Developer Information

Blackmagic Camera Control

Includes Blackmagic SDI Camera Control Protocol, Embedded Tally Control Protocol, Visca Commands for PTZ control via SDI, Blackmagic Bluetooth Camera Control, S.Bus and PWM control

October 2018

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Blackmagic SDI Camera Control Protocol

Version 1.3

If you are a software developer you can use the SDI Camera Control Protocol to construct devices that integrate with our products. Here at Blackmagic Design our approach is to open up our protocols and we eagerly look forward to seeing what you come up with!

Overview

The Blackmagic SDI Camera Control Protocol is used by ATEM switchers, Blackmagic 3G-SDI Shield for Arduino and the Blackmagic Camera Control app to provide Camera Control functionality with supported Blackmagic Design cameras. Please refer to the 'Understanding Studio Camera Control' chapter section of this manual, or the ATEM Switchers Manual and SDK manual for more information. These can be downloaded at www.blackmagicdesign.com/support.

This document describes an extensible protocol for sending a uni directional stream of small control messages embedded in the non-active picture region of a digital video stream. The video stream containing the protocol stream may be broadcast to a number of devices. Device addressing is used to allow the sender to specify which device each message is directed to.

Assumptions

Alignment and padding constraints are explicitly described in the protocol document. Bit fields are packed from LSB first. Message groups, individual messages and command headers are defined as, and can be assumed to be, 32 bit aligned.

Blanking Encoding

A message group is encoded into a SMPTE 291M packet with DID/SDID x51/x53 in the active region of VANC line 16.

Message Grouping

Up to 32 messages may be concatenated and transmitted in one blanking packet up to a maximum of 255 bytes payload. Under most circumstances, this should allow all messages to be sent with a maximum of one frame latency.

If the transmitting device queues more bytes of message packets than can be sent in a single frame, it should use heuristics to determine which packets to prioritize and send immediately. Lower priority messages can be delayed to later frames, or dropped entirely as appropriate.

Abstract Message Packet Format

Every message packet consists of a three byte header followed by an optional variable length data block. The maximum packet size is 64 bytes.

Destination device (uint8)	Device addresses are represented as an 8 bit unsigned integer. Individual devices are numbered 0 through 254 with the value 255 reserved to indicate a broadcast message to all devices.
Command length (uint8)	The command length is an 8 bit unsigned integer which specifies the length of the included command data. The length does NOT include the length of the header or any trailing padding bytes.

Command id (uint8)	The command id is an 8 bit unsigned integer which indicates the message type being sent. Receiving devices should ignore any commands that they do not understand. Commands 0 through 127 are reserved for commands that apply to multiple types of devices. Commands 128 through 255 are device specific.
Reserved (uint8)	This byte is reserved for alignment and expansion purposes. It should be set to zero.
Command data (uint8[])	The command data may contain between 0 and 60 bytes of data. The format of the data section is defined by the command itself.
Padding (uint8[])	Messages must be padded up to a 32 bit boundary with 0x0 bytes. Any padding bytes are NOT included in the command length.

Receiving devices should use the destination device address and or the command identifier to determine which messages to process. The receiver should use the command length to skip irrelevant or unknown commands and should be careful to skip the implicit padding as well.

Defined Commands

Command 0 : change configuration

Category (uint8)	The category number specifies one of up to 256 configuration categories available on the device.
Parameter (uint8)	The parameter number specifies one of 256 potential configuration parameters available on the device. Parameters 0 through 127 are device specific parameters. Parameters 128 though 255 are reserved for parameters that apply to multiple types of devices.
Data type (uint8)	The data type specifies the type of the remaining data. The packet length is used to determine the number of elements in the message. Each message must contain an integral number of data elements.

Currently defined values are:

0: void / boolean	A void value is represented as a boolean array of length zero. The data field is a 8 bit value with 0 meaning false and all other values meaning true.
1: signed byte	Data elements are signed bytes
2: signed 16 bit integer	Data elements are signed 16 bit values
3: signed 32 bit integer	Data elements are signed 32 bit values
4: signed 64 bit integer	Data elements are signed 64 bit values
5: UTF-8 string	Data elements represent a UTF-8 string with no terminating character.

Data types 6 through 127 are reserved.

128: signed 5.11 fixed point	Data elements are signed 16 bit integers representing a real number with 5 bits for the integer component and 11 bits for the fractional component. The fixed point representation is equal to the real value multiplied by 2^11. The representable range is from -16.0 to 15.9995 (15 + 2047/2048).

Data types 129 through 255 are available for device specific purposes.

Operation type (uint8)	The operation type specifies what action to perform on the specified parameter. Currently defined values are:
0: assign value	The supplied values are assigned to the specified parameter. Each element will be clamped according to its valid range. A void parameter may only be 'assigned' an empty list of boolean type. This operation will trigger the action associated with that parameter. A boolean value may be assigned the value zero for false, and any other value for true.
1: offset / toggle value	Each value specifies signed offsets of the same type to be added to the current parameter values. The resulting parameter value will be clamped according to their valid range. It is not valid to apply an offset to a void value. Applying any offset other than zero to a boolean value will invert that value.

