

## TL936P R5 Motorized Telephoto Day/Night 4K Compatible Megapixel Lens



9mm



36mm

- ✓ Compatible with 4K cameras with 5+ megapixel resolution for demanding applications
- ✓ Fully motorized with zoom, focus, iris, IR cut, and limit switches
- ✓ 4x zoom: 9-36mm for long reach and field of view optimization
- ✓ Optional motor control board available (MCR500) for easy integration
- ✓ P-iris for precise aperture control
- ✓ IR corrected for true Day/Night cameras
- ✓ Compact design (< 62.5mm TTL) to fit into domes as small as 4" mini-dome size
- ✓ CS-mount
- ✓ For 1/3", 1/2.7" HD, 1/2.5" and 1/2.3" 4K\* sensors

### TL936 lens specifications

Focal length	9-36mm
Mount type	CS-mount
Iris type	P-iris
Image circle	Ø7.6mm at FL 9mm
Resolution	5+ megapixel
F/#	F/1.5 to close
Focus range	2.5m to infinity
IR Correction	440nm – 950nm (Day/Night)
Lens length (TTL)	<62.5mm (TTL)
Back focal length (BFL)	8.7mm (in air)
Relative illumination	>30%
Lens transmission	>80%
Weight	
Operating temperature	-20C to 60C (<70% humidity, non-condensing)
Storage temperature	-20C to 70C (<90% humidity, non-condensing)
CS mount slip range	320°

**Field of view for sensor sizes**

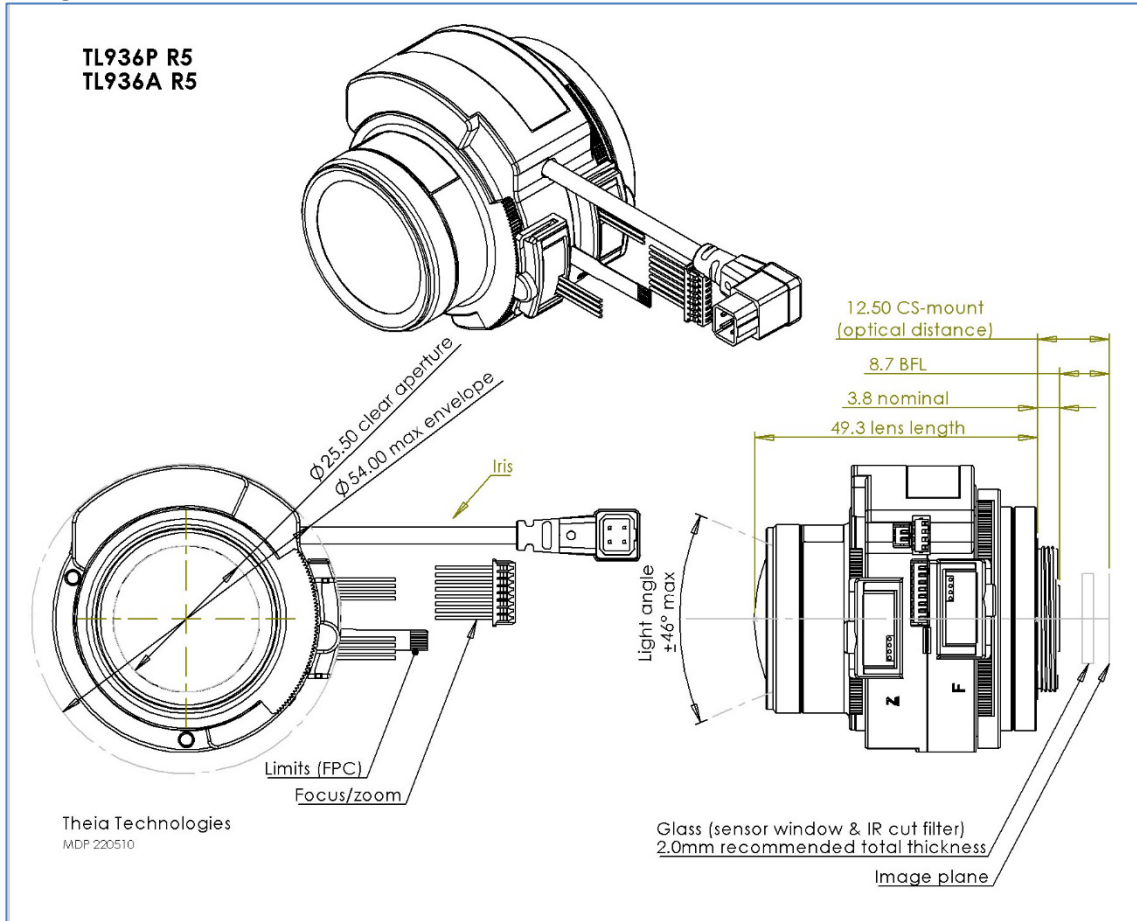
Sensor size	1/3"	1/2.7" HD	1/2.5"	1/2.3" 4K*
Field of view (H)	30° - 7.1°	37° - 8.6°	36° - 8.5°	39° - 10°
Field of view (V)	22° - 5.3°	20° - 4.8°	27° - 6.3°	19° - 5.0°
Field of view (D)	38° - 8.8°	42° - 9.9°	46° - 10.6°	44° - 11°

