



More Precision

thermoIMAGER TIM // Compact thermal imaging cameras





thermoIMAGER TIM LightWeight

Extra light thermoIMAGER mini PC for flight applications

- Fully-radiometric IR inspection with up to 640x480 pixels
- 380g two-piece design: independent, additional use of the IR camera with any Windows PC or tablet PC
- Simultaneous 32Hz video signal generation in real time in parallel to "on-board" records in VGA resolution (125Hz in the VGA subframe mode)
- GPS and GoPro support
- Comprehensive TIMConnect analysis software included
- Automatic transfer of flight video data (IR and GoPro) to USB stick



Photovoltaic thermography from the air

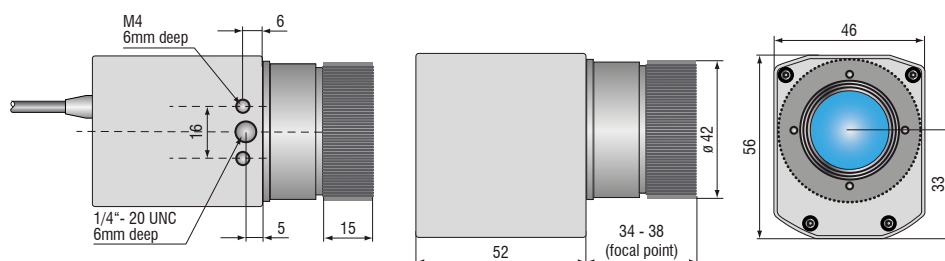
The 380-gram thermal imaging camera can be mounted to a quadcopter to carry out defect analysis on solar cells.



Possible extension with GoPro Hero camera, GPS USB flash drive and 2.4GHz flight control receiver



Temperature monitoring for building thermography



Model		TIM LightWeight
Optical resolution		640 x 480 pixels / 382 x 288 pixels
Temperature ranges		-20°C to 900°C
Spectral range		7.5 to 13μm
System accuracy		±2°C or ±2%, whichever is greater
Lens		13°... 90° HFOV
Thermal sensitivity (NETD)		40/80mK (depending on the camera model)
Operating temperature		0°C to 50°C / 70°C (TIM 450)
Storage temperature		-20°C to 50°C
Relative humidity		10 - 95% / non-condensing
Power supply		10...48V DC
Power consumption		12W
Cooling		Active (integrated fan)
Dimensions	TIM camera	46 x 56 x 90mm
	Miniature PC	96 x 67 x 47mm
Weight		380g (TIM camera + miniature PC)
Material (housing)		aluminum
Board		Odroid XU4
Processor		Samsung Exynos/ 2GHz
Operating system		Linux
Storage		16GB eMMC, 2GB RAM (LPDDR3), SDHC card (16GB), USB 3.0-Stick (128GB)
Ports		Ethernet (GigE / 1000Mbit/s), 2 x USB 3.0, 1 x USB 2.0, 1 x mini USB for GoPro Hero3+ (or better), 1 x HDMI, 1 x TVout, JR plug
Terminals		+5V DC out, Video IN (VIS camera), TVout, 2x external switches
Control (via JR plug or terminal)		Start/stop recording, VIS switch/IR camera
Additional functions		GPS support, 5 status LEDs

thermoIMAGER TIM LightWeight

**Scope of supply****TIM 400/450 or TIM 640**

- TIM process camera
incl. a selectable lens
- Instruction Manual
- USB cable 40cm integrated
- Software
- Aluminum case
- Miniature PC