Operation types 2 through 127 are reserved.

Operation types 128 through 255 are available for device specific purposes.

Data (void)	The data field is 0 or more bytes as determined by the data type and number of elements.

The category, parameter, data type and operation type partition a 24 bit operation space.

Group	ID	Parameter	Type	Index	Minimum	Maximum	Interpretation
Lens	0.0	Focus	fixed16	–	0	1	0.0 = near, 1.0 = far
	0.1	Instantaneous autofocus	void	–	–	–	trigger instantaneous autofocus
	0.2	Aperture (f-stop)	fixed16	–	-1	16	Aperture Value (where fnumber = sqrt(2^AV))
	0.3	Aperture (normalised)	fixed16	–	0	1	0.0 = smallest, 1.0 = largest
	0.4	Aperture (ordinal)	int16	–	0	n	Steps through available aperture values from minimum (0) to maximum (n)
	0.5	Instantaneous auto aperture	void	–	–	–	trigger instantaneous auto aperture
	0.6	Optical image stabilisation	boolean	–	–	–	true = enabled, false = disabled
	0.7	Set absolute zoom (mm)	int16	–	0	max	Move to specified focal length in mm, from minimum (0) to maximum (max)
	0.8	Set absolute zoom (normalised)	fixed16	–	0	1	Move to specified focal length: 0.0 = wide, 1.0 = tele
	0.9	Set continuous zoom (speed)	fixed16	–	-1	+1.0	Start/stop zooming at specified rate: -1.0 = zoom wider fast, 0.0 = stop, +1 = zoom tele fast

Group	ID	Parameter	Type	Index	Minimum	Maximum	Interpretation
Video	1.0	Video mode	int8	[0] = frame rate	–	–	24, 25, 30, 50, 60
				[1] = M-rate	–	–	0 = regular, 1 = M-rate
				[2] = dimensions	–	–	0 = NTSC, 1 = PAL, 2 = 720, 3 = 1080, 4 = 2k, 5 = 2k DCI, 6 = UHD
				[3] = interlaced	–	–	0 = progressive, 1 = interlaced
				[4] = Color space	–	–	0 = YUV
	1.1	Gain	int8		1	16	1 = 100 ISO, 2 = 200 ISO, 4 = 400 ISO, 8 = 800 ISO, 16 = 1600 ISO
	1.2	Manual White Balance	int16	[0] = color temp	2500	10000	Color temperature in K
			int16	[1] = tint	-50	50	tint
	1.3	Set auto WB	void	–	–	–	Calculate and set auto white balance
	1.4	Restore auto WB	void	–	–	–	Use latest auto white balance setting
	1.5	Exposure (us)	int32		1	42000	time in us
	1.6	Exposure (ordinal)	int16	–	0	n	Steps through available exposure values from minimum (0) to maximum (n)
	1.7	Dynamic Range Mode	int8 enum	–	0	1	0 = film, 1 = video,
	1.8	Video sharpening level	int8 enum	–	0	3	0 = off, 1 = low, 2 = medium, 3 = high
	1.9	Recording format	int16	[0] = file frame rate	–	–	fps as integer (eg 24, 25, 30, 50, 60, 120)
				[1] = sensor frame rate	–	–	fps as integer, valid when sensor-off-speed set (eg 24, 25, 30, 33, 48, 50, 60, 120), no change will be performed if this value is set to 0
				[2] = frame width	–	–	in pixels
				[3] = frame height	–	–	in pixels
				[4] = flags	–	–	[0] = file-M-rate
					–	–	[1] = sensor-M-rate, valid when sensor-off-speed-set
					–	–	[2] = sensor-off-speed
					–	–	[3] = interlaced
					–	–	[4] = windowed mode
	1.10	Set auto exposure mode	int8	–	0	4	0 = Manual Trigger, 1 = Iris, 2 = Shutter, 3 = Iris + Shutter, 4 = Shutter + Iris
	1.11	Shutter angle	int32	–	100	36000	Shutter angle in degrees, multiplied by 100
	1.12	Shutter speed	int32	–	24	2000	Shutter speed value as a fraction of 1, so 50 for 1/50th of a second
	1.13	Gain	int8	–	-128	127	Gain in decibel (dB)
	1.14	ISO	int32	–	0	2147483647	ISO value