\*4K format 4000x2000 pixels



Visit Theia's website for more information about the TL936 telephoto lenses.

**Lens drawing**



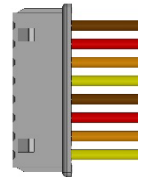
CAD models can be downloaded from [TheiaTech.com/936CAD](http://TheiaTech.com/936CAD)

## Zoom/Focus motor specifications

Drive	Stepper motor 2 phase bipolar drive
Operation voltage	3.3V (operating range 2.6~4.8V)
Maximum motor temperature*	Do not let the motor temperature exceed 92°C
Coil resistance	28.5Ω ±7%
Gear ratio	1:2308
Zoom number of steps	2994 steps between hard stops
Zoom speed range	600pps to 1000pps**
Zoom cam rotation	57°
Focus number of steps	5180 steps between hard stops
Focus speed range	600pps to 1000pps**
Focus cam rotation	101°
Focus/zoom connectors	Housing: Molex 51021-0800 Terminal: Molex 50058-8000
Cable length	150mm

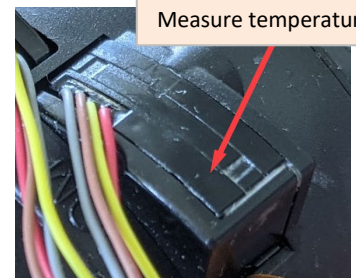
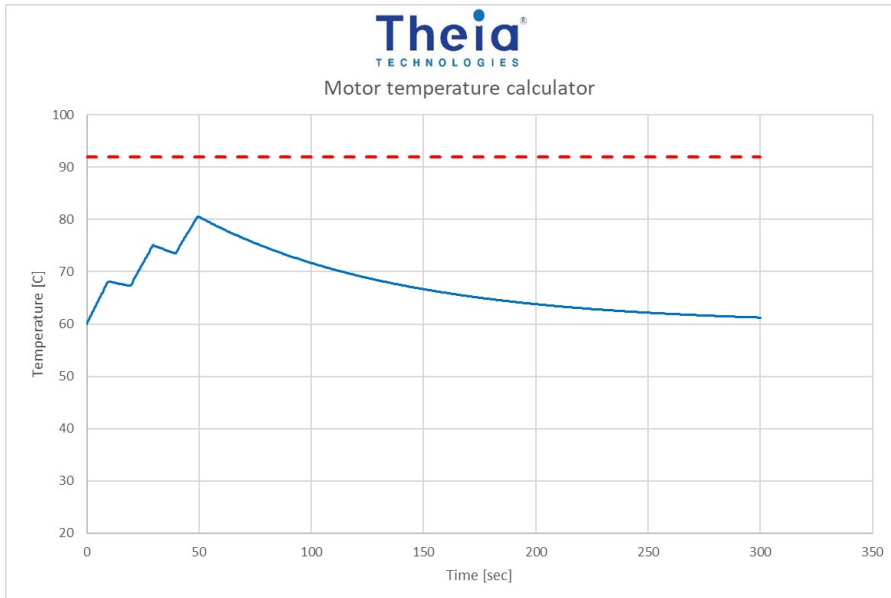
Zoom: Wide -> Tele				
Focus: Near -> ∞				
Step	A+	A-	B+	B-
0	H	L	H	L
1	L	H	H	L
2	L	H	L	H
3	H	L	L	H

Pin	Color	Function	Motor
1	Brown	A+	Focus
2	Red	A-	Focus
3	Gray	B+	Focus
4	Yellow	B-	Focus
5	Brown	A+	Zoom
6	Red	A-	Zoom
7	Gray	B+	Zoom
8	Yellow	B-	Zoom



\*Theia's motor temperature calculator can be used to estimate the focus and zoom motor temperatures after a set number of run/ cool down cycles. This can be downloaded from Theia's website (see the QR code below).

