INGENIERIA
ELECTRONICA, MICROPROCESADORES, ENERGIA
T. DE LOQUI 58 - 9400 RIO GALLEGOS

CL2bm1 Atmel AVR CPU board: main features and combination with M4/E peripheral expansion

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1. Introduction: CL2bm1 board is an evolutionary step from previous data-logging design (DLCy - based on the PSoC 1 architecture), seeking to meet requirements of greater data storage capacity using flash memory SD cards. This CPU board is based on 8-bit AVR controllers and the socket can be fitted with AtMega32 to ATMega1284P controllers in DIP40 formats, with up to 128KB of Flash. These boards have been used in rigorous climate, isolated systems applications for oil-industry and testing systems since october 2010, with very good results. Figure 1 shows a block diagram of the board.

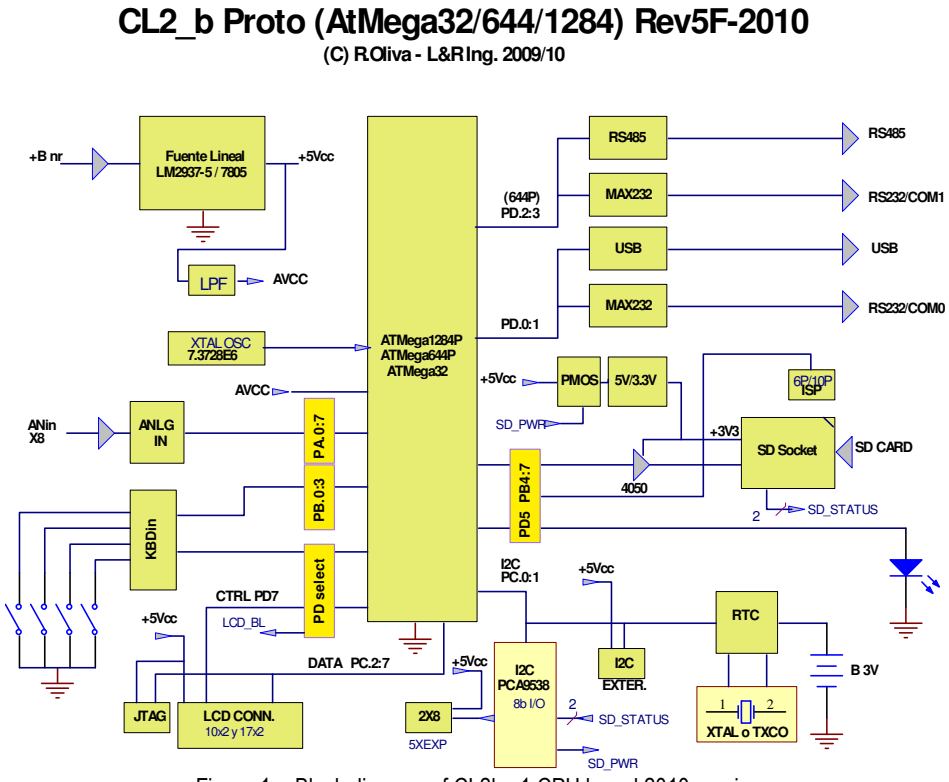


Figure 1 - Block diagram of CL2bm1 CPU board 2010 version

Current systems use mostly the ATMega1284P controller, with 128 KB of Flash, 16 KB of RAM, 2 KB of EEPROM and two serial ports, running at 14.4 MHz. Main components are:

a) Power supply with LDO regulators for +5 y 3.3V, up to 16V input (8-12V recommended).

b) Analog inputs for onboard 10-bit ADC

c) 4 contact membrane keyboard interface

d) Character LCD interface.
e) I2C expansion port and PCF8563 Real Time Clock with TXCO.
f) SD card interface
g) Serial RS232, RS485 and socketed USB module (FT232).
h) I2C PCA9538 I/O port

I2C bus communications are used to communicate with an auxiliary board based on PSoC-1 family of microcontrollers.This board also offers an I/O interface for the PCA9538 device.