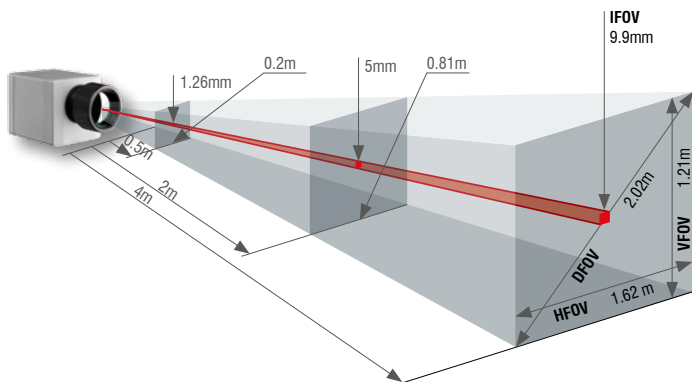
TIM 160 / 200	Focal length [mm]	Angle	Minimum measurement distance*	Distance to measurement object [m]												
					0.02	0.1	0.2	0.3	0.5	1	2	4	6	10	30	100
160 x 120 px																
23° Standard lens	10	23°	0.2m	HFOV [m]	0.012	0.043	0.08	0.12	0.21	0.41	0.81	1.62	2.44	4.1	12.2	40.6
		17°		VFOV [m]	0.009	0.032	0.06	0.09	0.15	0.30	0.60	1.21	1.81	3.0	9.0	30.1
		29°		DFOV [m]	0.015	0.054	0.10	0.16	0.26	0.51	1.01	2.02	3.03	5.1	15.2	50.5
				IFOV [mm]	0.1	0.3	0.5	0.8	1.3	2.5	5.0	9.9	14.9	24.8	74.4	248.0
		2.48mrad														
6° Telephoto lens	35.5	6°	0.5m	HFOV [m]					0.06	0.11	0.23	0.45	0.68	1.1	3.4	11.3
		5°		VFOV [m]				0.04	0.09	0.17	0.34	0.51	0.8	2.5	8.5	
		8°		DFOV [m]				0.07	0.14	0.28	0.57	0.85	1.4	4.2	14.2	
				IFOV [mm]				0.4	0.7	1.4	2.8	4.2	7.0	21.1	70.4	
		0.70mrad														
48° Wide angle lens	5.7	41°	0.2m	HFOV [m]	0.022	0.082	0.16	0.23	0.38	0.76	1.51	3.00	4.50	7.5	22.5	74.9
		31°		VFOV [m]	0.016	0.059	0.11	0.17	0.28	0.55	1.10	2.19	3.28	5.5	16.4	54.5
		51°		DFOV [m]	0.027	0.101	0.19	0.29	0.47	0.94	1.86	3.72	5.57	9.3	27.8	92.7
				IFOV [mm]	0.1	0.4	0.9	1.3	2.2	4.4	8.8	17.5	26.3	43.9	131.6	438.6
		4.39mrad														
72° Wide angle lens	3.3	72°	0.2m	HFOV [m]	0.039	0.152	0.29	0.43	0.72	1.42	2.84	5.66	8.49	14.1	42.4	141.4
		52°		VFOV [m]	0.027	0.106	0.20	0.30	0.50	0.99	1.98	3.95	5.92	9.9	29.6	98.6
		89°		DFOV [m]	0.048	0.186	0.36	0.53	0.87	1.74	3.46	6.91	10.35	17.2	51.7	172.3
				IFOV [mm]	0.2	0.8	1.5	2.3	3.8	7.5	15.0	30.0	45.0	75.1	225.2	750.8
		7.51mrad														