The example below shows 60C ambient temperature and 3.5V motor. The motor is driven for 10 seconds with 10 seconds cool down between moves. After 3 moves, the motor is allowed to cool down which takes about 4 minutes.



Motor temperature calculator  
[TheiaTech.com/calculators](http://TheiaTech.com/calculators)

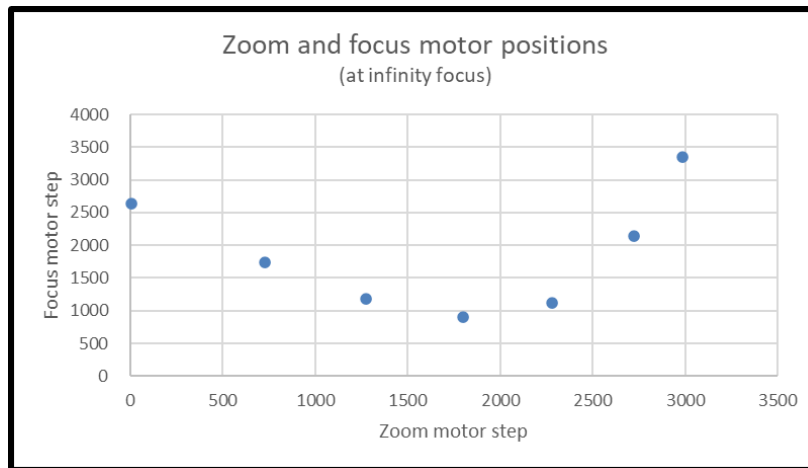
\*\*Zoom and focus **motor positions may be affected** by backlash and lost steps during movement. Lost steps are affected by the driving conditions. It is best to drive the motor between 600pps and 1000pps with 4-12 steps of acceleration/deceleration. Acceleration is especially helpful at higher driving speeds. Within these limits, the lost steps are tested to be <20 steps per full zoom range and <20 steps per full focus range.

Zoom/Focus motor step map (at infinite focus position). Photo interrupter (PI) positions are only accessible on lenses with limit stops.

<i>Zoom motor</i>		<i>Focus motor</i>	
<i>Note</i>	<i>Step</i>	<i>Note</i>	<i>Step</i>
Hard stop (wide)	0	Hard stop (far)	0
Wide design position	10	Far focus design	26
PI (1) position	36	PI (1) position	52
PI (2) position	2958	PI (2) position	5128
Tele design position	2984	Near focus design	5154
Hard stop (tele)	2994	Hard stop (near)	5180

Zoom/Focus synchronizing map (observe min/max motor speeds)

<i>Focal length</i>	<i>Zoom motor note</i>	<i>Zoom motor step number</i>	<i>Focus motor step number</i>
<i>[mm]</i>		<i>[#]</i>	<i>[#]</i>
9.27	Wide end	10	2631
12.19		731	1743
15.3		1273	1186
19.47		1800	898
24.56		2281	1117
30.86		2725	2138
35.45	Tele end	2985	3353



**Notes:**

These motorized lenses are intended for integration into cameras and require motor drivers and controllers. Typically, Theia works with the camera manufacturer to ensure that the camera motor controller matches the lens. It is possible to supply your own motor controller, but Theia cannot guarantee that your motor controller will not damage the lens. Theia does not offer any warranty on the suitability of these motorized lenses for any particular camera. These motorized lenses are **not intended for continuous use** of the motors as in PTZ applications. Theia offers motor control boards that are suitable to control motorized lenses with P-iris.

## P-iris motor specifications

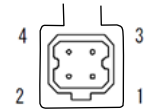
Drive	Stepper motor 2 phase bipolar drive
Operating voltage	4V (2.7~5.0V)
Number of steps	Step 1: stop Step 2: Full open Step 72: Full close Step 75: stop
Basic step angle	18°
Maximum response freq.	200 pps
Coil resistance	30Ω ±10% (each phase)

P-iris: open->close				
Step	A+	A-	B+	B-
0	H	L	H	L
1	L	H	H	L
2	L	H	L	H
3	H	L	L	H

### Connector type 2 (CCTV)

Connector type	Housing: EYC 221
Cable length	300mm

Pin	Function
1	B+
2	A+
3	A-
4	B-



## P-iris motor map

Step	Aperture Size [mm2]	F/#
1	95.0	1.54
5	90.8	1.54
10	82.1	1.61
15	72.8	1.71
20	63.4	1.83
25	54.0	1.98
30	44.9	2.17
35	36.0	2.42