Group	ID	Parameter	Type	Index	Minimum	Maximum	Interpretation
Audio	2.0	Mic level	fixed16	–	0	1	0.0 = minimum, 1.0 = maximum
	2.1	Headphone level	fixed16	–	0	1	0.0 = minimum, 1.0 = maximum
	2.2	Headphone program mix	fixed16	–	0	1	0.0 = minimum, 1.0 = maximum
	2.3	Speaker level	fixed16	–	0	1	0.0 = minimum, 1.0 = maximum
	2.4	Input type	int8	–	0	2	0 = internal mic, 1 = line level input, 2 = low mic level input, 3 = high mic level input
	2.5	Input levels	fixed16	[0] ch0	0	1	0.0 = minimum, 1.0 = maximum
				[1] ch1	0	1	0.0 = minimum, 1.0 = maximum
	2.6	Phantom power	boolean	–	–	–	true = powered, false = not powered
Output	3.0	Overlay enables	uint16 bit field	–	–	–	bit flags: [0] = display status, [1] = display frame guides Some cameras don't allow separate control of frame guides and status overlays.
	3.1	Frame guides style (Camera 3.x)	int8	[0] = frame guides style	0	8	0 = HDTV, 1 = 4:3, 2 = 2.4:1, 3 = 2.39:1, 4 = 2.35:1, 5 = 1.85:1, 6 = thirds
	3.2	Frame guides opacity (Camera 3.x)	fixed16	[1] = frame guide opacity	0.1	1	0.0 = transparent, 1.0 = opaque
	3.3	Overlays (replaces .1 and .2 above from Cameras 4.0)	int8	[0] = frame guides style	–	–	0 = off, 1 = 2.4:1, 2 = 2.39:1, 3 = 2.35:1, 4 = 1.85:1, 5 = 16:9, 6 = 14:9, 7 = 4:3
				[1] = frame guide opacity	0	100	0 = transparent, 100 = opaque
				[2] = safe area percentage	0	100	percentage of full frame used by safe area guide (0 means off)
				[3] = grid style	–	–	bit flags: [0] = display thirds, [1] = display cross hairs, [2] = display center dot

Group	ID	Parameter	Type	Index	Minimum	Maximum	Interpretation
Display	4.0	Brightness	fixed16	–	0	1	0.0 = minimum, 1.0 = maximum
	4.1	Overlay enables	int16 bit field	–	–	–	0x4 = zebra
				–	–	–	0x8 = peaking
				–	–	–	
	4.2	Zebra level	fixed16	–	0	1	0.0 = minimum, 1.0 = maximum
	4.3	Peaking level	fixed16	–	0	1	0.0 = minimum, 1.0 = maximum
	4.4	Color bars display time (seconds)	int8	–	0	30	0 = disable bars, 1-30 = enable bars with timeout (s)
	4.5	Focus Assist	int8	[0] = focus assist method	–	–	0 = Peak, 1 = Colored lines
				[1] = focus line color	–	–	0 = Red, 1 = Green, 2 = Blue, 3 = White, 4 = Black
Tally	5.0	Tally brightness	fixed16	–	0	1	Sets the tally front and tally rear brightness to the same level. 0.0 = minimum, 1.0 = maximum
	5.1	Front tally brightness	fixed16	–	0	1	Sets the tally front brightness. 0.0 = minimum, 1.0 = maximum
	5.2	Rear tally brightness	fixed16	–	0	1	Sets the tally rear brightness. 0.0 = minimum, 1.0 = maximum Tally rear brightness cannot be turned off
Reference	6.0	Source	int8 enum	–	0	2	0 = internal, 1 = program, 2 = external
	6.1	Offset	int32	–	–	–	+/- offset in pixels
Configuration	7.0	Real Time Clock	int32	[0] time	_	_	BCD - HHMMSSFF (UCT)
				[1] date	_	_	BCD - YYYYMMDD
	7.1	System language	string	_	_	_	ISO-639-1 two character language code
	7.2	Timezone	int32	_	_	_	Minutes offset from UTC
	7.3	Location	int64	[0] latitude	_	_	BCD - s0DDdddddddddddd where s is the sign: 0 = north (+), 1 = south (-); DD degrees, dddddddddddd decimal degrees
				[1] longitude	_	_	BCD - sDDDdddddddddddd where s is the sign: 0 = west (-), 1 = east (+); DDD degrees, dddddddddddd decimal degrees

Group	ID	Parameter	Type	Index	Minimum	Maximum	Interpretation
Color Correction	8.0	Lift Adjust	fixed16	[0] red	-2	2	default 0.0
				[1] green	-2	2	default 0.0
				[2] blue	-2	2	default 0.0
				[3] luma	-2	2	default 0.0
	8.1	Gamma Adjust	fixed16	[0] red	-4	4	default 0.0
				[1] green	-4	4	default 0.0
				[2] blue	-4	4	default 0.0
				[3] luma	-4	4	default 0.0
	8.2	Gain Adjust	fixed16	[0] red	0	16	default 1.0
				[1] green	0	16	default 1.0
				[2] blue	0	16	default 1.0
				[3] luma	0	16	default 1.0
	8.3	Offset Adjust	fixed16	[0] red	-8	8	default 0.0
				[1] green	-8	8	default 0.0
				[2] blue	-8	8	default 0.0
				[3] luma	-8	8	default 0.0
	8.4	Contrast Adjust	fixed16	[0] pivot	0	1	default 0.5
				[1] adj	0	2	default 1.0
	8.5	Luma mix	fixed16	–	0	1	default 1.0
	8.6	Color Adjust	fixed16	[0] hue	-1	1	default 0.0
				[1] sat	0	2	default 1.0
	8.7	Correction Reset Default	void	–	–	–	reset to defaults

