STAR-07

Industrial Pattern Projection

STAR-07 is a high performance DLP® projector based upon the Texas Instruments micromirror technology and designed to serve in demanding industrial applications. Widely used in multimedia and digital cinema since more than one decade, the well proven DLP technology has become an important tool for industrial solutions as well. The heart of the STAR-07 projector is a 0.7" DLP chip that consists of an array of 1024x768 mirrors. These bi-stable mirrors flip into opposite tilt positions within microseconds to generate the desired patterns. STAR-07 provides precise high-speed control for each individual mirror enabling outstanding flexibility and pattern frame rates of the projection output. The projector is equipped with a high-power LED light source that is the key for the compact and rugged design of the device.

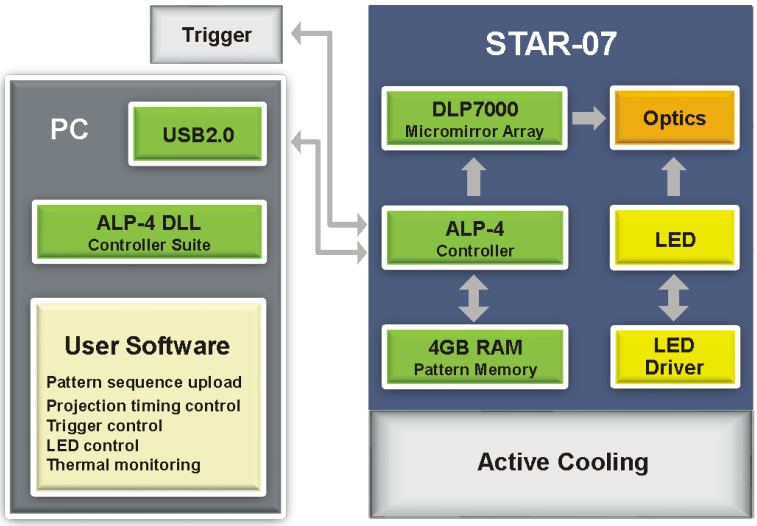
Typical use cases are machine vision illumination, 3D scanning, industrial exposure, and additive manufacturing. Beyond that, new emerging applications are well supported by an open SDK interface. STAR-07 comes with two lens options, the standard projection lens and a wide angle lens with fixed focal length.

System Architecture

The central control unit of STAR-07 is USB2.0 connected and realizes pattern upload, display, and synchronization. An integrated trigger facility supports a wide voltage range at its opto-coupler interface and is software programmable. The digital driver for the LED light source gives convenient access to power setting and temperature reading for thermal management.

System Control

The ViALUX ALP-4.2 Controller Suite is the central programming tool and provides all necessary functionality for product development. Sequences of patterns are uploaded from PC to the on-board memory via USB2.0 transfer with lossless compression. The properties of the display sequences, e.g. bit depth, picture time, trigger mode, repetitions can be freely defined to meet the respective application requirements. The ALP-4.2 firmware streams patterns from on-board SDRAM memory to the DLP7000 micro mirror array where the input pattern is one-to-one mapped to the mirrors. The patterns are updated in the global reset mode; that means all mirrors are switching simultaneously within a few microseconds. Grey value patterns are generated by controlled ON-time for each mirror yielding exact grey value linearity. The maximum global array switching rate is 22 727 fps; even higher frame rates can be achieved by partial updates of the micromirror array. Multiple STAR-07 devices can be run in parallel, conveniently controlled from the same application program and precisely synchronized by the trigger facility. The ALP-4.2 API is well proven for all Discovery™4100 chipsets; the DLL supports C++, VBasic, .NET, LabVIEW, and other development platforms. Microsoft® operating systems are supported up to the most recent Windows® versions both, 32-bit and 64-bit. The ALP-4 USB2.0 driver is robust, validated, UIF compliant and 24/7 proven in industrial and medical use.*



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Specifications

LED options

	RED	GREEN	BLUE	VIOLET	WHITE
Typical dominant wavelength	613 nm	525 nm	460 nm	405 nm	-
Spectral bandwidth FHWM	19 nm	34 nm	20 nm	14 nm	-
STAR-07 output *	330 lm 1 450 mW	850 lm 1 550 mW	140 lm 2 550 mW	- 2 150 mW	1100 lm -

* Typical value for continuous projection, pulse operation may yield higher output

