



# **CARVEC RC Signal Master Multi-Protocol Signal Processor**

**User Manual – Issue 1**

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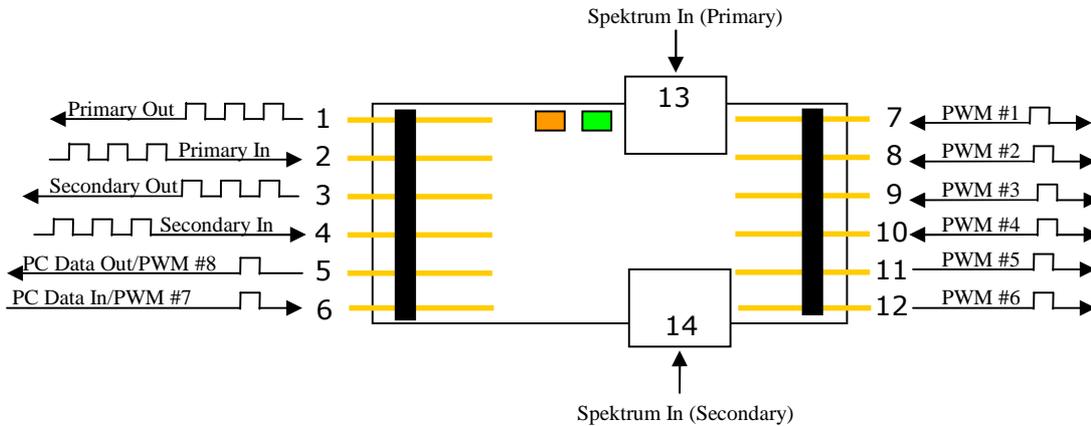
## Overview

- Connect up to 5 RC Receivers simultaneously
- Supports SBUS/SBUS2/PPM/Spektrum/PWM receiver types
- Generate up to 8 PWM outputs from any inputs
- Read up to 4 PWM inputs and merge to any output
- Freely mix inputs from any receiver into the outputs of another
- Apply special functions to any input (eg Servo slow-down)
- Real-time PC display of all input and output signals
- First-Choice, Second-Choice and Failsafe settings for every output signal – automatically switch between input signals when other go invalid.
- Use any input to switch any output between the first- and second- choice without restrictions. Eg. Use 1 RC channel to switch any or all output channels between 2 different receivers.
- 50Hz or 400Hz servo output rate.
- Selectable 760us or 1520us null-pulse.
- Operates from 3v to 15v DC.
- Upgradeable firmware

## Applications

- Single/Dual Operator Camera Gimbal Control switching
- Stick input smoothing (Eg for camera control)
- Merging up to 5 radios + receivers inputs to one output
- Pilot handover switching
- Safety Pilot take-control switching
- Student/Trainer switching with different Receiver types.
- Backup transmitter/receiver switching

## Module Pin Assignments



Port	Function
1	Primary serial data channel output
2	Primary serial data channel input
3	Secondary serial data channel output
4	Secondary serial data channel input
5	PC link data Out / PWM #8 (output only)
6	PC Link Data In / PWM #7 (output only)
7	PWM #1 (input or output)
8	PWM #2 (input or output)
9	PWM #3 (input or output)
10	PWM #4 (input or output)
11	PWM #5 (output only)
12	PWM #6 (output only)
13	Spektrum satellite input (Primary)
14	Spektrum satellite input (Secondary)

All the middle row of pins are connected together and must be the battery '+'.  
 All the lower row of pins are connected together and connect to the battery '-' (Gnd)

If a Spektrum satellite receiver is connected at the same time as an SBUS/PPM receiver then the first 8 Spektrum channels will appear in the top 8 channels of the input – thus allowing up to 4 separate receivers to be used simultaneously.

