

Theia

TECHNOLOGIES



TL1250
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4K
12 MEGApix

**DAY
NIGHT**



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4K Megapixel Resolution Lenses
Fully Motorized
Compact Size
Superior Day/Night Correction



TL410 family 4K Resolution Day/Night lenses up to 1/1.7" sensors

- ✓ **Ultra high resolution for 4K cameras**, up to 12.4 megapixel
- ✓ Available in DC **auto-iris**, **P-iris**, and **manual iris** versions
- ✓ **Fully motorized versions**, or combinations with zoom, focus, iris, IR cut, limit switch; non-motorized versions also available
- ✓ IR corrected for true **Day/Night** cameras
- ✓ **Compact design** to fit into domes as small as 4" mini-dome size
- ✓ **CS-mount** and smooth **D25 board mount** options, as well as **C-mount**
- ✓ Used for sensor sizes 1/2.5", 1/2.3", 1/2", 1/1.8", and **up to 1/1.7"** (Sony IMX178, Sony IMX226 for example)

TL410 lens family specifications

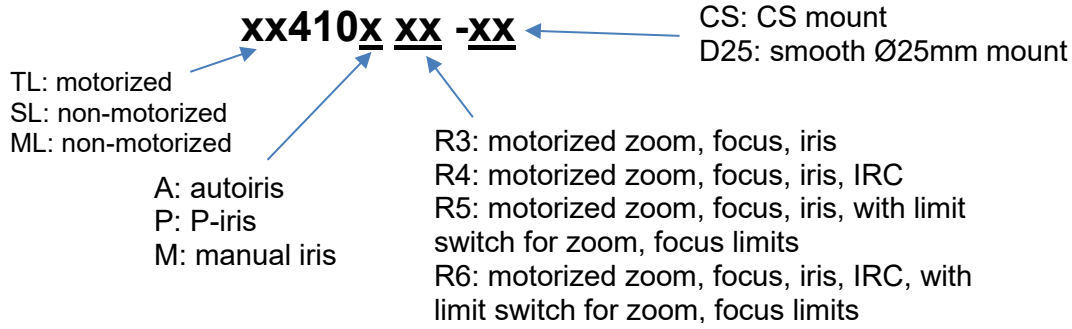
Focal length	4-10mm
Image circle	Ø9.4mm
Resolution	12.4 megapixel
F/#	F/1.4 @ 4mm – F/2.4 @ 10mm to close
Focus Range	0.5m to infinity
IR Correction	Day/Night
Lens length	< 64mm TTL
Back focal length	BFL 8.4mm (in air)
CRA	< 7°
Distortion	< 61% at 4mm, < 8% at 10mm
Relative illumination	>45%
Lens transmission	>80%
Weight	69-78g (depending on version)
Operating temperature	-20C to 60C (<70% humidity, non-condensing)
Storage temperature	-30C to 70C (<90% humidity, non-condensing)

Field of view for sensor sizes

Sensor size	1/1.7"	1/1.8"	1/1.8" 4K*	1/2"	1/2.3"	1/2.5"
Horizontal	112° - 44°	110° - 43°	110° - 43°	93° - 37°	90° - 36°	83° - 33°
Vertical	81° - 33°	71° - 29°	52° - 21°	68° - 28°	67° - 27°	60° - 25°
Diagonal	149° - 55°	139° - 52°	126° - 48°	120° - 46°	117° - 45°	106° - 42°

