ITALIAN AIR FORCE – METEOROLOGICAL SERVICE

RESMA

W.M.O.

Field Rainfall Intensity Intercomparison
ET/IOC SIIB-3 MEETING

"Little Goodwill Men for great projects"

DATA ACQUISITION SYSTEM

Vigna di Valle, 26.02 – 02.03.2007

Vuerich Emanuele

SUBJECTS

Measurement, acquisition and control system

- ✓ Data acquisition requirements and output data (RI, RA, TT)
- ✓ D.A. System characteristics
- ✓ … and sampling

ET is working with RESMA

REQUIREMENTS and OUTPUT DATA

According to questionnaires and available manuals of the selected instruments, an excel file was created by Site Manager to show specific data acquisition requirements (DA_tab.xls).
In particular, the summary of selected rain gauges outputs is:

tot=	*28*	*19*	*5*	*2*	*2*
tot=		RS485	TIP	RS232	PULSE/freq

DA_tab

- ✓ **The summary describes the complete configuration of the instruments output and meanwhile it defines the hardware requirements of the acquisition system**
- ✓ **Delay time RI [minutes] and Output cycle [seconds] for each rain gauge define the first approach to sampling strategy (best synchronization for one-minute RI values)**

REQUIREMENTS and OUTPUT DATA

- ✓ **"Parameters" columns of DA_tab.xls define the elementary characteristics of instruments data emission and the emitted parameters**

15	*22*	*2*	*0*
RI	RA	TT	OT

DA_tab

- ✓ **The real consistency of rain gauges outputs is shown**
- ✓ **Several instruments do not emit RI as output data for acquisition (only RA or TT)!**
- ✓ **Several instruments emits both RA and RI (both data in DA?)**
- ✓ **A <u>transfer function</u> (with or without corrections) should be applied to instruments output to receive intercomparison data RI mm/h**
- ✓ **<u>Participants should provide their transfer function for RI or to implement it inside own instruments output system.</u>**

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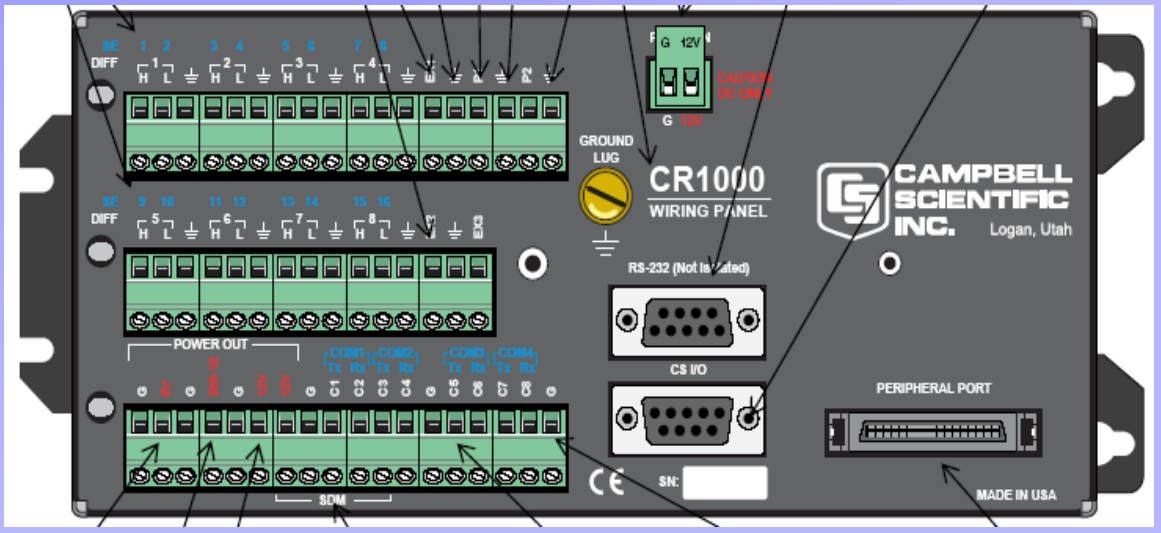
RESMA + ET + Family components During baloon lanch