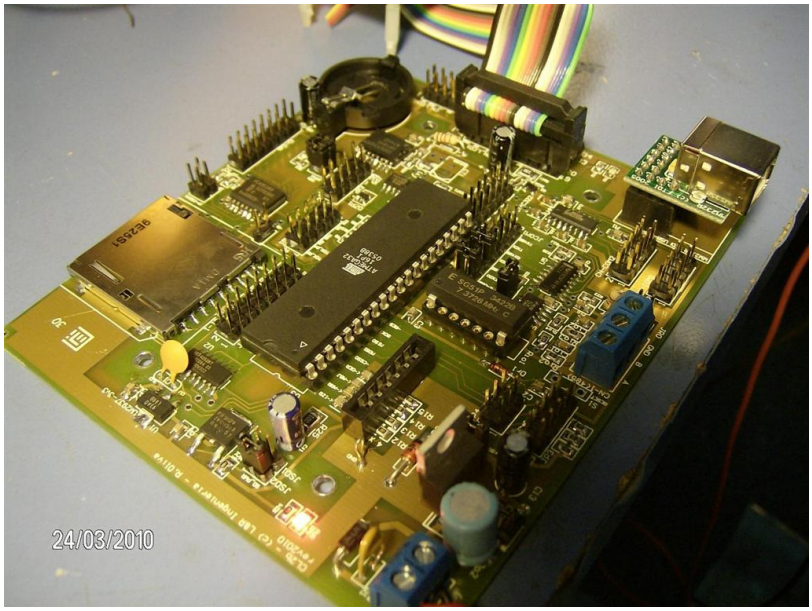
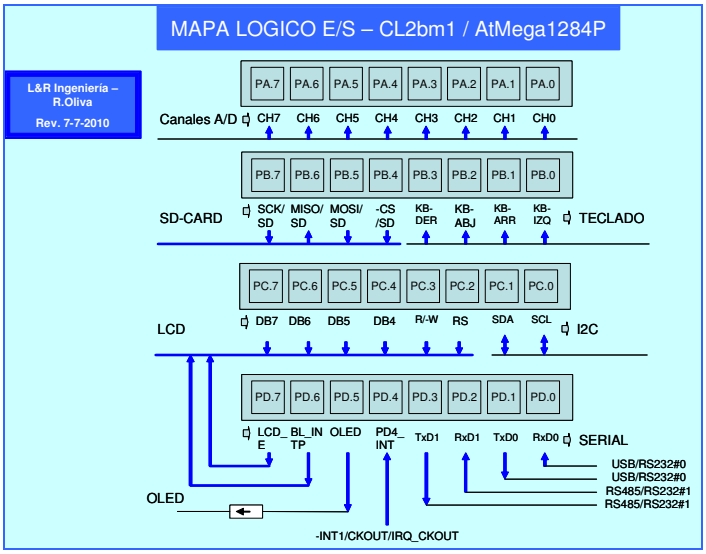


Figure 2 - CL2bm1 – board assembly

2. Programming: The ATMega1284P controller on CL2bm1 can be programmed in C using compatible cross-compilers, typically CodevisionAVR from HPInfoTech [HPI,2012] , or AVR Studio 6 from Atmel. Programs are compiled on a standard PC and downloaded to the board via a 6 pin ISP connector, using the low cost USB ATAVRISP2 interface from Atmel. Field upgrades and EEPROM saving are straightforward.

Programming interface is as shown on Figure 3 (left). ADC channels are general purpuse 10-bit resolution, if greater resolution is required 3 13-bit ADC inputs are available on the M4/E. The serial COM0 port can be routed to the FT232/USB module or towards the half DS14C232 interface, COM1 can be routed to the other DS14C232 half or to an RS485 (DS3695) interface with optional hardware Driver Enable circuit.