*4K format = 4000 x 2000 pixels

Lens designation

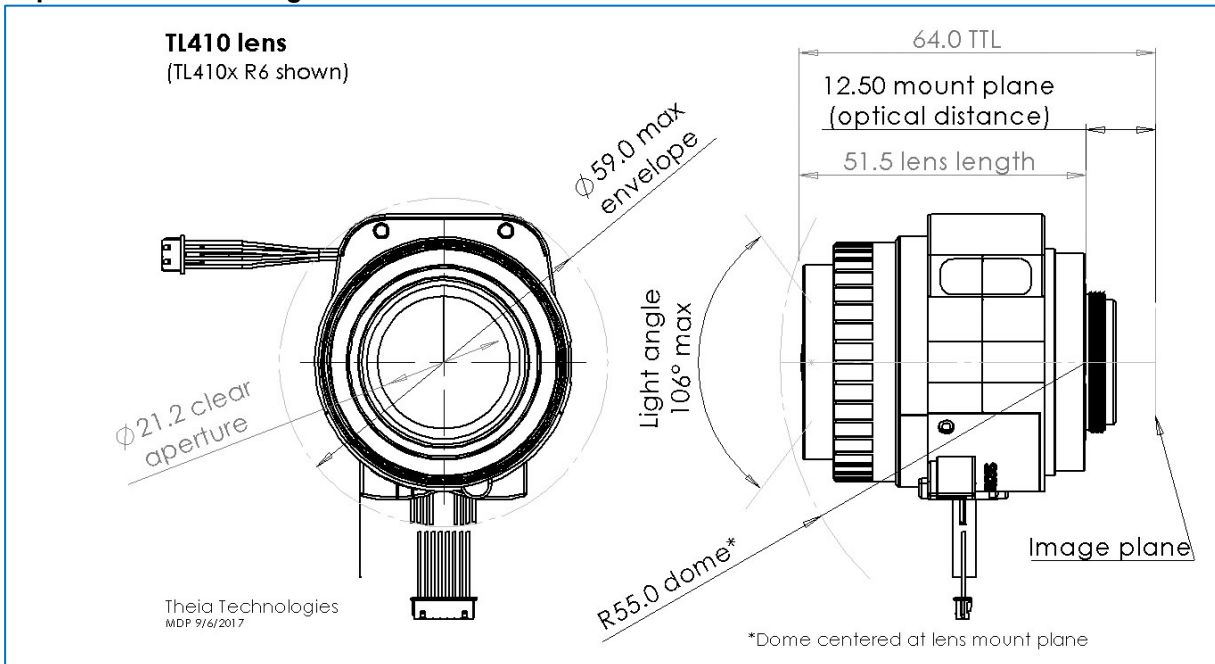


Production versions: (call for other versions)

SL410M (manual lens, manual iris, CS mount)
 SL410A (manual lens, DC autoiris, CS mount)
 SL410P (manual lens, P-iris, CS mount)
 ML410M (manual lens, manual iris, C mount)
 TL410A R6-CS (fully motorized, DC autoiris lens)
 TL410P R6-CS (fully motorized, P-iris lens)
 TL410P R6-25 (fully motorized, P-iris, D25 mount)

Other versions are available by special request and may

Representative drawing

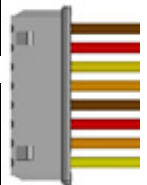


Zoom/Focus motor specifications (TL410)

Drive	Stepper motor 2 phase bipolar drive			
Operation voltage	3.3V (operating range 2.6~4.8V)			
Maximum continuous operation time (seconds) for operation voltage and ambient temperature*		3.3V	4.0V	4.8V
	20C	60s	12s	6s
	40C	35s	9s	5s
	60C	20s	6s	4s
Coil resistance	28.5Ω (±7%)			
Gear ratio	1:2025			
Zoom number of steps	4073 steps between hard stops			
Zoom speed range	800pps to 1500pps*			
Zoom cam rotation	85°			
Focus number of steps	9354 steps between hard stops			
Focus speed range	800pps to 1500pps*			
Focus cam rotation	196°			
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	Yellow	B+	Focus
4	Gray/Orange	B-	Focus
5	Brown	A+	Zoom
6	Red	A-	Zoom
7	Gray/Orange	B+	Zoom
8	Yellow	B-	Zoom

