**XMM Optical Monitor**

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# MSSL $^{XMM}$OM Power Budget Breakdown

DOCUMENT: XMM-OM/MSSL/SP/0012.07

5-Jun-96

| Issue | Date | Changes |
|---|---|---|
| 1 | 30-Sep-92 | |
| 2 | 24-Jun-94 | update |
| 3 | 15-Nov-94 | update |
| 4 | | update |
| 5 | 4-Jul-95 | update |
| 6 | 31-May-96 | update |
| | | |

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|---|---|
| Machine File-System Directory: | \\mssls7\pc\projects\xmm-om\sp\0007.05\ |
| Document File Name: | POWERB~1.DOC |
| Application: | MS Word 6 |
| Included files: | Power.xls |
| Print Date (this): | 5-Jun-96 @ 18:11 |
| Printer: | Postscript |

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# Introduction

## EID-B Requirements

The EID-B Issue 3 gives two figures for allocated power for the whole of the OM instrument:

64W Average

83W Peak

These figures are assumed to include Keep Alive Power, and are the maximums from Beginning of Life to End of Life.

It is proposed to amend the EID-B with the following tables:

| +28 V Power (W) | | | |
|---|---|---|---|
| | OFF | Maximum Average | Long Peak |
| OM1 | 34 | 50.9 | 66.2 |
| OM2 active | 0 | 11.8 | 11.8 |
| OM2 inactive | 0 | 0 | 0 |
| TOTAL | 34 | 62.7 | 78 |

| Keep Alive Power (W) | | | |
|---|---|---|---|
| | OFF | Maximum Average | Long Peak |
| OM1 | 0 | 0 | 0 |
| OM2 active | 0.5[1] | 0.01[1] | 0.01[1] |
| OM2 inactive | 0.5[2] | 0.5[1] | 0.5[1] |

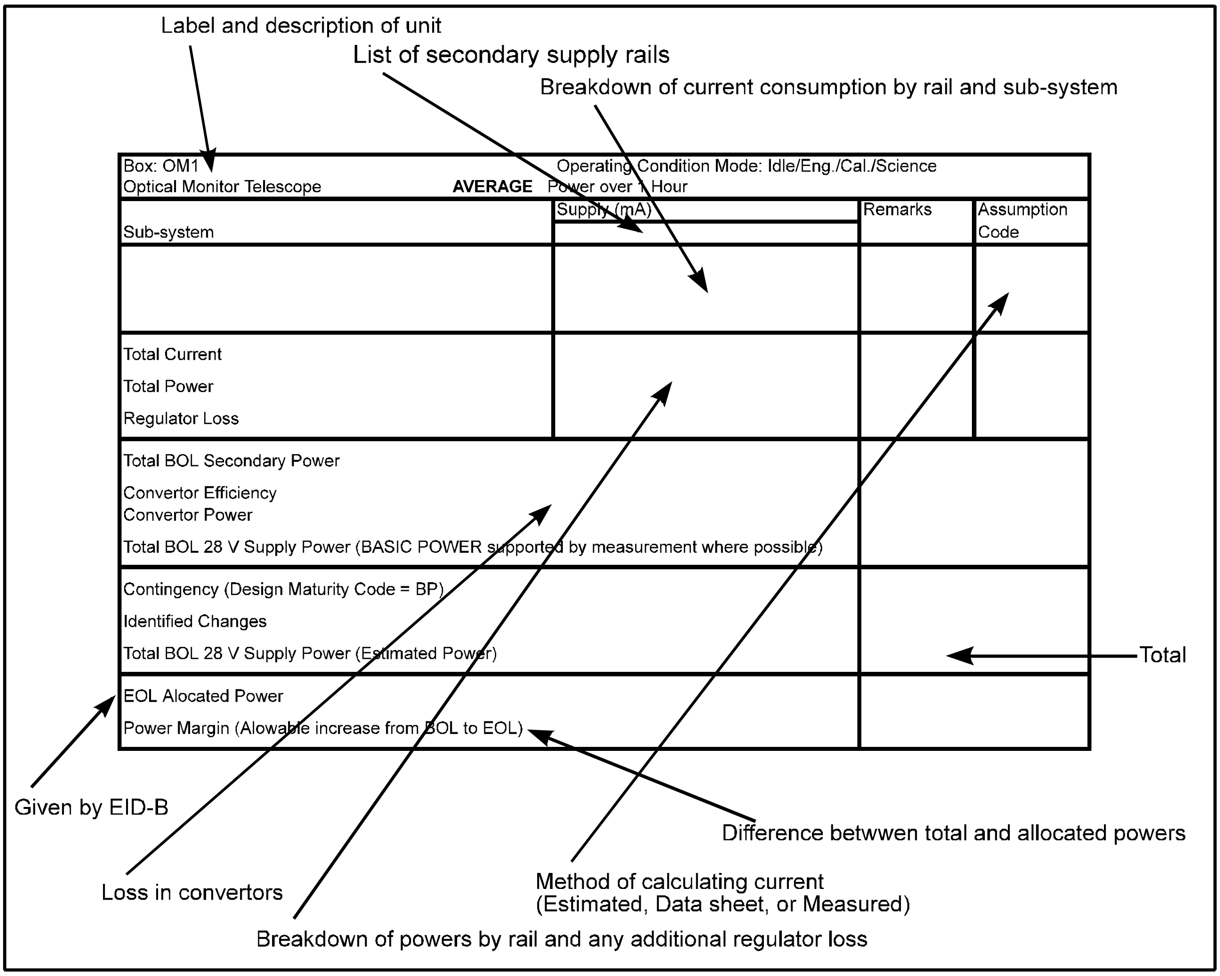
OM2 active refers to the one of the two redundant units which is powered up while the instrument is ON, and OM2 inactive is the other un-powered unit.

