

Q: Where can I find product specifications and information to help me use my TI290?

A: Refer to the TI290 Instruction Manual for detailed product specifications.

Q: Which mobile devices are compatible for use with the Klein Tools TI290 Thermal Imager?

A: The TI290 Thermal Imager is compatible with devices using Android® 7 or iOS 11 and higher.

Q: What is Emissivity:

A: Emissivity is a property which measures an object's ability to emit or radiate thermal energy based on its material and the nature of its surface. Most organic, painted, or oxidized surfaces have emissivity values close to 0.95 (default). For specific details on the emissivity for various objects to use with your TI290, please review the Klein Tools Emissivity Settings Chart for Non-Metal and Metal Materials.

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EMISSIVITY CHART

FOR NON-METAL MATERIALS

| | Temp F° (C°) | Emissivity |
|-----------------------|-----------------------|------------|
| Adobe | 68 (20) | 0.9 |
| Asbestos | | |
| Board | 100 (38) | 0.96 |
| Cement | 32-392 (0-200) | 0.96 |
| Cement, Red | 2500 (1371) | 0.67 |
| Cement, White | 2500 (1371) | 0.65 |
| Cloth | 199 (93) | 0.9 |
| Paper | 100-700 (38-371) | 0.93 |
| Slate | 68 (20) | 0.97 |
| Asphalt, pavement | 100 (38) | 0.93 |
| Asphalt, tar paper | 68 (20) | 0.93 |
| Basalt | | |
| | 68 (20) | 0.72 |
| Brick | | |
| Red, rough | 70 (21) | 0.93 |
| Gault Cream | 2500-5000 (1371-2760) | .26-.30 |
| Fire Clay | 2500 (1371) | 0.75 |
| Light Buff | 1000 (538) | 0.8 |
| Lime Clay | 2500 (1371) | 0.43 |
| Fire Brick | 1832 (1000) | .75-.80 |
| Magnesite, Refractory | 1832 (1000) | 0.38 |
| Grey Brick | 2012 (1100) | 0.75 |
| Silica, Glazed | 2000 (1093) | 0.88 |
| Silica, Unglazed | 2000 (1093) | 0.8 |
| Sandlime | 2500-5000 (1371-2760) | .59-.63 |
| Carborundum | | |
| | 1850 (1010) | 0.92 |
| Ceramic | | |
| Alumina on Inconel | 800-2000 (427-1093) | .69-.45 |
| Earthenware, Glazed | 70 (21) | 0.9 |
| Earthenware, Matte | 70 (21) | 0.93 |
| Greens No. 5210-2C | 200-750 (93-399) | .89-.82 |
| Coating No. C20A | 200-750 (93-399) | .73-.67 |
| Porcelain | 72 (22) | 0.92 |
| White Al2O3 | 200 (93) | 0.9 |
| Zirconia on Inconel | 800-2000 (427-1093) | .62-.45 |
| Clay | | |
| | 68 (20) | 0.39 |
| Fired | 158 (70) | 0.91 |
| Shale | 68 (20) | 0.69 |
| Tiles, Light Red | 2500-5000 (1371-2760) | .32-.34 |
| Tiles, Red | 2500-5000 (1371-2760) | .40-.51 |
| Tiles, Dark Purple | 2500-5000 (1371-2760) | 0.78 |
| Concrete | | |
| Rough | 32-2000 (0-1093) | 0.94 |
| Tiles, Natural | 2500-5000 (1371-2760) | .63-.62 |
| Brown | 2500-5000 (1371-2760) | .87-.83 |
| Black | 2500-5000 (1371-2760) | .94-.91 |