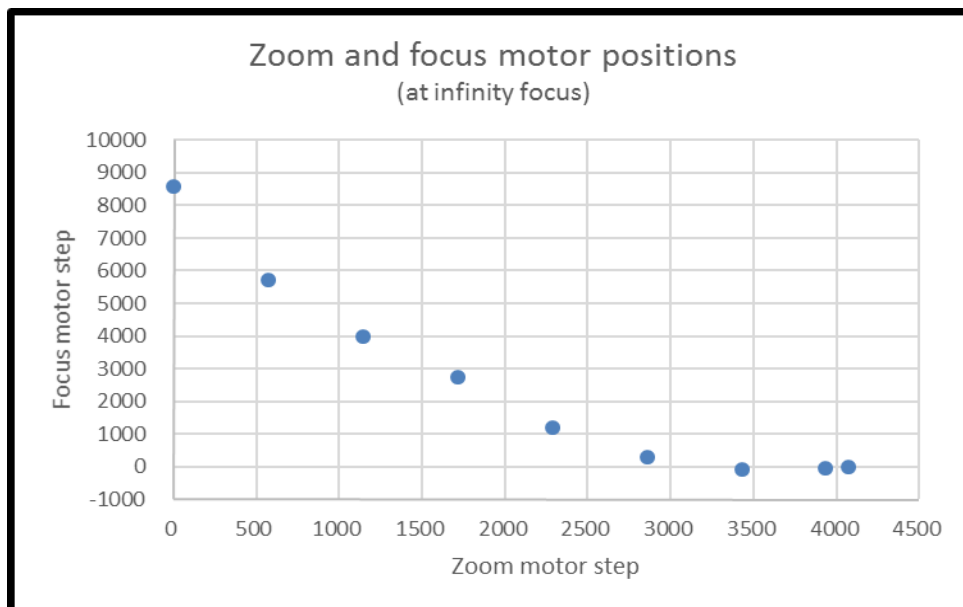


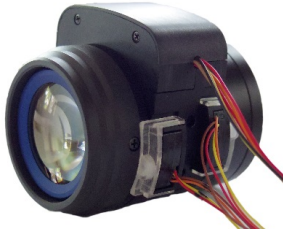
*Do not let motor temperature exceed 115°C

Zoom/Focus motor map for focus at infinity

Focal length	Note	Zoom ring rotation	Zoom motor step number	Focus ring rotation	Focus motor step number
[mm]		[deg]	[#]	[deg]	[#]
	Mech. stop	0	0	191.22	9118
4.15	Wide zoom end	0	0	180.00	8583
4.96		12.00	572	120.00	5722
5.77		24.00	1144	83.44	3979
6.58		36.00	1717	57.59	2746
7.39		48.00	2289	24.83	1184
8.19		60.00	2861	5.70	272
9.00		72.00	3433	-1.87	-89
9.70	PI trigger (zoom)	82.50	3934	-1.25	-60
9.90	Tele zoom end	85.42	4073	0.00	0
	PI trigger (focus)			2.50	119
	Mech. stop	85.42	4073	-12.22	-583

*PI: photo interrupter trigger point for applicable models TL410A R5, TL410P R5, TL410A R6, TL410P R6





TL1250 family 4K Resolution Day/Night lenses for 1/1.7" sensors

- ✓ **Ultra high resolution for 4K cameras**, up to 12.4 megapixel
- ✓ Available in DC **autoiris**, **P-iris**, and **manual iris** versions
- ✓ **Fully motorized versions**, or combinations with zoom, focus, iris, IR cut, limit switch; non-motorized versions also available
- ✓ IR corrected for true **Day/Night** cameras
- ✓ **Compact design** to fit into domes as small as 4" mini-dome size
- ✓ **CS-mount** and smooth **D25 board mount** options
- ✓ Used for sensor sizes 1/2.5", 1/2.3", 1/2" 1/1.8", and **up to 1/1.7"** (Sony IMX178, Sony IMX226 for example)

TL1250 lens family specifications

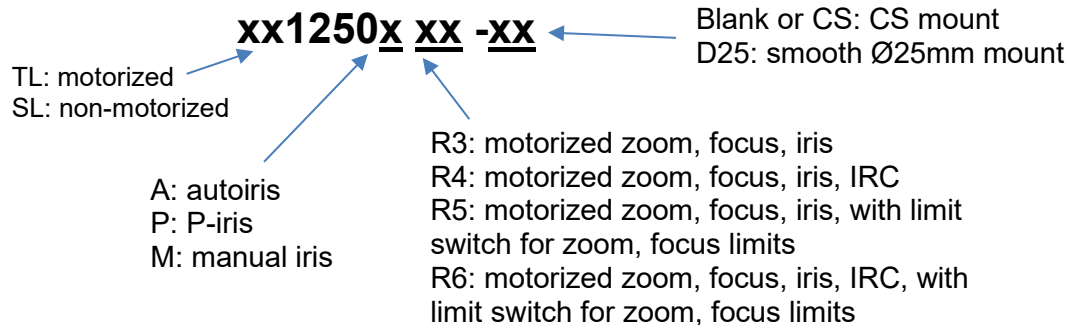
Focal length	12-50mm
Image circle	Up to Ø9.4mm
Resolution	12.4 megapixel
F/#	F/1.8 @ 12mm - F/2.4 @ 50mm to close
IR Correction	Day/Night
Focus Range	2.0m - infinity
Lens length	< 64mm TTL
Back focal length	BFL 8.2mm (in air)
CRA	< 7°
Distortion	< 10% at 12mm, < 2% at 50mm
Relative illumination	>40%
Lens transmission	>80%
Weight	TBD
Operating temperature	-20C to 60C (<70% humidity, non-condensing)
Storage temperature	-30C to 70C (<90% humidity, non-condensing)