DATA ACQUISITION CHARACTERISTICS

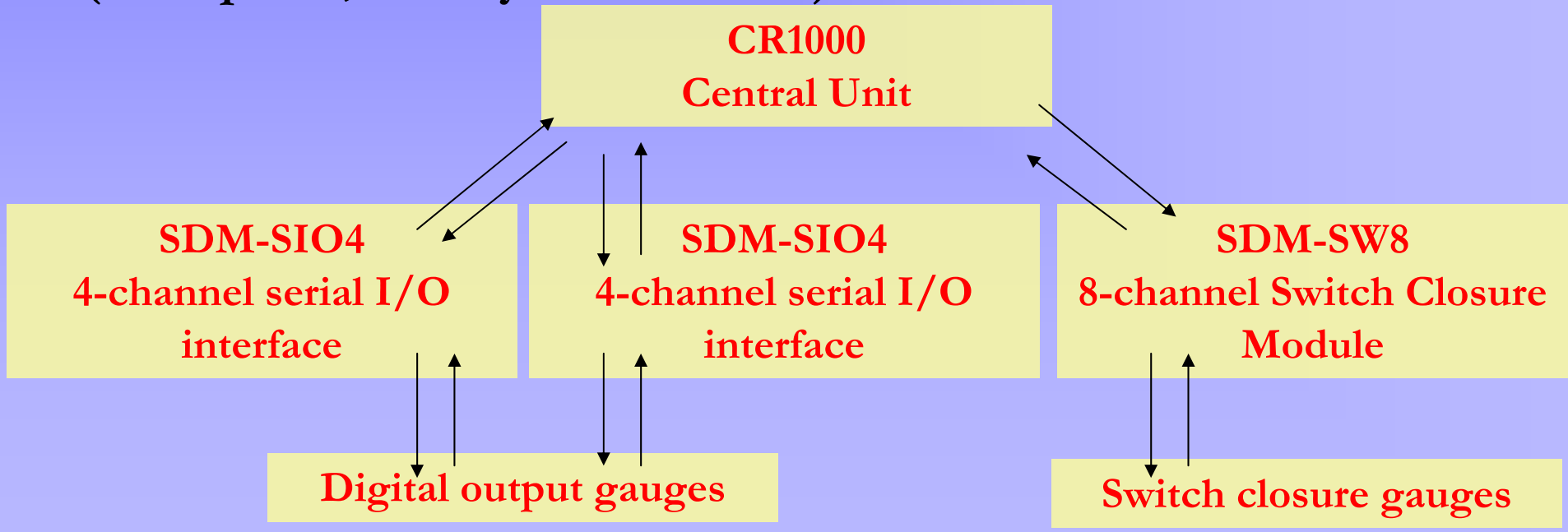
- ✓ According to previous general requirements and Field Intercomparison Operational Aspects (Geneva, Dec. 2005), a RESMA D.A. system for RI measurements has been designed
- ✓ It consists in a hierarchy dependent homogeneous architecture, composed of one main central acquisition unit (Measurements and Control system) and a subsystem of peripherals/modules with separately programmable ports which are able to acquire both analogue and digital signals from instruments.

CR1000
Central Unit
Campbell Scientific
(USA)