## LED Flash Indications

Immediately after power-up, the green LED will flash rapidly while the module waits to establish comms with the PC software. If the PC is not connected, this will last about 0.5 seconds. If the PC is detected it will exit this mode and so the flashing may be too quick to be seen.

After the PC init phase, the 2 LED's will flash to indicate the configuration of the primary (green LED) and secondary (yellow LED) input channels as follows:

Flashes	Configuration
1	SBUS

2	Spektrum
3	PPM

Next, if the PC link is active then the yellow LED will light at half-brightness.

From this point, the green LED will light when the primary input channel is valid and the yellow LED will light (full strength) when the secondary input is valid.

If the primary input is not valid, the green LED will flash periodically to indicate the module is powered and running.

# PC Configuration

## Connecting to the PC

Note: A CARVEC USB adapter (available separately) is required for PC configuration and firmware update.

The module is connected to a PC via ports 5 and 6. Port 6 is received data (from the PC) and port 5 is data out to the PC. Appendix A has more details on the wiring diagram for the USB adapter connection.

The adapter should be set to default to be COM port 10 (see appendix A for instructions on how to do this).

## Installing the PC Software

The Signal Master PC software is installed by running the ‘Setup.exe’ file from the installation folder. Please follow on-screen prompts to install.

When the software is started, it will present a screen which looks like this:



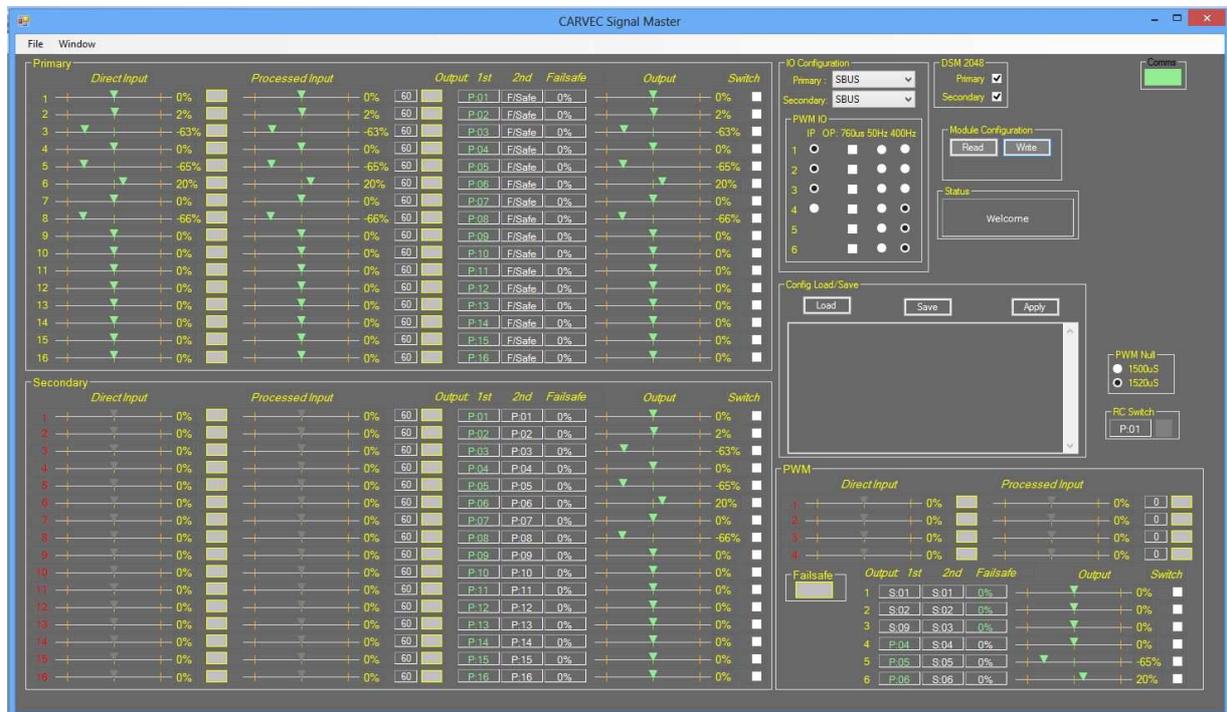
If an error message appears saying the com port is not valid, select ‘Windows->Comms Link’ and select the correct value.

