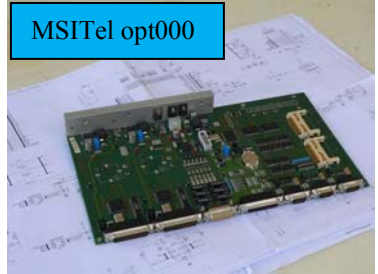
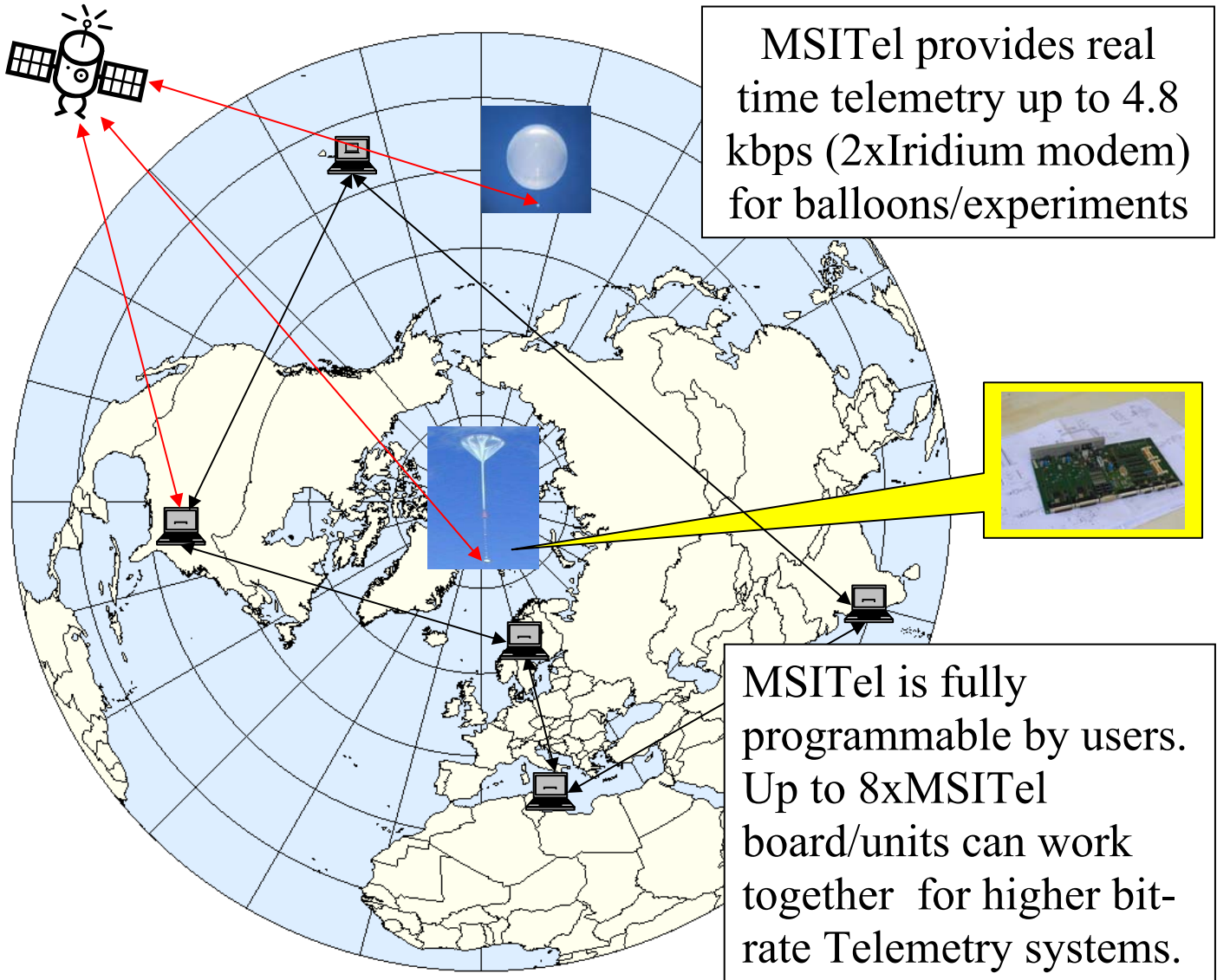