Group	ID	Parameter	Type	Index	Minimum	Maximum	Interpretation
Media	10.0	Codec	int8 enum	[0] = basic codec	–	–	0 = RAW, 1 = DNxHD, 2 = ProRes, 3 = Blackmagic RAW
				[1] = codec variant	–	–	RAW: 0 = Uncompressed, 1 = lossy 3:1, 2 = lossy 4:1
					–	–	ProRes: 0 = HQ, 1 = 422, 2 = LT, 3 = Proxy, 4 = 444, 5 = 444XQ
					–	–	Blackmagic RAW: 0 = Q0, 1 = Q5, 2 = 3:1, 3 = 5:1, 4 = 8:1, 5 = 12:1
	10.1	Transport mode	int8	[0] = mode	–	–	0 = Preview, 1 = Play, 2 = Record
				[1] = speed	–	–	-ve = multiple speeds backwards, 0 = pause, +ve = multiple speeds forwards
				[2] = flags	–	–	1<<0 = loop, 1<<1 = play all, 1<<5 = disk1 active, 1<<6 = disk2 active, 1<<7 = time-lapse recording
				[3] = active storage medium	–	–	0 = CFast card, 1 = SD
PTZ Control	11.0	Pan/Tilt Velocity	fixed 16	[0] = pan velocity	-1.0	1.0	-1.0 = full speed left, 1.0 = full speed right
				[1] = tilt velocity	-1.0	1.0	-1.0 = full speed down, 1.0 = full speed up
	11.1	Memory Preset	int8 enum	[0] = preset command	–	–	0 = reset, 1 = store location, 2 = recall location
			int8	[1] = preset slot	0	5	–

Example Protocol Packets

Operation	Packet Length	Byte															
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		header				command			data								
		destination	length	command	reserved	category	parameter	type	operation								
trigger instantaneous auto focus on camera 4	8	4	4	0	0	0	1	0	0								
turn on OIS on all cameras	12	255	5	0	0	0	6	0	0	1	0	0	0				
set exposure to 10 ms on camera 4 (10 ms = 10000 us = 0x00002710)	12	4	8	0	0	1	5	3	0	0x10	0x27	0x00	0x00				
add 15% to zebra level (15 % = 0.15 f = 0x0133 fp)	12	4	6	0	0	4	2	128	1	0x33	0x01	0	0				
select 1080p 23.98 mode on all cameras	16	255	9	0	0	1	0	1	0	24	1	3	0	0	0	0	0
subtract 0.3 from gamma adjust for green & blue (-0.3 ~= 0xfd9a fp)	16	4	12	0	0	8	1	128	1	0	0	0x9a	0xfd	0x9a	0xfd	0	0
all operations combined	76	4	4	0	0	0	1	0	0	255	5	0	0	0	6	0	0
		1	0	0	0	4	8	0	0	1	5	3	0	0x10	0x27	0x00	0x00
		4	6	0	0	4	2	128	1	0x33	0x01	0	0	255	9	0	0
		1	0	1	0	24	1	3	0	0	0	0	0	4	12	0	0
		8	1	128	1	0	0	0x9a	0xfd	0x9a	0xfd	0	0				

Blackmagic Embedded Tally Control Protocol

Version 1.0 (30/04/14)

This section is for third party developers or anybody who may wish to add support for the Blackmagic Embedded Tally Control Protocol to their products or system. It describes the protocol for sending tally information embedded in the non-active picture region of a digital video stream.

Data Flow

A master device such as a broadcast switcher embeds tally information into its program feed which is broadcast to a number of slave devices such as cameras or camera controllers. The output from the slave devices is typically fed back to the master device, but may also be sent to a video monitor.

The primary flow of tally information is from the master device to the slaves. Each slave device may use its device id to extract and display the relevant tally information.

Slave devices pass through the tally packet on their output and update the monitor tally status, so that monitor devices connected to that individual output may display tally status without knowledge of the device id they are monitoring.

Assumptions

Any data alignment / padding is explicit in the protocol. Bit fields are packed from LSB first.

Blanking Encoding

One tally control packet may be sent per video frame. Packets are encoded as a SMPTE 291M packet with DID/SDID x51/x52 in the active region of VANC line 15. A tally control packet may contain up to 256 bytes of tally information.

