain the serial number of that TAB. If there is no TAB connected to the VBS when an event occurs then these bytes will be zero (ASCII zero).

### 3.1.4 CRC

The CRC will be a standard CRC-16 (IBM,  $x^{16} + x^{15} + x^2 + 1$ ) type check done from the first byte of the payload to the last byte of the payload.

### 3.1.5 End of packet

The end of packet structure is configurable in the same way as the start of packet header. It is configurable to be any zero to 5 bytes and is configured using the PC configuration software. The default configuration is 2 bytes being a carriage return (0x0A) and line feed (0x0D).

## 3.2 Event data

The events that will be sent over the accessory port as listed in Table 7.

Table 7: List of events and event numbers

Event number	Event information
01	VBS power up (power connected)
02	Initial sample failed
03	Random sample failed
04	Initial sample passed
05	Random sample passed
06	Possible push start
07	Override period started
08	Override period ended (can be from valid TAB signal or timeout)
09	Emergency override period started
10	Forced sample request
11	Random sample request
12	Call time expired (failed to give sample on request)
13	Circumvention - breath related
14	Circumvention - suck-back
15	Circumvention - blowing too hard
16	System rearmed – start time expired
17	System rearmed – restart time expired
18	TAB connected
19	Driver change request
20	Driver change passed
21	Driver change failed
22	Driver change call expired
23	Manual sample
24	Passed after random call expired
25	Passed after driver change call expired
26	Failed after random call expired
27	Failed after driver change call expired
28	Circumvention – Insufficient sample
29	Door opened
30	Ignition on
31	Ignition off
32	Database deleted

### 3.3 Example event 1

The following example packet is an initial sample fail done with VBS serial number A12345, TAB serial number T23456, alcohol measured is 0.345 mg/l and was done at 07:20:00 on the 6<sup>th</sup> of July 2010.

Table 8: Example event 1 outline

Preamble	Start of packet	Payload	CRC	End of packet
0xAA,0xAA	720VBS	See Table 9: Example event 1 payload	XX	0x0A,0x0D

Table 9: Example event 1 payload

VBS Serial no.	H	H	M	M	S	S	Y	Y	M	M	D	D	Event	Alcohol	TAB serial no.
A 1 2 3 4 5	0	7	2	0	0	0	1	0	0	7	0	6	0 2	0 3 4 5	T 2 3 4 5 6

## 4 ACK/NAK and resending

In order to negate communication errors as system of acknowledgements and resends will be implemented. The use of this ACK/NAK system will be configurable to allow for simplex data streaming of the events when the system receiving does not have the ability for duplex communications, this configuration will be done via the PC configuration program during installation. In order to prevent events being lost, an event data queue will be implemented that will contain up to 3 events while they are being transmitted to the telematics device.

### 4.1 ACK/NAK and resending

When data is sent the receiving system it must reply with an ACK. If the VBS does not receive the ACK after a certain period (TBD) and it is configured to require the ACK it will then repeat the message. If an error has occurred during the transmission the VBS can receive a NAK, this will indicate the message will need to be resent.

#### 4.1.1 ACK received

If a packet is sent and an ACK is received by the VBS it indicates the correct reception of the packet and no further communications happens with regards to this packet.

#### 4.1.2 NAK received

If a packet is sent and a NAK is received by the VBS it indicated that a communications error has occurred. The error could be related to a bit error resulting in an incorrect CRC or a UART framing error etc. The response required by the VBS is to resend the packet. As the reception of the NAK indicated the readiness of the receiving system the VBS will resend immediately after reception of the NAK. In the case of a NAK being received repeatedly for a single packet, the VBS will only resend the packet (TBD) number of times.

#### 4.1.3 No ACK or NAK received

If a packet is sent (and the VBS is configured to require an ACK) and there is neither an ACK nor a NAK received by the VBS after a certain period (TBD) it will be assumed that the receiving system did not receive the packet. If this happens the VBS will resend the packet (TBD) number of time before discarding the packet.

#### 4.1.4 Event stack/queue

Should an event be in transmission and another event is triggered the second event data will be stored on a stack to be sent after the completion of the current event. The depth of this stack will be (TBD)

## 5 VBS Command set

The addition of a set of commands to the VBS will allow 3<sup>rd</sup> party telematics devices to control certain functionality of the 720 system. The command set is defined in this section.

The VBS commands will be sent in a similar structure to the event data output, using the configured header and footer bytes and baud rate. The commands will be variable length with the length being defined in the first byte after the header. The length is only the length of the payload and command number, it does not include the header, CRC and footer lengths. All data in the payload and command number will be sent and received in ASCII while the header, length, CRC and footer can be any value (0x00 to 0xFF).