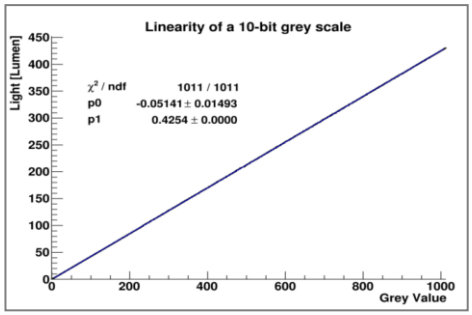
Lens options

		Mass M	Distortion	Working distance D Throw ratio TR	Uniformity (IEC) Contrast FOFO	MTF
Standard lens		M = 150 g	0.2 %	D > 0.4 m TR= 1.8	+25%/-30% 2000:1	45% @ 36 lp/mm
Wide angle lens		M = 580 g	5.5 %	D > 0.5 m TR = 0.9	+26%/-23% @D=1m 2000:1	30% @ 36 lp/mm @ 462 nm

Frame rates

DMD array (AOI)	1024 x 768	1024 x 768	1024 x 768	1024 x 768	1024 x 768	1024 x 512
Bit depth	8-bit	7-bit	6-bit	5-bit	1-bit	1-bit
Frame rate	290 fps	569 fps	1 091 fps	2 016 fps	22 727 fps	30 300 fps

Greyscale linearity



ALP-4 supports precise bit-plane timing enabling outstanding greyscale linearity in connection with synchronized camera recording.

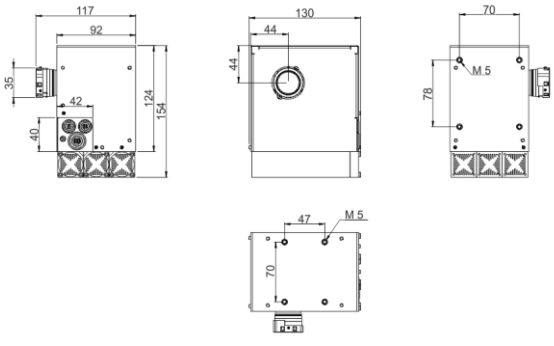
Grey value deviations are < 0.06% of the full-scale value.

General

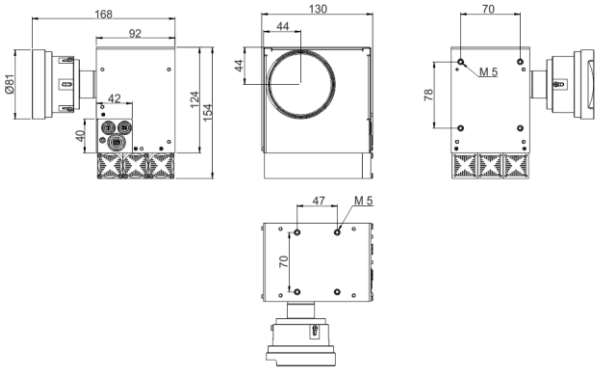
Mass (without lens)	Input power	Operating temperature	Storage temperature	Regulations	LED lifetime
2000 g	DC 12-24V 150 W	10°C to 40°C non-condensing	-10°C to 50°C non-condensing	CE FCC Class A	>10.000 h (ON time)

Dimensions [mm]

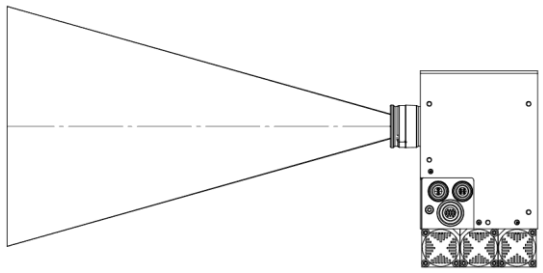
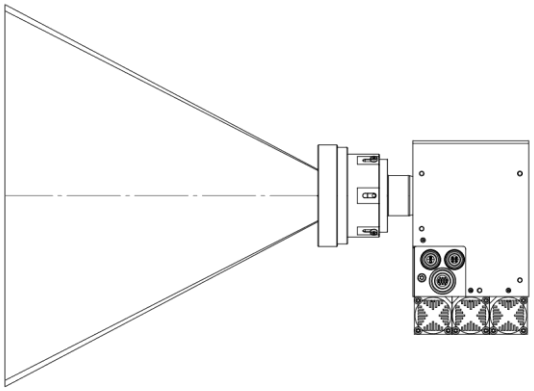
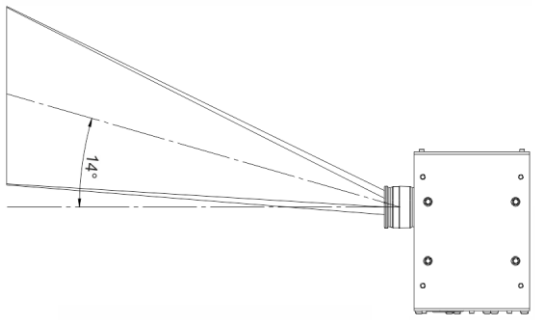
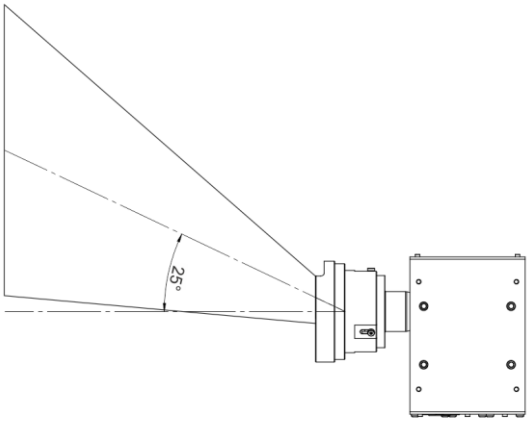
Standard lens