Field of view for sensor sizes

Sensor size	1/1.7"	1/1.8"	1/1.8" 4K*	1/2"	1/2.3"	1/2.5"
Horizontal	36° - 8.6°	36° - 8.6°	35° - 8.5°	30° - 7.4°	30° - 7.2°	27° - 6.7°
Vertical	26° - 6.5°	23° - 5.8°	17° - 4.3°	23° - 5.6°	22° - 5.5°	20° - 5.0°
Diagonal	46° - 11°	44° - 10°	40° - 9.5°	39° - 9.2°	38° - 9°	34° - 8.3°

*4K format = 4000 x 2000 pixels

Lens designation

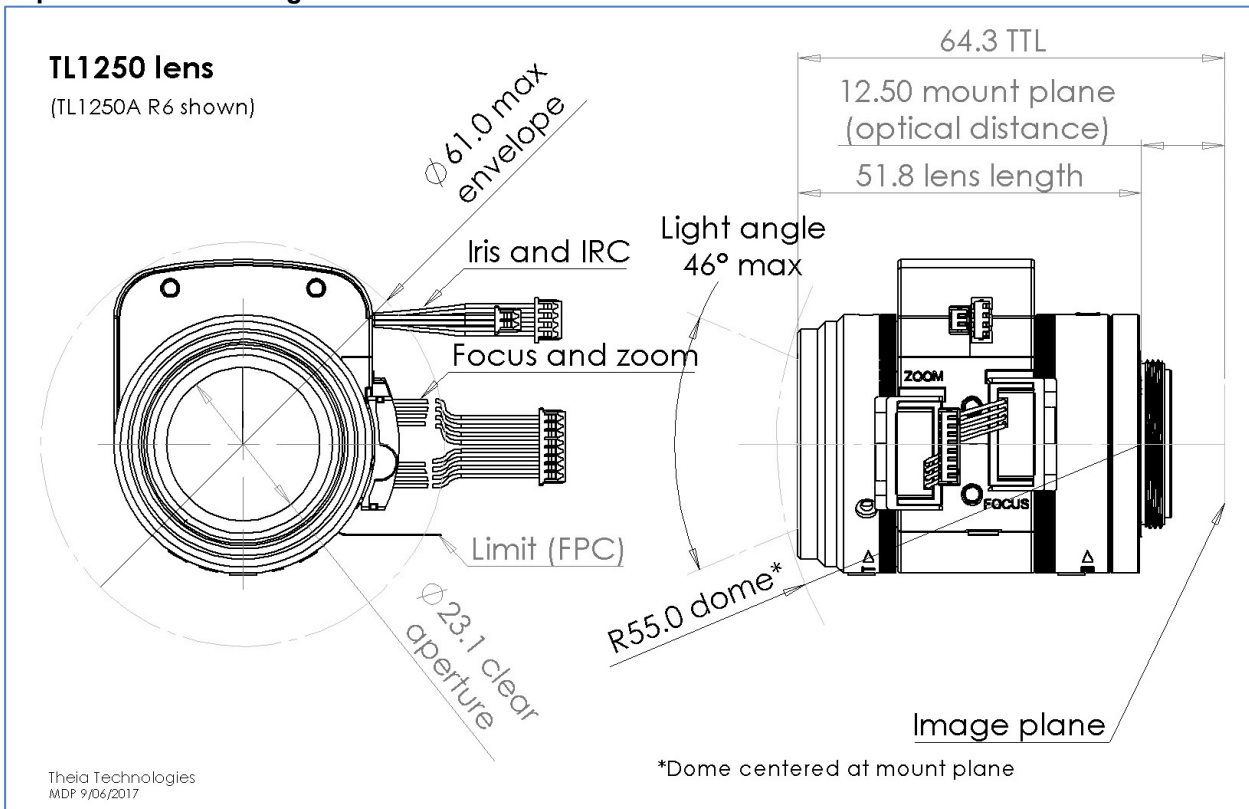


Production versions: (call for other versions)

SL1250M (manual lens, manual iris, CS mount)
 SL1250A (manual lens, DC autoiris, CS mount)
 SL1250P (manual lens, P-iris, CS mount)
 TL1250AR6-CS (fully motorized, DC autoiris lens)
 TL1250PR6-CS (fully motorized, P-iris lens)
 TL1250PR6-25 (fully motorized, P-iris lens, D25 mount)