Step	Aperture Size [mm2]	F/#
40	27.7	2.76
45	20.0	3.24
50	13.2	3.98
55	7.5	5.30
60	3.1	8.20
65	0.8	15.71
70	0.1	56.29
72	0.0	Closed

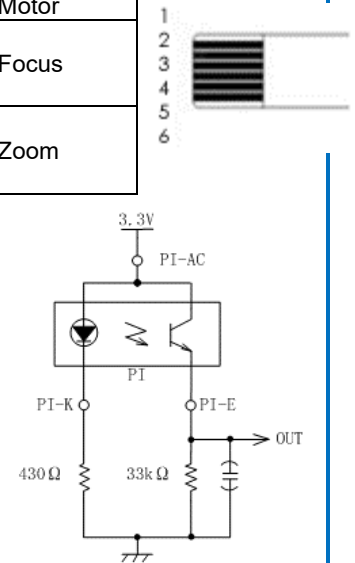
## Zoom/Focus limit switch

Type	Photo interrupter phototransistor
Part model	Sharp GP1S396HCPSF
Operating voltage	3.3V
Output level	>2.2V HIGH <0.6V LOW
Connector type	FPC cable
Board-side mating connector type (not supplied)	Molex 52746-0671 Molex 52745-0697 Molex 52559-0652
Cable length	90mm

Pin*	Function	Motor
1	Emitter	Focus
2	Anode/Collector	
3	Cathode	
4	Emitter	Zoom
5	Anode/Collector	
6	Cathode	

\*cable side pin designation matches Molex 52746-0671 connector (contacts on bottom)

Recommended circuit for each photo interrupter



## Alternate lens options

There are other options for motor configurations, iris types, and mount types. Please visit [www.theiatech.com](http://www.theiatech.com) to learn more about our other lens options and to download the datasheets for other lenses.

<i>Theia</i> ® PN	Varifocal	Mount type	Mount slip ring	Iris type	CCTV iris connector	Molex iris connector	IR corrected (day/night)	IR cut switch	Zoom motor	Focus motor	PI limits	Focal length	MP rating	FOV (HxV)	f/#	Image circle	Biggest sensor format	MOD [m]	Lens Length (mount)	Lens Length (TTL)	Weight
TL936A R6 CS	✓	CS	✓	A		✓	✓	✓	✓	✓	✓	9-36	12 (4K)	39x19 to 10.0x5.0	f/1.5	8.3	1/2.3"	2.5	49	61.5	70
TL936A R5 CS	✓	CS	✓	A	✓		✓		✓	✓	72										
TL936A R4 CS	✓	CS	✓	A		✓	✓	✓	✓		69										
TL936P R6 CS	✓	CS	✓	P		✓	✓	✓	✓	✓	68										
TL936P R6 25	✓	D25		P		✓	✓	✓	✓	✓	72										
TL936P R5 CS	✓	CS	✓	P	✓		✓		✓	✓	69										
TL936P R4 CS	✓	CS	✓	P		✓	✓	✓	✓		68										
TL936P R3 CS	✓	CS	✓	P	✓		✓		✓	✓	70										

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## Revisions

Rev	Version	Change	Reason
	160104	Changed DC iris damper coil resistance	Corrected error
		Changed IR cut pin-out	Changed to match industry standard
		Updated production version list	Added new models
	160113	Added motor energizing time maximums	Clarification to prevent focus/zoom motor overheating
		Updated temperature spec	Consistent with motor supplier specification
	161107	Changed drawing	Added 2mm glass to drawing
	170109	Changed PI FPC pin-out	To match bottom side contacts connector; top side connector may have been discontinued
	170906	Added pictures and drawings of different lens versions	
	180117	Corrected FPC pinout	Pinout numbering was reversed
	181206	Motor speed	Updated focus/zoom motor speeds, recommended speeds were not specified. Updated P-iris speed
		Added QR code	Linked to TL936 webpage
	200106	Added page number and revision in footer	Revision control
	200306	Added Z/F motor step note	Motor position accuracy not previously specified
		Updated motor speed specs	Focus/zoom recommended speed too high, adjusted to tested range
		Zoom/focus map	Changed the map to be more clear and corrected zoom step errors in the table
	200327	Added motor cooling graph	New information
		Highlighted model numbers	Clarified which specification sections are applicable to different family members
1	220516	Templated specification	Allows easier creation of individual lens specifications
2	221018	Corrected image circle size	Incorrect value, probably copied from another spec when templated
		Added revision circles	Better tracking of revisions