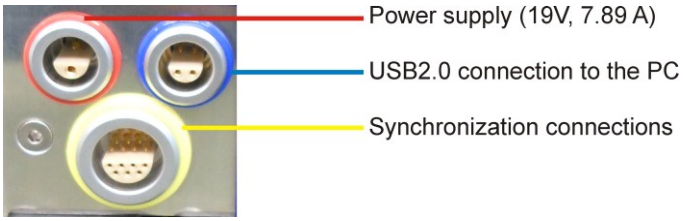
Wide angle lens



Lens Shift

Standard lens	Wide angle lens
	
	

Connections



Synchronization Connections (yellow)

Pin	Signal	I/O	Limit	Description / usage
1		OC Out [1]	10mA	*reserved for future use*
2	STAR-07 Cascade	OC Out [1]	10mA	for serializing multiple STAR-07 projectors in a chain
3	Frame Trigger	OC Out [1]	10mA	outputs one pulse per frame, e.g. for synchronizing a slave camera; ALP API commands: • AlpSeqTiming (SynchDelay, SynchPulseWidth): relation to frame timing • AlpDevControl (ALP_SYNCH_POLARITY)
4		OC Out [1]	10mA	*reserved for future use*
5	Device Power GND	Out		from primary power supply (see also Pin 9)
6	DC 5V +	Out	5V 200mA	galvanic isolated supply voltage (see also Pin 10), e.g. for driving opto couplers
7	V_{DD} common	V_{DD}	50V	common supply voltage for all OC outputs
8		OC In [1]	3.3 – 24V	*reserved for future use*
9	Device Power V_{DD}	Out	Vprimary 1A	taken from primary STAR-07 projector power supply: 19V, not fused (see also Pin 5)
10	DC 5V GND	Out		galvanic isolated supply voltage (see also Pin 6), e.g. for driving opto couplers
11	V_{SS} common	GND		common ground/return of all OC inputs
12		OC In [1]	3.3 – 24V	*reserved for future use*
13	STAR-07 Cascade	OC In [1]	3.3 – 24V	for cascading multiple STAR-07 projectors in a chain
14	Frame Trigger	OC In [1]	3.3 – 24V	triggers next frame in sequence, e.g. for synchronization with a master camera ALP API commands: • AlpProjControl: ALP_PROJ_MODE=ALP_SLAVE • AlpSeqTiming (TriggerInDelay): relation to frame timing • AlpDevControl (ALP_TRIGGER_EDGE)

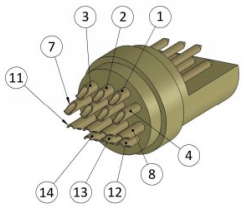
[1] OC – Opto Couplers

	Min	Typical	Max
Input	5mA 3.3V	6mA 5V	8mA 24V
Output	5mA V_{DD}=5V		10mA 50V / 150mW