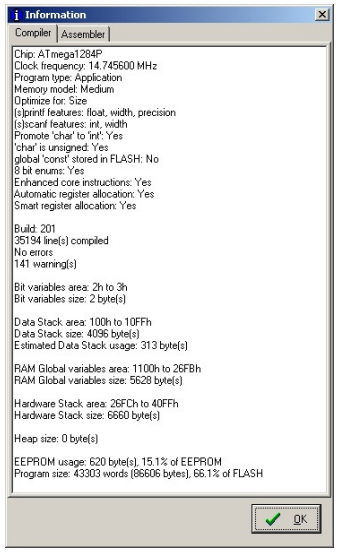


Figura 3 I/O logic from the CL2bm1 board, and compiler output of C CodevisionAVR from HPInfotech

Although most applications are interrupt-based and use no underlying operating system, it is technically viable to use FreeRTOS on ATMega1284P with a very small footprint.

3. Aplications: A number of these boards have been used since end of 2010 in isolated systems in oil industry (Figure 4), to control hybrid wind/PV power systems for chemical dosification pumps in oil wells.

Figura 4 CL2bm1 (left) in hybrid system for oil industry – Paraje Boleadoras/Campo Indio (Santa Cruz)

Others have been used for small wind turbine testing and certification, withing systems known as PWRC2. These use a CL2bm1 board, coupled to a TRIADC simultaneous 13bit-ADC module on the M4/E board to sample DC voltage and current. These systems also sample wind intensity, direction, temperature and barometric pressure, to statistically generate a small wind turbine power curve under IEC 61400-12-1 (2005) Annex H. An external METEO module, based on PSoC 1 communicates via RS485 with the CL2bm1 board.

On Figure 5 recently installed PWRC2 systems for the Small Wind Testing facility from INTI (National Industrial Technology Institute) in Cutral-Có / Neuquén, Argentina. Power supply is from a 24V DC UPS, a series of LM2576 modules bring down the voltage to 10.5V to supply the CL2bm1, M4E, sensor and external METEO module (Figure 6). An external Secondwind Nomad2 reference station is supplied with 14.4V from the same UPS.

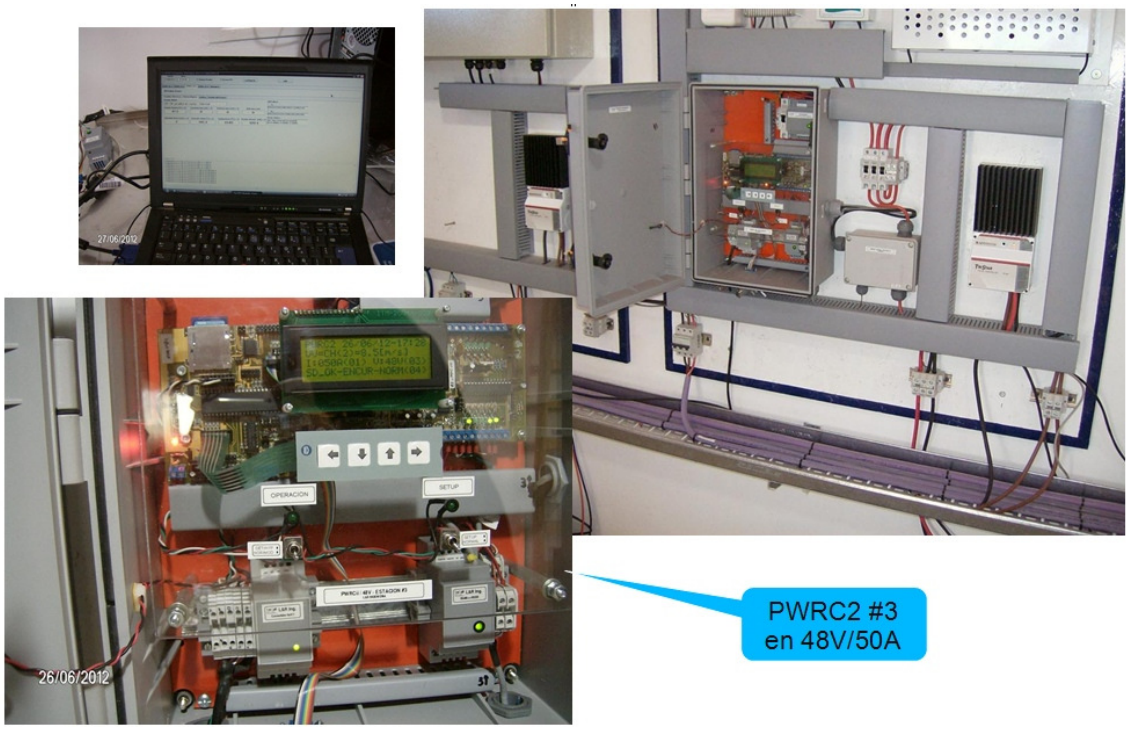


Figure 5: PWRC2 testing systems based on CL2bm1 and M4/E boards at INTI Testing facility in Cutral-Có Neuquén. Top left - SCADA access using Modbus from each CL2bm1.

