

OBC (On Board Computer)

The **COTS** (Commercial-Off-The-Shelf) **OBC** (On Board Computer) is a computer system for space application at low cost ready to be used to control little Platform for LEO satellite, control of space equipments and human mission (i.e.: Shuttle, ISS).

The main characteristics of the OBC are:

- Minimum dimensions and weight
- Low power consumption
- Mass Memory
- Data acquisition and actuator commands generation
- SW routine Real Time



The OBC basic unit is composed of the four modules:

- **CPU**
- **Mass Memory**
- **I/O Serial and Analogic** (PCM-A/D-12)
- **Standard Interface** (PCM –ESCC)

controlled by a high level Operative System Real Time.

CPU Module

The core of the OBC is a high integration PC/AT ELAN 520 133 MHz board with 20VAX MIPS throughput (developed by SECO srl –Arezzo- Italy) and a full complement of standard PC interfaces including:

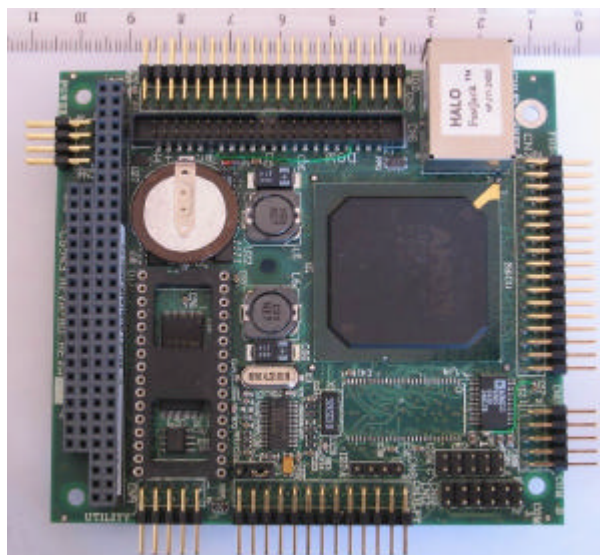
- 4 asynchronous serial ports
- 1 floppy disk drive port
- 1 IDE (hard disk drive) port
- 1 standard keyboard and PS/2 mouse port

The CPU board offers 32 Mbytes of DRAM and includes 512 Kbytes of Flash Memory to hold the BIOS and any eventual start-up code. Additional ROM or Flash EPROM (Disk On Chip) lot and Ethernet I/F are available.

A full EISA standard expansion bus is available through the PC-104 stackable interface.

The module works with a 5VDC power supply.

The mechanical dimensions of the CPU module are: 3.5" x 3.8" x 0.6" (90x96x15.2 mm).



Mass Memory Module



The FFD 250-IDE-1024 Solid State Flash Disk (developed by M-System) is a non-volatile mass memory storage (Flash EPROM) unit IDE interface compatible.

Two IDE devices can be connected to the relevant expansion bus. These read/write devices have capacities in the range of the Gbyte and offer very low power consumption and more than 1 million read/write cycles.

The capacity of the mounted memory is : 1024MB.

The FFD has an embedded Error Detection and error Correction Code (EDC/ECC) hardware and software mechanism. The FED EDC/ECC is based on the 48 bit Reed Solomon Algorithm.

The dimensions of the Mass memory are:

3.945"x 2.75"x 0.67" (100.20 x 69.85 x 17 mm).

I/O Serial and Analogic (PCM-A/D12) Module

To acquire the external telemetries status a high precision PCM-A/D-12 board has been added to the stack to provide:

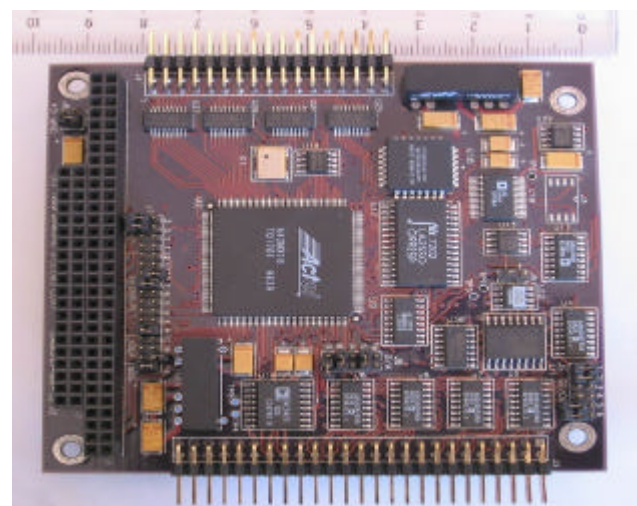
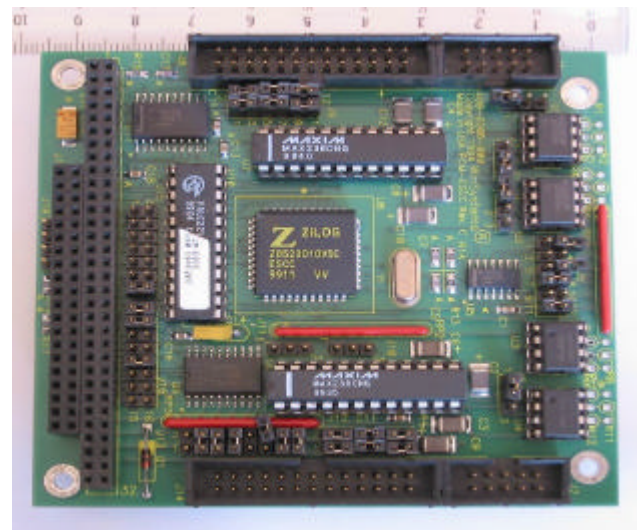
- 8 differential or 16 single-ended analogue input channels(12 bit of resolution) with programmable ranges and gains (typical -10V to + 10V dc)
- 2 single-ended analogue output channels (12 bit of resolution) with programmable ranges.
- A high precision voltage reference, temperature compensated.
- 8 input and 8 output bit programmable digital signals.
- 2 timer/counter for synchronisation purpose or frequency measurements.

Also this board offers polling, interrupt and full DMA capabilities.

The dimension of this card is:
3.6"x 3.8" x0.6" (92.16 x 97.28 x15.36 mm).

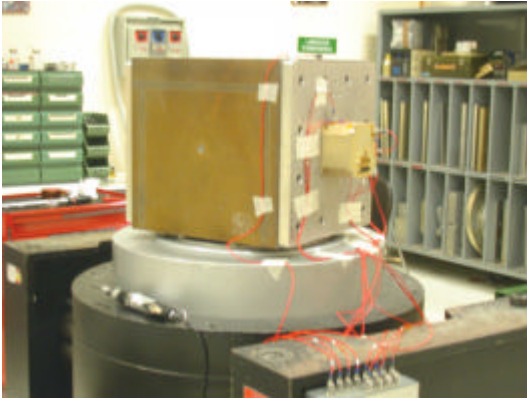
Standard Interface (PCM-SCC Data Communication) Module

To offer a valid alternative to the basic communication of the standard PC, a second board is added to the CPU board to provide two full-duplex high-speed independent serial channels.



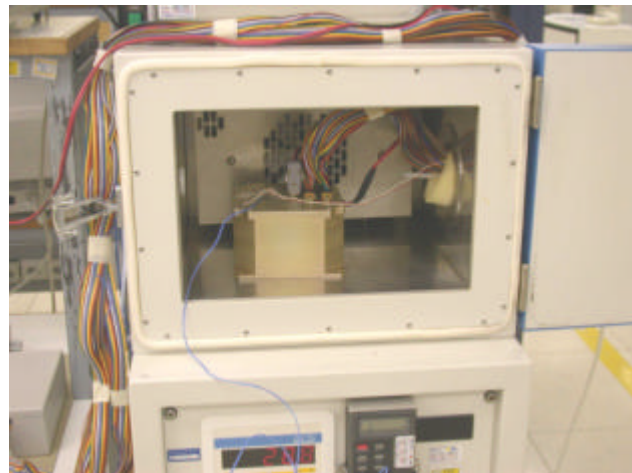
The two channels can be separately programmed for asynchronous or synchronous data links. In the latter case many character or bit oriented protocols are available, including SDL/HDLC. This board (manufactured by WINSYSTEM) offers polling, interrupt and full DMA capabilities.