| | Temp F° (C°) | Emissivity |
|------------------------------|------------------|------------|
| Cotton Cloth | 68 (20) | 0.77 |
| Dolomite Lime | 68 (20) | 0.41 |
| Emery Corundum | 176 (80) | 0.86 |
| Glass | | |
| Convex D | 212 (100) | 0.8 |
| Convex D | 600 (316) | 0.8 |
| Convex D | 932 (500) | 0.76 |
| Nonex | 212 (100) | 0.82 |
| Nonex | 600 (316) | 0.82 |
| Nonex | 932 (500) | 0.78 |
| Smooth | 32-200 (0-93) | .92-.94 |
| Granite | | |
| | 70 (21) | 0.45 |
| Gravel | | |
| | 100 (38) | 0.28 |
| Gypsum | 68 (20) | .80-.90 |
| Ice, Smooth | 32 (0) | 0.97 |
| Ice, Rough | 32 (0) | 0.98 |
| Lacquer | | |
| Black | 200 (93) | 0.96 |
| Blue, on Al Foil | 100 (38) | 0.78 |
| Clear, on Al Foil (2 coats) | 200 (93) | .08-.09 |
| Clear, on Bright Cu | 200 (93) | 0.66 |
| Clear, on Tarnished Cu | 200 (93) | 0.64 |
| Red, on Al Foil (2 coats) | 100 (38) | .60-.74 |
| White | 200 (93) | 0.95 |
| White, on Al Foil (2 coats) | 100 (38) | .69-.88 |
| Yellow, on Al Foil (2 coats) | 100 (38) | .57-.79 |
| Lime Mortar | 100-500 (38-260) | .90-.92 |
| Limestone | 100 (38) | 0.95 |
| Marble, White | | |
| Smooth, White | 100 (38) | 0.56 |
| Polished Grey | 100 (38) | 0.75 |
| Mica | 100 (38) | 0.75 |
| Oil on Nickel | | |
| 0.001" Film | 72 (22) | 0.27 |
| 0.002" Film | 72 (22) | 0.46 |
| 0.005" Film | 72 (22) | 0.72 |
| Thick" Film | 72 (22) | 0.82 |
| Oil, Linseed | | |
| On Al Foil, uncoated | 250 (121) | 0.09 |
| On Al Foil, 1 coat | 250 (121) | 0.56 |
| On Al Foil, 2 coats | 250 (121) | 0.51 |
| On Polished Iron, .001 Film | 100 (38) | 0.22 |
| On Polished Iron, .002 Film | 100 (38) | 0.45 |
| On Polished Iron, .004 Film | 100 (38) | 0.65 |
| On Polished Iron, Thick Film | 100 (38) | 0.83 |

| | Temp F° (C°) | Emissivity |
|-----------------------------|--------------|------------|
| Paints | | |
| Blue, Cu2O3 | 75 (24) | 0.94 |
| Black, CuO | 75 (24) | 0.96 |
| Green, Cu2O3 | 75 (24) | 0.92 |
| Red, Fe2O3 | 75 (24) | 0.91 |
| White, Al2O3 | 75 (24) | 0.94 |
| White, Y2O3 | 75 (24) | 0.9 |
| White, ZnO | 75 (24) | 0.95 |
| White, MgCO3 | 75 (24) | 0.91 |
| White, ZrO2 | 75 (24) | 0.95 |
| White, ThO2 | 75 (24) | 0.9 |
| White, MgO | 75 (24) | 0.91 |
| White, PbCO3 | 75 (24) | 0.93 |
| Yellow, PbO | 75 (24) | 0.9 |
| Yellow, PbCrO4 | 75 (24) | 0.93 |
| Paints, Aluminium | | |
| | 100 (38) | .27-.67 |
| 10% Al | 100 (38) | 0.52 |
| 26% Al | 100 (38) | 0.3 |
| Dow XP-310 | 200 (93) | 0.22 |
| Paints, Bronze | | |
| Low | | .34-.80 |
| Gum Varnish (2 coats) | 70 (21) | 0.53 |
| Gum Varnish (3 coats) | 70 (21) | 0.5 |
| Cellulose Binder (2 coats) | 70 (21) | 0.34 |
| Paints, Oil | | |
| All colours | 200 (93) | .92-.96 |
| Black | 200 (93) | 0.92 |
| Black Gloss | 70 (21) | 0.9 |
| Camouflage Green | 125 (52) | 0.85 |
| Flat Black | 80 (27) | 0.88 |
| Flat White | 80 (27) | 0.91 |
| Grey-Green | 70 (21) | 0.95 |
| Green | 200 (93) | 0.95 |
| Lamp Black | 209 (98) | 0.96 |
| Red | 200 (93) | 0.95 |
| White | 200 (93) | 0.94 |
| Quartz, Rough, Fused | | |
| | 70 (21) | 0.93 |
| Glass, 1.98 mm | 540 (282) | 0.9 |
| Glass, 1.98 mm | 1540 (838) | 0.41 |
| Glass, 6.88 mm | 540 (282) | 0.93 |
| Glass, 6.88 mm | 1540 (838) | 0.47 |
| Opaque | 570 (299) | 0.92 |
| Opaque | 1540 (838) | 0.68 |
| Red Lead | 212 (100) | 0.93 |
| Rubber, Hard | 74 (23) | 0.94 |
| Rubber, Soft, Grey | 76 (24) | 0.86 |
| Sand | 68 (20) | 0.76 |
| Sandstone | 100 (38) | 0.67 |
| Sandstone, Red | 100 (38) | .60-.83 |
| Sawdust | 68 (20) | 0.75 |
| Shale | 68 (20) | 0.69 |

