

## Serial Protocol of SCB-1, PSM-10 and EYE-10

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### Introduction

The SCB-1, PSM-10 and EYE-10 can be controlled via the RS-232-port by a computer or a control-system. It is possible to perform all functions of the IR-remote-control such as Zoom, Focus, Presets, etc. as well as a lot of other functions like reading and setting zoom-position, etc. . There is also the possibility to transfer images to the computer. The used protocol is called SCOTI (for SCB operating and transfer interface).

### Connection

The serial-port of the camera is a standard 9-pin-Sub-D-connector, which can be found on most computers too. Only pin 2 (RxD), 3 (TxD) and 5 (GND) must be connected. The default baud rate is 9600 (changeable). There is no parity, 8 data-bits, 1 stop-bit and no handshaking.

The high transfer-rates are useful to transfer images via RS-232 (not possible with 9600). Please note that baud rates above 115200 are not supported by all PCs and may require special drivers and/or hardware.

### Changing the Baud rate

It is possible to change the baud rate from 9600 to 19200, 38400, 57600, 115200, 230400, 460800 or 921600. To change the baud rate, switch the unit on and press MENU-key for four seconds, until the Extra-Menu appears. There the baud rate can be changed.

The baud rate can be changed with the Camera Control software too.

Following baud rates are supported since firmware v1.03a (and later):

19200 baud/s  
38400 baud/s  
57600 baud/s

### Control-Commands

The controlling of the camera is done by sending codes to the camera: these codes perform the desired action. There is no need for Carriage Return, Linefeed or similar. The communication is packet-oriented: The host sends a packet and the camera replies to it with "OK" or an error (e.g. if the checksum was incorrect). A new packet from the host can be sent after the reply from the previous packet was received (or a timeout occurred).

## Version Check

A special command, which is the only command that does not use the packet-format is 76hex (ASCII 'v'). If the camera receives this command, it will respond with "PSM-10 Vx.xxx"+CR+LF. This command can be used for easy communication-check with a terminal program and is also included for compatibility with other WolfVision Products.

## Firmware update

Download new firmware from the Internet ([www.wolfvision.com/wolf/fware.html#c](http://www.wolfvision.com/wolf/fware.html#c)).

Select "firmware update" in the "extras-menu" of the camera control software to start the update procedure.

## Hints

For the image-transfer, the serial port is the bottleneck, because a lot of data has to be transmitted. To reduce this bottleneck, the PSM-10 support baud rates up to 921600 baud. However, most PCs support only up to 115200 baud and require special extension cards for higher baud rates (a high speed RS-232 extension card is optional available). For this high baud rates, short RS-232 cables are necessary (below 2m is recommended).

If operating commands work fine, but image transfer does not, you may try to reduce the transmit block size in the Picture View Menu (at the cost of transfer speed). At very high baud rates, you can also set the transmit size to 4K (default is 1K) to further optimize the speed.

## General information to Camera Control

When the Camera Control software is used, enter the data bytes of the command in "Custom Command"-function only.

E.g. Power On (00 F2 05 50 Checksum): enter "05 50" in Camera Control-Software "Custom Command"-Function.

## Commands of Camera, Future

The SCOTI protocols of all WolfVision (stand alone) cameras are almost the same.

Only some commands more or less are supported on other Camera-types due to the different technologies.

In the future (at higher firmware-versions) further commands may be added which are not supported yet (listed commands are available with Firmware version V1.07b).

## Packet-Format

Short-Packet-Format: For short packets (up to 15 Byte Data):

00hex Len+F0hex Data[1] Data[2] ... Data[Len] Checksum

Long-Packet-Format: For long packets (up to 61439 Byte Data):

00hex Len H Len L Len-Checksum Data[1] Data[2] ... Data[Len] Data-Checksum

The long-packet-format-data can also be used for short packets (below 15 bytes of data). The long packet-format is mainly used for the "OSD Write Line"-command and for image transfers.