Packet Format

Each tally status consists of 4 bits of information:

uint4

bit 0:	program tally status (0=off, 1=on)
bit 1:	preview tally status (0=off, 1=on)
bit 2-3:	reserved (0x0)

The first byte of the tally packet contains the monitor device tally status and a version number.

Subsequent bytes of the tally packet contain tally status for pairs of slave devices. The master device sends tally status for the number of devices configured/supported, up to a maximum of 510.

struct tally

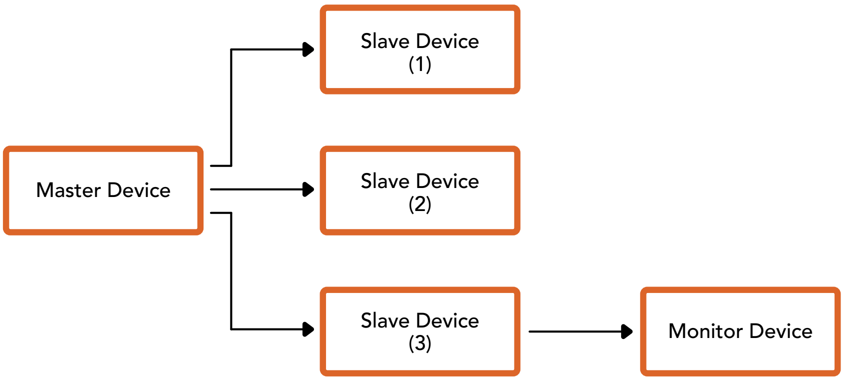
uint8

bit 0:	monitor device program tally status (0=off, 1=on)
bit 1:	monitor device preview tally status (0=off, 1=on)
bit 2-3:	reserved (0b00)
bit 4-7:	protocol version (0b0000)

uint8[0]

bit 0:	slave device 1 program tally status (0=off, 1=on)
bit 1:	slave device 1 device preview tally status (0=off, 1=on)
bit 2-3:	reserved (0b00)
bit 4:	slave device 2 program tally status (0=off, 1=on)
bit 5:	slave device 2 preview tally status (0=off, 1=on)
bit 6-7:	reserved (0b00)

uint8[1]
bit 0: slave device 3 program tally status (0=off, 1=on)
bit 1: slave device 3 device preview tally status (0=off, 1=on)
bit 2-3: reserved (0b00)
bit 4: slave device 4 program tally status (0=off, 1=on)
bit 5: slave device 4 preview tally status (0=off, 1=on)
bit 6-7: reserved (0b00)
. . .



Byte	7 MSB	6	5	4	3	2	1	0 LSB
0	Version (0b0)	Version (0b0)	Version (0b0)	Version (0b0)	Reserved (0b0)	Reserved (0b0)	Monitor Preview	Monitor Program
1	Reserved (0b0)	Reserved (0b0)	Slave 1 Preview	Slave 1 Program	Reserved (0b0)	Reserved (0b0)	Slave 0 Preview	Slave 0 Program
2	Reserved (0b0)	Reserved (0b0)	Slave 3 Preview	Slave 3 Program	Reserved (0b0)	Reserved (0b0)	Slave 2 Preview	Slave 2 Program
3	...							

Visca Commands for PTZ control via SDI

Pan-tiltDrive	Up	8x 01 06 01 VV WW 03 01 FF	**VV:** Pan speed 01 to 18 **WW:** Tilt speed 01 to 17 **YYYY:** Pan position F725 to 08DB (center 0000) **ZZZZ:** Tilt position FE70 to 04B0 (image flip: OFF) (center 0000) Tilt position FB50 to 0190 (image flip: ON) (center 0000)
	Down	8x 01 06 01 VV WW 03 02 FF	
	Left	8x 01 06 01 VV WW 01 03 FF	
	Right	8x 01 06 01 VV WW 02 03 FF	
	UpLeft	8x 01 06 01 VV WW 01 01 FF	
	UpRight	8x 01 06 01 VV WW 02 01 FF	
	DownLeft	8x 01 06 01 VV WW 01 02 FF	
	DownRight	8x 01 06 01 VV WW 02 02 FF	
	Stop	8x 01 06 01 VV WW 03 03 FF	
	AbsolutePosition	8x 01 06 02 VV WW 0Y 0Y 0Y 0Y 0Z 0Z 0Z 0Z FF	
	RelativePosition	8x 01 06 03 VV WW 0Y 0Y 0Y 0Y 0Z 0Z 0Z 0Z FF	
	Home	0Y 0Y 0Y 0Y 0Z 0Z 0Z 0Z FF	
	Reset	8x 01 06 05 FF	
CAM_Memory	Reset	8x 01 04 3F 00 0p FF	**p:** Memory number (=0 to 5) Corresponds to 1 to 6 on the remote commander.
	Set	8x 01 04 3F 01 0p FF	
	Recall	8x 01 04 3F 02 0p FF	

Compatible motorized heads include the following:

- KXWell KT-PH180BMD
- PTZOptics PT-Broadcaster
- RUSHWORKS PTX Model 1

Blackmagic Bluetooth Camera Control

Blackmagic cameras with Bluetooth LE implement a variety of features and commands that allow users to control their cameras wirelessly. Developers have full access to these features for their custom applications.