The MSITel module family

allows your ground console to be everywhere while balloon experiments run everywhere



MSITel has the following main features:

16043 Chiavari (Ge) - Via S.Andrea di Rovereto 33 CS – Codice Fiscale e Partita IVA 0101713.099.6
 Tel +39 0185 318444- Fax +39 0185 472835 email len@len.it <http://www.len.it>

- Management of two Iridium (or Hayes compatible) modem devices, that can set to operate either in *backup mode* (2400 bps) or in *split mode* (4800 bps)
- Management of the 2 integrated GPS units
- Polling of the external instrumentation both by direct user commands and by user-defined instructions (by macro-language). All communications are carried out through serial line connection (RS232 or RS485 standard)
- One 115 Kbps serial port, dedicated to scientific data, operating either in *burst mode* or *on-demand mode*
- Two serial channels, dedicated to housekeeping data from external instrumentation, operating in *on-demand mode*
- Data acquisition of the local I/O according to the macro-language instructions
- 6 digital outputs, reed relays buffered, max 0.5A
- 8 digital inputs (0-5 V)
- 6 digital output, buffered, max 100 mA @50V
- 2 analog outputs 10mA @6 V max
- 4 analog inputs, 5 V fr
- Storage of the acquired data into non-volatile support (Compact Flash)
- Sending of the acquired data, through the satellite line, to the Ground Station with a special protocol, according to the meta-language instructions (down-link telemetry).
- Execution of commands received by the Ground Station (up-link telemetry)
- Management of data to be addressed to other onboard (external) units
- Very low power consumption, 250 mA in standby mode @12V

The MSITel allows extended function customization according to user defined instruction (by meta-language scripts). More than one MSITel module, up to eight, can be used to have higher (up to 38400 bps) telemetry bit-rate by using an additional unit (available by LEN).

More technical details

All the data acquired by the unit, even if not transmitted according to priority rules (user defined), are stored in Compact Flash cards (up to 8 Gbytes). MSITel H_1.2 makes use of a *real-time clock*, synchronized with onboard GPS, to provide absolute timing for the data storage. This provides a safe time correlation for all stored events.

The connection with the (Iridium) modems (both the master and the back-up units) is provided by a 9-wire RS-232 serial line (hardware handshake). The power supply to each modem unit is provided separately. The bandwidth (bit-rate) can be doubled by using both the onboard modem units (*split mode*), simultaneously.