Header	Length	Command number	Payload	CRC	Footer
Configurable	1 byte	2 bytes (ASCII)	Variable (ASCII)	2 bytes	Configurable

## 5.1 VBS information request (01)

### 5.1.1 Overview

On reception of the VBS information request the VBS will reply with all relevant information about the unit. This will include software and hardware details, serial number of the VBS, event memory status, override code offset and ignition status (ON or OFF). Note that as the data may vary in magnitude the length of the payload and the location of specific data may not be constant.

### 5.1.2 Request packet payload details

Header	Length	Command number	Payload	CRC	Footer
Configurable	2 (0x02)	01	(none)	2 bytes	Configurable

### 5.1.3 Reply packet payload details

The reply packet consists of the following fields that are comma separated as such;

VBS serial no.	HW version	SW version	Number of events	Override offset	Ignition status
----------------	------------	------------	------------------	-----------------	-----------------

The following is an example of the reply to a VBS information request given by a VBS with serial number A12345, hardware version 01, software version number 0203, number of events in the database 6789 and override offset code of 2 and the ignition is on.

Header	Length	Command number	Payload	CRC	Footer
Configurable	27 (0x1B)	01	A12345,01,0203,6789,2,ON	2 bytes	Configurable

## 5.2 Override request (02)

### 5.2.1 Overview

On reception of the override command the VBS will enter an override period, in hours, that is defined in the last two bytes of the packet (giving a maximum time of 99 hours). This is a secured command and as such will require the rolling override pin code specific for the unit. The VBS will reply with a pass message when a valid pin code is used or fail message if the pin code is incorrect. In addition to the replies to the request the VBS will send out a normal override period started packet in the event of a correct pin code.

The override code is generated using the serial number of the device and the override offset. The code generation tools are for use only by approved distributors.

### 5.2.2 Request packet payload details

Header	Length	Command number	Payload	CRC	Footer
Configurable	7 (0x07)	02	5,2 bytes (code, hours)	2 bytes	Configurable

### 5.2.3 Reply packet payload details

#### 5.2.3.1 Pass

Header	Length	Command number	Payload	CRC	Footer
Configurable	6 (0x06)	02	PASS	2 bytes	Configurable

#### 5.2.3.2 Fail

Header	Length	Command number	Payload	CRC	Footer
Configurable	6 (0x06)	02	FAIL	2 bytes	Configurable

### 5.3 VBS time request (03)

#### 5.3.1 Overview

On reception of the VBS time request the VBS will reply with the current time on the VBS.

#### 5.3.2 Request packet payload details

Header	Length	Command number	Payload	CRC	Footer
Configurable	2 (0x02)	03	none	2 bytes	Configurable

#### 5.3.3 Reply packet payload details

The reply packet consists of the following fields, in a format based on ISO-8601 standard time format YY-MM-DD,hh:mm:ss;

Year	Month	Day	Hours	Minutes	Seconds
------	-------	-----	-------	---------	---------

The following is an example of the reply to a VBS time request when the VBS has a time and date of 25 December 2010, 15:06:45.

Header	Length	Command number	Payload	CRC	Footer
Configurable	19 (0x13)	03	10-12-25,15:06:45	2 bytes	Configurable

## 5.4 Set VBS time request (04)

### 5.4.1 Overview

On reception the set VBS time command the VBS will set its internal RTC to the time included in the payload. The time included will be checked to see if there are no illogical inputs and if there are any the VBS will reply with a fail message otherwise it will reply with a pass message. The payload is based on the ISO-8601 standard time format YY-MM-DD, hh:mm:ss.

Day	Month	Year	Hours	Minutes	Seconds
-----	-------	------	-------	---------	---------

### 5.4.2 Request packet payload details

The following is an example of a request to set the VBS time to 25 December 2010, 15:06:45

Header	Length	Command number	Payload	CRC	Footer
Configurable	19 (0x13)	04	10-12-25,15:06:45	2 bytes	Configurable

### 5.4.3 Reply packet payload details

The following are the possible replies from the VBS for the set time request.

#### 5.4.3.1 Pass

Header	Length	Command number	Payload	CRC	Footer
Configurable	6 (0x06)	04	PASS	2 bytes	Configurable

#### 5.4.3.2 Fail

Header	Length	Command number	Payload	CRC	Footer
Configurable	6 (0x06)	04	FAIL	2 bytes	Configurable



## 5.5 Reset VBS (05)

### 5.5.1 Overview

On reception of the reset VBS command the VBS will perform a full software reset. This command is not meant to be used unless an error has occurred on the VBS and must be used with caution. There will be no event packet sent after this command as this is not a power on reset.

### 5.5.2 Request packet payload details

The following is an example of a request to reset the VBS.

Header	Length	Command number	Payload	CRC	Footer
Configurable	02	05	None	2 bytes	Configurable

### 5.5.3 Reply packet payload details

The following are the possible replies from the VBS for the set time request.