The following services and characteristics describe the full range of communication options that are available to the developer.

Service: Device Information Service

UUID: 180A

Characteristics

Camera Manufacturer

UUID: 2A29

Read the name of the manufacturer (always “Blackmagic Design”).

Camera Model

UUID: 2A24

Read the name of the camera model (eg. “URSA Mini Pro”).

Service: Blackmagic Camera Service

UUID: 291D567A-6D75-11E6-8B77-86F30CA893D3

Characteristics

Outgoing Camera Control (encrypted)

UUID: 5DD3465F-1AEE-4299-8493-D2ECA2F8E1BB

Send Camera Control messages.

These messages are identical to those described in the Blackmagic SDI Camera Control Protocol section above. Please read that section for a list of supported messages and required formatting information.

For an example of how packets are structured, please see the ‘example protocol packets’ section in this document.

Incoming Camera Control (encrypted)

UUID: B864E140-76A0-416A-BF30-5876504537D9

Request notifications for this characteristic to receive Camera Control messages from the camera.

These messages are identical to those described in the Blackmagic SDI Camera Control Protocol section above. Please read that section for a list of supported messages and required formatting information.

Timecode (encrypted)

UUID: 6D8F2110-86F1-41BF-9AFB-451D87E976C8

Request notifications for this characteristic to receive timecode updates.

Timecode (HH:MM:SS:mm) is represented by a 32-bit BCD number: (eg. 09:12:53:10 = 0x09125310)

Camera Status (encrypted)
UUID: 7FE8691D-95DC-4FC5-8ABD-CA74339B51B9

Request notifications for this characteristic to receive camera status updates.

The camera status is represented by flags contained in an 8-bit integer:

None	= 0x00
Camera Power On	= 0x01
Connected	= 0x02
Paired	= 0x04
Versions Verified	= 0x08
Initial Payload Received	= 0x10
Camera Ready	= 0x20

Send a value of 0x00 to power a connected camera off.

Send a value of 0x01 to power a connected camera on.

Device Name
UUID: FFAC0C52-C9FB-41A0-B063-CC76282EB89C

Send a device name to the camera (max. 32 characters).

The camera will display this name in the Bluetooth Setup Menu.

Protocol Version
UUID: 8F1FD018-B508-456F-8F82-3D392BEE2706

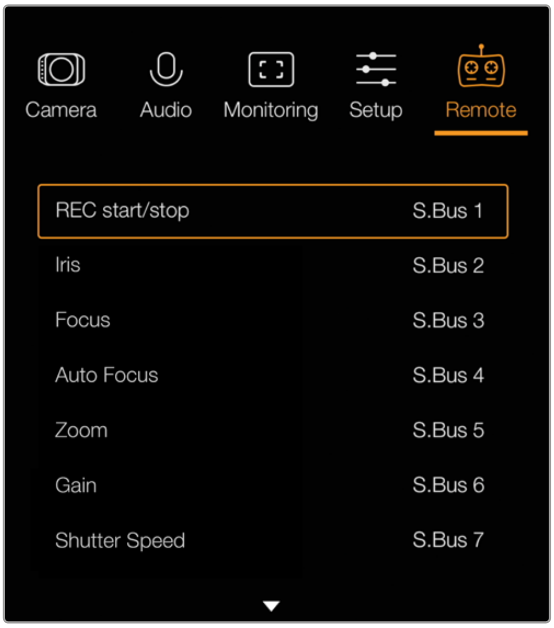
Read this value to determine the camera's supported CCU protocol version.

NOTE Encrypted characteristics can only be used once a device has successfully bonded or paired with the Blackmagic Camera. Once a connection has been established, any attempt to write to an encrypted characteristic will initiate bonding. For example, writing a 'Camera Power On' (0x01) message to the Camera Status characteristic.

Once bonding is initiated, the camera will display a 6-digit pin in the Bluetooth Setup Menu. Enter this pin on your device to establish an encrypted connection. The device will now be able to read, write and receive notifications from encrypted characteristics.

S.Bus

Blackmagic Micro Studio Camera 4K and Blackmagic Micro Cinema Camera feature a 'remote' settings menu for setting remote functions using the S.Bus protocol. This protocol uses 1 connection to control up to 17 channels, and each of these channels can be mapped to a specific camera function. S.Bus receivers and decoders can be found in most major hobby stores online as they are often used for radio remote control of airplane and helicopter models.



Remote settings – Blackmagic Micro Studio Camera 4K.