Once the PC software is running, observe the LEDs on the USB adapter. One should be flashing quite quickly which indicates it is trying to connect to the module.

With the PC software running and the adapter LED flashing, power on the Signal Master module. It should detect the PC connection and the LED will light solid (after the 'mode input flash – see LED Flash Indications section). Also the 'Comms' indicator on the PC display top-right hand corner should turn green.

Now click 'read' on the PC software in the box labelled 'Module Configuration'. The fields should all change to show the current configuration. If this is successful, you are ready to go.

# PC Configuration Utility



## Primary and Secondary Serial Input Channels

Let's take a look at the PC display. The two panels on the left hand side show the configuration for the primary and secondary serial data channels (ie the SBUS/PPM/Spektrum data streams). The two work identically and independently.

The numbers down the left hand side are the individual channel numbers (1 to 16). These are coloured red when the channel is invalid, yellow when the channel is valid and turn orange when the channel is in failsafe.

The column to the right of the channel numbers is the value of the channel which is being received. It is updated in real-time so you can monitor what the sticks and switches do.

To the right of this is the 'processed' channel input. Each input channel can have some processing applied according to the parameter shown in the white box. As the input channel changes on the left, the corresponding 'processed' value can be monitored in real time too.

To the right of the 'processed' channel, we have the 'Output' for each channel. This display allows us to monitor what is actually going out from the module. For every channel in the output, there is a 'first choice', a 'second choice' and a 'failsafe'. In normal operation, the channel will be driven by the first one which is valid. The one which is being used right now is written in green.

The 'first' and 'second' choices show which input channel is being used to drive them – for example "P:03". The first character shows the source and is normally "P" (primary channel) "S" (secondary channel) or "R" (RC (ie PWM) input channel). It may also be "F/Safe" which means it will use its failsafe value.

The numbers indicate which channel from the source is selected. If the channel has the letter "-P" at the end then it means it is using the processed version of the input.

Normally the 'First choice' will be used if it is valid and the 'Second choice' automatically selected if it is not. However, if the 'Switch' checkbox on the right hand side is checked, it means that the selection will be reversed if the RC switch channel is 'On' (the RC switch channel selection is shown in the PWM section on the right hand side of the display). This allows channels to be individually switched between the first and second choices under control of another channel.

## ***PWM Input Channels***

The module has 8 PWM connections of which 4 may be configured as either inputs or outputs and 4 are permanent outputs. The selection is made in the 'PWM IO' section in the upper right hand quarter of the display.

The status of the PWM inputs + outputs is shown in the bottom right hand corner. The display of information is the same as for the primary+secondary input channels.

Note: PWM outputs 7 and 8 share a connection with the PC interface. If the PC connection is active, these outputs are not available – though their values can still be seen on the display to allow checking.

## ***RC Switch Selection***

The RC-switch configuration is shown in the lower right hand side of the display. It includes the identification of the input signal which is used to control it.

The switch will be 'On' when the input value > 50% and off in other cases. When the switch is 'On', the box immediately to the right will light up green. The status of all the outputs will change in real-time so it is possible to monitor the effects of the switch on the output channels.

## ***Config Load/Save***

This window allows you to load or save the current configuration to a file. If you type some reminder text into the white box, it will be saved along with the config.

When the config file is loaded, the white box will display the memo saved with the config and the 'Apply' button will turn orange. The current config will not be changed until 'Apply' is clicked.

Some predefined configs are included in the installation folder.