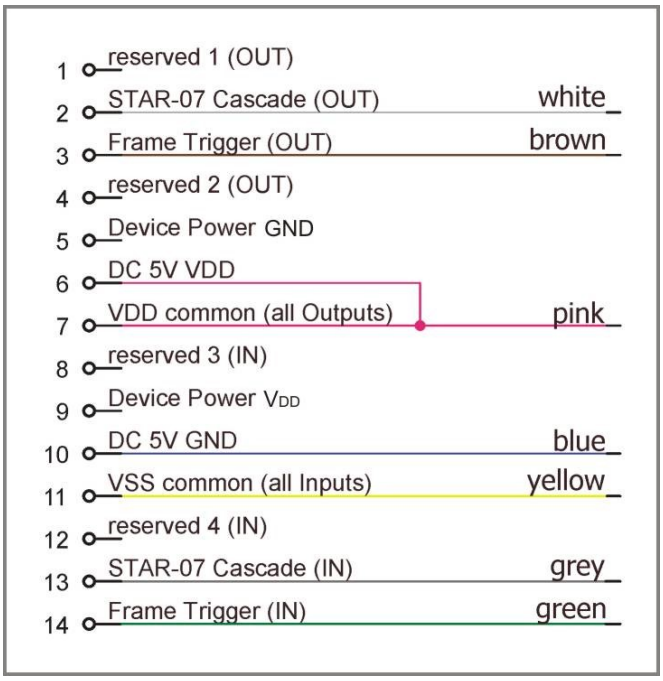
All input and output signals are driven by opto couplers permitting 250VDC isolation. Inputs are equipped with constant current regulators; therefore, no further external resistors are required over a wide voltage range.

STAR-07 Interface Cable

Lemo plug internal, soldering side



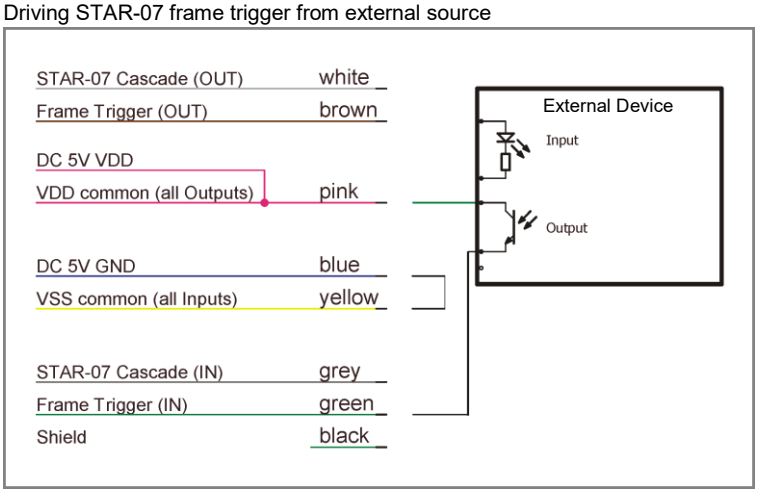
Lemo plug FFA.2C.314.CLAC



Lemo: FFA.2C.314.CLAC52Z	straight plug, 14-pin, cable collet 4.7-5.1mm for bend relief
Lemo: GMA.1B.045.DJ	bend relief, 4.5-4.9mm, YELLOW
Lemo: 070 140	Multiconductor shielded cable, 7x0.14mm², max. 250V PVC, grey, outer diameter 5.0mm

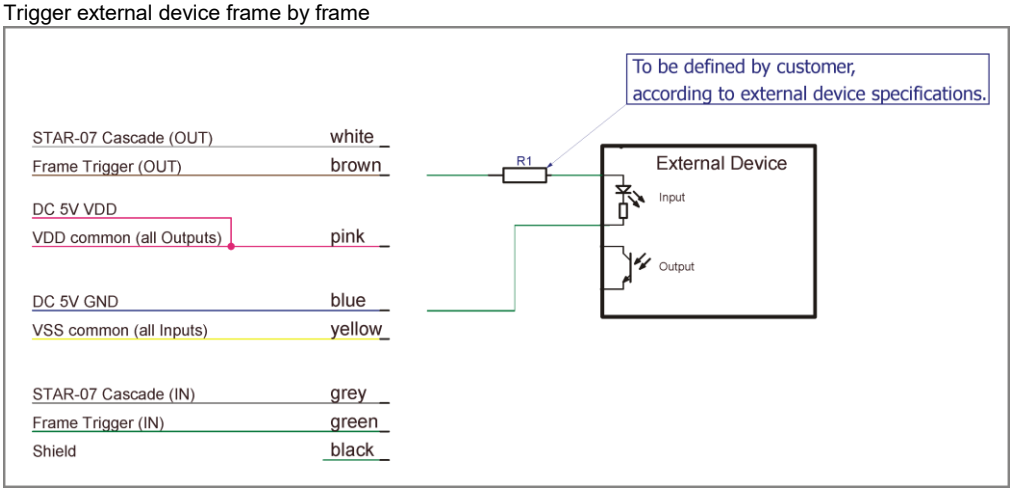
Application Example 1

Driving STAR-07 frame trigger from external source



Application Example 2

Trigger external device frame by frame



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