Assigning Camera Functions to S.Bus Channels

If you are using S.Bus to control your Blackmagic Micro Studio Camera 4K, you can use the 'remote' menu to assign the following functions to individual S.Bus channels:

- Trigger record
- Iris
- Focus
- Auto focus
- Zoom
- Gain
- Shutter speed
- White balance
- Audio levels
- Frame rate

If you are using S.Bus to control your Micro Cinema Camera, you can use the 'remote' menu to assign the following functions individual S.Bus channels:

- Trigger record
- Iris
- Focus
- Auto focus
- Zoom
- ISO
- Shutter angle
- White balance
- Audio levels
- Frame rate
- Codec

To assign functions to individual S.Bus channels, simply select the function you wish to control and assign an available channel using the ‘up,’ ‘down’ and ‘set’ buttons.

Standard radio transmitters for remote control vehicles that support the S.Bus protocol are usually setup with control ranges built into their controller output, so that all you need to do is assign camera functions to the correct individual S.Bus channels for remote control of your camera functions.

You can also use the S.Bus protocol to develop your own sophisticated custom control solutions.

Developing a Custom Controller

If you would like to develop your own custom camera control solutions, you can use the S.Bus input on the expansion cable as a way to interface camera functions on Blackmagic Micro Studio Camera 4K and Blackmagic Micro Cinema Camera.

When sending commands via the S.Bus input to your camera, the input values will need to be between 44 and 212 in order to be interpreted by the camera. A value of 128 is considered to be the midpoint or neutral position when using a radio control transmitter.

The way in which specific commands are sent to the camera will depend upon how you have mapped the camera functions to your controller.

There are two ways to map the commands to the controls.

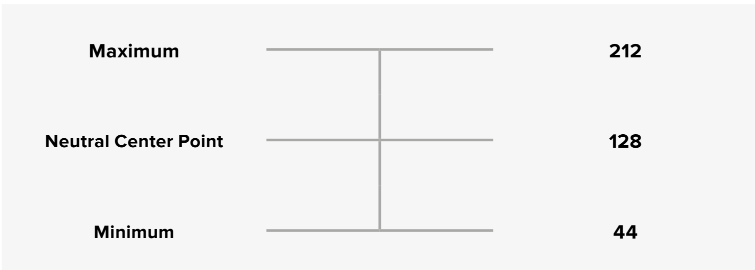
- The first type maps settings to specific ranges of the input so that sending a value within a certain range will trigger a particular setting.

  For example, the f-stop settings on a lens from f1.8 to f22 will be distributed along the entire range of 44 to 212. Sending a value between 44 and 51 would set the lens to f1.8. These values will then continue along the entire range so that sending a value between 206 and 212 would select f22. Zoom and focus changes are controlled the same way.

f1.8	f2	f2.8	f4	f5.6	f8	f11	f16	f22
44–61	62–79	80–97	98–115	116–133	134–151	152–169	170–197	198–212

- The second type of control registers any change from the neutral value of 128 to a value above or below and then back to the neutral point. This will be considered by the camera as a valid toggle signal, which increases or decreases the assigned settings. Settings like the REC trigger, autofocus, gain/ISO, shutter value, white balance and frame rate work on this basis.

  You could assign camera functions to a control like a spring loaded joystick which snaps back to a neutral center point after each movement up or down. In this example a value of 44 would represent the maximum downward position of the joystick and 212 would represent the maximum upward position, while the center functions as a neutral point with a value of 128.



  For example, if your gain settings are mapped to a joystick in this way, then after each upward movement of the joystick it would return to the neutral point in the center which toggles the camera to increase gain by one increment, say from 0dB to 6dB.

You could also send this same information in numerical form to another type of controller that uses numerical values. In this case you would send a value of 128, followed by a value above 128 such as 212, and then back to 128 again. The camera will register this as an increment command and change the gain from 0dB to 6dB.

The way in which you assign commands will depend upon the kind of control system that you are using to control your camera and the type of control that you want to assign. Spring loaded controls that snap back to a neutral point are very common on radio control transmitters for model aircraft and drones.

If you are using a Futaba style remote control, some functions will be more suited to the rotating dials or analogue sticks, whilst other functions will be more suited to the switches.

PWM

The 'remote' settings menu also allows you to configure the PWM channels connected to the expansion port on your Blackmagic Micro Cinema Camera.