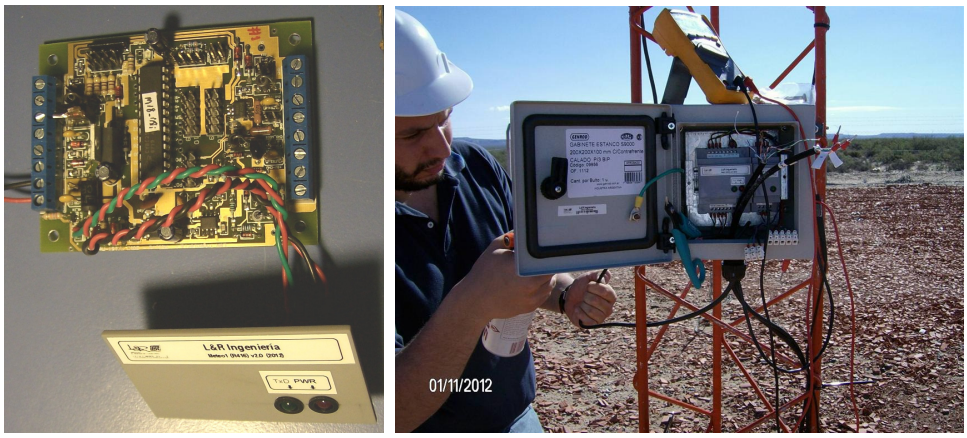


Figura 6: METEO v1.1 (2012) and installation at INTI Cutral-Có

4. Peripheral board *M4/E* with I/O using PSoC 1 as an I2C slave: M4/E is used for analog and digital I/O with over-voltage protection. in communication with the main CL2bm1, based on Cypress PSoC I 29466 controllers working as I2C-slaves. Typical installation is shown coupled to CL2bm1 (Figure 9), its block diagram appears in Figure 7, and programming model in Figure 8.

