

Thermoelectric cooling

Some of VIGO devices are provided with thermoelectric cooling. Cooling of infrared detectors reduces noises, increases responsivity, shifts the cut-off wavelength toward longer wavelengths (in HgCdTe detectors) and toward shorter wavelengths (in InAs / InAsSb detectors).

Two-, three- and four-stage thermoelectric coolers are available. Operation of TE coolers is based on Peltier effect. Thermoelectric coolers are supplied with DC power supply.

Temperature control

Thermoelectrically cooled detectors are equipped with built-in thermistor to provide precise control an measurements of detector active element temperature.

The electricity applied to between terminals of thermistors should be under the maximum power dissipation at 25°C (100 mW) not to destroy the thermosensor. For the measurement of resistance, the power should not exceed 1 mW.

The relation between the resistance and the temperature:

$$R_T = R_{T_0} \exp\left(\beta \cdot \frac{T_0 - T}{T \cdot T_0}\right)$$

$R_{T_0} = 2.2 \text{ k}\Omega \pm 3\%$ at $T_0 = 298 \text{ K}$

$\beta = 3500 \text{ K} \pm 1$

Resistance vs. temperature of thermistor

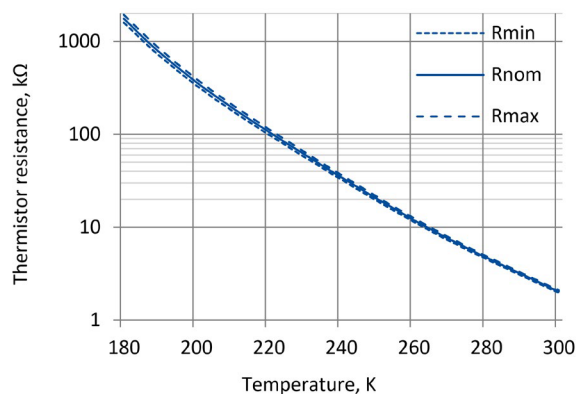
T, K	T, °C	R _{min} , k	R _{nom} , k	R _{max} , k
180	-93	1594.97	1757.95	1935.84
182	-91	1336.02	1469.90	1615.75
184	-89	1124.16	1234.66	1354.81
186	-87	950.46	1042.11	1141.58
188	-85	807.57	883.99	966.78
190	-83	689.57	753.62	822.88
192	-81	591.68	645.64	703.89
194	-79	510.07	555.75	604.98
196	-77	441.68	480.54	522.34
198	-75	384.05	417.25	452.91
200	-73	335.23	363.71	394.26
202	-71	293.65	318.17	344.43
204	-69	258.05	279.23	301.88
206	-67	227.41	245.76	265.36
208	-65	200.91	216.85	233.85
210	-63	177.89	191.77	206.55
212	-61	157.81	169.92	182.79
214	-59	140.22	150.80	162.03
216	-57	124.76	134.02	143.83
218	-55	111.14	119.25	127.83
220	-53	99.10	106.21	113.72
222	-51	88.44	94.67	101.25
224	-49	78.98	84.44	90.21
226	-47	70.57	75.37	80.42
228	-45	63.09	67.30	71.73
230	-43	56.42	60.12	64.01
232	-41	50.49	53.74	57.15
234	-39	45.19	48.05	51.04
236	-37	40.47	42.98	45.61
238	-35	36.26	38.47	40.77

Thermoelectric coolers parameters^{*)}

Parameter	Cooling		
	2TE	3TE	4TE
Active element temperature T _{det} , K	-230	-210	-195
Maximum TEC voltage V _{max} , V	1.3	3.6	8.3
Maximum TEC current I _{max} , A	1.20	0.45	0.40
Maximum heat pumping capacity Q _{max} , W	0.36	0.27	0.28

^{*)} – Depend on temperature of the hot side of the TE cooler. Typically specified for 300 K.

Thermistor characteristics



T, K	T, °C	R _{min} , k	R _{nom} , k	R _{max} , k
240	-33	32.51	34.45	36.47
242	-31	29.16	30.87	32.64
244	-29	26.18	27.68	29.24
246	-27	23.51	24.84	26.21
248	-25	21.14	22.30	23.51
250	-23	19.02	20.05	21.11
252	-21	17.13	18.04	18.98
254	-19	15.45	16.25	17.07
256	-17	13.95	14.65	15.38
258	-15	12.61	13.23	13.87
260	-13	11.41	11.96	12.53
262	-11	10.34	10.83	11.33
264	-9	9.38	9.82	10.26
266	-7	8.52	8.91	9.31
268	-5	7.75	8.10	8.45
270	-3	7.07	7.37	7.69
272	-1	6.45	6.72	7.00
274	1	5.89	6.13	6.38
276	3	5.38	5.60	5.83
278	5	4.93	5.13	5.32
280	7	4.52	4.69	4.87
282	9	4.15	4.30	4.46
284	11	3.81	3.95	4.09
286	13	3.50	3.63	3.75
288	15	3.22	3.33	3.45
290	17	2.96	3.06	3.17
292	19	2.73	2.82	2.91
294	21	2.51	2.59	2.68
296	23	2.32	2.39	2.46
298	25	2.13	2.20	2.27