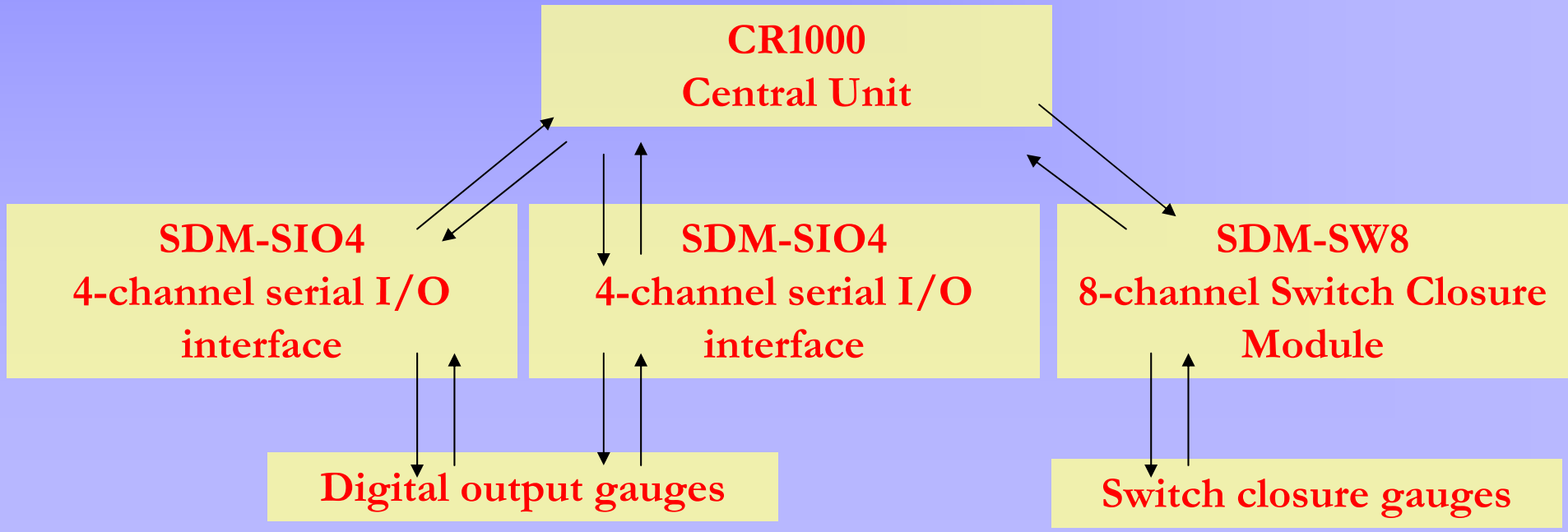
DATA ACQUISITION CHARACTERISTICS

- ✓ To satisfy data acquisition of the full set of instruments, the minimum configuration is composed by 1 peripheral for switch closure/tips and 7 peripherals for RS485/232; pulse/frequency signals (2 of them) directly acquired by the central unit
- ✓ Modules are directly connected to instruments (not interrupted cables). The main unit and peripherals have a triple power supply (solar panel, battery and 220VAC).



DATA ACQUISITION CHARACTERISTICS

- ✓ Peripherals and central unit are connected by a fast cable BUS with "deisy chain" (suggested 37,6 baud).
- ✓ The suggested communication speed between instruments and peripherals is 9,6 baud (at this speed, with high quality cables, RS232 signals are not degraded for long distances > 15 metres)
- ✓ This hierarchy separates the data acquisition steps



DATA ACQUISITION CHARACTERISTICS

CR 1000 relevant characteristics

- ✓ **The CR1000 provides precision measurement capabilities in a rugged, battery-operated package**
- ✓ **Programmable with a CRBasic Program Editor**
- ✓ **Packbus network communication protocol**
- ✓ **Data storage, internal 2MB SDRAM**
- ✓ **Ethernet interface with flash memory slot to communicate with Pc and others CR1000**
- ✓ **Digital I/O ports (software selectable) for SDM (high-speed data exchange mechanism)**
- ✓ **Polling modules execution rate: 10ms to 30 min**
- ✓ **Environment resistant: -25°C to +50°C**

CR1000
Central Unit

DATA ACQUISITION CHARACTERISTICS

SDM-SIO4 channel digital I/O interface relevant characteristics

- ✓ **4 configurable serial RS232 ports which allow it to be connected to intelligent serial sensors, display boards, printers or satellite links.**
- ✓ **This device is designed to send data to and receive data from the sensors, and process it in parallel with the datalogger's own program sequence, thus making the complete datalogging system faster and more efficient.**
- ✓ **It can handle the incoming and outgoing data in many different ways. Combinations of data sent from the datalogger and pre-stored strings can be sent, allowing complex formatted data to be sent. For input, the SDM-SIO4 can transfer data in the same form as received from a sensor to the datalogger, or it can be programmed to filter out critical data from a sensor and only pass back the data the datalogger requires.**
- ✓ **It works on the concept of input filters (RX,TX completely programmable)**
- ✓ **Errors detection with CRC (cyclic redundant checksum)**

