RCP Manual

RCP Version 1.0

Note for SKAARHOJ controllers with Blackmagic 3G-SDI Arduino Shields and Studio Fiber Converter/Camera Fiber Converter

We have tested Blackmagics fiber converter products in general to work with SDI output. This includes the Mini Converter, ATEM Camera Converter, ATEM Studio Converter and ATEM Talkback Converter 4K. The only product we know does not work is the Studio Fiber Converter/Camera Fiber Converter. This product is not compatible with their own 3G-SDI shield which is the component we use inside the RCPs and other products. While the Studio Fiber Converter/Camera Fiber Converter will forward shading data from an ATEM switcher it will not do so for the 3G-SDI shield.

Bottom line is this: We cannot change this situation, only Blackmagic Design can decide to upgrade either the Studio Fiber Converter/Camera Fiber Converter or the 3G-SDI Arduino Shield to make it work. At this point we can suggest that you rather connects a controller to an ATEM switcher which will work as the master for sending out the shading data. You might employ a cheap ATEM switcher for only this purpose.

Congratulations!

Congratulations with your RCP for Blackmagic Cameras! SKAARHOJ is dedicated to making operation of broadcast hardware easier for people making live video and the RCP is a great example of this dream in action. With real tangible buttons, knobs and joysticks you can now control your Blackmagic cameras like you never could before. Furthermore, you just bought yourself a piece of hardware that will grow with you as your needs expand, regardless of whether they do so tomorrow or in two years. With a combination of Open Source hardware and software principles and the UniSketch firmware running on the device, you have an unparallelled level of control for an embedded hardware solution. You can immediately tweak how your RCP works and down the road you will benefit from firmware upgrades that includes new and expanded features as well other cameras supported.

We sincerely hope you will be a happy owner of our brand and continue to purchase our solutions and recommend us to others. Should we in any way fail to fulfill your expectation or do you simply want to share ideas for improvement, we will lend you an ear for any feedback!

Contents

Getting started

The RCP has a "Sony form factor" which makes it a drop-in replacement in OB-vans where you probably already have rack space ready for it. On the back you find connections for power, ethernet and SDI in and out and GPIO. On the front you will find displays, buttons, knobs and handles to manage the CCU of your camera.

Out of the box the RCP uses the SDI output to send CCU data to a Blackmagic camera. The minimal configuration is to connect the SDI out of the RCP to SDI in on your Blackmagic camera. Make sure the rotational switch under the bottom of the RCP is set to the same camera ID as you camera. Turn on power and as you pull the iris handle or adjust lift and gain you should see the picture on the cameras viewfinder change accordingly.

Connect SDI out to SDI in on your camera

Set DIP switch to #1 in order to control camera with ID 1

Notice, using the SDI output means the RCP does not know what settings the camera already has. So any parameter set for the first time may result in a "jump" in settings on the camera. After that they should be absolutely smoothly adjusted.

In a more likely scenario you will connect the RCP with SDI input from a switcher and using the DB9 plug for triggering tally light on the display as well as routing joystick override to a videohub GPI input. You likely own multiple of our RCPs as well, so a whole array of RCPs would be connected in the same way:
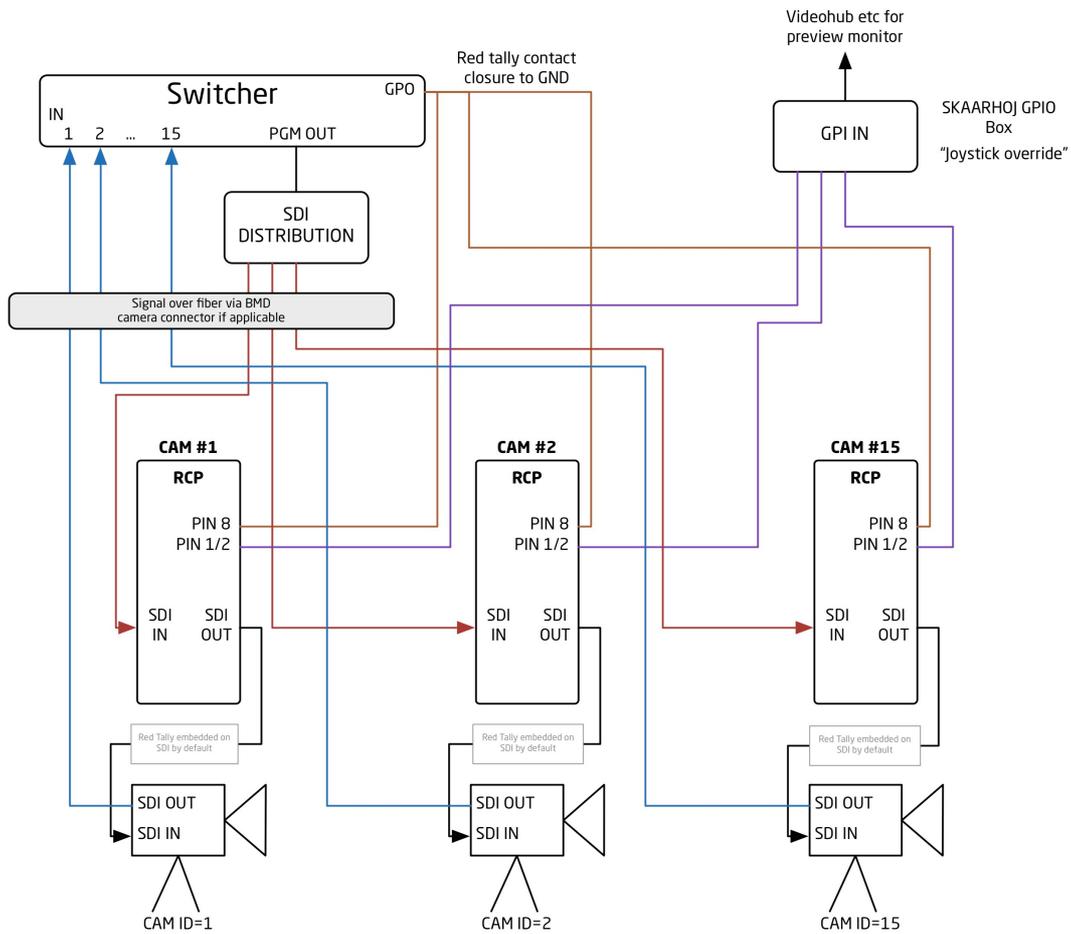
Even though the RCP will work without an SDI input, it's recommended to feed one. Only for cameras like the Micro Studio Camera where you have no viewfinder on the camera it makes no sense, but otherwise the SDI input is forwarded on the SDI output to the camera so the camera operator can see the return feed picture on his viewfinder.