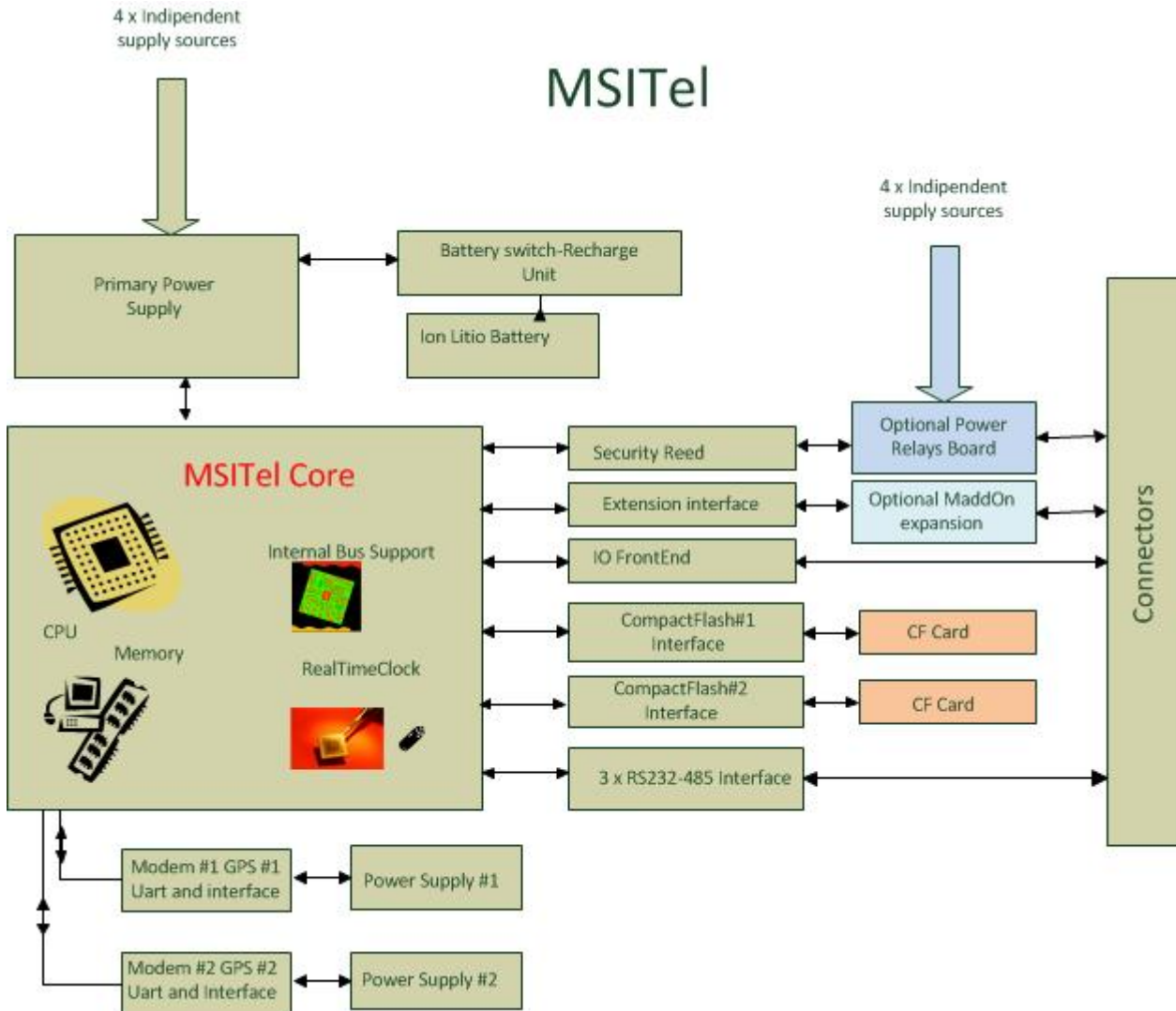
The MSITel board unit has also additional sensors for monitoring Power Supply Voltage, internal VDC and the unit actual temperature.

MSITel main specifications:

- Power Supply Voltage range: 9÷40VDC
- Operating Temperature range: -40°C to +60°C
- Operating pressure: tested from 1000 mBar down to ≤1mBar
- Unit size: 323mm x 189mm x 35mm (main-board); 410 mm x 315 mm x 155 mm (MSITel Opt-004)
- Weight: 3.4 kg (opt 001); 8.6 kg (opt 004, IP66 box which includes 2 x Iridium modem and backup LI-Ion batteries)
- MSITel is available in many versions: stand-alone and main-board (to be integrated into a cabinet unit with other control units). ***This feature allows users to build their own specific Telemetry system around MSITel.***

MSITel redundancy strategy

Many MSITel electronic sections are duplicated due to the lower MTTF (Mean Time To Failure) of their components; the redundant part ensure the correct MSITel working even in case of failures on the primary. The different sections (each box reported in the following figure) has completely independent hardware, meaning that they are not affected by the other sections eventually failure. The logical interface between MSITel parts are shown by arrows in the figure.