Len H and Len L are the High- and Low-Byte of the 16 bit Length. The High-Byte is not allowed to get F0hex or higher, as this would indicate the short-packet-format. In the short-packet-format, F0hex is added to the length, so F1hex is for 1 byte length, F2hex for 2 byte, etc.

The checksum is the ones-complement (bit-wise NOT) of the sum of all length- and data-bytes (truncated to 8 bit).

The length-checksum is the ones-complement (bit-wise NOT) of the sum of both length-bytes (truncated to 8 bit).

The data-checksum is the ones-complement (bit-wise NOT) of the sum of all data-bytes (truncated to 8 bit).

The shortest possible packet has a length of 4 Bytes (using the short-packet-format): 1 Byte Header, 1 Byte Length, 1 Byte Data and 1 Byte Checksum.

If the camera receives the start of a packet, but not enough data, it will timeout after 1 second and sends a time-out-error-packet.

The data-checksum is the ones-complement (bit-wise NOT) of the sum of all data-bytes (truncated to 8 bit).

The shortest possible packet has a length of 4 Bytes (using the short-packet-format): 1 Byte Header, 1 Byte Length, 1 Byte Data and 1 Byte Checksum. For example, if Data is 01hex:

00hex	F1hex	01hex	0Dhex
Header	Length	Data	Checksum
			F1hex+01hex=F2hex
			FFhex-F2hex=0Dhex

Following message in the long-packet-format would have the same effect:

00hex	00hex	01hex	FEhex	01hex	FEhex
Header	Length H	Length L	Len-Checksum	Data	Data-Checksum
			00hex+01hex=01hex		FFhex-01hex=FEhex
			FFhex-01hex=FEhex		Ones-Complement
			Ones-Complement		

The host and the camera should both ignore all the data that they receive if a header is not detected (however, the camera will respond to 76hex with a version-string) If the camera detects a checksum-error, it will reply with a checksum-error-packet and the host should resend the packet. If e.g. the header from the host is corrupted, the camera will not detect the header and will not respond to the packet. The host should then time-out and resends the packet. If a false header is detected (e.g. a Data-Byte is 00hex) a checksum-error will be generated. If the camera receives the start of a packet, but not enough data, it will timeout after 1 second and sends a time-out-error-packet.

## Replies from the camera

	H	L	D	C	Remarks
Command OK:	00	F1	01	0D	reply within max. 0.5s
Illegal Command:	00	F1	10	FE	
Command failed:	00	F1	11	FD	Command not possible in the moment
Parameter wrong:	00	F1	12	FC	(or wrong command length)
Checksum Error:	00	F1	20	EE	
Timeout Error:	00	F1	21	ED	after the 00-header, the rest of the command must be sent within 1 sec.
Command to long:	00	F1	22	EC	(Receive Buffer Overflow)

Short Inquiry Reply (no Command Ok will be sent):

00 Fx 60 R[1] R[2] ... R[x-1] C

Long Inquiry Reply (no Command Ok will be sent):

00 LenH LenL C 60 R[1] R[2] ... R[Len-1] C

(all numbers are hex, C=Checksum, H=Header, L=Length, D=Data)

## Commands

C=Checksum, P=Position (1 Byte), PH/PL: Position (2Byte) High/Low-Byte, Sp=Speed, H=Header, L=Length; VL=Value

## Checksum and Ones-complement

To calculate the checksum, add the hex values of all commands together and subtract the last two digits of the amount from FF.

