



# 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

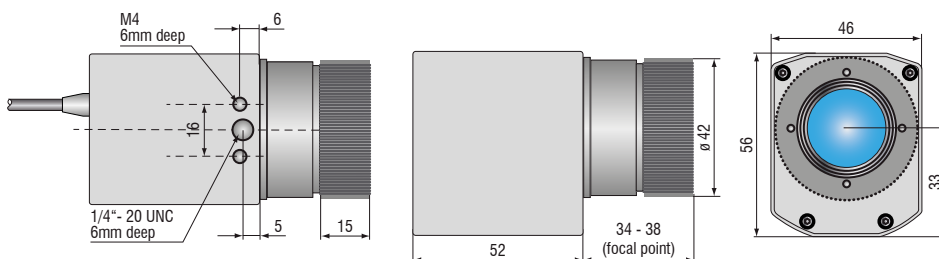
The 380-gram thermal imaging camera can be mounted to a quadcopter to carry out defect analysis on solar cells.



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

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	
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	
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 640 640 x 480 px	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
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](http://www.micro-epsilon.com/optikkalkulator).

TIM M1 / TIM M05 <sup>1)</sup>	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	16	20° 15° 25° 0.94mrad	0.2m	HFOV [m]		0.07	0.11	0.18	0.36	0.72	1.43	2.15	3.6	10.7	35.8
				VFOV [m]		0.05	0.08	0.14	0.27	0.54	1.08	1.62	2.7	8.1	27.0
				DFOV [m]		0.09	0.13	0.22	0.45	0.90	1.79	2.69	4.5	13.5	44.9
				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° 10° 16° 0.60mrad	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
				VFOV [m]	0.017	0.03	0.05	0.09	0.17	0.35	0.69	1.04	1.7	5.2	17.3
				DFOV [m]	0.029	0.06	0.09	0.14	0.29	0.57	1.15	1.72	2.9	8.6	28.7
				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° 5° 8° 0.30mrad	1.5m	HFOV [m]				0.06	0.11	0.23	0.46	0.69	1.1	3.4	11.5
				VFOV [m]				0.04	0.09	0.17	0.35	0.52	0.9	2.6	8.6
				DFOV [m]				0.07	0.14	0.29	0.57	0.86	1.4	4.3	14.4
				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° 3° 5° 0.20mrad	2.0m	HFOV [m]					0.08	0.15	0.31	0.46	0.8	2.3	7.6
				VFOV [m]					0.06	0.12	0.23	0.35	0.6	1.7	5.8
				DFOV [m]					0.10	0.19	0.38	0.57	1.0	2.9	9.6
				IFOV [mm]					0.2	0.4	0.8	1.2	2.0	6.0	20.0

<sup>1)</sup> 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 <sup>1)</sup> 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	16	39° 25° 46° 0.94mrad	0.2m	HFOV [m]		0.14	0.21	0.36	0.72	1.43	2.87	4.30	7.2	21.5	71.6
				VFOV [m]		0.09	0.14	0.23	0.45	0.90	1.80	2.70	4.5	13.5	45.0
				DFOV [m]		0.17	0.25	0.42	0.85	1.69	3.38	5.08	8.5	25.4	84.6
				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° 16° 30° 0.60mrad	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
				VFOV [m]	0.029	0.06	0.09	0.14	0.29	0.58	1.15	1.73	2.9	8.6	28.8
				DFOV [m]	0.054	0.11	0.16	0.27	0.54	1.08	2.17	3.25	5.4	16.2	54.1
				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° 8° 15° 0.30mrad	1.5m	HFOV [m]				0.11	0.23	0.46	0.92	1.38	2.3	6.9	22.9
				VFOV [m]				0.07	0.14	0.29	0.58	0.86	1.4	4.3	14.4
				DFOV [m]				0.14	0.27	0.54	1.08	1.62	2.7	8.1	27.1
				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° 5° 10° 0.20mrad	2.0m	HFOV [m]					0.15	0.31	0.61	0.92	1.5	4.6	15.3
				VFOV [m]					0.10	0.19	0.38	0.58	1.0	2.9	9.6
				DFOV [m]					0.18	0.36	0.72	1.08	1.8	5.4	18.0
				IFOV [mm]					0.2	0.4	0.8	1.2	2.0	6.0	20.0

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