The DB-9 GPI connected can be used to toggle a video source for a CCU operator preview screen. When the joystick top button or the "Prev" button is pressed, a relay is shorting pin 1 and 2 on the DB 9 plug. This can be routed to a subsystem that will select the right camera on the preview monitor. The DB9 plug also lets you take a tally signal into the device on pin 8. If this pin is shorted to GND (pin 5 or 9) the display backlight will change from white to red.

The menu system

The RCP has a fantastic clear OLED display divided into 2x4 tiles. Each tile corresponds to one of the 2x4 rows of black knobs, also called encoders:
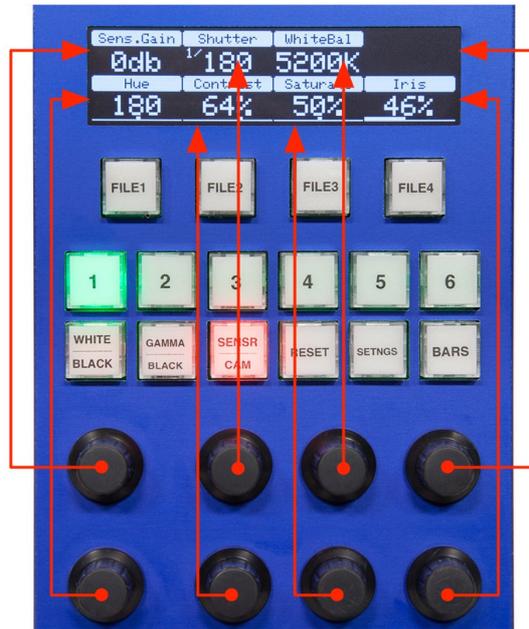
As you press the three keys "White/Black", "Gamma/Black" and "Sensor/Cam" you will see the content of the tiles change. This is the three "menu states" of the controller.

If you press the knobs down you will see a "coarse" mode toggle on/off. This is indicated by a small wave symbol on the display. When you are in coarse-mode the values will change in larger steps than otherwise. The setting is individual per knob.

If you press and hold an encoder for a second, the setting will typically reset its value.

| Coarse mode on | Coarse mode off |
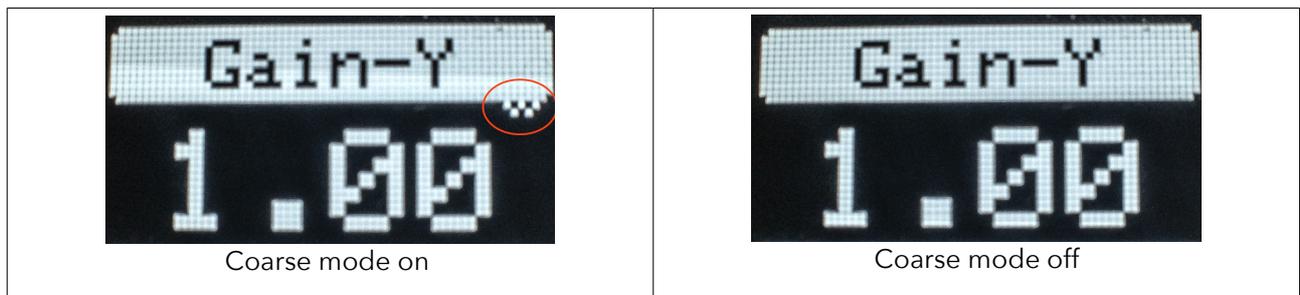
Under the hood

This is for the curious users: If you enter the UniSketch configuration interface of your RCP, you will see be able to configure the displays and knobs. The display could actually be set up as one big display, four display tiles or 2x4 (=8) display tiles which is what we use here. Each display tile is configured to simply reflect the function of another "HWC" (Hardware Interface Component) namely the encoders:
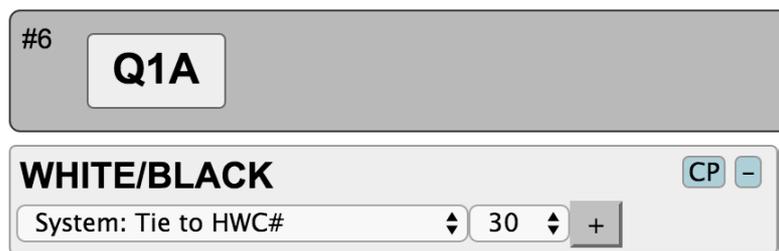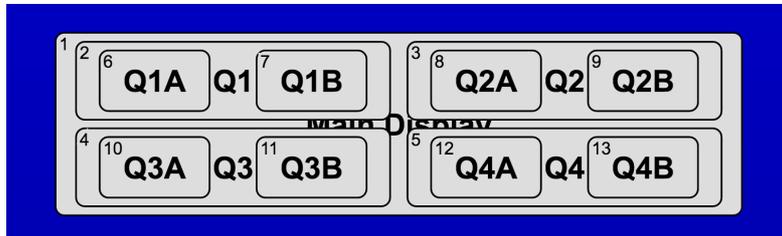
In this case, HWC#30 is the upper left encoder:
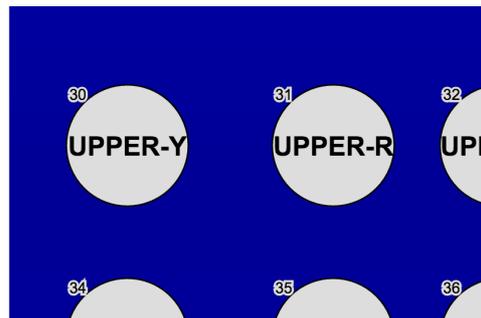
This encoder is configured to act differently depending on which of the three the menu states are being used:
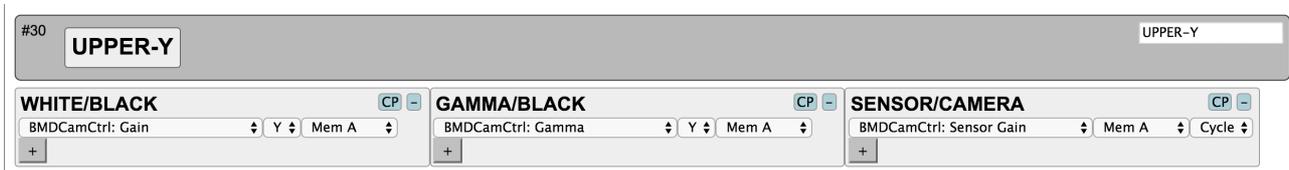
In case the first menu state activated by the "WHITE/BLACK" button, the knob will adjust luminance gain (high lights = white), otherwise if "GAMMA/BLACK" is activated it will adjust luminance Gamma (midtones) and in the third case of "Sensor/Camera", the sensor gain (db) is adjusted.