Example:

00hex	F2hex	01hex	20hex	<b>EChex</b>
Header	Length	Data	Data	Checksum

00hex	+	F2hex	+	01hex	+	20hex	=	<u>113hex</u>
				FFhex	-	13hex	=	<u>EChex</u>

## Zoom

Function	H	L									Remarks
Zoom Tele	00	F2	01	20	<i>EC</i>						with Speedup after 1 sec, disables freeze / memories
Zoom Wide	00	F2	01	30	<i>DC</i>						with Speedup after 1 sec, disables freeze / memories
Zoom Stop	00	F2	01	10	<i>FC</i>						
Optical Zoom Tele w/ var. Speed	00	F3	01	21	Sp	C					Sp=Speed from 1 (slow) to F (fastest)
Optical Zoom Wide w/ var. Speed	00	F3	01	31	Sp	C					Sp=Speed from 1 (slow) to F (fastest)
Optical Zoom to Position	00	F4	01	40	PH	PL	C				PH/PL: Zoom-Position 0hex=Wide, FFFhex=Tele
Digital Zoom to Position	00	F4	01	41	PH	PL	C				PH/PL: Digital Zoom- Position, 0hex=Wide (1x), FFFhex=Tele (2x)
Get Optical Zoom-Pos	00	F2	01	60	<i>AC</i>						
Reply:	00	F3	60	H	L	C					HL=Optical Zoom-Position from 0hex (wide) to FFFhex (tele)
Get Digital Zoom-Pos	00	F2	01	61	<i>AB</i>						
Reply:	00	F3	60	H	L	C					HL=Digital Zoom-Position from 0hex (wide) to FFFhex (tele)
Disable Digital Zoom	00	F2	01	50	<i>BC</i>						When zooming towards tele, digital zoom will not be automatically activated
Enable Digital Zoom	00	F2	01	51	<i>BB</i>						Digital zoom will be automatically activated at tele
Enable Digital Zoom w/ Stop	00	F2	01	52	<i>BA</i>						Zoom will stop at tele and a message will appear. When zooming is started again, digital zoom will be activated.
Enable Digital Zoom w/ Message	00	F2	01	53	<i>B9</i>						Digital Zoom will be automatically activated at tele and an info-message will appear.

Invariable checksums are calculated and will be found in the last cell of the respective command (values are written in italic numbers for better distinguishability).

All other checksums are variable and has to be calculated by the programmer, because these checksums are depending on the command.

## Focus

Function	H	L									Remarks
Focus Near	00	F2	02	20	<i>EB</i>						with Speedup after 1 sec, switches AF off, disables freeze / memories
Focus Far	00	F2	02	30	<i>DB</i>						with Speedup after 1 sec, switches AF off, disables freeze / memories
Focus Stop	00	F2	02	10	<i>FB</i>						
Focus Near w/ var. Speed	00	F3	02	21	Sp	C					Sp=Speed from 1 (slow) to F (fastest), switches AF off
Focus Far w/ var. Speed	00	F3	02	31	Sp	C					Sp=Speed from 1 (slow) to F (fastest), switches AF off
Focus to Position	00	F4	02	40	PH	PL	C				PH/PL: Focus-Position 0hex=Near, FFFhex=Far, switches AF off
AF Off	00	F2	02	50	<i>BB</i>						
Perform One Push AF	00	F2	02	51	<i>BA</i>						disables freeze / memories
Continuous AF	00	F2	02	52	<i>B9</i>						
Get Focus-Pos and AF-Setting	00	F2	02	60	<i>AB</i>						
Reply:	00	F4	60	H	L	AF	C				HL=Optical Zoom-Position from 0hex (near) to FFFhex (far), AF: 0=OFF, 1=ON, 2=One-Push-AF in progress

