**测温二次标定**

**Secondary Calibration**

**V3.0**

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| **版本**  **Version** | **时间**  **Date** | **说明 Description** |
| **V1.0** | 2019-12-12 | 初始版本 |
| **V1.1** | 2020-02-11 | 调整黑体设定温度、增加人体测温标定补充 |
| **V1.2** | 2020-02-25 | 新增二次标定单点标定功能 |
| **V2.0** | 2020-08-22 | 修改二次标定功能相关的命令接口为新的SDK接口 |
| **V3.0** | 2021-05-17 | 适配ASIC相关指令 |

**概述Overview：**

Tiny红外模组集成到整机中后，需要测温二次标定才可获得较准确的测温效果。本文系统的介绍了二次标定实现流程。测温二次标定计算在模组固件中已经实现，上位机只需调用libiruvc库中的相关命令接口按照标定流程操作即可完成标定过程。相关的命令用法参考SDK中libirsdk.chm接口说明文档。

When the user integrates the module into the whole machine, it will inevitably cause a certain temperature measurement deviation due to the changes of thermal distribution and optical structure (add window, etc.). Therefore, Secondary calibration& Lid pattern noise correction is required in the whole machine. The secondary calibration calculation has been realized in module firmware, and the Master terminal only needs to call the relevant command interface in libiruvc library to complete the calibration process. Refer to the libirsdk. chm interface description in the SDK.

**一、两点标定Two-point secondary calibration：**

1. **准备工作****Preparation**
2. 准备两台黑体A和B，温度设置为TA和TB；

Prepare two black bodies A and B, and set the temperature to TA and TB.

1. 黑体分别可以放置于模组视场中心，黑体面距离模组镜头约0.25m。

The black body can be placed in the center of the module field of view, and the black face is about 0.25m away from the module lens.

\*建议高增益模式下，TA和TB分别设置为293K和393K，低增益模式下，TA和TB分别设置为373K和673K

\* You are advised to set TA and TB to 293K and 393K respectively in high gain mode and 373K and 673K respectively in low gain mode

\*人体测温只需要在高增益模式下标定，TA=303K，TB=313K

\* Creature Radiometry only needs to be calibrated in high-gain mode, TA=303K, TB=313K

\*使用工业高增益模式的用户，如果对5℃以下的低温目标精度比较关心，可将第一个温度点温度降低到283K。

\* Industrial high-gain mode: If you are concerned about the temperature measurement accuracy of the low-temperature target below 5℃, you can lower the temperature of the first temperature point to 10℃.

1. 等待黑体达到设定温度

Wait for the blackbody to reach the set temperature

\*实际黑体发射率不可能为1，需要修正。黑体面温度均匀稳定的区域至少需要占据画面中心9\*9像素以上。

\* The actual blackbody emissivity cannot be 100% and needs to be corrected. The area with uniform and stable temperature should occupy at least 9 x 9 pixels in the center of the image.

2. **模组温度稳定后，后进入二次标定流程：**

**After the module temperature is stabilized, the process is entered**：

1. 将低温黑体A置于画面中心处

Place the low-temperature black body A in the center of the picture

1. 发送VDCMD\_PROP\_SET\_AUTO\_SHUTTER\_PARAM指令，选择参数SHUTTER\_PROP\_SWITCH，设置value为0，关闭自动快门。

Send the VDCMD\_PROP\_SET\_AUTO\_SHUTTER\_PARAM command, select the parameter SHUTTER\_PROP\_SWITCH, set value to 0, and close the auto FFC.

1. 发送VCMD\_FW\_ISP\_OOC\_B\_UPDATE指令，参数为B\_UPDATE(0)，进行快门校正。

Send VCMD\_FW\_ISP\_OOC\_B\_UPDATE command with parameter B\_UPDATE(0) for FFC.

1. 采集低温黑体数据， 发送VCMD\_ISP\_TPD\_KTBT\_RECAL\_2\_POINT指令，设置point order为0，设置Temp为黑体的实际温度（单位开尔文）。

Collect low-temperature blackbody data, Send VCMD\_ISP\_TPD\_KTBT\_RECAL\_2\_POINT command, set point order to 0, and set Temp to the actual temperature of the black body in Kelvin.

1. 将高温黑体B置于画面中心处

Place the high-temperature black body B in the center of the picture

1. 发送VCMD\_FW\_ISP\_OOC\_B\_UPDATE指令，参数为B\_UPDATE(0)，进行快门校正。

Send VCMD\_FW\_ISP\_OOC\_B\_UPDATE command with parameter B\_UPDATE(0) for FFC.