Take this as an example! All functions described in this manual are governed in this way by the web interface and the overall functional description we provide here is merely a description of the shipping default. For a detailed understanding of how the various interface components interacts with features on various hardware devices, please refer to the UniSketch manual.

File buttons

There are four file buttons on the device:
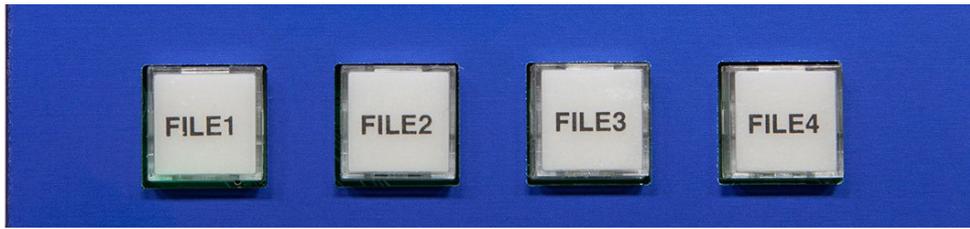
Press any of these and if CCU settings are stored in this particular memory bank, it will be sent to the camera. At this point the button will blink for 10 seconds and if you push the button again within this period of time you will revert back to the settings you had before you pushed the button.

If you press and hold any of these buttons for a second the current settings will be saved in the memory bank associated with the button. A button without light means there are no settings associated with it.

Custom buttons

The RCP has 6 buttons dedicated to user defined functions:
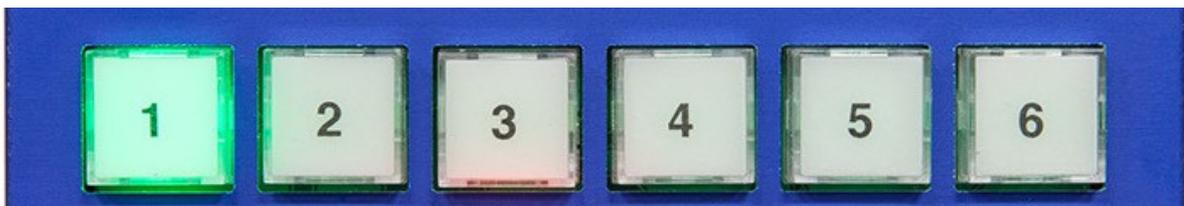
Feel free to change the cap labels to something else than "U1" - "U6" as you find out what you prefer these buttons should do for you. (Simply pull the caps up gently with your fingers or a pair of pliers, then disassociate the diffuser from the clear cap and you can substitute the transparency inside).

The custom buttons will only do something for you if you set it up in your RCPs UniSketch web interface:

Click any of the buttons to set it up:

You should immediately jump down on the page to a section that will look something like this:

#18	**U1**					U1	

WHITE/BLACK	INS CP –	GAMMA/BLACK	INS CP –	SENSOR/CAMERA	INS CP –
VideoHub: Route Input to Output ⇕ | Input: 1 ⇕		+		+	
Output: 10 ⇕ | ⇕ +					

#19	**U2**					U2	

WHITE/BLACK	INS CP –	GAMMA/BLACK	INS CP –	SENSOR/CAMERA	INS CP –
SmartScope: Scope ⇕ | B ⇕		+		+	
Cycle ⇕ | ⇕ +					
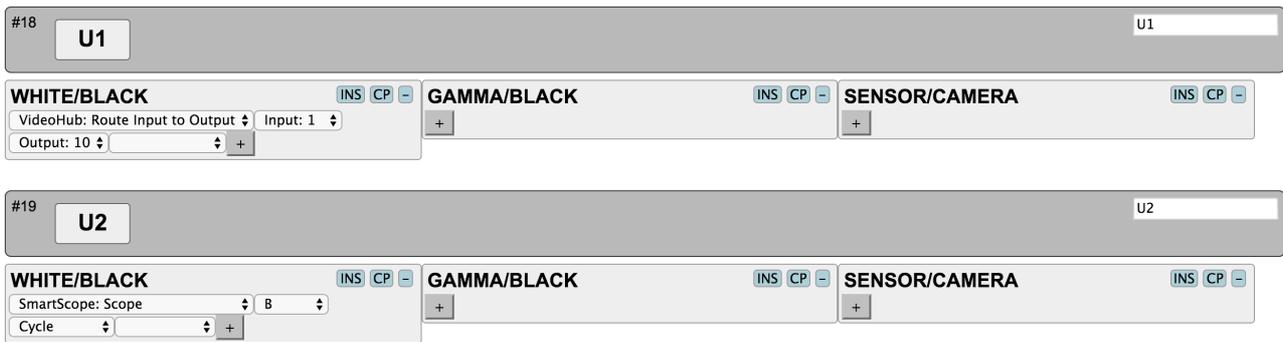
In this example the button "U1" is set up to route input 1 on a Blackmagic videohub to output 10 and button "U2" will cycle through the possible scope options on the right screen of a SmartView Duo. Neat isn't it? You probably have other needs, but we are sure you will find a way to serve them with UniSketch.

A short note here: In this example, the function assigned under the "White/Black" menu state will be used as well in the two other menu states even though no actions are specified. This is how UniSketch works; it defaults to the actions of the first column unless something else is specified. This keeps things simple but yet more powerful combinations is easily at reach (since you may want your user buttons to also change function depending on a menu state…)

The lower section of the RCP

Below the top buttons, display and encoders you find stuff like the ID display:

This will show you the camera number selected on the Cam# selector under the bottom. If pin 8 on the DB9 plug is shorted to ground (pin 5 or 9), it will change color to red instead of white.

The Master Black knob on the left will give you direct access to "Lift-Y" as Blackmagic call master black. This parameter is also adjusted by the joystick wheel if your RCP is delivered with a joystick. The same setting is also found in the menu architecture since it's a part of the YRGB parameters of the camera CCU. One half of the small OLED display is dedicated to showing the master black value at all times too.

On the right you will find the limiter. This knob limits the range of the iris control knob or handle. The right side of the OLED display shows the current iris value in percent. The bar below the number has tiny indicators that show where the limits are if you apply them. The limits basically sets a limit to how far you can adjust the iris value in both the high and low ends. You toggle between changing the high and low ends by pressing the knob down.

The Iris joystick is the iconic hardware interface component known from professional CCUs for all major camera brands. It has a back/forth slider function as well as a ring on the bell. If you push and pull the joystick you will adjust iris while if you turn the ring you will adjust the master black level. On top of the joystick you will find a button and if you push it, you will toggle the relay on the DB-9 connector ("Joystick override").