Vibration Tests



The OBC equipment has been fully characterised and tested against the environmental and life requirements for the space applications: **Vibration, Thermal Cycles** (168hours/ 47 cycles from -20°C to +70°C) have been performed according to the applicable ECSS-E-10-03A standard. In addition a **Total Dose Radiation Test** has been performed [Rad tolerant up to 10 KRad].

Thermal Cycles



From the hardware viewpoint this computer system can be used with any standard PC/AT compatible operating system. To fully take advantage of the architecture and to improve the reliability of the application the IMT provides the system with a dedicated configuration of QNX version 6. QNX is a leading scalable, hard real time, micro-kernel based, multitasking operating system chosen for many mission critical applications throughout the world.

All applications SW are written in C++, compatibility with other low-level languages has tested the.

A complete demonstration unit is available for customer verification. A flight unit development would need about 20 weeks for delivery, depending on application software requirements.

OBC Specification

ELECTRICAL

Power Supply: + 5V,
 Power consumption: Less than 5.1Watt, as tested

Standard Interfaces:

Serial (COM): 4 serial asynchronous RS 232port based on 16 bit FIFO UARTS
 Some ports are re-configurable as RS-422 or RS-485
 Full availability of a TTY control console via these ports

Parallel (LPT): 1 bi-directional digital I/O, configurable as EPP/ECP or Centronics
 Single-bit SW controllable as generic discrete I/O for control application
 (8 bits In/Out, 5 bits In only, 4 bits Out only).
 Also usable as Floppy Disk port

Synchronous Serial: 2SCC port based on Z85230, capable up to 921 Kbps Mbps each.
 Full support for SDLC/HDLC and byte oriented protocols.
 Multiple enc/dec capabilities: Manchester, FM1, FM0 NRZ,NRZ1

Other: AT-101 Keyboard interface
 PS/2 type mouse port

Analogue I/F:

Analogue Inputs: 16 SE or DE inputs based on a 12 bit A7D resolution.
 Input range: Bipolar: $\pm 10V$, $\pm 5V$, $\pm 2.5V$, $\pm 1V$, $\pm 0.5V$, availability of one custom range.
 Maximum Input Voltage: $\pm 10V$ for linear operation
 Overvoltage protection: $\pm 35V$ on any analog input without damage.

Sampling Speed: 100,000samples/sec maximum (DMA operation) with various triggering option including external trigger.

Analog Outputs: 2 single-ended, based on a 12-bit D/A resolution.
 Output range: Unipolar, 0-5V, adjustable, or external reference input.
 Output current: $\pm 8mA$ max per channel (minimum output load 2K Ω).

Discrete I/F

Input Voltage :	Logic 0 = 0V min, 0.8V max	Logic 1= 2V min, 5V max
Input current :	$\pm 1 \mu A$ max. per line	
Output voltage:	Logic 0 = 0V min, 0.33V max	Logic 1= 3.8V min, 5V max
Output current :	$\pm 4mA$ max per line	

MECHANICAL

Dimensions: 100mm H, 130mm W, 130 mm D
 Material: Milled Aluminium
 Weight: Less than 0.7Kg
 Cooling: Conductive

ENVIRONMENTAL

Operating Temperature: $-20^{\circ}C \div +60^{\circ}C$
 Storage Temperature: $-20^{\circ}C \div +85^{\circ}C$
 Radiation: Rad tolerant up to 10Krad (Si) operating

LIFE

3 years for LEO applications (< 1000Km)

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