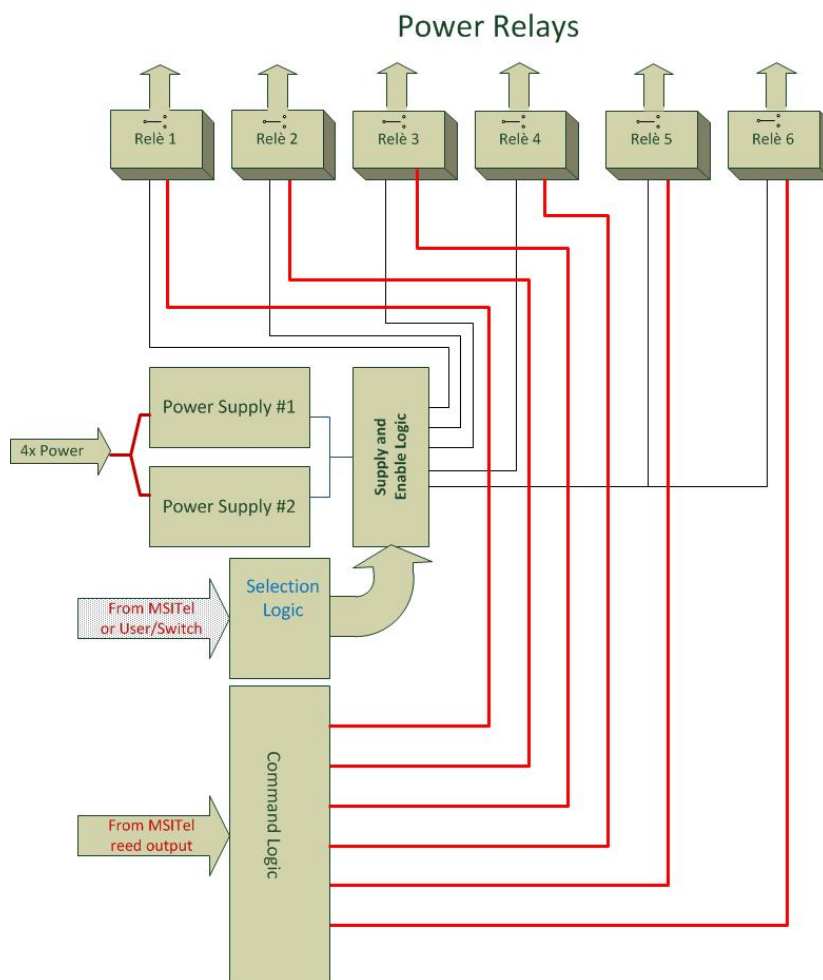


MSITel expansion RELAYS BOARD

MSITel foreseen an expansion relays board to make the REED able to drive up to 16 A (switch current). The board is directly connected to MSITel so that the relays are enabled by the same reed command (so maintaining their safety rules); the relays activation is performed by a power supply manager, which can use up to 4 different external power supply sources. For safety rule the relays can be activated in three different ways:

1. always active
2. from user command
3. from MSITel command

In figure is shown the schematic of the board.