TIM 400 / 450 / G7	Focal length [mm]	Angle	Minimum measurement distance*	Distance to measurement object [m]												
					0.02	0.1	0.2	0.3	0.5	1	2	4	6	10	30	100
382 x 288 px																
29° Standard lens	18.7	29° 22° 37° 1.34mrad	0.2m	HFOV [m] VFOV [m] DFOV [m] IFOV [mm]		0.060 0.045 0.074 0.1	0.11 0.08 0.14 0.3	0.16 0.12 0.20 0.4	0.27 0.20 0.33 0.7	0.53 0.40 0.66 1.3	1.0 0.78 1.3 2.7	2.1 1.6 2.6 5.4	3.1 2.3 3.9 8.0	5.2 3.9 6.5 13.4	15.6 11.7 19.5 40.1	52.1 39.0 65.1 133.7
38° Standard lens Phase-out model available until June 2017	15	38° 29° 48° 1.67mrad	0.2m	HFOV [m] VFOV [m] DFOV [m] IFOV [mm]	0.024 0.018 0.030 0.1	0.079 0.060 0.099 0.2	0.15 0.11 0.18 0.4	0.21 0.16 0.27 0.5	0.35 0.26 0.44 0.9	0.70 0.52 0.87 1.7	1.39 1.04 1.73 3.4	2.76 2.07 3.46 6.7	4.14 3.11 5.18 10.0	6.9 5.2 8.6 16.7	20.7 15.5 25.9 50.0	68.9 51.7 86.2 166.7
13° Telephoto lens (except for G7)	41	13° 10° 17° 0.61mrad	0.5m	HFOV [m] VFOV [m] DFOV [m] IFOV [mm]					0.12 0.09 0.15 0.3	0.23 0.17 0.29 0.6	0.47 0.35 0.58 1.2	0.94 0.70 1.17 2.5	1.40 1.05 1.75 3.7	2.3 1.7 2.9 6.1	7.0 5.2 8.8 18.4	23.4 17.5 29.2 61.2
53° Wide angle lens	10.5	53° 40° 66° 2.38mrad	0.2m	HFOV [m] VFOV [m] DFOV [m] IFOV [mm]		0.11 0.08 0.14 0.2	0.21 0.15 0.26 0.5	0.31 0.23 0.38 0.7	0.51 0.37 0.63 1.2	1.0 0.73 1.2 2.4	2.0 1.4 2.5 4.8	4.0 2.9 4.9 9.5	6.0 4.3 7.4 14.3	9.9 7.2 12.2 23.8	29.7 21.6 36.7 71.5	99.0 71.9 122.3 238.4
62° Wide angle lens Phase-out model available until June 2017	11	62° 49° 79° 2.27mrad	0.5m	HFOV [m] VFOV [m] DFOV [m] IFOV [mm]	0.040 0.030 0.050 0.1	0.136 0.103 0.170 0.2	0.26 0.19 0.32 0.5	0.38 0.28 0.47 0.7	0.62 0.47 0.77 1.2	1.22 0.92 1.53 2.29	2.42 1.83 3.03 4.56	4.83 3.65 6.05 9.11	7.23 5.47 9.06 13.65	12.0 9.1 15.1 22.7	36.1 27.3 45.2 68.2	120.3 90.9 150.8 227.3
80° Wide angle lens	7.7	80° 56° 97° 3.25mrad	0.2m	HFOV [m] VFOV [m] DFOV [m] IFOV [mm]		0.182 0.119 0.218 0.3	0.35 0.23 0.41 0.7	0.84 0.55 1.00 1.6	0.84 0.54 1.00 1.6	1.65 1.08 1.97 3.3	3.29 2.14 3.92 6.5	6.55 4.28 7.83 13.0	9.82 6.41 11.73 19.5	16.4 10.7 19.5 32.5	49.0 32.0 58.5 97.4	163.4 106.6 195.1 324.7