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# Iris

Function	H	L									Remarks
Iris Open	00	F2	03	20	<i>EA</i>						with Speedup after 1 sec, switches AI off, disables freeze / memories
Iris Close	00	F2	03	30	<i>DA</i>						with Speedup after 1 sec, switches AI off, disables freeze / memories
Iris Stop	00	F2	03	10	<i>FA</i>						
Iris Open w/ var. Speed	00	F3	03	21	Sp	C					Sp=Speed 1 (slow) or 2 (fast), switches AI off
Iris Close w/ var. Speed	00	F3	03	31	Sp	C					Sp=Speed 1 (slow) or 2 (fast), switches AI off
Iris to Position	00	F4	03	40	PH	PL	C				PH/PL: Iris-Position 0hex=Close, FFFhex=Open, switches AI off
Gain to Position	00	F3	03	41	P	C					P: Gain in dB (from 0 to 32dec), switches AGC off
Shutter to Position	00	F4	03	42	PH	PL	C				PH/PL: Shutter-Position (1 to 792), switches ASC off
Exposure Compensation (Brightness level adjustment)	00	F3	03	43	P	C					P: -10 to +10 (default=Zero), Twos-Complement
AI Off	00	F2	03	50	<i>BA</i>						Auto-Iris, if disabled, also AGC and ASC will not work, disables freeze / memories
AI On	00	F2	03	51	<i>B9</i>						disables freeze / memories
AGC Off	00	F2	03	52	<i>B8</i>						Auto-Gain-Control
AGC On	00	F2	03	53	<i>B7</i>						
ASC Off	00	F2	03	54	<i>B6</i>						Auto-Shutter-Control
ASC On	00	F2	03	55	<i>B5</i>						
Get Iris-Pos	00	F2	03	60	<i>AA</i>						
Reply:	00	F7	60	HI	LI	G	HS	LS	M	C	
											HI,LI=Optical Iris-Position from 0hex (close) to FFFhex (open), G=Gain in dB (0-34dec), HS,LS=Shutter-Setting (TBD), M(bit0):ASC, M(bit1): AGC, M(bit2): AI (1=ON, 0=OFF)

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## White Balance

Function	H	L									Remarks
Manual WB	00	F2	04	50	<i>B9</i>						
Perform One-Push-WB	00	F2	04	51	<i>B8</i>						
Auto-Tracking WB	00	F2	04	52	<i>B7</i>						
Set Manual WB	00	F4	04	40	PR	PB	C				PR: Red gain (-120dec to 120dec) PB: Blue gain (-120dec to 120dec) (Twos-Complements)
Get WB-Settings	00	F2	04	60	<i>A9</i>						
Reply:	00	F4	60	R	B	M	C				R: Red Gain (-120dec to 120dec) B: Blue gain (-120dec to 120dec) M: 0=ATW, 1=AWB, 2=Manu

Invariable checksums are calculated and will be found in the last cell of the respective command (values are written in italic numbers for better distinguishability).

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## Presets

Function	H	L									Remarks
Store Preset	00	F3	05	40	P	C					P=Preset no. (1 to 9 )
Recall Preset	00	F3	05	41	P	C					P=Preset no. (1 to 9 )
Store Power-On-Preset	00	F2	05	10	<i>F8</i>						
Recall Power-On-Preset	00	F2	05	11	<i>F7</i>						

Invariable checksums are calculated and will be found in the last cell of the respective command (values are written in italic numbers for better distinguishability).

All other checksums are variable and has to be calculated by the programmer, because these checksums are depending on the command.

## Image Memories

Function	H	L									Remarks
Store Memory	00	F3	06	40	P	C					P=Memory no. (1 to 4 )
Recall Memory	00	F3	06	41	P	C					P=Memory no. (1 to 4 )
Freeze, Update Freeze	00	F2	06	10	<i>F7</i>						
Unfreeze, Memory Off	00	F2	06	11	<i>F6</i>						
Get Memory-Settings	00	F2	06	60	<i>A7</i>						
Reply:	00	F2	60	M	C						M=0: Live, 1-4: Memory 1-4, FFhex: Freeze On

Invariable checksums are calculated and will be found in the last cell of the respective command (values are written in italic numbers for better distinguishability).

All other checksums are variable and has to be calculated by the programmer, because these checksums are depending on the command.