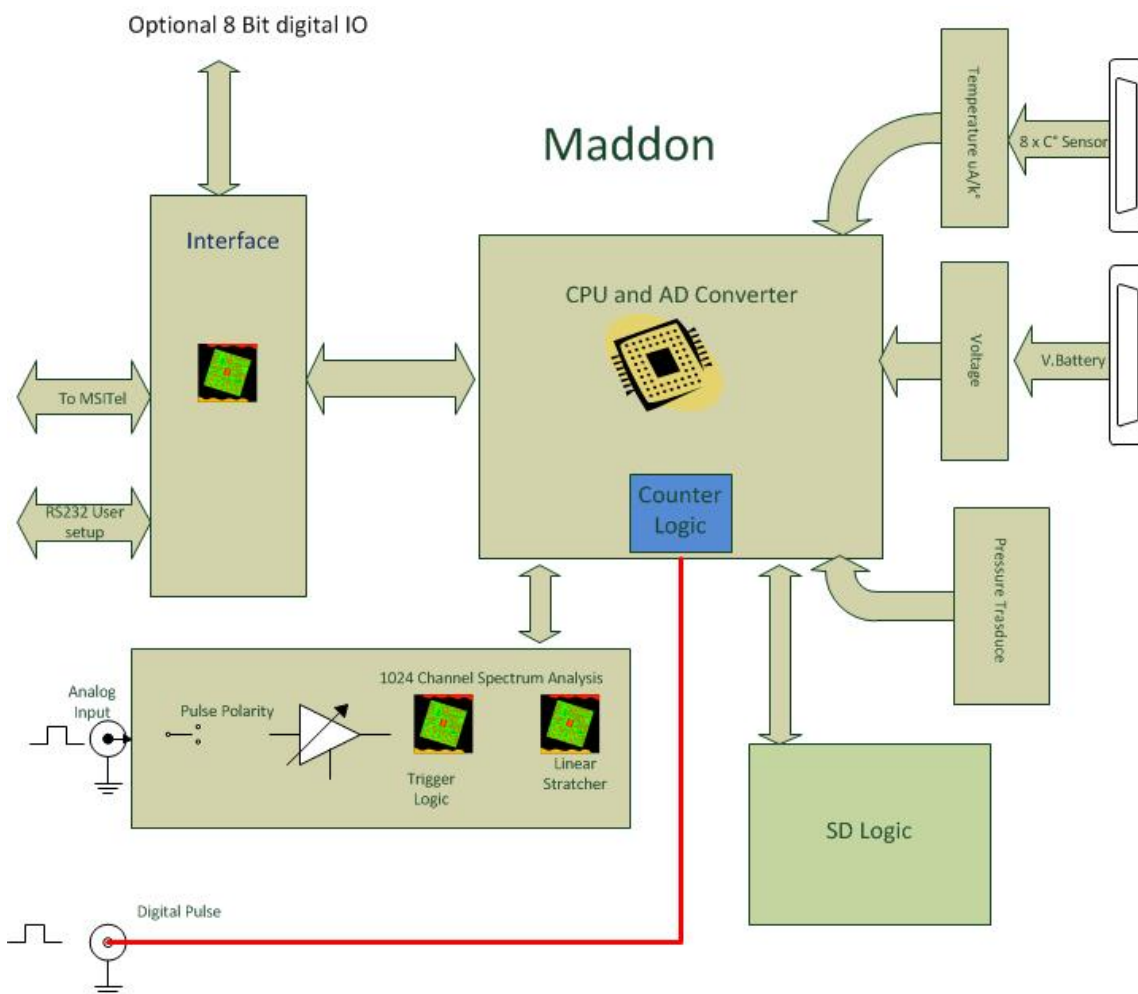
MSITel Add On (MaddOn)

MaddOn is an additional board which has to be put on the MSITel main board. MSITel and MaddOn communicate through a bus connector, so that MaddOn can send its internal data to the telemetry and so to ground.

As reported in figure MaddOn is able to:

- interface itself with MSITel or with a monitor PC by RS232 port
- measure its power supply voltage and board temperature
- measure up to 8 additional external temperature sensors
- measure the 4 voltages of the different MSITel power supplies
- measure the pressure in the range 1 mBar ÷ 1 Bar
- measure the rate of a TTL external pulse source
- measure the rate and make the energy spectrum of an analog external source (by a 1024 channel ADC)
- manage up to 8 additional digital IO
- store data on HCSD memory

MSITel is able to set and read MaddOn status, IO and Spectrum analysis, save on its CF and sending them to the ground station by an user-made MTL (Metalanguage) program or simply by sending telemetry up commands.



MSITel H_1.2 module S/W description

All the MSITel units are delivered together with complete documentation (user and technical manuals) and Ground Station s/w packages performing the following tasks:

- MSITel_Compiler: Parser, Compiler and CF image generator of Meta-language script
- MSITel_DCF: Decoder of data stored into CF during operations

- MSITel Link_Decoder: Software for connection to remote MSITel, decoder of real-time telemetry-down data, encoder of tele-commands for telemetry-up, LAN and Ethernet data sharing and data storage
- MSITelHK: decoder for housekeeping channel, LAN and Ethernet data sharing or local data
- MSITelScd: decoder for scientific channel, LAN and Ethernet data sharing or local data

If needed, the users can create their own Ground Station software and Quick-Look by following instructions into Technical Manuals. All the supplied software works on Windows® Operating System (Windows® 98 / 2000/ 2003 server /XP