| | Temp F° (C°) | Emissivity |
|-----------------------------|--------------------|------------|
| Silica, Glazed | 1832 (1000) | 0.85 |
| Silica, Unglazed | 2012 (1100) | 0.75 |
| Silicon Carbide | 300-1200 (149-649) | .83-.96 |
| Silk Cloth | 68 (20) | 0.78 |
| Slate | 100 (38) | .67-.80 |
| Snow, Fine Particles | 20 (-7) | 0.82 |
| Snow, Granular | 18 (-8) | 0.89 |
| Soil | | |
| Surface | 100 (38) | 0.38 |
| Black Loam | 68 (20) | 0.66 |
| Plowed Field | 68 (20) | 0.38 |
| Soot | | |
| Acetylene | 75 (24) | 0.97 |
| Camphor | 75 (24) | 0.94 |
| Candle | 250 (121) | 0.95 |
| Coal | 68 (20) | 0.95 |
| Stonework | 100 (38) | 0.93 |
| Water | 100 (38) | 0.67 |
| Waterglass | 68 (20) | 0.96 |
| Wood | Low | .80-.90 |
| Beech Planed | 158 (70) | 0.94 |
| Oak, Planed | 100 (38) | 0.91 |

EMISSIVITY CHART

FOR METAL MATERIALS

Non-Metal and Metal Materials

| | Temp F° (C°) | Emissivity |
|----------------------------|---------------------|------------|
| Alloys | | |
| 20-Ni, 24-CR, 55-FE, Oxid. | 392 (200) | 0.9 |
| 20-Ni, 24-CR, 55-FE, Oxid. | 932 (500) | 0.97 |
| 60-Ni, 12-CR, 28-FE, Oxid. | 518 (270) | 0.89 |
| 60-Ni, 12-CR, 28-FE, Oxid. | 1040 (560) | 0.82 |
| 80-Ni, 20-CR, Oxidised | 212 (100) | 0.87 |
| 80-Ni, 20-CR, Oxidised | 1112 (600) | 0.87 |
| 80-Ni, 20-CR, Oxidised | 2372 (1300) | 0.89 |
| Aluminium | | |
| Unoxidised | 77 (25) | 0.02 |
| Unoxidised | 212 (100) | 0.03 |
| Unoxidised | 932 (500) | 0.06 |
| Oxidised | 390 (199) | 0.11 |
| Oxidised | 1110 (599) | 0.19 |
| Oxidised at 1110°F (599°C) | 390 (199) | 0.11 |
| Oxidised at 1110°F (599°C) | 1110 (599) | 0.19 |
| Heavily Oxidised | 200 (93) | 0.2 |
| Heavily Oxidised | 940 (504) | 0.31 |
| Highly Polished | 212 (100) | 0.09 |
| Roughly Polished | 212 (100) | 0.18 |
| Commercial Sheet | 212 (100) | 0.09 |
| Highly Polished Plate | 440 (227) | 0.04 |
| Highly Polished Plate | 1070 (577) | 0.06 |
| Bright Rolled Plate | 338 (170) | 0.04 |
| Bright Rolled Plate | 932 (500) | 0.05 |
| Alloy A3003, Oxidised | 600 (316) | 0.4 |
| Alloy A3003, Oxidised | 900 (482) | 0.4 |
| Alloy 1100-0 | 200-800 (93-427) | 0.05 |
| Alloy 24ST | 75 (24) | 0.09 |
| Alloy 24ST, Polished | 75 (24) | 0.09 |
| Alloy 75ST | 75 (24) | 0.11 |
| Alloy 75ST, Polished | 75 (24) | 0.08 |
| Bismuth, Bright | | |
| | 176 (80) | 0.34 |
| Bismuth, Unoxidised | | |
| | 77 (25) | 0.05 |
| | 212 (100) | 0.06 |
| Brass | | |
| 73% Cu, 27% Zn, Polished | 476 (247) | 0.03 |
| 73% Cu, 27% Zn, Polished | 674 (357) | 0.03 |
| 62% Cu, 37% Zn, Polished | 494 (257) | 0.03 |
| 62% Cu, 37% Zn, Polished | 710 (377) | 0.04 |
| 83% Cu, 17% Zn, Polished | 530 (277) | 0.03 |
| Matte | 68 (20) | 0.07 |
| Burnished to Brown Colour | 68 (20) | 0.4 |
| Cu-Zn, Brass Oxidised | 392 (200) | 0.61 |
| Cu-Zn, Brass Oxidised | 752 (400) | 0.6 |
| Cu-Zn, Brass Oxidised | 1112 (600) | 0.61 |
| Unoxidised | 77 (25) | 0.04 |
| Unoxidised | 212 (100) | 0.04 |
| Cadmium | 77 (25) | 0.02 |
| Carbon | | |
| Lampblack | 77 (25) | 0.95 |
| Unoxidised | 77 (25) | 0.81 |
| Unoxidised | 212 (100) | 0.81 |
| Unoxidised | 932 (500) | 0.79 |
| Candle Soot | 250 (121) | 0.95 |
| Filament | 500 (260) | 0.95 |
| Graphitized | 212 (100) | 0.76 |
| Graphitized | 572 (300) | 0.75 |
| Graphitized | 932 (500) | 0.71 |