## Color / Contrast Setting

(available with firmware v1.03a and later)

Function	H	L								Remarks
Set Color / Contrast	00	F2	04	80	VL	C				VL=0, 1, 2
Get Color / Contrast - Settings	00	F2	04	A0	69					
Reply:	00	F2	60	D	C					D=0: color/contrast 0 D=1: color/contrast 1 D=2: color/contrast 2

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All other checksums are variable and has to be calculated by the programmer, because these checksums are depending on the command.

## User I/O

Function	H	L									Remarks
Set User LEDs	00	F3	07	40	P	C					P=LED-Bit-Pattern (0 to 7), if Bit is set, LED is on. Bit 0: User-LED 1 Bit 1: User-LED 2 Bit 2: User-LED 3
Get User Keys	00	F2	07	60	A6						
Reply:	00	F2	60	K	C						K(bit 0): Userkey 1, K(bit 1): Userkey 2, K(bit 2): Userkey 3, K(bit 3): Userkey 4 (1=pressed, 0=unpressed)

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## Image

Function	H	L								Remarks
Set XGA/60Hz	00	F2	08	10	<i>F5</i>					Change is memorized in EEPROM
Set XGA/75Hz	00	F2	08	11	<i>F4</i>					Change is memorized in EEPROM
Positive Mode	00	F2	08	12	<i>F3</i>					
Negative Mode	00	F2	08	13	<i>F2</i>					
Set Detail	00	F3	08	40	P	C				P=Detail: 0=OFF, 1=MED, 2=HIGH
Get Resolution	00	F2	08	60	<i>A5</i>					
Reply:	00	F3	60	10	F	C				10=Color, XGA, 1CCD, F=V-Frequency in Hz (e.g. 4Bhex=75Hz)
Get Positive/Negative	00	F2	08	61	<i>A4</i>					
Reply:	00	F2	60	N	C					N=0: Positive, N=1: Negative
Get Detail	00	F2	08	62	<i>A3</i>					
Reply:	00	F2	60	D	C					D=0: Detail off, D=1: Detail low, D=2: Detail high
Image Rotate 180°	00	F2	0C	10	<i>F1</i>					
Image orientated normal	00	F2	0C	11	<i>F0</i>					Image not rotated and not mirrored
Image mirrored hor.	00	F2	0C	12	<i>EF</i>					Image mirrored horizontally
Image mirrored vert.	00	F2	0C	13	<i>EE</i>					Image mirrored vertically
Store mirror/rotate settings permanently	00	F2	0C	20	<i>E1</i>					

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## Image Transfer

Function	H	L									Remarks
Capture Picture	00	F4	09	10	PM	PC	C				PM=Memory: 0=Live, 4-7=Memory 0-3 PC=Capture Mode: 0: Full Resolution 80-8F: Updated Preview Tile 0-15 C0-CF: Not Updated Preview Tile 0-15 Not available at 9600 baud.
Get Picture Block 4k	00	F2	09	60	<i>A4</i>						Not available at 9600 baud.
Get Picture Block 1k	00	F2	09	61	<i>A3</i>						Not available at 9600 baud.
Get Picture Block 256Byte	00	F2	09	62	<i>A2</i>						Not available at 9600 baud.
Get Picture Block 32Byte	00	F2	09	63	<i>A1</i>						Not available at 9600 baud.
Get Picture Block 8Byte	00	F2	09	64	<i>A0</i>						Not available at 9600 baud.

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All other checksums are variable and has to be calculated by the programmer, because these checksums are depending on the command.

## Power Control

(available with firmware v1.02c and later)

Function	H	L									Remarks
Power On	00	F2	05	50	<i>B8</i>						
Power Off	00	F2	05	51	<i>B7</i>						switch camera to standby-mode
Get Power	00	F2	05	52	<i>B6</i>						
Reply:	00	F2	60	D	C						D=1: Standby-mode D=2: powered on

Invariable checksums are calculated and will be found in the last cell of the respective command (values are written in italic numbers for better distinguishability).

All other checksums are variable and has to be calculated by the programmer, because these checksums are depending on the command.