Other versions are available by special request and may be added to regular production

Representative drawing

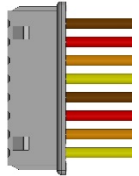


Zoom/Focus motor specifications (TL1250)

Drive	Stepper motor 2 phase bipolar drive			
Operation voltage	3.3V (operating range 2.6~4.8V)			
Maximum continuous operation time (seconds) for operation voltage and ambient temperature*		3.3V	4.0V	4.8V
	20C	60s	12s	6s
	40C	35s	9s	5s
	60C	20s	6s	4s
Coil resistance	28.5Ω (±7%)			
Gear ratio	1:1954			
Zoom number of steps	3256 steps between hard stops			
Zoom speed range	800pps to 1500pps*			
Zoom cam rotation	75°			
Focus number of steps	8467 steps between hard stops			
Focus speed range	800pps to 1500pps*			
Focus cam rotation	195°			
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	Orange	B+	Focus
4	Yellow	B-	Focus
5	Brown	A+	Zoom
6	Red	A-	Zoom
7	Orange	B+	Zoom
8	Yellow	B-	Zoom

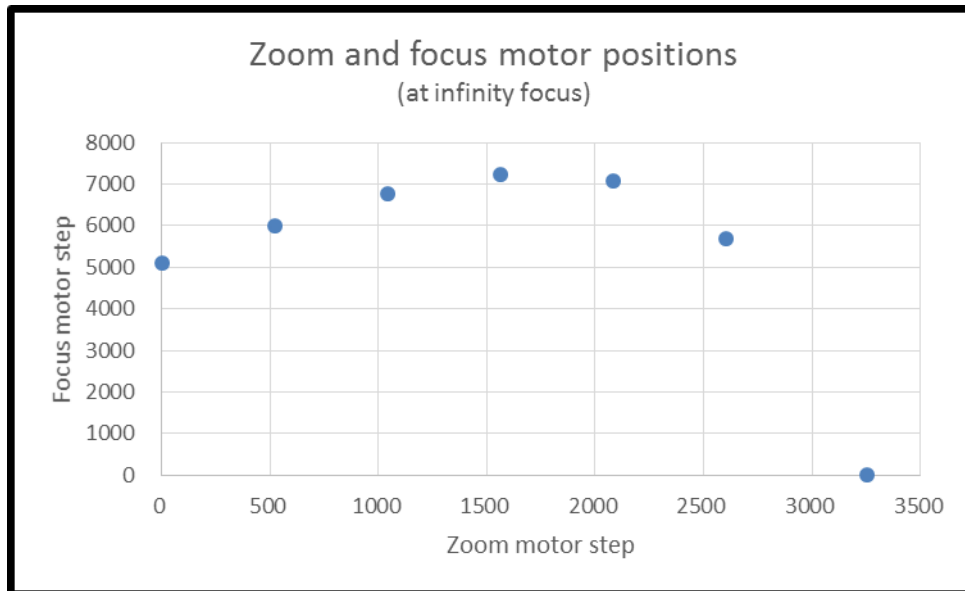


*Do not let motor temperature exceed 115°C

Zoom/Focus motor map for focus at infinity

Focal length	Zoom motor note	Zoom ring rotation	Zoom motor step number	Focus ring rotation	Focus motor step number
[mm]		[deg]	[#]	[deg]	[#]
	Mechanical stop	0	0	187.50	8139
12.36	Wide end	0	0	117.58	5104
	PI trigger	2.5	109		
14.83		12.00	521	138.38	6007
18.05		24.00	1042	156.09	6776
22.28		36.00	1563	166.80	7241
27.86		48.00	2084	163.10	7080
35.20		60.00	2605	131.01	5687
	PI trigger			2.50	109
49.00	Tele end	75.00	3256	0.00	0
	Mechanical stop	75.00	3256	-7.50	-326

*PI: photo interrupter trigger point for applicable models TL1250*R5 and TL1250*R6





TL936 Motorized Telephoto Day/Night 4K Compatible Megapixel Lens



9mm



36mm

- ✓ Compatible with 4K cameras (1/2.3" Sony IMX172 for example) with **5+ megapixel resolution** for demanding applications
- ✓ **Fully motorized versions**, or combinations with zoom, focus, iris, IR cut, and limit switch
- ✓ **4x zoom**: 9-36mm for long reach and field of view optimization
- ✓ Available in DC **auto-iris** and **P-iris** versions
- ✓ IR corrected for true **Day/Night** cameras
- ✓ **Compact** design (< 50mm TTL) to fit into domes as small as 4" mini-dome size
- ✓ CS-mount and smooth D25 board mount options
- ✓ For 1/3", 1/2.7" HD, 1/2.5" and 1/2.3" 4K* sensors