TIM 640	Focal length [mm]	Angle	Minimum measurement distance*	Distance to measurement object [m]											
					0.1	0.2	0.3	0.5	1	2	4	6	10	30	100
640 x 480 px															
33° Standard lens	18.7	33° 25° 41° 0.91mrad	0.2m	HFOV [m]	0.068	0.13	0.19	0.31	0.60	1.20	2.38	3.57	5.9	17.8	59.3
				VFOV [m]	0.051	0.09	0.14	0.23	0.45	0.89	1.77	2.65	4.4	13.2	44.2
				DFOV [m]	0.085	0.16	0.23	0.38	0.75	1.49	2.97	4.45	7.4	22.2	74.0
				IFOV [mm]	0.1	0.2	0.3	0.5	0.9	1.8	3.6	5.5	9.1	27.3	90.9
15° Telephoto lens	41.5	15° 11° 19° 0.41mrad	0.5m	HFOV [m]				0.13	0.26	0.52	1.05	1.57	2.6	7.8	26.1
				VFOV [m]				0.10	0.20	0.39	0.79	1.18	2.0	5.9	19.6
				DFOV [m]				0.17	0.33	0.66	1.31	1.96	3.3	9.8	32.7
				IFOV [mm]				0.2	0.4	0.8	1.6	2.5	4.1	12.3	41.0
60° Wide angle lens	10.5	60° 45° 75° 1.62mrad	0.2m	HFOV [m]	0.128	0.25	0.36	0.59	1.17	2.32	4.63	6.94	11.6	34.6	115.4
				VFOV [m]	0.091	0.18	0.26	0.42	0.83	1.66	3.31	4.96	8.3	24.7	82.4
				DFOV [m]	0.157	0.30	0.44	0.72	1.43	2.85	5.69	8.52	14.2	42.6	141.8
				IFOV [mm]	0.2	0.3	0.5	0.8	1.6	3.2	6.5	9.7	16.2	48.6	161.9
90° Super wide angle lens	7.7	90° 64° 111° 2.21mrad	0.2m	HFOV [m]	0.220	0.43	0.63	1.03	2.03	4.04	8.06	12.07	20.1	60.3	200.8
				VFOV [m]	0.138	0.27	0.39	0.64	1.27	2.53	5.05	7.57	12.6	37.8	125.9
				DFOV [m]	0.260	0.50	0.73	1.21	2.39	4.76	9.50	14.24	23.7	71.1	237.0
				IFOV [mm]	0.2	0.4	0.7	1.1	2.2	4.4	8.8	13.2	22.1	66.2	220.8

FOV = Field of view; HFOV = Horizontal field of view; VFOV = Vertical field of view; DFOV = Diagonal dimension of the total measuring field at the object level; IFOV = Indicated field of view
Table with examples showing which measuring field sizes and pixel sizes are reached at which distance. Various lenses are available for optimal configuration of the camera.
Wide angle lenses have radial distortion due to the angle of their aperture. The TIMConnect software has an algorithm which corrects this distortion.

* Please note: The measurement accuracy of the camera may lie outside of the specifications for distances below the defined minimum measurement distance.



- Standard-, telephoto- and wide angle lenses for adaptation to different applications
- High quality germanium lenses and special anti-reflective coating for excellent optics
- Factory-calibrated lenses for easy exchange of optical system without recalibration

Measuring field sizes can be calculated online at www.micro-epsilon.com/optikkalkulator.