On some RCPs the joystick is substituted by an encoder instead. This is a hardware option we provide. The encoder has the advantage that it better lends itself to controlling multiple cameras with a single RCP since it doesn't sit in an absolute position like the joystick does. On the other hand, the encoder generally provides a less desirable feel for seasoned RCP operators who would prefer the joystick and multiple units.

| Joystick Version | Multi Turn Encoder Version |
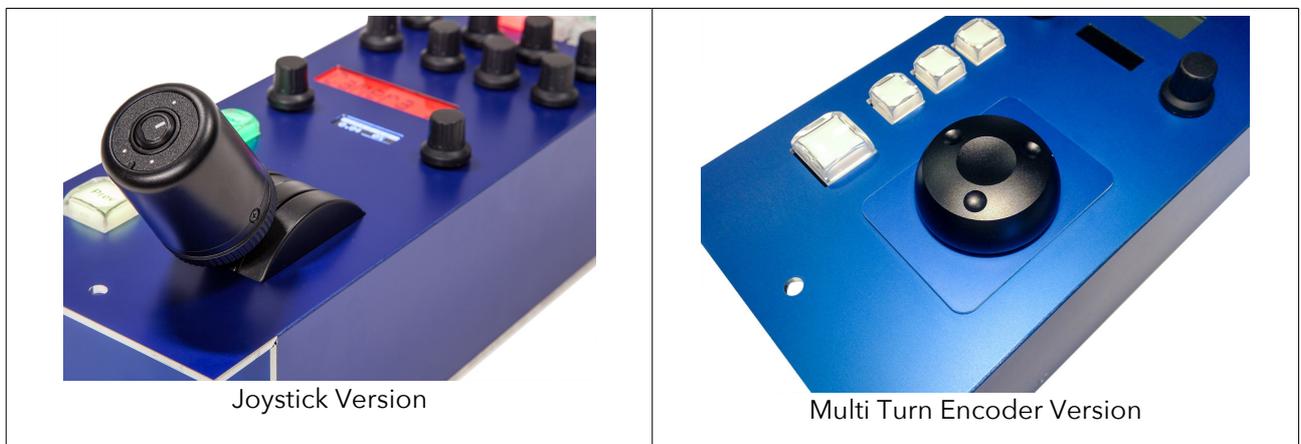
Inactive panel: This button disables all parameter change from the panel for as long as it's active. Press the button to toggle this function on and off.

Rel: This will "zoom" 200% into the value range of the iris joystick so becomes more sensitive around it's current position. For example; if the joystick is at 50% and you activate "Rel" then it will now move between 25% and 75%. If you want more sensitivity in the high end, move the joystick all the way to "100%" before activating "Rel" and you will now adjust within the range of 50%-100%

Auto Iris: Sends Auto Iris command to the camera. Requires lens support.

Prev: This button triggers the joystick override relay (DB-9 pin 1-2 is shorted) momentarily (like the top button of the joystick does).

This describes the default behaviors of those components, but you may want to modify how they work, so if you read on you will find instructions on how to use UniSketch to set up different behaviors.

A note on Tally features

Pin 8 (input) on the DB-9 connector will activate a red tally light on the display if shorted to ground (pin 5 and 9). But it will also set the red tally flag on the SDI output. In other words: The DB-9 input also sends "red tally" to the camera in parallel to setting red tally on the ID display on the RCP. The UniSketch configuration that makes this possible looks like this:
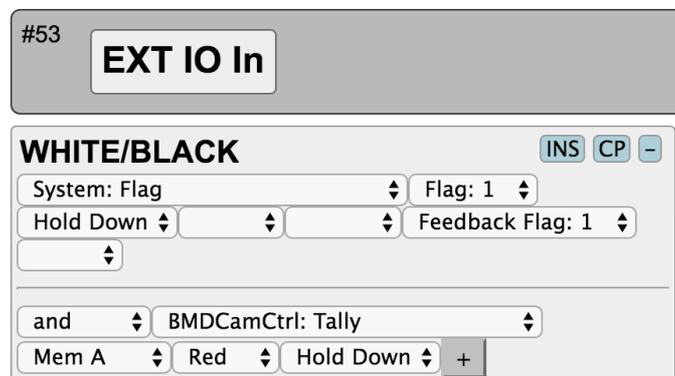
Now, if you do *not* want the RCP to override incoming tally information on the SDI input, you may like to remove the second of the two actions you see above. If you remove this action (or never activate the input

pin), tally should not be overridden on the SDI out, but the first time a tally signal is detected, the internal logic of the SDI shield will turn on tally override mode and block incoming tally signals if any.

UniSketch Firmware

Your RCP runs on the SKAARHOJ UniSketch OS firmware. This is a universal firmware running on all our devices. It allows you to make something entirely different out of your RCP if you wish by simply changing values in drop down boxes. Of course your RCP ships with a meaningful default configuration – otherwise we couldn't have written this short manual about how it works out of the box. And you may never have to touch the UniSketch OS interface, but now you know what sort of power is down there. Since this is all standard, we recommend you download the UniSketch manual from our website if you wish to know anything in detail about the underlying and how to operate it.

Enter the UniSketch OS Fimware by connecting the RCP to your computer with the USB programming cable and press "Online Configuration"

Connect your controller with the USB programming cable and press "Online Configuration" to enter the configuration page on cores.skaarhoj.com for your particular controller.	Edit, modify and tweak your config and press save.	Press "Check for Updates" to update the firmware on your controller
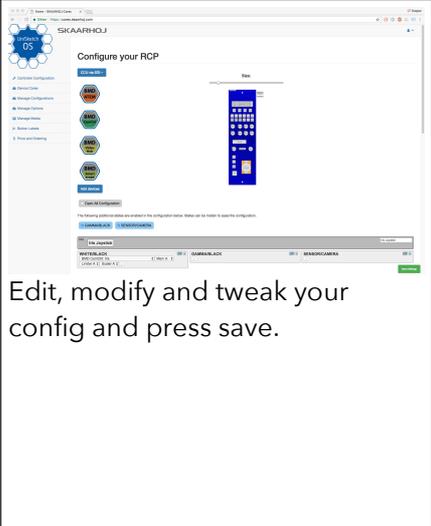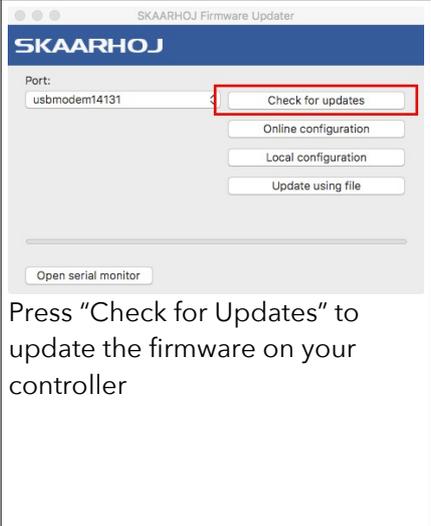
Sensor Gain / Camera Gain Setting Range

Traditionally the setting range have been from 0dB to 18dB. With the introduction of "Blackmagic Camera 4.7 Update" for the Micro Studio Camera 4K a new rage have been introduced with values from -12dB to 12dB. In order for the RCP to reflect and set the gain setting range propperly you need to configure for the 0/18dB or the -12/12dB range in Device Core Options. The procedure for setting this Device Core Options is desribed in the manual for Camera Control Actions and ATEM Control Actions (see below).

