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Abstract

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Abstract

Companies are constantly seeking to implement continuous improvements in all sectors, seeking to build a relationship of reliability with their customers by improving the quality of their products. Given this scenario, this study aims to apply the power increase of a power supply to optimize a process. The implementation was made in a company of the industrial center of Manaus-AM. The proposal presented in this paper, points implementation of maintenance improvements, adaptation in the power supply and cost reduction.

Keywords: electric power; improvement; cost reduction.

Introduction

All electronic circuits need electrical power to function. However, this power is not always available in the form required for the electronic circuit, whether in a power outlet or even in a battery, most often operated with low continuous voltages [1].

Power supply is widely used because of its simplicity and cost. It features fast response, load and power variation used in various applications. It is abbreviated by the acronym PSU (Power Supply Unit), which

supplies the equipment with the required electrical voltage, having several output voltage values, INPUT (Voltage Input): 110/220 V and OUTPUT (Voltage Output): +3, 3 V, + 5.0 V, + 12 V, -5 V and -12 V. PSUs convert the utility's alternating input voltage (AC) to continuous voltages used by the electronics [2]. With this perspective, we will analyze the operation and the possibility of applying a change of load elevation, maintaining the same functionality that meets the needs and important factors such as practicality of maintenance and economy, aiming at reducing the cost of material purchase. In this case, it is evident that an adjustment can be made using the material in stock, taking into consideration the analysis and study of the change in the laboratory, where we will use digital multimeter to calibrate the desired stresses.

According to [3], most electrical and electronic circuits have inductive and capacitive loads that in the alternating voltage system inject and store energy in the grid, operating as reactive equipment that does not behave according to voltage. This device has the ability to supply and absorb electrical power.

However, the work presented is a power conversion to voltage PSU project, with adjustable output from 0 V to 12 V with the objective of transforming a power supply from 400 W to 600 W, resulting in a maximum output power at 1200 W module operation. After conversion, the PSU must work in parallel with another PSU to achieve the required power in the operation of the equipment. Converter types can be classified according to variable type (AC or DC) and the stage number can enable efficient conversion [4].

In general, electronics are present in various environments such as: homes, businesses and industries. Power supplies include converting alternating current to direct current, such as alternative energy processing, power amplifiers, household appliances, robotics, drive systems for electric and hybrid vehicles, as well as many other applications [5].

Thus, the number of PSUs used per module was reduced from 3 to 2, hoping that the results will be satisfactory to ensure efficiency in technical handling, facilitating the reading and interpretation of results, and the technical team can perform the work with ease. guarantee in the environment and enabling application in other process machines.

Theoretical Referential

The importance of electronics in the development of our society is evident, the prediction of important technological advances that will continue to influence the coming decades. Both today and in the future, any professional who wants to use, understand and modify the world we live in will need a thorough knowledge of the operational and scientific foundations of our modern technology. It is therefore necessary for today's student to be familiar with the wide variety of experimental techniques in order to learn how to buy and use these new technologies efficiently [6].

From the point of view of [6], it is necessary to learn how to design and build equipment that is not commercially produced, becomes indispensable for innovative scientific work. Today's existing methodologies and technology are changing from innovative to obsolete. An active professional has a hard time catching up with, and of course only those with good basic education can succeed in the long run. Assessments of the magnitude of physical phenomena require that they be made accurately and increasingly accurate due to modern technology.

According to [7], it is extremely relevant to read the instruction manual accurately before using any device. It is through this information contained in the manual that we get the correct information, what conditions the equipment can or cannot measure. Follow manufacturer's recommendations for calibration / calibration on measuring equipment constantly for use. In energized circuits care must be taken not to short circuit.
The largest PSU of heat generated in electronic components is semiconductor material. They are designed with encapsulations to withstand this heat, but have difficulty transferring this heat to the environment due to their limited capacity. Depending on its mode of operation heat is not uniformly generated in the semiconductor, it is produced by the current flowing in the component and transferring it to the environment before the temperature rises above its maximum limit [8].