#### 5.5.3.1 Pass

Header	Length	Command number	Payload	CRC	Footer
Configurable	6 (0x06)	05	PASS	2 bytes	Configurable

#### 5.5.3.2 Fail

Header	Length	Command number	Payload	CRC	Footer
Configurable	6 (0x06)	05	FAIL	2 bytes	Configurable

## 5.6 Set VBS configuration request (06)

### 5.6.1 Overview

On reception of the VBS configuration set command the VBS will configure itself to the settings included in the payload of the packet. The configuration will first be processed and checked. The resulting configuration will be mirrored, and if any of the configuration bytes do not fall into a correct range the VBS will return these values to their default. The payload requires a two byte selection number followed by a comma and then a three byte configuration setting field.

The VBS configuration will be done piecewise where each configuration setting will be accessed individually. The settings available are listed in Table 10.

Table 10: Configuration option and ranges

Configuration	Details	Selection number
Random sample time	Range 5min to 180min (zero disables random sample)	1
Rand sample offset time	Range 3min to 30min	2
Forced sample time	Range 3min to 30min (zero disables forced sample)	3
Call period time	Range 1min to 30min	4
Language	See language configuration table (TBA)	5
Start time	Range 1min to 30min	6
Restart time	Range 1min to 180min	7
Push start time	Range 1min to 30min	8
Output 1 time	Range 1second to 60seconds	9
Output 2 time	Range 1second to 60seconds	10
Output 3 time	Range 1second to 60seconds	11

### 5.6.2 Request packet payload details

The following is an example of a request to change the random sample time to 25minutes.

Header	Length	Command number	Payload	CRC	Footer
Configurable	06 (0x06)	06	01,025	2 bytes	Configurable

### 5.6.3 Reply packet payload details

The following are the possible replies from the VBS for the configuration change request in the example above.

#### 5.6.3.1 Pass

Header	Length	Command number	Payload	CRC	Footer
Configurable	6 (0x06)	06	01,025	2 bytes	Configurable

#### 5.6.3.2 Fail

Header	Length	Command number	Payload	CRC	Footer
Configurable	6 (0x06)	06	01,030	2 bytes	Configurable

## 5.7 VBS configuration request (07)

### 5.7.1 Overview

On reception of the VBS configuration request the VBS will reply with the current configuration of the setting requested. The selection is based on Table 10.

### 5.7.2 Request packet payload details

The following is an example of a request to read the start time which for this example is 10minutes.

Header	Length	Command number	Payload	CRC	Footer
Configurable	03 (0x03)	07	8	2 bytes	Configurable

### 5.7.3 Reply packet payload details

The following are the possible replies from the VBS for the configuration read request in the example above.

Header	Length	Command number	Payload	CRC	Footer
Configurable	6 (0x06)	06	8,10	2 bytes	Configurable

## 5.8 TAB calibration request (08)

### 5.8.1 Overview

On reception of the TAB calibration request the VBS will reply with the currently connected TABs calibration date, if there is no TAB connected the calibration date will be all zero. The reply will include the serial number of the TAB as well as the calibration date.

### 5.8.2 Request packet payload details

The following is an example of a request to for the calibration date.

Header	Length	Command number	Payload	CRC	Footer
Configurable	02 (0x02)	08	(no payload)	2 bytes	Configurable

### 5.8.3 Reply packet payload details

The following is the general format of the reply from the VBS for the configuration read request.

Header	Length	Command number	Payload	CRC	Footer
Configurable	6 (0x06)	08	Serial number, calibration date	2 bytes	Configurable

### 5.8.4 Example reply packet

After the VBS has received the calibration date request the following will be the reply based on the TAB connected with a serial number of T12345 and a calibration date of 1<sup>st</sup> March 2011.

Header	Length	Command number	Payload	CRC	Footer
Configurable	17 (0x11)	08	T12345,11,03,01	2 bytes	Configurable

## 5.9 Auto-configuration request

### 5.9.1 Overview

When a system is connected to the VBS it can self configure a VBS to a pre-configured setup that is programmed in the VBS. This command is done over the default baud rate by default but can be used after the baud rate is configured differently from the standard.

The list of pre-configured settings will be increased for each system as it is incorporated into the VBS. The reason for this is to allow for faster installation of the system without having to connect the PC to the VBS to configure the interface protocol.

Table 11 : List of pre-configured interface settings

Configuration number	Details	Selection number
Default (PFK)	56000 kbaud, 0xAA-0xAA start, 0x0A-0x0D stop	1
TBD		2
TBD		3
TBD		4
TBD		5

### 5.9.2 Request packet payload details

The auto-configuration request is a simplified request using four byte structure starting with @PC(X) where X is the selection number.