TL936 lens family specifications

Focal length	9-36mm
Resolution	5+ megapixel
F/#	F/1.5 to close
IR Correction	Day/Night
Lens length	<50mm
Focus range	2.5m - infinity
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

Lens designation

TL936x xx -xx

Blank or CS: CS mount
D25: smooth Ø25mm mount

A: autoiris
P: P-iris

R3: motorized zoom, focus, iris
R4: motorized zoom, focus, iris, IRC
R5: motorized zoom, focus, iris, with limit switch for zoom, focus limits
R6: motorized zoom, focus, iris, IRC, with limit switch for zoom, focus limits

Production versions (call for other version):

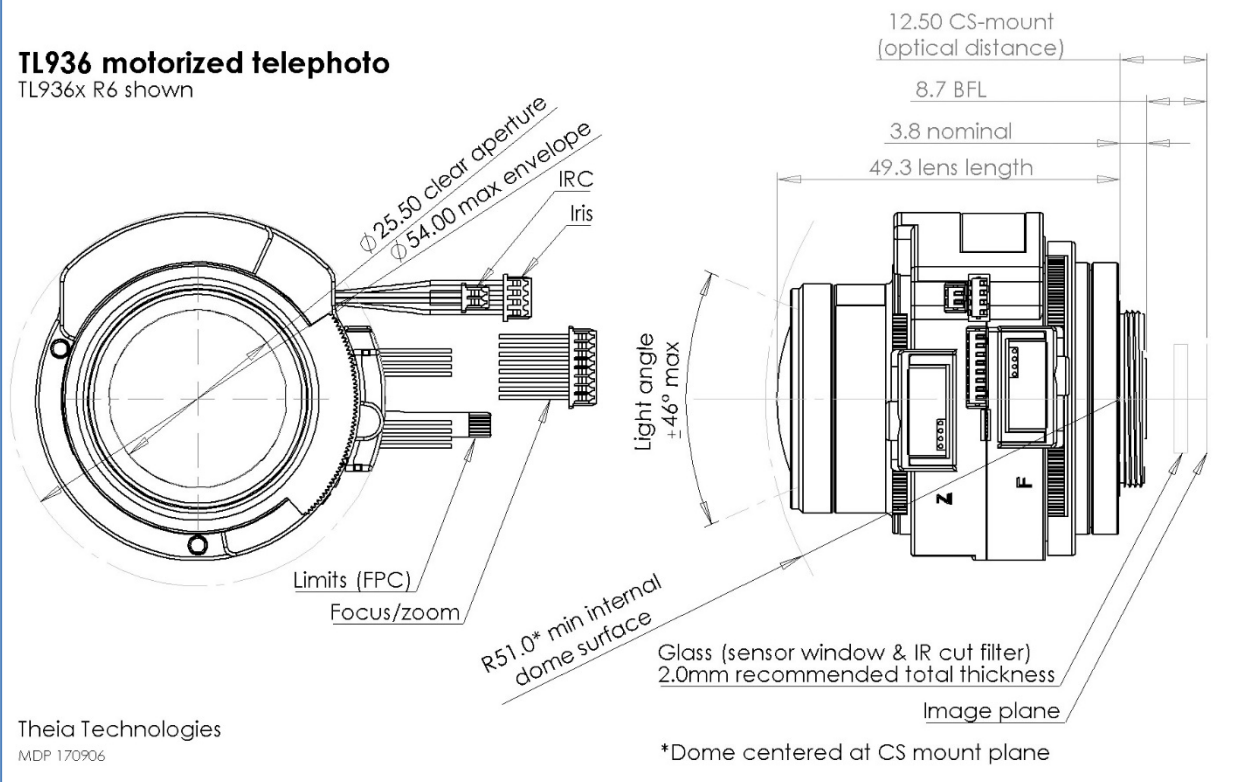
TL936A R6 TL936P R6 TL936P R6 25
TL936A R5
TL936A R4 TL936P R4
 TL936P R3

Other versions are available by special request and may be added to regular production depending on volume.

