

# THE DESIGN FOR PRESETTING DATA AUTOMATICALLY IN HIRFL POWER SUPPLY CONTROL SYSTEM

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## Abstract

This article introduces the structure of power supply in HIRFL(Heavy Ion Research Facility in Lanzhou) and designs a program which can preset power supply data (Power supply values) automatically. We use Labview which is produced by NI Corporation to read data from Excel, access the Oracle database and send the generated instructions to power supply controllers[1]. This program brings great convenience to physicists. It is used in SSC(Separated Sector Cyclotron) power supply system. The result shows that we can preset data quickly and accurately.

## INTRODUCTION

Heavy Ion Research Facility in Lanzhou (HIRFL) is for the basic research on nuclear physics, irradiative material and biology[2]. The power supply control system plays a significant role in the whole control system. There are two types of controllers to control the power supply. The first type is based on MSC1210 chip which is produced by Texas Instruments, another is based on ATmega128 chip which is produced by Atmel[3][4]. We use gateway to connect Ethernet and MSC1210 controller. The function of the gateway is to convert network signals into serial port signals. The structure of power supply control system is shown in Figure 1. It is inconvenient to preset needed power supply values artificially because the quality of power supplies is very large as well as different beam sources need different power supply values. In this article, we design a program to preset power supply values automatically.

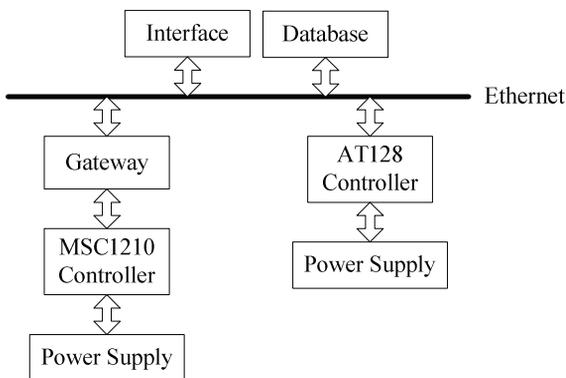


Figure 1: The structure of PS control system.

## GENERAL DESCRIPTIONS

This part includes five sections and each section is introduced in detail as following. The flow diagram of the whole design is shown in Figure 2.

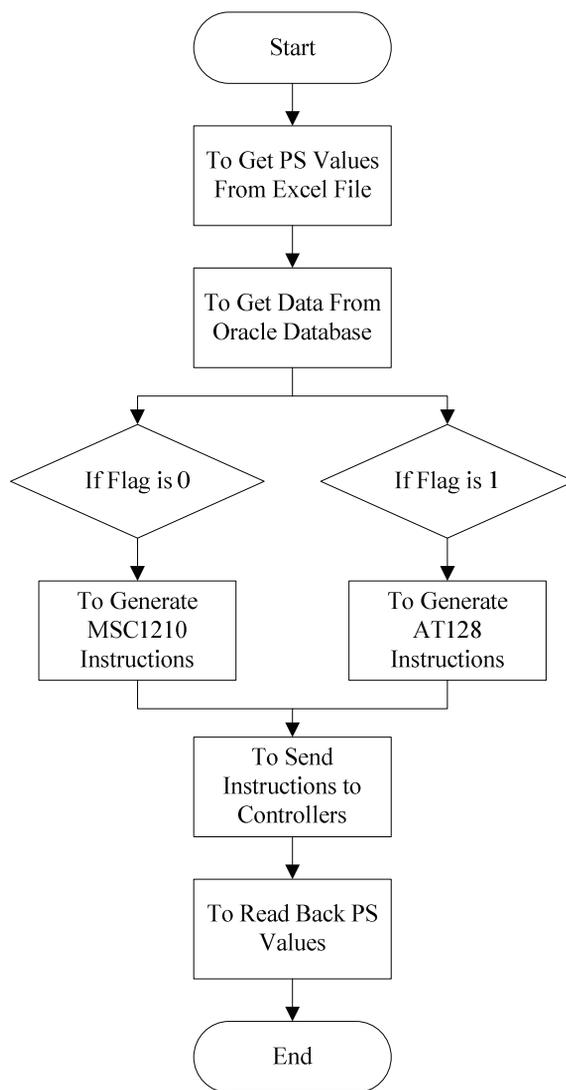


Figure 2: The flow diagram of the design.