TIM M1 / TIM M05 ¹⁾	Focal length [mm]	Angle	Minimum measurement distance*	Distance to measurement object [m]											
					0.1	0.2	0.3	0.5	1	2	4	6	10	30	100
382 x 288 px															
f=16mm wide angle lens	16	20°	0.2m	HFOV [m]		0.07	0.11	0.18	0.36	0.72	1.43	2.15	3.6	10.7	35.8
		15°		VFOV [m]		0.05	0.08	0.14	0.27	0.54	1.08	1.62	2.7	8.1	27.0
		25°		DFOV [m]		0.09	0.13	0.22	0.45	0.90	1.79	2.69	4.5	13.5	44.9
		0.94mrad		IFOV [mm]		0.2	0.3	0.5	0.9	1.9	3.8	5.6	9.4	28.1	93.8
f=25mm standard lens	25	13°	0.5m	HFOV [m]	0.023	0.05	0.07	0.11	0.23	0.46	0.92	1.38	2.3	6.9	22.9
		10°		VFOV [m]	0.017	0.03	0.05	0.09	0.17	0.35	0.69	1.04	1.7	5.2	17.3
		16°		DFOV [m]	0.029	0.06	0.09	0.14	0.29	0.57	1.15	1.72	2.9	8.6	28.7
		0.60mrad		IFOV [mm]	0.1	0.1	0.2	0.3	0.6	1.2	2.4	3.6	6.0	18.0	60.0
f=50mm telephoto lens	50	7°	1.5m	HFOV [m]				0.06	0.11	0.23	0.46	0.69	1.1	3.4	11.5
		5°		VFOV [m]				0.04	0.09	0.17	0.35	0.52	0.9	2.6	8.6
		8°		DFOV [m]				0.07	0.14	0.29	0.57	0.86	1.4	4.3	14.4
		0.30mrad		IFOV [mm]				0.2	0.3	0.6	1.2	1.8	3.0	9.0	30.0
f=75mm Super telephoto lens	75	4°	2.0m	HFOV [m]					0.08	0.15	0.31	0.46	0.8	2.3	7.6
		3°		VFOV [m]					0.06	0.12	0.23	0.35	0.6	1.7	5.8
		5°		DFOV [m]					0.10	0.19	0.38	0.57	1.0	2.9	9.6
		0.20mrad		IFOV [mm]					0.2	0.4	0.8	1.2	2.0	6.0	20.0

¹⁾ TIM M05 only available with OF25 lens | Please note: the camera provides 382 x 288 px in the 80Hz mode

TIM M1 / M05 with VGA ¹⁾ Resolution	Focal length [mm]	Angle	Minimum measurement distance*	Distance to measurement object [m]											
					0.1	0.2	0.3	0.5	1	2	4	6	10	30	100
764 x 480 px															
f=16mm wide angle lens	16	39°	0.2m	HFOV [m]		0.14	0.21	0.36	0.72	1.43	2.87	4.30	7.2	21.5	71.6
		25°		VFOV [m]		0.09	0.14	0.23	0.45	0.90	1.80	2.70	4.5	13.5	45.0
		46°		DFOV [m]		0.17	0.25	0.42	0.85	1.69	3.38	5.08	8.5	25.4	84.6
		0.94mrad		IFOV [mm]		0.2	0.3	0.5	0.9	1.9	3.8	5.6	9.4	28.1	93.8
f=25mm standard lens	25	26°	0.5m	HFOV [m]	0.046	0.09	0.14	0.23	0.46	0.92	1.83	2.75	4.6	13.8	45.8
		16°		VFOV [m]	0.029	0.06	0.09	0.14	0.29	0.58	1.15	1.73	2.9	8.6	28.8
		30°		DFOV [m]	0.054	0.11	0.16	0.27	0.54	1.08	2.17	3.25	5.4	16.2	54.1
		0.60mrad		IFOV [mm]	0.1	0.1	0.2	0.3	0.6	1.2	2.4	3.6	6.0	18.0	60.0
f=50 mm telephoto lens	50	13°	1.5m	HFOV [m]				0.11	0.23	0.46	0.92	1.38	2.3	6.9	22.9
		8°		VFOV [m]				0.07	0.14	0.29	0.58	0.86	1.4	4.3	14.4
		15°		DFOV [m]				0.14	0.27	0.54	1.08	1.62	2.7	8.1	27.1
		0.30mrad		IFOV [mm]				0.2	0.3	0.6	1.2	1.8	3.0	9.0	30.0
f=75 mm Super telephoto lens	75	9°	2.0m	HFOV [m]					0.15	0.31	0.61	0.92	1.5	4.6	15.3
		5°		VFOV [m]					0.10	0.19	0.38	0.58	1.0	2.9	9.6
		10°		DFOV [m]					0.18	0.36	0.72	1.08	1.8	5.4	18.0
		0.20mrad		IFOV [mm]					0.2	0.4	0.8	1.2	2.0	6.0	20.0

¹⁾ TIM M05 is only available with OF25 lens | Please note: the camera provides 764 x 480 px in the 32Hz mode