1.1. Measuring instrument

The purpose in solving electrical measurement problems is the evaluation and the multimeter, being the main work tool of the technician in the areas involving electrical and electronic. In the analysis and calibration of the PSU voltages, this instrument helps to identify the root cause of the electrical circuit defects, obtaining data for analysis in order to conclude on the errors, making the necessary calibration according to the informed specification [9].

1.2. Structured Single Plug Tester (ASPT) Testing Machine

According to the ASPT 21797-01 [10] machine user manual, the system is controlled by a manager called Rackpc, a type of coupled industrial computer where it controls four modules that make up the machine. External connections are: a barcode reader, connected to the keyboard port of the PC and used to enter and send information, and a keyboard connection.

1.3. Chamber

A Chamber contains two modules and has a glass door to allow viewing through the LEDs, checking in the test of the active product. Each chamber has an independently controlled thermal environment. According to the manual, Chamber's temperature is factory set to operate at 75 °C.

1.4. Functional Test Module

Module connection descriptions will be covered, where PSU's will be allocated, focusing on this project implemented with the intuition of improvement. The module (Figure 01) is the metal structure that weighs approximately 55 kg without adapters and 65 kg with adapters. For 3.5” size hard disk (HDD) and 2.5” size (HDD) testing. The module also has electronic test boards and three 400 W PSUs with four slots each, being two 12 V DC slots and two 5 V DC slots. Modules are removable only from the front of the rack. The functional test module makes up, fixture (adapters), communication and electronic data cables, cooling coolers and management communication boards.

Figure 01 - Functional test module.
Source: Western Digital – Digitron, 2010.

1.5. The Module Bulkhead Card (MBH)

It is the main board of the module where it communicates all data information with the CBC (Chamber Backplane Card) and IDC (Intelligent Driver Controller), transmitting the communication with the main computer (Rackpc). The ultimate goal of this operation is to test the manufactured product. The MBH card receives power from all three PSUs and a data communication cable that sends readout information from the PSUs to the Disk Operating System (DOS) mode software or disk operating system.

1.6. PSU'sscheme

It is the numbered connection scheme of the PSU that connects to the MBH card for communication between them. A connection of the module PSUs as described in the user manual. This connection is made through the bus of a JP1, JP2, JP3 & JP4 connection to MBH card. Connects to PSU channels according to numbering indicator as shown in instruction manual.

PSUs provide voltage lines that monitor each voltage slot and detect appropriate voltage tolerance range in each slot and power on the IDCs, which communicate and control the test units that are monitored by the PC in the rack. This control / communication link is provided by the 'ATA4' card, a WD (Western Digital) designed card connected to an ISA slot on the PC. In the ASPT system, the ATA4 board provides two 40-way flat cable connections, one for each of the two modules in one chamber. These cables are routed through the rack and each plug into a connector on the front panel of a module. This connector is part of another board called a Module Buffer Board (MBB) located next to the module panel. MBB is also a WD project and provides buffering (data transmission) between ATA4 and IDC on the back of the module.