## Changing Input Channel Selections

Any of the input channel selections can be easily changed by simply clicking on the one you want. When you do this, all of the possible channel selections have a button next to them which will light up green. Simply click the button for the channel you want to assign and it's identification will appear in the selection box you originally clicked.

All input channels are assigned this way including the RC switch.

While the selection is in progress, the inputs are still updated in real time so you can move the transmitter sticks etc to verify which one you want.

If you start a selection but want to cancel it, simply press the 'esc' key.

If you want an input to select the channels 'Failsafe' value then click the green box inside the small section titled 'Failsafe' on the lower right hand side of the display.

When 'Failsafe' is selected as the input source, the actual % entered in the failsafe window for the channel will be used. This allows a channel to output a fixed % servo pulse.

## Failsafe setting

Each channel has a failsafe setting. This value will be used if both the first and second choice sources are not valid. To change the value, simply click it and enter the new one.

If you enter 'Hold' then the output will remain at the last valid input.

### Note on SBUS Failsafe

For SBUS, the input signal remains active even when the receiver is in failsafe. Each channel may have a failsafe set up in the radio which the channel will change to when it goes into failsafe.

If the failsafe setting for a channel is set to 'Hold' and an input channel is SBUS, it will use the SBUS failsafe value for the output. This provides a method to preserve the use of the radio failsafe method. Remember that if an actual % is specified for the failsafe, it will be used for the output if SBUS goes into failsafe and override the radio failsafe.

## **Q&A**

### ***How do I change which input channel is used for driving an output channel ?***

Each output has a first choice, a second choice and a failsafe parameter. Click the one you want to change and it will either ask you to enter the failsafe %, or buttons next to all the inputs will turn green. Simply click the green button next to the input signal you want to use.

Don't forget to write the config to the module to see the result reflected on the display of the signals.

### ***How do I use the module to smooth out stick movements for smoother slew control of a radian module ?***

Each input channel also has a 'processed' version with a parameter which controls the effect. The parameter can be changed by clicking on it and entering the new value. The only processing supported at this time is slew rate limiting. The value of the parameter should be from 0 (fast response) to 63 (very slow response). 60 is a good starting point then adjust up or down to get the Radian response as you like it.

Note that the CARVEC G-Lock software upgrade for the Radian has slew smoothing built-in which should be used instead of the Signal-Master processing.

### ***Both LED's are flashing quickly and opposite to each other***

This means the internal configuration has failed a checksum test and may be corrupted. You need to write your config to the module again to clear this error.

### ***There is no output coming from the primary or secondary serial channel outputs***

The output will not start until at least one of the signals in it has gone valid. Once the output has started, it will remain active even if all input signals go invalid.

### ***How can I use PWM outputs 7+8 as they share the PC Link connections ?***

PWM Outputs 7+8 are only driven when the PC is not connected. They are slightly different from Servo outputs 1..6 as they have a maximum output rate of 200Hz instead of 400Hz.

### ***What is the operating voltage for the module ?***

The module will operated from any voltage from 3.5v to 12 volts without damage.

## ***I cannot get the PC software to connect to the module***

Before the module is powered, the PC software must be running and attempting to connect to the module via the USB dongle. You can see if this is happening because the yellow LED on the module will be flashing quite quickly.

When the module is connected and then powered, the PC software should establish comms and the yellow LED will light solid.

Please refer to Appendix A for details of how the module and the Dongle should be connected.

## ***How do I switch between radios for single/dual operator installations ?.***

Connect all receiver inputs from both radios to the module. They can connect via SBUS/Spektrum/PPM through the primary channels or via PWM through the 4 PWM input channels.

If you use PWM, be sure to set them as 'Inputs'.

It is recommended to use the primary channel as the one which connects to the Radian as it mean everything can be operated while the PC software is connected.

For the first radio, use the PC display to decide which stick inputs you want to assign as the controls for all the slew channels and the Radian Mode channel. Assign these to the '1<sup>st</sup> choice' for the primary channel outputs.