| | Temp F° (C°) | Emissivity |
|------------------------------|--------------------------|------------|
| Chromium | | |
| | 100 (38) | 0.08 |
| | 1000 (538) | 0.26 |
| Chromium, Polished | | |
| | 302 (150) | 0.06 |
| Cobalt, Unoxidised | | |
| | 932 (500) | 0.13 |
| | 1832 (1000) | 0.23 |
| Columbium, Unoxidised | | |
| | 1500 (816) | 0.19 |
| | 2000 (1093) | 0.24 |
| Copper | | |
| Cuprous Oxide | 100 (38) | 0.87 |
| Cuprous Oxide | 500 (260) | 0.83 |
| Cuprous Oxide | 1000 (538) | 0.77 |
| Black, Oxidised | 100 (38) | 0.78 |
| Etched | 100 (38) | 0.09 |
| Matte | 100 (38) | 0.22 |
| Roughly Polished | 100 (38) | 0.07 |
| Polished | 100 (38) | 0.03 |
| Highly Polished | 100 (38) | 0.02 |
| Rolled | 100 (38) | 0.64 |
| Rough | 100 (38) | 0.74 |
| Molten | 1000 (538) | 0.15 |
| Molten | 1970 (1077) | 0.16 |
| Molten | 2230 (1221) | 0.13 |
| Nickel Plated | 100-500 (38-260) | 0.37 |
| Dow Metal | | |
| | 0.4-600 (-18-316) | 0.15 |
| Gold | | |
| Enamel | 212 (100) | 0.37 |
| Plate on .0005 Silver | 200-750 (93-399) | .11-.14 |
| Plate on .0005 Nickel | 200-750 (93-399) | .07-.09 |
| Polished | 100-500 (38-260) | 0.02 |
| Polished | 1000-2000 (538-1093) | 0.03 |
| Haynes Alloy C, | | |
| Oxidised | 600-2000 (316-1093) | .90-.96 |
| Haynes Alloy 25, | | |
| Oxidised | 600-2000 (316-1093) | .86-.89 |
| Haynes Alloy X, | | |
| Oxidised | 600-2000 (316-1093) | .85-.88 |
| Inconel Sheet | | |
| | 1000 (538) | 0.28 |
| | 1200 (649) | 0.42 |
| | 1400 (760) | 0.58 |
| Inconel X, Polished | | |
| | 75 (24) | 0.19 |
| Inconel B, Polished | | |
| | 75 (24) | 0.21 |
| Iron | | |
| Oxidised | 212 (100) | 0.74 |
| Oxidised | 930 (499) | 0.84 |
| Oxidised | 2190 (1199) | 0.89 |
| Unoxidised | 212 (100) | 0.05 |
| Red Rust | 77 (25) | 0.7 |
| Rusted | 77 (25) | 0.65 |
| Liquid | 2760-3220 (1516-1771) | .42-.45 |