1. 采集高温黑体数据，发送VCMD\_ISP\_TPD\_KTBT\_RECAL\_2\_POINT指令，设置point order为1，设置temp为黑体的实际开尔文温度。该过程需要等待15-20秒。

Collect high-temperature blackbody data, Send VCMD\_ISP\_TPD\_KTBT\_RECAL\_2\_POINT command, set point order to 1, and set Temp to the actual temperature of the black body in Kelvin. The wait time is about 15~20 seconds.

1. 调用VDCMD\_PROP\_SET\_AUTO\_SHUTTER\_PARAM函数的SHUTTER\_PROP\_SWITCH为1，打开自动快门。

Send the VDCMD\_PROP\_SET\_AUTO\_SHUTTER\_PARAM command, select the parameter SHUTTER\_PROP\_SWITCH, set value to 1 to open the auto FFC.

注意事项Notes：

\*标定失败后，需要发送VCMD\_SPI\_DEFAULT\_RESTORE的CFG\_TPD参数重置温度计算参数，重新进行二次标定。

\* If the calibration fails, send CFG\_TPD of VCMD\_SPI\_DEFAULT\_RESTORE to restore the calibration data and perform secondary calibration again.

\*若模组为可切换高低增益版本，需要分别进行二次标定。

\* If the module is a switchable high-low gain version, perform secondary calibration in two cases.

\*必须在开启测温功能的情况下采集黑体数据，这样才可以评估二次标定的效果。

\*Data must be collected with temperature measurement enabled so that the effect can be evaluated.

**二、单点标定功能One-point secondary calibration**

1.准备工作Preparation

* 1. 准备一台黑体，温度设置为T0。

Prepare one black bod, and set the temperature to T0.

\*建议高低增益下分别设置应用场合的中值温度

\* It is recommended to set the median temperature for the application scenarios under high and low gain respectively

\*人体测温只需要在高增益模式下标定T0，建议设置为308K

\* Creature Radiometry only needs to calibrate T0 in high-gain mode, and 308K is recommended

* 1. 将黑体放置于模组视场中心，黑体面距离模组镜头约0.25m。

The black body can be placed in the center of the module field of view, and the black face is about 0.25m away from the module lens.

* 1. 等待黑体达到设定温度

Wait for the blackbody to reach the set temperature

\*实际黑体发射率不可能为1，需要修正。黑体面温度均匀稳定的区域至少需要占据画面中心9\*9像素以上。

\* The actual blackbody emissivity cannot be 100% and needs to be corrected. The area with uniform and stable temperature should occupy at least 9 x 9 pixels in the center of the image.

**2. 模组温度稳定后，后进入二次标定单点标定流程：**

**After the module temperature is stabilized, the process is entered：**

1. 将黑体置于画面中心处。

Place the body in the center of the picture

1. 发送VDCMD\_PROP\_SET\_AUTO\_SHUTTER\_PARAM指令，选择参数SHUTTER\_PROP\_SWITCH，设置value为0，关闭自动快门。

Call set\_prop\_auto\_shutter\_params function with SHUTTER\_PROP\_SWITCH 0 to close the auto FFC.

1. 发送VCMD\_FW\_ISP\_OOC\_B\_UPDATE指令，参数为B\_UPDATE(0)，进行快门校正。

Send VCMD\_FW\_ISP\_OOC\_B\_UPDATE command with parameter B\_UPDATE(0) for FFC.

1. 采集黑体的温度，发送VCMD\_ISP\_TPD\_KTBT\_RECAL\_1\_POINT指令，参数为黑体的实际开尔文温度。

Collect blackbody data, Send VCMD\_ISP\_TPD\_KTBT\_RECAL\_1\_POINT command, and set the parameter as the actual blackbody temperature (in Kelvin). The wait time for the USB command interface is about 11 seconds, and the wait time for the I2C command interface is about 20 seconds.

1. 调用VDCMD\_PROP\_SET\_AUTO\_SHUTTER\_PARAM函数的SHUTTER\_PROP\_SWITCH为1，打开自动快门。

Send the VDCMD\_PROP\_SET\_AUTO\_SHUTTER\_PARAM command, select the parameter SHUTTER\_PROP\_SWITCH, set value to 1 to open the auto FFC.

注意事项Notes：

\*标定失败后，需要发送VCMD\_SPI\_DEFAULT\_RESTORE的CFG\_TPD参数重置温度计算参数，重新进行二次标定。

\* If the calibration fails, send CFG\_TPD of VCMD\_SPI\_DEFAULT\_RESTORE to restore the calibration data and perform secondary calibration again.

\*若模组为可切换高低增益版本，需要分别进行二次标定。

\* If the module is a switchable high-low gain version, perform secondary calibration in two cases.

\*必须在开启测温功能的情况下采集黑体数据，这样才可以评估二次标定的效果。

\*Data must be collected with temperature measurement enabled so that the effect can be evaluated.