SDM-SIO4
4-channel serial I/O interface

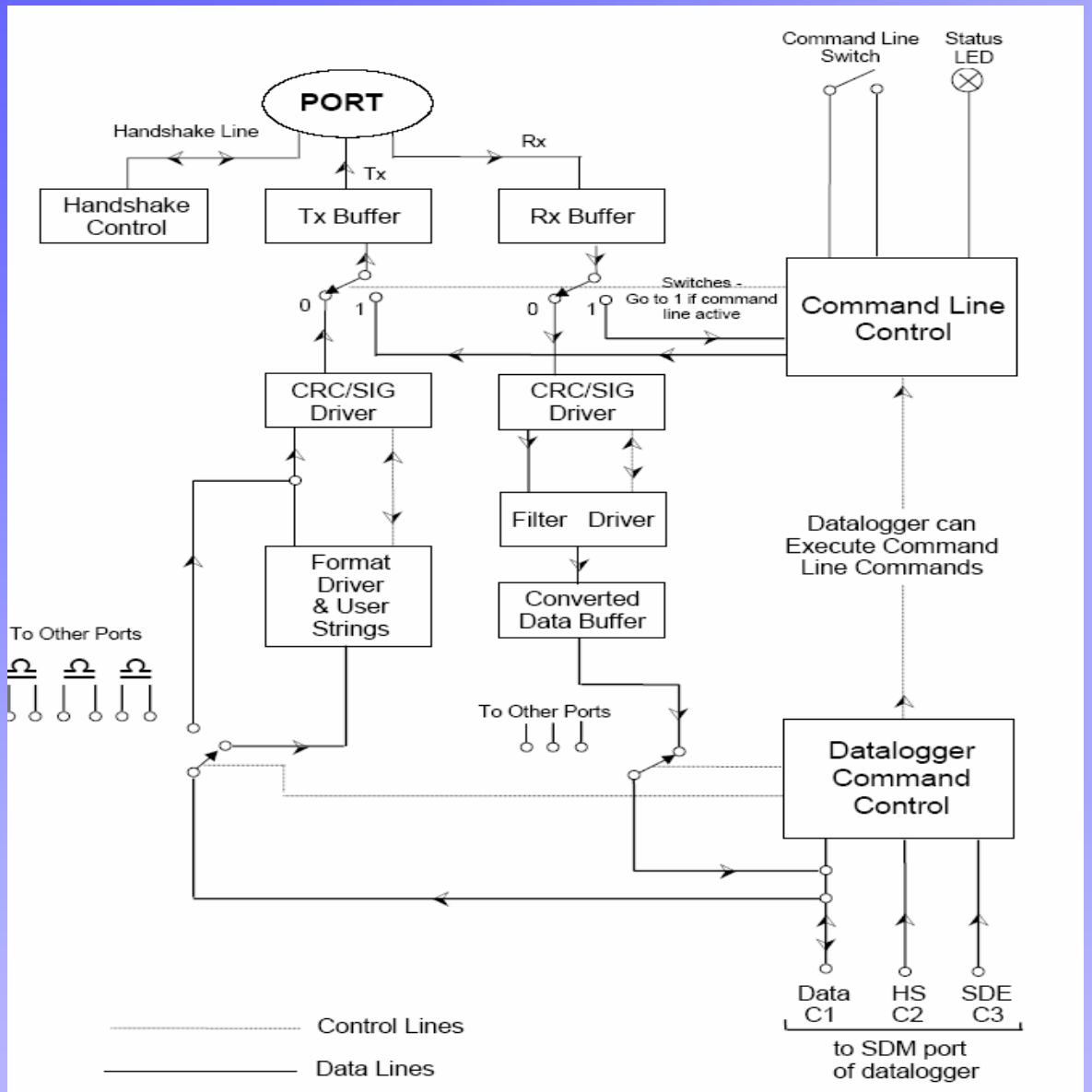


Figure 1 Schematic Diagram of the SDM-SIO4

SDM-SIO4
4-channel serial I/O interface
FLOW CHART

DATA ACQUISITION CHARACTERISTICS

SDM-SW8 channel switch closure module relevant characteristics

- ✓ The 8 channel SDM-SW8A Switch Closure Input Module measures up to 8 channels of switch closure or voltage pulse inputs.
- ✓ Each channel may be configured to read single-pole double-throw (SPDT) switch closure, single-pole single-throw (SPST) switch closure, or voltage pulse.
- ✓ Output options include counts, duty cycle, and state
- ✓ Sampling frequency 500HZ (2ms)
- ✓ Max input frequency = 100HZ (50% duty cycle)
- ✓ Each channel has an accumulator for counts and duty cycles
- ✓ Counts accumulator resets when exceeds 65535
- ✓ Duty Accumulator resets every 131s (2ms*65535)= 2 min
- ✓ Count accumulator time resetting depends on input frequency: Tsampling=65535/f
- ✓ "Watchdog" reset of processor in occasional failures

SDM-SW8
8-channel Switch Closure Module