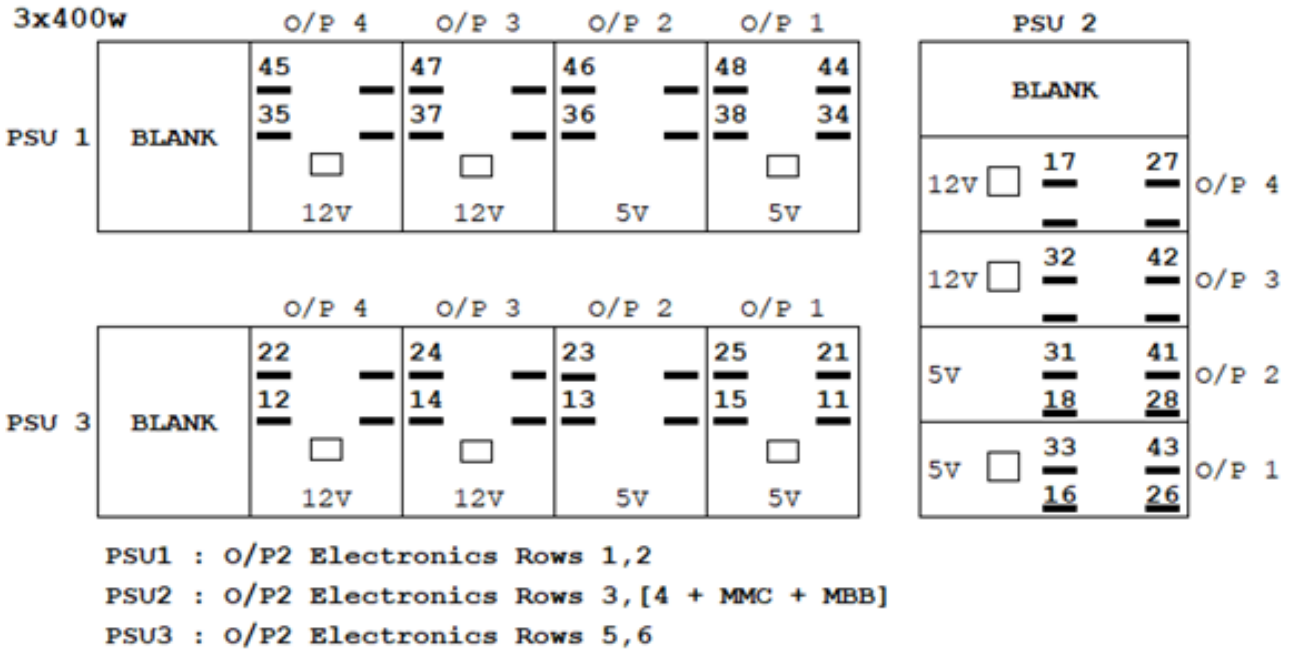

Figure 02 - Single-Plug Tester User Manual (PSU) wiring diagram.
Source: Western Digital – Digitron, 2010.

PSU1 connects IDCs 1 and 2, PSU2 connects IDCs 3,4 and the Module Management Card (MMC), PSU3 connects IDCs 5 and 6. PSU and module communication are via cable MMC board with O / P reference (Output voltage) from 1 to 4, being used for reading only in three slots of each PSU. In figure 03 is shown, for better visualization, how the three PSUs installed in the functional test module are interconnected, in particular, is the data cable connection for communication with the software.

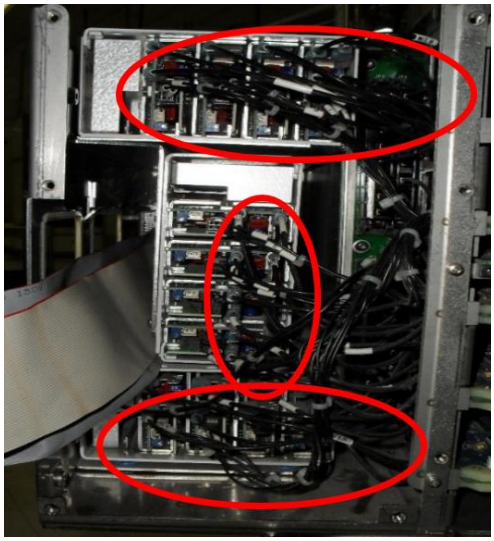

Figure 03 - Module with 3 PSU's (1200W).
Source: Western Digital – Digitron, 2010.