The OFF state includes the spacecraft powered heaters (see later section).

## OM Power Budget Tables

An example of the power budget tables is given below:

[1]This is the keep alive power




The link with the previous tables in the EID-B is the EOL Allocated power figure near the bottom of this table. In the example above for: OM1, Average power, at end of life, for main power - the new figure would be 33.3W.

## Operating Conditions and Power Variations (Key to Power Budget Tables)

For each instrument unit and state where the power consumption is distinct, a power budget table is given. The cases are summarised below.

| Power Budget Table No. | Average | Max. Average | Long Peak | Short Peak |
|---|---|---|---|---|
| OM1 | | | | |
| Idle/Eng./Cal./Science Modes | | 1*(50.9W) | 2*(66.2W) | |
| Safe Mode | | 3 | 4 | |
| OM2 active | | | | |
| All Modes | | 5*(11.61W) | | |
| Power-on | | 7(17W) | | |
| OM2 active/inactive | | | | |
| OFF | | 6*(0.89W) | | |

The entries marked * relate to the EID-B table, except in the EID, the Keep alive power is listed separately, and here BOL vs EOL power is identified inside the budget tables.

On power-on OM2 briefly consumes more power, while the OM1 is in safe mode, hence the instrument is still well within its power budget. This increased power is due to the PROMs in the ICU.

## Major contributors to load variation in the OM

Within the telescope module there are a number of power consuming units which will vary the overall power consumption within limits.

The heaters, and motors are the units which have varying power consumption and account for the peak powers in the budget.

The Heaters have a cycle period of less than 1 hour such that the average measured over 1 hour will be reasonably constant.

The table below illustrates the relationship between maximum, average and minimum power of those units with a varying power consumption.

| | | Regulated Power | Converter Efficiency | Total |
|---|---|---|---|---|
| Motors | | | 65% | |
| | Min | 0.0 W | 0.0 W | 0.0 W |
| | Max | 10.0 W | 5.4 W | 15.4 W |
| | Avg | 0.5 W | 0.3 W | 0.8 W |
| | | | | |
| Heaters | | | 100% | |
| | Min | 0W | 0.0 W | 0 W |
| | Max | 41 W | 0.0 W | 41 W |
| | Avg | 23 W | 0.0 W | 23 W |

The power budget defines the maximum power that can be consumed in any 100ms period (the long peak), and the maximum power that can be consumed over 5 minutes (the maximum average). This means that the cycle period for the heaters, must be less than or equal to 5 minutes if the power consumed by these units is varying and dissipating the 'maximum average'.

The motors are limited to dissipating no more than 0.5W averaged over 5 mins, this equates to an energy of 150 Ws. For the 10W filter wheel motors, the total amount of time spent by the motors moving is limited to 15 seconds in any 5 minute period. This is most easily expressed in terms of a budget of filter position, i.e. 30 filter positions in 5 minutes.

## Changes to Earlier Versions

Issue 6 modifies the tables that mirror the EID-B. The Power Breakdown into Thermal Nodes is now worst case. The new MSSL thermal model information is included.

Issue 5 excludes power due to the Red detector.

Issue 4 changed from Issue 2, 24-Jun-94 with minor changes from Issue 3. The earlier power budget was inconsistent with that allocated in the EID-B and thus in this version the required power has been REDUCED to meet the allocated power. The average power has decreased by 2.78W and the peak power has decreased by 7.98W as explained in the section "EID-B Requirements" of this document.

Internal to the instrument, most of the power requirements have increased slightly, and the power converters will have a lower efficiency than assumed in version 2. To counter these changes, the red beam steering mechanism has been removed from the budget, and the contingency has been reduced to reflect more accurate estimates.

## Power Breakdown into Thermal Nodes

| NODE | MAXIMUM AVERAGE | MINIMUM AVERAGE |
|---|---|---|
| Blue Camera Head | 6.7 | 6 |
| Blue High Voltage | 1.6 | 0.5 |
| Blue Processing Electronics | 6.7 | 3.7 |
| TMPSU | 8.7 | 7.5 |
| Motors | 0.8 | |
| Heaters | | |
| TOTAL | 24.5 | 17.7 |

Note: The above maximum average figures are End of Life and include all contingency. They are therefore to be considered as worst case. The minimum average are the lowest expected powers in any operational (Safe, Idle, Science, Calibration) Mode.