

## Four channel Tesla Meter Interface with CAMAC using Micro Controller

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### Introduction

Electromagnets are used to bend and focus the ion beams in particle accelerators and magnetic spectrometers. For accurate setting of the magnetic field, it is necessary to read the field values and set the current accordingly. Commercially available Tesla meter such as DTM-151( Group 3 Model) offer accurate high resolution measurement of magnetic flux density with direct digital display. Though they offer RS-232 communication for remote readout, it is not very convenient to incorporate multiple devices into existing CAMAC based accelerator control system. We have developed a single width four channel CAMAC module which can be used to read four Tesla meters and incorporate the magnetic field values into existing control system pages.

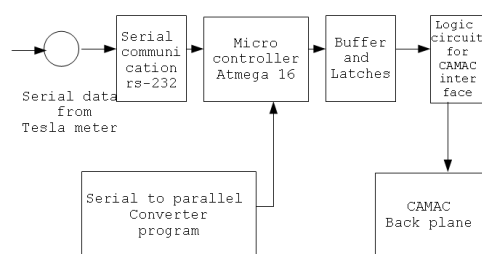
### Circuit Description

The block diagram of the CAMAC module is shown in Fig.1. This single width module is designed to receive the the serial output from the Tesla Meter and send the readings to the CAMAC back plane. Four such Tesla meters can be readout using one module. We have used DTM-151. These Tesla meters measures the magnetic fields up to 3 Tesla with polarity indication and resolution up to 1 part in 600,000.

### Block Diagram of the Module

In this block diagram it shows for one channel in this Module from four channels.

Fig. 1



The module uses At mega 16 Micro controller as an interface between the Tesla meter serial output and the CAMAC parallel Back plane. The micro controller supports RS232 communications and communicates with outside devices through four ports. It supports Universal Synchronous and Asynchronous Serial Receiver and Transmitter at the baud rates of 9600 bps to 57.6 kbps.

### Programming Technique

The Tesla Meter's role is to act as a listener when it receive the commands from the Micro controller and transmit the field values. The Atmega16 micro controller is programmed in C language to send the commands to Tesla meter. The Tesla meter transmit the field readings on the bus as serial data format and the Micro controller receives them through the Rx D , Tx D pins.

The DIP switch positions inside the Tesla meter board decides the baud rate set to receive

the serial data. To match the signals from the back plane of Tesla meter to the CAMAC module front panel, an adapter has been wired. Micro controller take the serial format, the program which is running inside convert the serial data into the parallel data as a binary format and latches into the 16 bit registers. At mega micro controllers are programmed using gnu - gcc compilers.

This board contains integrated devices to convert the RS-232 signals to other compatible signals for logic circuits. CAMAC interfacing logic unit and latches and buffers for four Tesla meters are assembled in one single board. The module has four RS232 connectors on the front panel which are connected to the Four Tesla meters. The data can be read by using the CAMAC commands F0.A(i) (i= 0 to 3 corresponding to four channels). Fig.3 shows the photograph of the module.

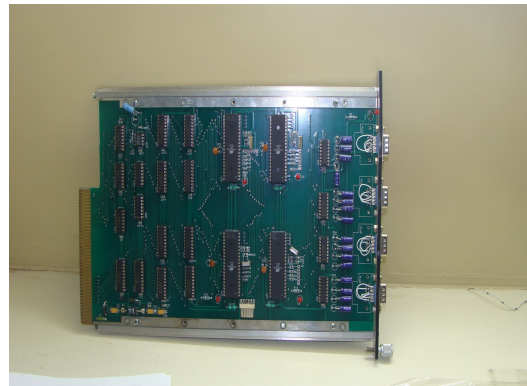


Fig.3

The module has been tested and incorporated into the existing control system for the accelerator and the spectrometer magnets at IUAC. Fig. 2 shows the module readout of the Analyser magnetic field plotted against the power supply current.

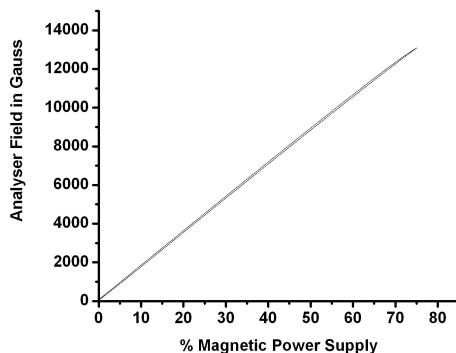


Fig.2

### Specifications

Range : Measures magnetic fields over four ranges up to 3 Tesla or in Gauss range.

Resolution: 1 part in 600,000.

Interfacing option : Rs -232

Polarity : Depends upon field direction

### Acknowledgment

We would like to acknowledge Mr. Kundan for his help in the implementation of this project. Help from Mr. Sunil and Mr Subir during the testing of the module is also acknowledged.

### Conclusion

A four channel CAMAC module for interfacing the Tesla meter has been developed. The module uses Atmega16 micro controller for data conversion and bus interfacing. Using the CAMAC module, the reading of the magnetic field values are integrated into existing control system.

### References

- [1] Atmel AVR micro controller instruction set Manual.
- [2] DTM-151 Digital Tesla Meter User's Manual .