Device Core Option: BMD ATEM

See "Blackmagic Design: ATEM Action" manual on http://skaarhoj.com/support/manuals/

Device Core Option: BMD CamCtrl

See "Blackmagic Design: Camera Control Actions" manual on http://skaarhoj.com/support/manuals/

Device support

As described above, when shipping from the factory, your RCP is set up to send CCU commands over the SDI output, the GPI output on the DB-9 connector (pin 1 is shorted to pin 2 or 3) will follow the "joystick override" buttons ("Prev" and button on top of joystick) and the GPI input on the DB-9 (pin 8 shorted to GND on pin 5 and/or 9) will provide tally light on the display which will also show the camera number selected.

The RCP supports communication with many more hardware devices over Ethernet if you need so (and more will be added with future firmware updates). This is configured via a web interface when the RCP is put in "config mode". The web interface has a device section where you can enable devices and set up their IP address:

Devices Settings

Controller IP Settings

IP:
192 . 168 . 10 . 99

Subnet Mask:
255 . 255 . 255 . 0

ATEM
☑ 192 . 168 . 10 . 240

BMDCamCtrl
☑ (Serial)

VideoHub
☐

SmartScope
☐

Camera support, data channels and cabling

Your RCP is designed to send CCU data to different types of cameras and through different channels. In its first version, only CCU data for Blackmagic cameras is supported, but soon CCU control of robotic cameras from Sony and Panasonic will follow as well. As other cameras are supported you will be able to download new firmwares that enable this.

Sending CCU data to Blackmagic cameras can happen over one of two different channels:

• The RCP embeds CCU data on the SDI return stream which you route through the RCP itself. For example, you would take the program out from your video switcher and route to the SDI in of the

RCP. The SDI out of the RCP is wired to the Blackmagic cameras SDI in. The RCP will embed CCU data on the SDI wire. This is the default behavior.

- Alternatively, you may connect the RCP to an ATEM switcher over Ethernet and send CCU commands into the ATEM switcher which will relay them for you to the camera chain via the return feed which is then assumed to be connected to an ATEM output.

The advantage of the default method using the SDI in and out of the RCP is it doesn't require an ATEM switcher and scales well. Simply use a distribution amplifier to route the program out into the RCP array and route the RCP SDI out to the cameras, even through fiber if you prefer. It's also the official way Blackmagic intend to let you use a hardware panel for CCU control. The disadvantage is if you liked the idea of embedding all CCU data for all cameras on a single SDI wire – this is not possible because you can't daisy chain the RCPs. (The reason for this is that every RCP would then have to relay the information from previous RCPs in the daisy chain and that would slow data transport down by at least one frame per RCP as well as be error prone since a single failing RCP will stop the whole data propagation).

The advantage of using an ATEM switcher on the other hand is that all cameras CCU data is embedded on a single SDI output (from the ATEM switcher) and CCU parameters could be controlled by multiple connected CCUs or the ATEM Software Control panel itself. However, there is a clear disadvantage in that the ATEM switcher range allows only between 5-8 clients to be connected at any time and each RCP would take up one such connection slot. In addition Blackmagic doesn't officially support this type of connection although it works very reliably for current and recent firmwares.

SDI Return Feed (For CCU Cam Control) SDI Out From Camera Any Video Input Device Micro Studio Camera 4K Studio Camera URSA Mini RCP	AUX *Optional* Any CCU Operator Monitor Ethernet SDI Return Feed (For CCU Cam Control) SDI Cam Feed Any ATEM Switcher RCP Micro Studio Camera 4K Studio Camera URSA Mini
Example of direct connection to an camera from the RCP.	*Example of camera connection via an distribution amplifier.*

In any case, the RCP must be set to the same camera ID as the camera it's supposed to control.

Configuring you RCP to either scenario – or future supported cameras

If you want to change your RCP from using the built in SDI in and out (the BMD Camera Control protocol) to using an ATEM switcher or any future supported camera you do this by accessing the config mode of your RCP. This is done by pressing and holding the reset button of the RCP until the status LED is blue (or white). All the general details of this is found in the manual for the SKAARHOJ UniSketch controllers, http://skaarhoj.com/support/unisketch/

When you are in config mode you can access a web interface that looks something like this for the iris control hardware component:

It instructs the iris joystick to send iris control commands over SDI out (Blackmagic Camera Control protocol) for the camera with the ID currently stored as a value in "Mem A" in the RCP (see section on camera selection).

If you click the dropdown box you will see other options for how this joystick should work. A list like this will appear. To change the iris control to go through an ATEM switcher you simply select "ATEM: Iris" instead.
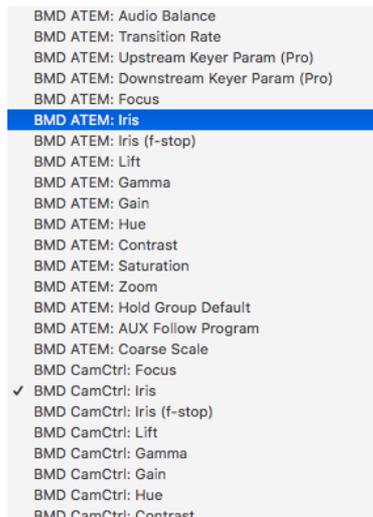
Now you will see how the iris joystick uses the connected ATEM switcher to send iris commands. Please observe there are two iris commands for the ATEM.

ATEM: Iris – range 0-100% Change will **not** be reflected in the ATEM Software Control Panel!
ATEM: Iris (f-stop) - range f1.4-f22 Change **will** be reflected in the ATEM Software Control Panel (you can even see how pulling the joystick will move the graphical on-screen joystick up and down.)
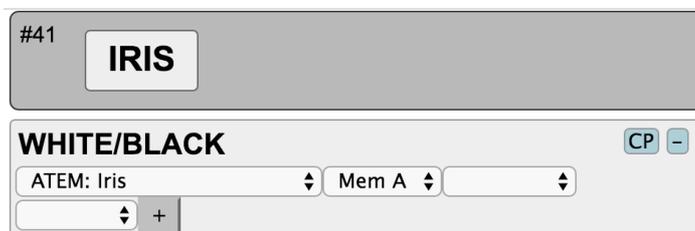
Camera selection

The RCP will send control signals addressed to the camera number set by the small DIP switch on the back of the unit. The switch has 16 positions. Position 1 corresponds to camera 1, position "A" is camera 10 and position "F" is camera 15 and so forth. Camera 0 is undefined and will probably yield funny data in the displays. Don't use camera ID 0!