Now do the same with the second radio – but this time assign them to the '2<sup>nd</sup> choice' for the primary channel outputs.

Now when the primary channel inputs are valid, they will be used for the output. If the inputs go invalid then the 2<sup>nd</sup> choice inputs will be selected automatically.

If you configure the '1<sup>st</sup> choice' signals from the cameramans radio and the main pilot as the '2<sup>nd</sup> choice' then when the cameraman turns on his radio, he will take control.

Alternatively, the RC switch can be configured to be from either the pilot or the cameramans radio. They can then control who has control with this switch. For this method, be sure to check the 'Switch' checkbox for all the output channels to be switched.

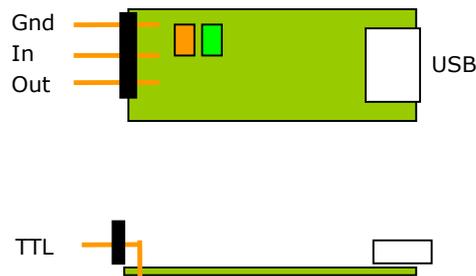
## ***Can I use the Spektrum ports at the same time as the SBUS/PPM ports ?***

Yes : if any data is received from either Spektrum port when that channel is configured for SBUS or PPM, the first 8 Spektrum signals will appear in channels 9 .. 16 of the input.

# Appendix A – PC connection using the CARVEC USB Adapter

## ***Dongle hardware connection and pin-out***

The CARVEC USB Adapter uses a high quality FTI chipset to provide a reliable data connection across all windows operating systems, both 32 and 64 bit.



Dongle	Module
Out	Port 4
In	Port 5
Gnd	Gnd

The Adapter provides data interfaces which supports direct microcontroller UART polarity signals.

NOTE: Do not connect any RS232 device directly. The module may be permanently damaged.

## ***Configuring the Adapter to automatically install as COM10:***

The RC Signal master module will attempt to connect to COM 10 when it starts. If there is no COM port10 then an error will result. It is useful to configure the module to always install as COM10. This is done as follows:

- 1) First connect the module and allow windows to automatically install the device driver.
- 2) When it is finished, go to the 'Control Panel' (Windows 7: from the start menu, Windows 8: Put the mouse pointer in the lower left of the screen, right click the mouse and select 'Control Panel')
- 3) From the control panel, click 'Device Manager'
- 4) In the device manager window, click 'Ports(COM & LPT)' to expand it and there should be a 'USB Serial Port (ComX)' where X is a number assigned by the operating system.
- 5) Right-click the 'USB Serial port' then left-click 'Properties'
- 6) In the properties window, click the 'Port Settings' tab

- 7) Next click the 'Advanced' button
- 8) In the COM port number, use the drop-down box and select COM10.
- 9) Now click OK. If windows gives you any warning, just click 'Yes' to continue.

Now each time the adapter is attached, it should come up as COM10. However if you plug it into a different USB port it may go back to another number – so this procedure needs to be repeated.

### ***Changing the PC software to use a different COM port***

As an alternative to using the above method, the PC software can be simply changed to match the COM port of the dongle. You need to know what COM port number the operating system has assigned by opening the control panel as described in the previous section.

On the main PC display click Window->Comms Port'. A window will appear which allows you to select the associated COM port.

### ***Verifying the PC software is connected to the correct USB Dongle***

If the USB Adapter is connected correctly and the PC software is running, the yellow LED will be seen to flash rapidly. This indicates the PC software is trying to connect to the Signal Master module.

## **Appendix B – Entering bootloader mode for firmware upgrade**

To place the module into bootloader mode to enable a firmware update using the CARVEC bootloader system, please short together the top pins of Ports 5 and 6 (Labelled PC on the module) then power on the module.

Entry into bootloader mode is signalled by both LEDs immediately lighting solid.

The module is now ready to be updated. Please see the documentation for the CARVEC bootloader system for further details.