## Key-Lock Control

(available with firmware v1.02c and later)

Function	H	L									Remarks
Key-Lock On	00	F2	05	60	A8						
Key-Lock Off	00	F2	05	61	A7						
Get Key-Lock	00	F2	05	62	A6						
Reply:	00	F2	60	D	C						D=1: Key-Lock not activated D=2: Key-Lock activated

Invariable checksums are calculated and will be found in the last cell of the respective command (values are written in italic numbers for better distinguishability).

All other checksums are variable and has to be calculated by the programmer, because these checksums are depending on the command.



## User OSD

Function	H	L									Remarks
Activate User OSD and Clear OSD	00	F2	0A	10	<i>F3</i>						Enables User-OSD-Commands and resets the OSD. OSD-Messages and Menu are suppressed.
Disable User OSD	00	F2	0A	11	<i>F2</i>						Disables User-OSD-Commands and allows Menu and camera messages.
First line double Height on	00	F2	0A	12	<i>F1</i>						Default: off
First line double Height off	00	F2	0A	13	<i>F0</i>						
Set line color	00	F4	0A	40	PL	PC	C				PL: Line (0 to 14), PC: Color (0 (black) to 7 (white, default))
Write Line	00	Fx	0A	50	PL	PC	PT	...	C		PL: Line (0 to 14), PC: Column (0 to 29), PT: ASCII-Code of text (up to 30 characters per line) The remainder of the line is not deleted. (For longer texts you need the long-packet-format!)
Get User OSD	00	F2	0A	60	<i>A3</i>						
Reply:	00	F2	60	D	C						D=0: User OSD inactive, D=1: User OSD active

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All other checksums are variable and has to be calculated by the programmer, because these checksums are depending on the command.

## User Logo

(available with firmware v1.04a and later)

Function	H	L									Remarks
Write User Logo	00	Fx	0A	80	PL	PT	C				Enter text in camera-Control-Software Logo Editor. PL=Line 0-14, PC=Column 0-29, PT=ASCII Code of Text (up to 30 characters per line)
Set Color Of User Logo	00	F4	0A	70	PL	PC	C				PL=line 0-14, PC=color 0-7
Set Clear Time Of User Logo	00	F3	0A	81	PL	C					PL=seconds 1-255

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## OSD menu control commands

(available with firmware v1.04a and later)

Function	H	L									Remarks
Enable Menu Button	00	F2	0A	A0	<i>63</i>						OSD menu on
Disable Menu Button	00	F2	0A	A1	<i>62</i>						OSD menu off
Get OSD Menu	00	F2	0A	A2	<i>61</i>						
Reply:	00	F2	60	D	<i>C</i>						D=1: OSD Menu disable, D=2: OSD Menu enable
Enable OSD Messages	00	F2	0A	A4	<i>5F</i>						
Disable OSD Messages	00	F2	0A	A5	<i>5E</i>						
Get OSD Messages	00	F2	0A	A6	<i>5D</i>						
Reply:	00	F2	60	D	<i>C</i>						D=1: OSD Messages disable, D=2: OSD Messages enable
Set Message Color	00	F3	0A	90	14	PL	C				PL=color 0-7

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## Firmware Update

Function	H	L									Remarks
Enter Bootloader	00	Fx	FF	10	Px	P..	C				Px...=Password
Get Version	00	F2	FF	60	<i>AE</i>						
Reply:	00	F2	60	V1	V2	..	Vx	C			Version-String (ASCII-Codes) in Format "PSM-10 Vx.xxx", e.g. „PSM-10 V1.02a“

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## Set Baud rate

Function	H	L									Remarks
SetBaudrate (non-permanent)	00	F3	FF	20	P	C					P = Baudrate: 0=9600, 1=115200, 2=230400, 3=460800, 4=921600, 5=19200, 6=38400, 7=57600
Memorize current Baudrate in EEPROM	00	F2	FF	21	<i>ED</i>						

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