Representative drawing

TL936 motorized telephoto

TL936x R6 shown

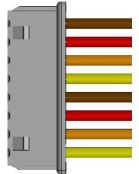


Zoom/Focus motor specifications (TL936)

Drive	Stepper motor 2 phase bipolar drive			
Operation voltage	3.3V (operating range 2.6~4.8V)			
Maximum continuous operation time (seconds) for operation voltage and ambient temperature		3.3V	4.0V	4.8V
	20C	60s	12s	6s
	40C	35s	9s	5s
	60C	20s	6s	4s
Coil resistance	28.5Ω ±7%			
Gear ratio	1:2308			
Zoom number of steps	2994 steps between hard stops			
Zoom speed range	800pps to 1500pps*			
Zoom cam rotation	57°			
Focus number of steps	5180 steps between hard stops			
Focus speed range	1000pps to 1500pps*			
Focus cam rotation	100°			
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

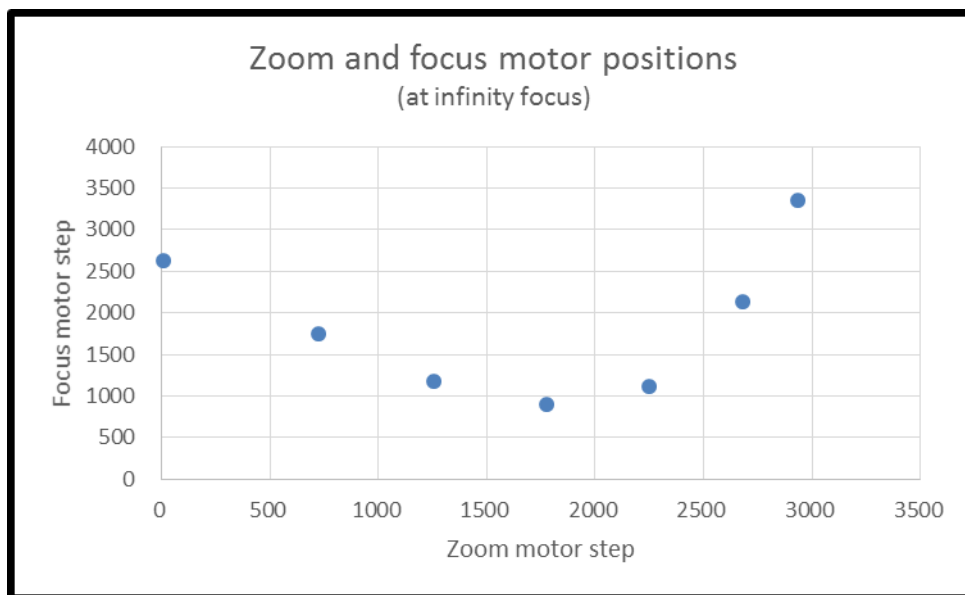
Pin	Color	Function	Motor
1	Brown	A+	Focus
2	Red	A-	Focus
3	Gray	B+	Focus
4	Yellow	B-	Focus
5	Brown	A+	Zoom
6	Red	A-	Zoom
7	Gray	B+	Zoom
8	Yellow	B-	Zoom



Zoom/Focus motor map for focus at infinity

Focal length	Zoom motor note	Zoom ring rotation	Zoom motor step number	Focus ring rotation	Focus motor step number
[mm]		[deg]	[#]	[deg]	[#]
	Mechanical stop	0.0	0	0.0	0
9.27	Wide end	0.2	10	51.3	2631
	PI trigger*	0.7	36		
12.19		14.10	723	34.0	1743
15.3		24.50	1256	23.1	1186
19.47		34.60	1774	17.5	898
24.56		43.80	2246	21.8	1117
30.86		52.30	2682	41.7	2138
	PI trigger*	56.70	2908		
35.45	Tele end	57.20	2933	65.4	3353
	Mechanical stop	57.40	2994	101.0	5180

*PI: photo interrupter trigger point for applicable models TL936A R5, TL936P R5, TL936A R6, TL936P R6



Common motor specifications For all motorized lenses

DC autoiris motor specifications

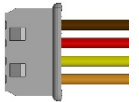
Applicable models: TLxxxA R3, TLxxxA R4, TLxxxA R5, TLxxxA R6

Drive	DC
Operation voltage	3V (2.5~5.0V)
Max current consumption	26mA
Drive coil resistance	190Ω ±10%
Damper coil resistance	855Ω ±7%