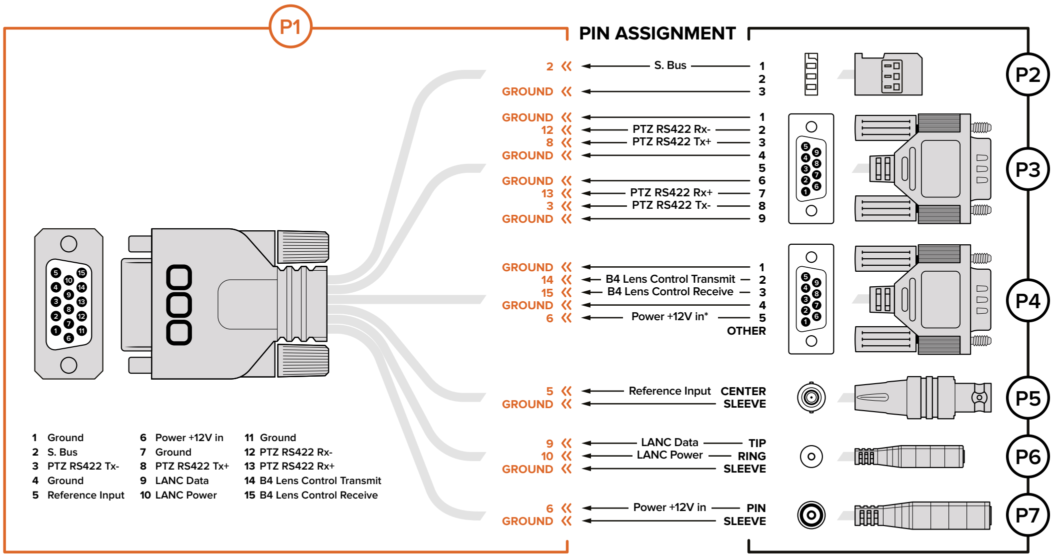
Analog radio control transmitters and receivers are typically used to drive servos on model airplanes, but can also be used for wireless remote control of the Blackmagic Micro Cinema Camera.

The 4 analog PWM radio remote control inputs on the expansion cable allow you to map camera functions to the controls on model airplane controllers. The dials, switches and joysticks on the radio controller are output on different radio channels and these channels can be assigned to four different camera functions in the remote settings menu. This provides you with a low cost, power efficient way to wirelessly control your camera. You can even generate your own PWM signals from your own Arduino or Raspberry Pi projects to control the camera.

Wiring Diagrams

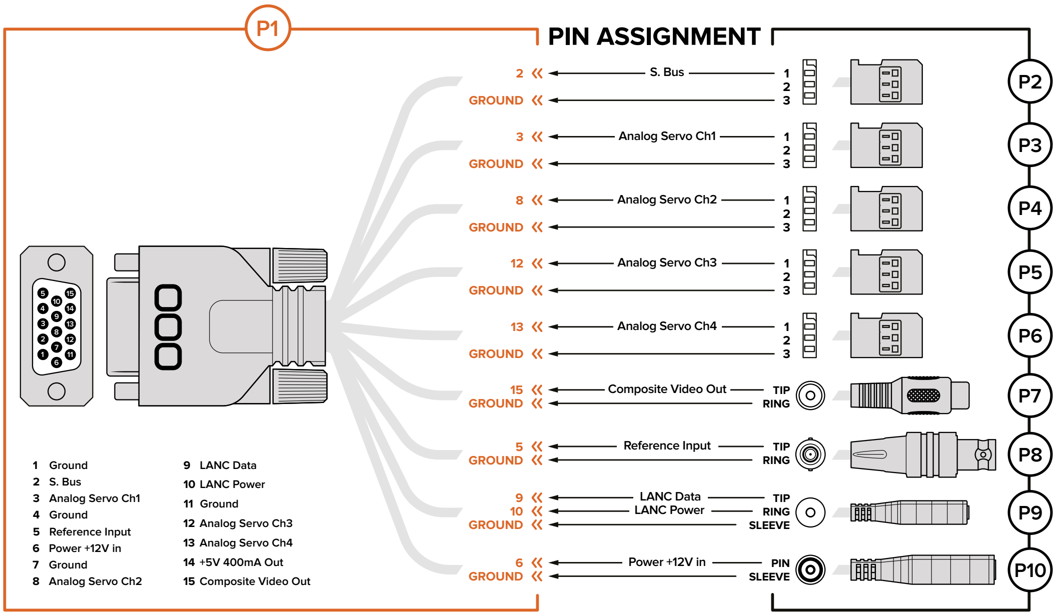
When using Blackmagic Micro Cinema Camera or Micro Studio Camera 4K's expansion port, you may only want to access one or two functions. For example, you may want to control an attached B4 Broadcast Lens while simultaneously receiving 12V power and a reference signal. It's easy to make a connector that will give you just these functions without the clutter of additional, unused connectors.

Use the following diagrams when wiring the expansion cables included or use it as an example of how you can wire up the connections on your own custom cable correctly. The full range of available pins are listed under group P1, while subsets used for particular functions, as well as their layout within the appropriate connectors, are shown in groups P2 and above.



* Power input to the camera is also used to power the lens. Beware of applying excessive voltages if you're using your own power supply to avoid damage to the lens.

Wiring diagram for the Blackmagic Micro Studio Camera 4K Expansion Cable



Wiring Diagram for the Blackmagic Micro Cinema Camera Expansion Cable