Selecting cameras in different ways

Under the hood (inside the configuration interface) the camera selector actually defines values for an internal memory register called "A" which is in turn used by any other component to define the camera number. If you look at the camera selection configuration it looks like this:
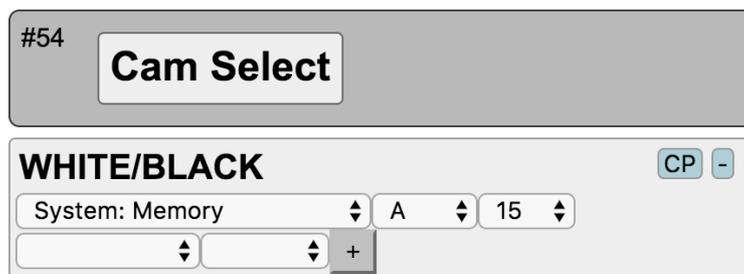
This means, the 16 positions of the switch will be mapped to values from 0-15 (16 in total). When you look at the Iris joysticks configuration you can see how the value of "Mem A" is used as the target camera number:
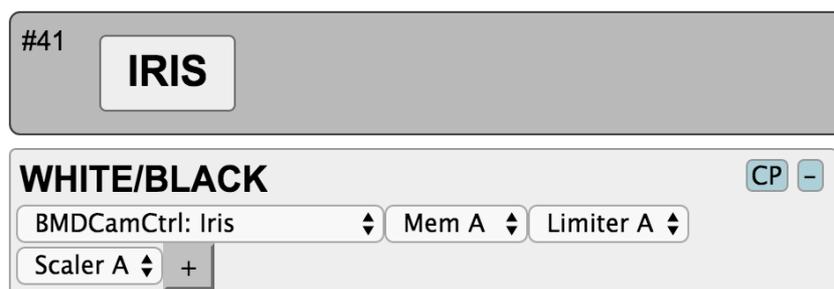
It's very easy to change your RCP to select camera in a different way. Lets assume you want the 6 user defined buttons U1-U6 to select camera instead. First you disable the Cam Select components function by selecting a blank function in the top:

```
#53
     Cam Select

WHITE/BLACK                          INS  CP  −
  [                    ⬍] +
```

Then you set up the buttons U1-U6 to set fixed values for Memory A (use "persist" so the value is saved for next time the controller boots):

```
#18
      U1

WHITE/BLACK                          INS  CP  −
  System: Memory        ⬍  A ⬍  1  ⬍  [          ⬍]
  Persist ⬍  +
```

```
#19
      U2

WHITE/BLACK                          INS  CP  −
  System: Memory        ⬍  A ⬍  2  ⬍  [          ⬍]
  Persist ⬍  +
```
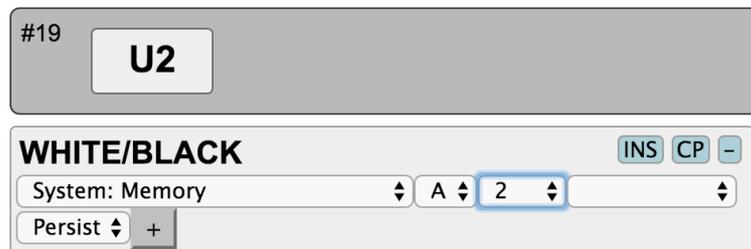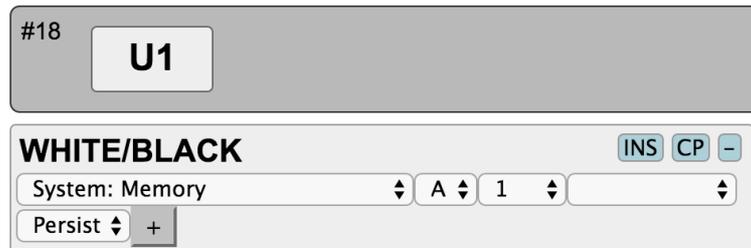
The big display, adjustment knobs and controller states

Access to adjust secondary parameters in CCU operation is achieved through the 8 knobs organized in two rows. The big display is set up to show information about whatever each of these knobs adjusts. Three buttons on the RCP is further used to change what the 8 knobs will adjust. These buttons has the labels "WHITE / BLACK", "GAMMA / BLACK" and "SENSOR / CAMERA".

Reorganising content in the menu

Under the hood – in the configuration web interface – the three buttons simply changes a so called state in the controller. Each state will instruct the controller to look for the actions to carry out in a different

column in the web interface. In the section "States" in the controller you can see the three states listed with their names:
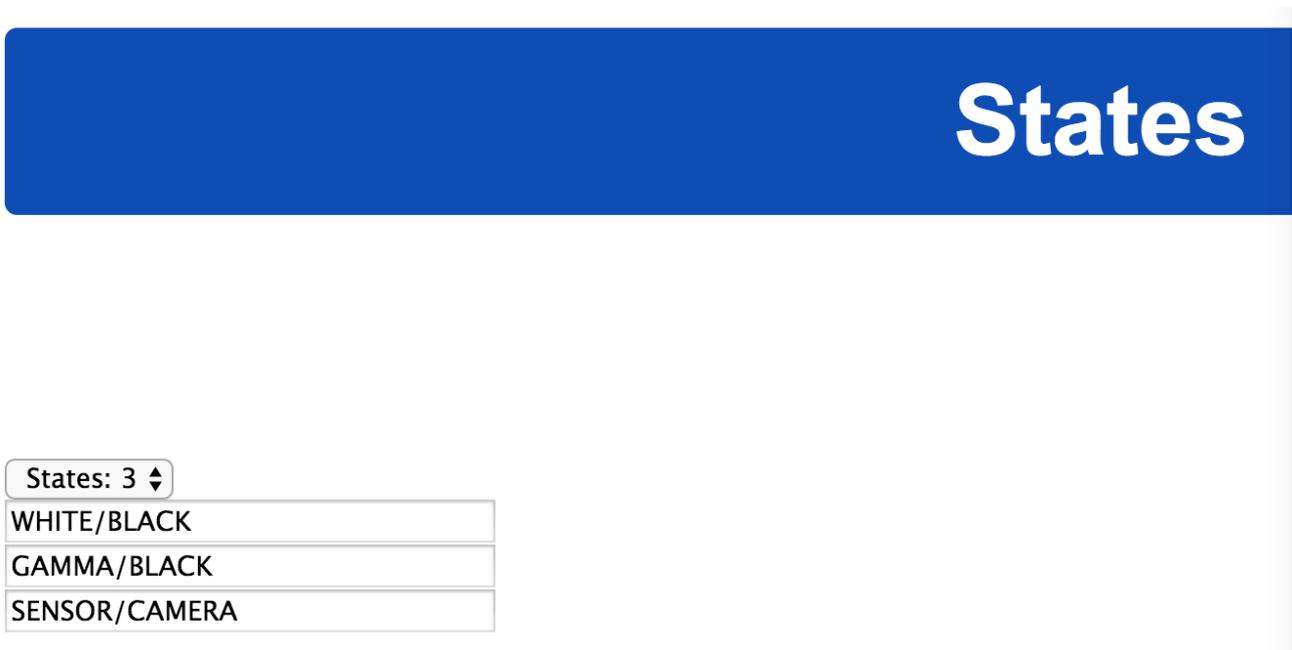
In the order they appear here, each state will have a number, respectively state 0, 1 and 2 in this case. If you turn your attention to how the three state selecting buttons are configured you see the correspondence:

#24
WHITE
BLACK

WHITE/BLACK   CP –
System: State   ▼   State: 0 ▼
▼   +

#25
GAMMA
BLACK

WHITE/BLACK   CP –
System: State   ▼   State: 1 ▼
▼   +

#26
SENSR
CAM

WHITE/BLACK   CP –
System: State   ▼   State: 2 ▼
▼   +
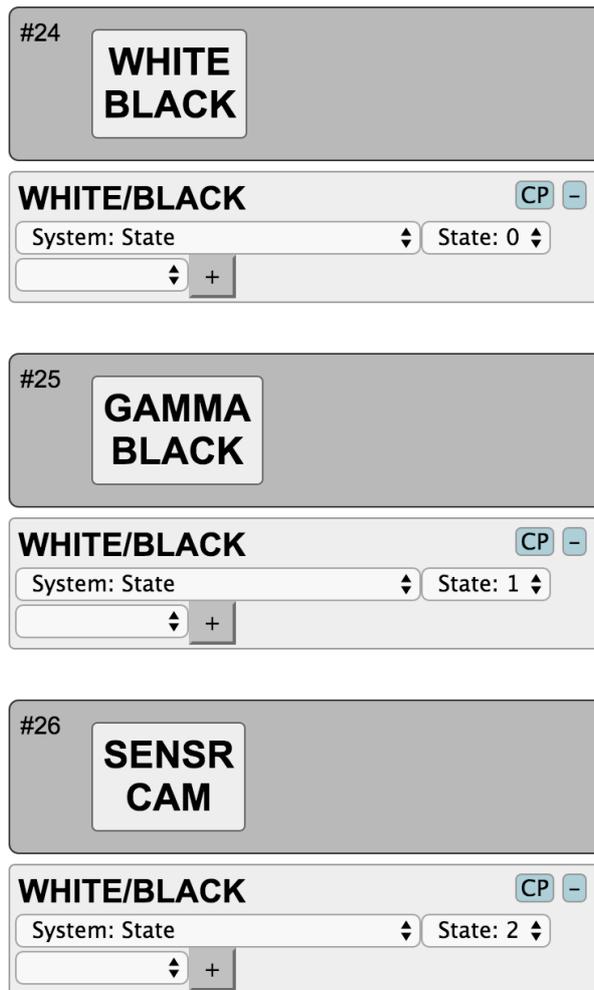
And if you look at how the knobs are configured, you see three columns of actions:

#30 **UPPER-Y**		UPPER-Y

WHITE/BLACK	CP −	GAMMA/BLACK	CP −	SENSOR/CAMERA	CP −
BMDCamCtrl: Gain ⇕ Y ⇕		BMDCamCtrl: Gamma ⇕ Y ⇕		BMDCamCtrl: Sensor Gain ⇕ Mem A ⇕	
Mem A ⇕ +		Mem A ⇕ +		Cycle ⇕ +	

#31 **UPPER-R**		UPPER-R

WHITE/BLACK	CP −	GAMMA/BLACK	CP −	SENSOR/CAMERA	CP −
BMDCamCtrl: Gain ⇕ R ⇕		BMDCamCtrl: Gamma ⇕ R ⇕		BMDCamCtrl: Shutter ⇕ Mem A ⇕	
Mem A ⇕ +		Mem A ⇕ +		Cycle ⇕ +	

#32 **UPPER-G**		UPPER-G

WHITE/BLACK	CP −	GAMMA/BLACK	CP −	SENSOR/CAMERA	CP −
BMDCamCtrl: Gain ⇕ G ⇕		BMDCamCtrl: Gamma ⇕ G ⇕		BMDCamCtrl: White Balance ⇕ Mem A ⇕	
Mem A ⇕ +		Mem A ⇕ +		Cycle ⇕ +	

#33 **UPPER-B**		UPPER-B

WHITE/BLACK	CP −	GAMMA/BLACK	CP −	SENSOR/CAMERA	CP −
BMDCamCtrl: Gain ⇕ B ⇕		BMDCamCtrl: Gamma ⇕ B ⇕		BMDCamCtrl: Detail ⇕ Mem A ⇕	
Mem A ⇕ +		Mem A ⇕ +		Cycle ⇕ +	

Changing how the various parameters are organized in the menu is now a simple matter of adding and removing actions within this framework. You can even add a fourth menu button setting up state "3" by adding a new state in the "States" section. This will result in yet a column of actions.

You may like to know that if an interface component has no actions in other columns than the first column it will fall back to whatever is in the first column. This explains why for instance the iris joystick is configured like this:

#41 **IRIS**		IRIS

WHITE/BLACK	CP −	GAMMA/BLACK	CP −	SENSOR/CAMERA	CP −
BMDCamCtrl: Iris ⇕ Mem A ⇕		+		+	
Limiter A ⇕ Scaler A ⇕ +					
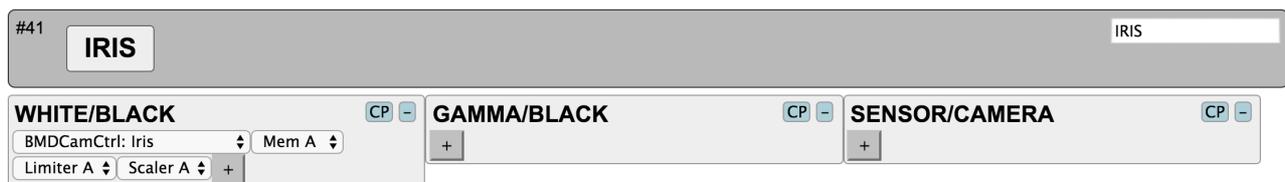
As you can see, there are no function in the "Gamma/Black" and "Sensor/Camera" columns but since the principle is to fall back to the first columns action, the iris joystick therefore does not change its function as you change the controller state.

In case you don't want to fall back to the default action, simply select the action "System: No Action" for a given component.