Applicable models: TLxxxA R4, TLxxxA R6

Connector type 1	Molex
Connector type	Housing: Molex 51021-0400 Terminal: Molex 50058-8000
Cable length	150mm

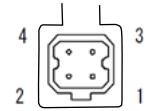
Pin	Color	Function
1	Brown	Control -
2	Red	Control +
3	Yellow	Drive +
4	Orange	Drive -



Applicable models: TLxxxA R3, TLxxxA R5

Connector type 2	CCTV
Connector type	Housing: EYC 221
Cable length	300mm

Pin	Function
1	Control -
2	Control +
3	Drive +
4	Drive -



P-iris motor specifications

Applicable models: TLxxxP R3, TLxxxP R4, TLxxxP R5, TLxxxP R6

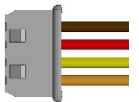
Drive	Stepper motor 2 phase bipolar drive
Operating voltage	4V (2.7~5.0V)
Number of steps	Step 1: stop Step 2: Full open Step 72: Full close Step 75: stop
Basic step angle	18°
Maximum response freq.	200pps
Coil resistance	30Ω ±10% (each phase)

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

Applicable models: TLxxxP R4, TLxxxP R6

Connector type 1	Molex
Connector type	Housing: Molex 51021-0400 Terminal: Molex 50058-8000
Cable length	150mm

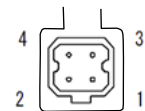
Pin	Color	Function
1	Brown	B+
2	Red	B-
3	Yellow	A+
4	Orange	A-



Applicable models: TLxxxP R3, TLxxxP R5

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 (TL410)

Step	Aperture Size [mm ²]	F/#
1	65.0	1.43 (open)
19	65.0	1.43 (open)
20	63.4	1.50
25	54.0	1.63
30	44.9	1.78
35	36.0	1.98
40	27.7	2.26
45	20.0	2.65
50	13.2	3.26
55	7.5	4.34
60	3.1	6.71
65	0.8	12.86
70	0.1	46.06
72	0.0	Closed

P-iris motor map (TL1250)

Step	Aperture Size [mm ²]	F/#
1	95.0	1.84
5	90.8	1.88
10	82.1	1.98
15	72.8	2.10
20	63.4	2.25
25	54.0	2.43
30	44.9	2.67
35	36.0	2.98
40	27.7	3.39
45	20.0	3.98
50	13.2	4.90
55	7.5	6.52
60	3.1	10.10
65	0.8	19.34
70	0.1	69.29
72	0.0	Closed

P-iris motor map (TL936)

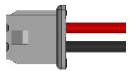
Step	Aperture Size [mm ²]	F/#
1	95.0	1.54
5	90.8	1.54
10	82.1	1.61
15	72.8	1.71
20	63.4	1.83
25	54.0	1.98
30	44.9	2.17
35	36.0	2.42
40	27.7	2.76
45	20.0	3.24
50	13.2	3.98
55	7.5	5.30
60	3.1	8.20
65	0.8	15.71
70	0.1	56.29
72	0.0	Closed

IR Cut specifications

Applicable models: TLxxxA R4, TLxxxP R4, TLxxxA R6, TLxxxP R6

Electrical specifications	
Drive	DC
Operating voltage	4.0V
Drive coil resistance	130Ω
Connector type	Housing: Molex 51021-0200 Terminal: Molex 50058-8000
Cable length	150mm
Optical specifications for IR filter (Day)	
Cut-on wavelength	405nm ±10nm
Visible transmission	430-610nm
Cut-off wavelength	650nm ±10nm
IR transmission	<5% max 700-1000nm <10% ave 1000-1100nm
Optical specifications for clear filter (Night)	
Visible transmission	400-1050nm

Mode	Pin 1	Pin 2
Day (IR filter)	L	H
Night (clear filter)	H	L
Wire color	Red	Black

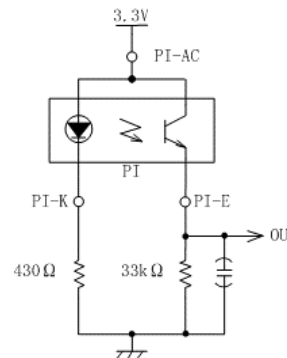


Zoom/Focus limit switch

Applicable models: TLxxxA R5, TLxxxP R5, TLxxxA R6, TLxxxP R6

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	150mm

Recommended circuit for each photo interrupter



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



*cable side pin designation matches Molex 52746-0671 bottom side contacts connector