## To Get Power Supply Names and Values

The data which contain the names and the preset values of power supplies are stored in Excel file. The first column is power supply names and the second column is the preset value. The DDE Open Conversation.vi is used to establish a connection between Labview and Excel file. In this VI, service must be 'Excel' and topic must be the name of the Excel file. The DDE Request.vi is used to get data from the first column and the second column of Excel file. At last, the connection must be closed using DDE Close Conversation.vi. These three VIs are shown in Figure 3.



Figure 3. VIs used to read data from Excel.

### To Access Oracle Database

The name of power supply is unique in Oracle database. We can acquire IP address, the value of DAC and ADC, the executive speed, the DAC channel and the flag bit through the power supply name. The DB Tools Open Connection.vi is used to open a database connection, in which username and password must be correct. The SQL language is used to search the table which contains the detail information of power supplies. Here is an example of SQL language.

```
SELECT *
FROM (Table name)
WHERE Column name='PS name'
```

The DB Tools Fetch Element Data.vi is used to fetch the data which are mentioned above. These VIs are shown in figure 4.

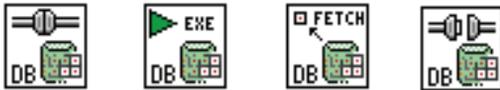


Figure 4: VIs used to access Oracle

### To Generate Executable Instructions

The flag of controller based on MSC1210 is 0 and another is 1. The executable instructions are different between MSC1210 and AT128. We need to generate two kinds of different instructions for both controllers. The output of AT128 is  $-10\text{v}\sim+10\text{v}$  but MSC1210 is  $0\sim+5\text{v}$ , both of the corresponding number is  $0\sim65535$ . If the flag bit is 0, the instruction which MSC1210 can executed is generated. For example, the instruction is 'FF1j1132767,-1,20EE', in which 'FF' is the header and 'EE' is the end. The first '1' stands for equipment number. The letter 'j' means setting voltage value. The second '1' means writing and the third '1' stands for multichannel. The number '32767' is the setting voltage value. The fourth '1' is the DAC channel number. The number '20' is frequency word of DAC. If the flag bit is 1, AT128 executable instruction is generated. The example of AT128 instruction is 'FFW132767EE'. 'FF' and 'EE' also mean the header and the end of the instruction. 'W' stands for 'Writing' and '1' is the number of DAC channel. The number '32767' also is the setting voltage value.

### To Send Generated Instructions

Once the instructions are generated, we should send them to corresponding controllers. TCP Open Connection.vi is used to open a TCP network connection with the address and remote port or service name. In this program, IP address is fetched from database and port number is the last number of IP address. TCP Write.vi is used to send instructions. We must use TCP Close

Connection.vi to close a TCP connection. These VIs are shown in Figure 5.

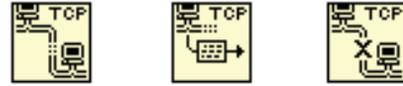


Figure 5: VIs used to connect with TCP network

### To Read Back Power Supply Value

The data which return from two types of controllers are different. The controller based on AT128 returns data automatically but MSC1210 doesn't. We should send an reading instruction to MSC1210. The form of reading instruction for MSC1210 is 'FF1h20EE', in which the first number '1' is the equipment number and the letter 'h' means reading voltage value from a single channel. The number '2' means reading and '0' means single channel. 'FF' and 'EE' are the header and the end of the instruction. The return data must be converted to the real value of power supply.

If we get the real value of power supply, we compare it with the preset value and work out at the absolute error and its percentage. We save the names of power supplies, the preset value, the real value of power supply, the absolute error and its percentage in another Excel file.

## CONCLUSION

The design is based on Labview, which is a powerful software and can communicate with Excel file, oracle database and TCP network easily. We firstly get the power supply names and values from Excel, then generate the executable instructions, connect with the two kinds of controllers and send the instructions to them. At last, we compare the preset values with the real values of the power supplies. We use the program to preset SSC power supplies and it saves many times to physicists.

## REFERENCES

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- [3] Xixiang Jiao, Lan Jing, Kewei Gu, etc, "Design of Digital Power Supply Control System Applied in Sector Focusing Cyclotron", HIGH POWER LASER AND PARTICLE BEAMS, Vol. 22(9), 2010.9, P(2155-2159).