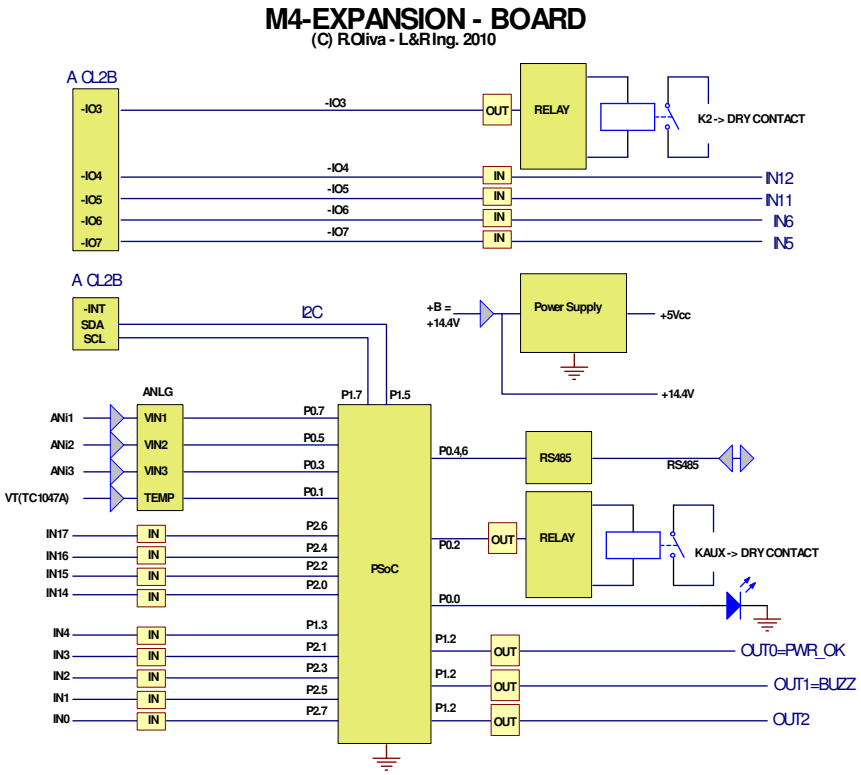


Figure 7: M4/E block diagram, I2C connected auxiliary board for CL2bm1.

5. References:

[HPI,2012] HP InfoTech S.R.L. http://www.hpinfotech.ro/

[Oliva y Cortez, 2011] Oliva, R. y Cortez, N. "Aspectos de implementación en una interfaz I2C para controladores PSoC y AVR" II Congreso de Microelectrónica Aplicada 2011, F.I. UNLP, 7 al 9 de setiembre de 2011, pp. 84, ISBN 978-950-34-0749-3.

[PSoC 1, 2011] Cypress PSoC 1 architecture http://www.cypress.com/psoc/

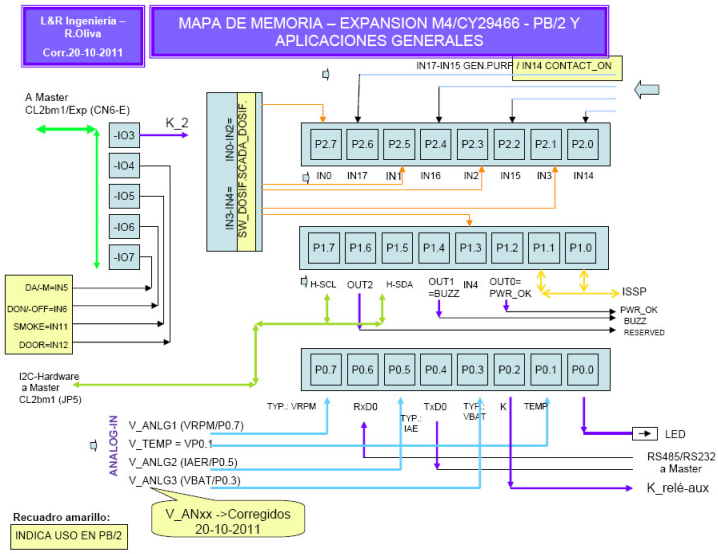


Figure8 : Logic I/O model for M4/E

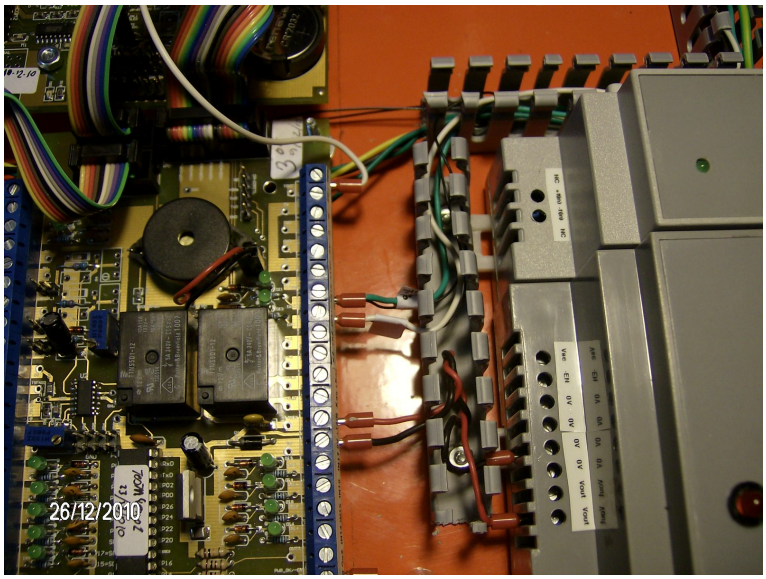


Figure 9 - M4/E board coupled to a CL2bm1 with I2C.