| | Temp F° (C°) | Emissivity |
|---|--------------------------|------------|
| Cast Iron | | |
| Oxidised | 390 (199) | 0.64 |
| Oxidised | 1110 (599) | 0.78 |
| Unoxidised | 212 (100) | 0.21 |
| Strong Oxidation | 40 (104) | 0.95 |
| Strong Oxidation | 482 (250) | 0.95 |
| Liquid | 2795 (1535) | 0.29 |
| Wrought Iron | | |
| Dull | 77 (25) | 0.94 |
| Dull | 660 (349) | 0.94 |
| Smooth | 100 (38) | 0.35 |
| Polished | 100 (38) | 0.28 |
| Lead | | |
| Polished | 100-500 (38-260) | .06-.08 |
| Rough | 100 (38) | 0.43 |
| Oxidised | 100 (38) | 0.43 |
| Oxidised at 1100 | 100 (38) | 0.63 |
| Gray Oxidised | 100 (38) | 0.28 |
| Magnesium | | |
| | 100-500 (38-260) | .07-.13 |
| Magnesium Oxide | | |
| | 1880-3140 (1027-1727) | .16-.20 |
| Mercury | | |
| | 32 (0) | 0.09 |
| | 77 (25) | 0.1 |
| | 100 (38) | 0.1 |
| | 212 (100) | 0.12 |
| Molybdenum | | |
| | 100 (38) | 0.06 |
| | 500 (260) | 0.08 |
| | 1000 (538) | 0.11 |
| | 2000 (1093) | 0.18 |
| Monel, Ni-Cu | | |
| | 392 (200) | 0.41 |
| | 752 (400) | 0.44 |
| | 1112 (600) | 0.46 |
| Monel, Ni-Cu Oxidised | | |
| | 68 (20) | 0.43 |
| Monel, Ni-Cu Oxid. at 1110degF | | |
| | 1110 (599) | 0.46 |
| Nickel | | |
| Polished | 100 (38) | 0.05 |
| Oxidised | 100-500 (38-260) | .31-.46 |
| Unoxidised | 77 (25) | 0.05 |
| Unoxidised | 212 (100) | 0.06 |
| Unoxidised | 932 (500) | 0.12 |
| Unoxidised | 1832 (1000) | 0.19 |
| Electrolytic | 100 (38) | 0.04 |
| Electrolytic | 500 (260) | 0.06 |
| Electrolytic | 1000 (538) | 0.1 |
| Electrolytic | 2000 (1093) | 0.16 |
| Nickel Oxide | | |
| | 1000-2000 (538-1093) | .59-.86 |
| Palladium Plate (.00005 on .0005 silver) | | |
| | 200-750 (93-399) | .16-.17 |
| Platinum | | |
| | 100 (38) | 0.05 |
| | 500 (260) | 0.05 |
| | 1000 (538) | 0.1 |

