

## Overview

The TCU is a versatile, customizable subsystem designed to manage the thermal environment of spacecraft, ensuring the reliable operation of critical systems in Low Earth Orbit. Featuring FPGA and SoC based control, the TCU provides precise and adaptable temperature regulation, making it suitable for a wide range of satellite missions.

## Reliable Thermal Management

The TCU is engineered to maintain optimal temperature levels for onboard systems, capable of interfacing with diverse thermal sensors and heaters. Its flexible design allows customization to specific mission requirements, ensuring that both power consumption and performance are optimized for long-duration missions.

## Designed for Space Applications

Built to withstand the harsh conditions of space, including radiation and temperature extremes, the TCU delivers consistent performance over a mission life of up to 5 years. The system's modular design allows it to be integrated into a variety of satellite platforms, from small to larger spacecraft.

- **Mission Life** 3 to 5 Years In Low Earth Orbit (LEO)
- **Customizable Configuration** Tailored Sensor Inputs And Heater Control Options
- **Temperature Control Accuracy**  $\pm 0.2^{\circ}\text{C}$
- **FPGA-Based Design** Flash-Based Architecture, SEU Immune
- **High Channel Count** 110 Sensor Inputs, 50 Heater Control Channels
- **Low Power Consumption** Less Than 4W (Without Heaters)
- **Real-Time Monitoring** Programmable Update Rate Of Better Than 1Hz
- **Environmental Resistance** Built For Radiation And Temperature Extremes

## Special Features

**SEU immune, Flash-Based SoC FPGA Architecture**

**Programmable Control For Heater Management**

**Wide-Range Thermal Sensor Compatibility**

**Low Power Consumption, Efficient Operation**

**Customizable Voltage And Configuration Options**

**Redundant Design Available For Mission-Critical Systems**



## TECHNICAL SPECIFICATIONS

### Processor & Memory

**Processor:** FPGA-based SmartFusion2 architecture

**Non-Volatile Memory:** 8Gb to 32Gb

**RAM/ROM:** MRAM (radiation immune)

### Budget

**Mass:** 1.1kg

**Dimensions:** 160 × 170 × 38 mm (Customizable)

**Power Supply:** +28VDC ±4V

**Power Consumption:** Less than 4W (without heaters)

### Interfaces

**Debug Interface:** JTAG, SoftConsole or Keil

**Serial Interfaces:** CAN, RS422 RS485, RS232

### Thermal Sensors

**Input Channels:** 110 channels

**Sensor Types:** Thermistor, RTD, Thermocouple, Custom

### Environment

#### Radiation Hardness:

Total Ionizing Dose: 30Krad (Si)

Latch-up Immune

SEE @ 60MeV

#### Temperature & Pressure:

-40 °C to +85 °C @ 10<sup>-8</sup> bar

#### Shocks:

2000g, 2000-10000Hz

#### Random Vibrations:

14g(RMS) 3-Axis, 20~2000Hz


### Heater Control

**Output Channels:** 50 channels, Up to 60W each

**Control Voltage:** 1V to 28V (up to 60V available)

**Temperature Control Accuracy:** ±0.2°C

**Update Rate:** Programmable, better than 1Hz

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