The ID display

The ID display shows the camera number currently selected and if the GPI input is held to ground, it will light up red instead of having a neutral white background color. So, shorting pin 8 on the DB-9 connector to GND (pin 5 or 9) will essentially make it work like a tally lamp.

Changing information source for the ID display

In case you use an ATEM switcher, you can have the display show the actual input name and red/green tally information. Bring the controller into config mode and access the web interface. By default it will be set up like this (invoking a custom handler that writes "Cam X" to the display and secures the red color based on the GPI input value):
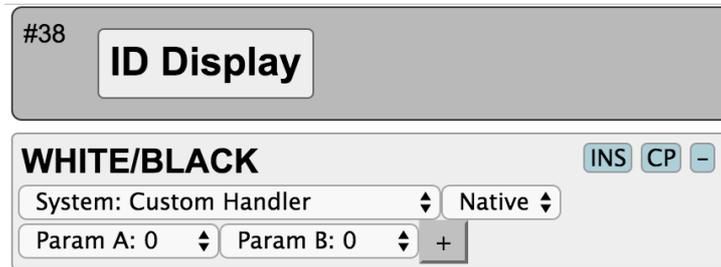
If you change this configuration accordingly, the name and tally status of input X on the ATEM switcher will be shown instead (where X is the camera number stored in Mem A – you could also set it to a different input number if you please):
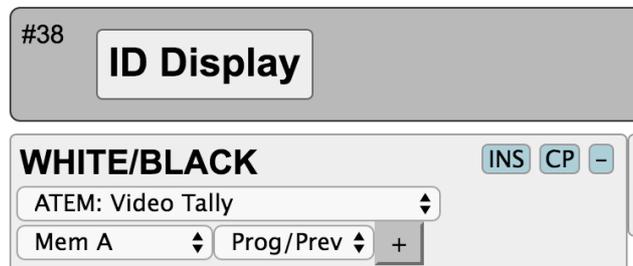
Joystick Override

By default, the preview buttons (the "PREV" button and the joystick top button) are set up to activate the relay connected between pin 1 and 2 on the DB-9 connector. This corresponds to a standard Sony RCP. Connect this output to your usual means of selecting source for a CCU operator preview monitor. You may want to check out the SKAARHOJ GPIO box as a great device to which multiple RCPs can be connected since it will let you group up your joystick override signals in a so called "hold group" so it will always fall back to the correct source.

Alternative Joystick Override behaviours

Instead of (or in addition to) flipping the relay you may want to directly control a video hub or ATEM switcher. In this case you need to bring the controller into config mode and load the web interface. The PREV button is by default configured like this:

```
#47
    Prev

WHITE/BLACK                        INS  CP  –
  System: Flag              ⬍    Flag: 0  ⬍
  Hold Down ⬍         ⬍              ⬍
  Feedback Flag: 0 ⬍      ⬍    +
```
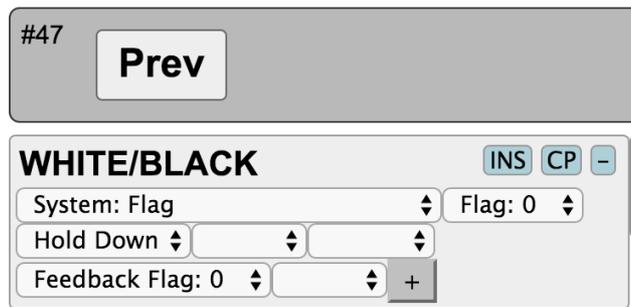
This configuration means that for as long as the button is pushed, Flag 0 in the controllers internal memory is set true (and the button will light up for as long as Flag 0 is true).

If you wish to change a route on a video hub momentarily, say input 4 to output 10, set it up like this:

```
#47
    Prev

WHITE/BLACK                        INS  CP  –
  VideoHub: Route Input to Output ⬍  Input: 4 ⬍
  Output: 10 ⬍  Hold Down    ⬍   +
```
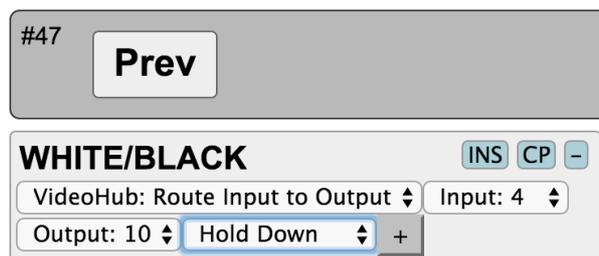
Whenever the button is released, it will fall back to whatever was routed to output 10 previously.

If you wish to route a given input on an ATEM switcher to a particular AUX output, you could set it up like this:

```
#47
    Prev

WHITE/BLACK                        INS  CP  –
  ATEM: AUX Output Src       ⬍   AUX 5 ⬍
  Mem A        ⬍  Hold Down  ⬍   +
```
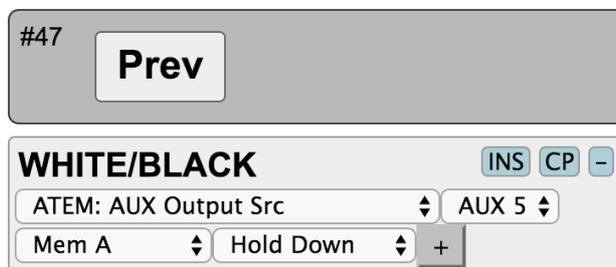
Here we have assumed the input number corresponds to the camera number, hence we use "Mem A".

As a side node, the top button on the joystick has been linked to the "Prev" button so they do exactly the same, this is achieved with this functionality. Therefore if you wish these two buttons to work in tandem, you just need to change the "Prev" buttons configuration and the other one will follow.

```
#43
    Prv

WHITE/BLACK                        INS  CP  –
  System: Tie to HWC#        ⬍   47  ⬍   +
```
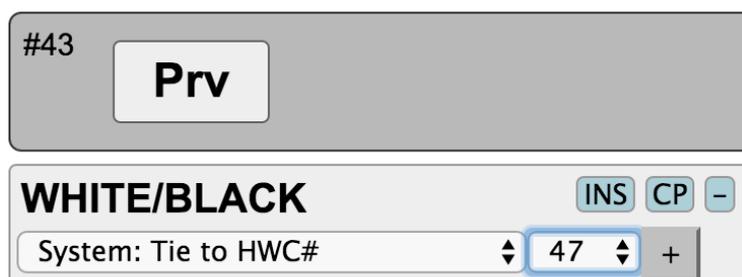
Support

If you have any issues or ideas to share with us, please write to support@skaarhoj.com

We will release new firmwares on a regular basis. This will include bugfixes as well as new general features to the UniSketch firmware as well as new hardware support. Visit http://skaarhoj.com/support/firmware-updater/ for more information and downloads.