EMISSIVITY CHART

FOR METAL MATERIALS

| | Temp F° (C°) | Emissivity |
|--|--------------------------|------------|
| Platinum, Black | | |
| | 100 (38) | 0.93 |
| | 500 (260) | 0.96 |
| | 2000 (1093) | 0.97 |
| Platinum Oxidised at 1100 | | |
| | 500 (260) | 0.07 |
| | 1000 (538) | 0.11 |
| Rhodium Flash (0.0002 on 0.0005 Ni) | | |
| | 200-700 (93-371) | .10-.18 |
| Silver | | |
| Plate (0.0005 on Ni) | 200-700 (93-371) | .06-.07 |
| Polished | 100 (38) | 0.01 |
| Polished | 500 (260) | 0.02 |
| Polished | 1000 (538) | 0.03 |
| Polished | 2000 (1093) | 0.03 |
| Steel | | |
| Cold Rolled | 200 (93) | .75-.85 |
| Ground Sheet | 1720-2010 (938-1099) | .55-.61 |
| Polished Sheet | 100 (38) | 0.07 |
| Polished Sheet | 500 (260) | 0.1 |
| Polished Sheet | 1000 (538) | 0.14 |
| Mild Steel, Polished | 75 (24) | 0.1 |
| Mild Steel, Smooth | 75 (24) | 0.12 |
| Mild Steel, liquid | 2910-3270 (1599-1793) | 0.28 |
| Steel, Unoxidised | 212 (100) | 0.08 |
| Steel, Oxidised | 77 (25) | 0.8 |
| Steel Alloys | | |
| Type 301, Polished | 75 (24) | 0.27 |
| Type 301, Polished | 450 (232) | 0.57 |
| Type 301, Polished | 1740 (949) | 0.55 |
| Type 303, Oxidised | 600-2000 (316-1093) | .74-.87 |
| Type 310, Rolled | 1500-2100 (816-1149) | .56-.81 |
| Type 316, Polished | 75 (24) | 0.28 |
| Type 316, Polished | 450 (232) | 0.57 |
| Type 316, Polished | 1740 (949) | 0.66 |
| Type 321 | 200-800 (93-427) | .27-.32 |
| Type 321 Polished | 300-1500 (149-815) | .18-.49 |
| Type 321 w/BK Oxide | 200-800 (93-427) | .66-.76 |
| Type 347, Oxidised | 600-2000 (316-1093) | .87-.91 |
| Type 350 | 200-800 (93-427) | .18-.27 |
| Type 350, Polished | 300-1800 (149-982) | .11-.35 |
| Type 446, Polished | 300-1500 (149-815) | .15-.37 |
| Type 17-7 PH | 200-600 (93-316) | .44-.51 |
| Type 17-7 PH Polished | 300-1500 (149-815) | .09-.16 |
| Type C1020, Oxidised | 600-2000 (316-1093) | .87-.91 |
| Type PH-15-7 MO | 300-1200 (149-649) | .07-.19 |

| | Temp F° (C°) | Emissivity |
|--|-----------------------|------------|
| Stellite, Polished | | |
| | 68 (20) | 0.18 |
| Tantalum, Unoxidised | | |
| | 1340 (727) | 0.14 |
| | 2000 (1093) | 0.19 |
| | 3600 (1982) | 0.26 |
| | 5306 (2930) | 0.3 |
| Tin, Unoxidised | | |
| | 77 (25) | 0.04 |
| | 212 (100) | 0.05 |
| Tinned Iron, Bright | | |
| | 76 (24) | 0.05 |
| | 212 (100) | 0.08 |
| Titanium | | |
| Alloy C110M, Polished | 300-1200 (149-649) | .08-.19 |
| Oxidised at 1000°F (538°C) | 200-800 (93-427) | .51-.61 |
| Alloy Ti-95A, Oxidised at 1000°F (538°C) | 200-800 (93-427) | .35-.48 |
| Anodized onto SS | 200-600 (93-316) | .96-.82 |
| Tungsten | | |
| Unoxidised | 77 (25) | 0.02 |
| Unoxidised | 212 (100) | 0.03 |
| Unoxidised | 932 (500) | 0.07 |
| Unoxidised | 1832 (1000) | 0.15 |
| Unoxidised | 2732 (1500) | 0.23 |
| Unoxidised | 3632 (2000) | 0.28 |
| Filament (Aged) | 100 (38) | 0.03 |
| Filament (Aged) | 1000 (538) | 0.11 |
| Filament (Aged) | 5000 (2760) | 0.35 |
| Uranium Oxide | | |
| | 1880 (1027) | 0.79 |
| Zinc | | |
| Bright, Galvanised | 100 (38) | 0.23 |
| Commercial 99.1% | 500 (260) | 0.05 |
| Galvanised | 100 (38) | 0.28 |
| Oxidised | 500-1000 (260-538) | 0.11 |
| Polished | 100 (38) | 0.02 |
| Polished | 500 (260) | 0.03 |
| Polished | 1000 (538) | 0.04 |
| Polished | 2000 (1093) | 0.06 |