1.7. Data Cable Configuration

The data cable has 3 read connection ways on each PSU, below we can see the connection configuration:

PSU1 - Slot 1 Connects, PS1 (O / P1), Slot 3 Connects, PS1 (O / P3), Slot 4 Connects, PS1 (O / P4)
PSU2 - Slot 1 Connects, PS2 (O / P1), Slot 3 Connects, PS2 (O / P3), Slot 4 Connects, PS2 (O / P4)
PSU3 - Slot 1 Connects, PS3 (O / P1), Slot 3 Connects, PS3 (O / P3), Slot 4 Connects, PS3 (O / P4)

Module PSUs include an automatic calibration feature. However, the 5V and 12V PSUs must be set within + 1% -0% of the rated output voltages, 5V and 12V, respectively, before connecting the auto calibration cables.

Material and Methods

In this first moment, a bibliographic study regarding the hardware architecture was performed in the elaboration of the change related to the conversion of the power supply that has 12V and 5V power channels, as well as the manual calibration study made by the digital multimeter, which follows the systematic operating process where it will be applied to the company here called company X.

The focus of this project is to reduce the number of power supplies from three to two PSUs, model and characteristic of the power supply LAMBDA Alfa 400 W [11], has its specific power of 400 watts with 4 voltage slots for each PSU. The reference values on the slot outputs: + 12 V, + 12 V, + 5 V and + 5 V.

The study area for implementation is located in Campos Sales - Tarumã neighborhood, in the north of Manaus-AM. Easily accessible for transportation and customers at a Manaus industrial hub company, this is an assembly industry (HDD) where the process assembly flow goes from the preparation of the Front End PCB to the HDD pre-assembly in the Back End end sector. The company works with other types of machine industries, however, we will cover only what will be our object of study that will serve as the basis for design and implementation of the project.

Analysis and Discussion of Results

A 12 V voltage circuit was added that was extracted from another 4-slot 400 W power supply, which we have as a spare part, now having 5 voltage slots which reduced the number of PSUs used in the functional test module. from 3 to 2. The necessary manual calibration adjustments were made, using the digital multimeter to adjust the 12 V voltage in the slot (Figure 04).

Figure04 – Circuit of one + 12V slot.

1.8. The Conversion

In order to achieve the goal, there was a need to change the data cable connection as a PSU was removed. Initially the data cable had its configuration distributed to 3 PSUs, this connection was adapted and its distribution started to connect the two PSUs, resulting in a positive expectation.

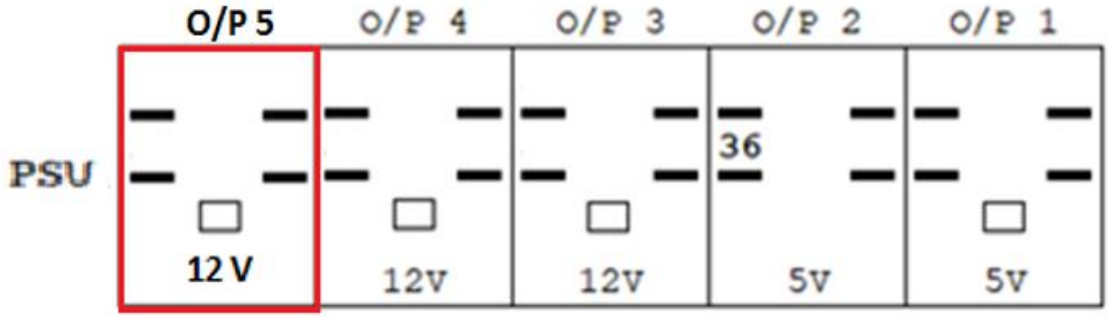

Figure 05 - 12 V Voltage Slot Scheme added at PSU.

In figure 06, follows the scheme of connection of the final project PSUs between the data cable to 2 power PSUs, the PSUs now distribute their connections for hardware / software monitoring. PSU 1 controls the binding and monitoring lines of the IDCs 1,2,3 boards and PSU2 controls the binding and monitoring lines of the IDCs 5,6, (4 + MMC + MBB). The connections are left: 15, 25, 34 and 44 and PS2 (OP1).

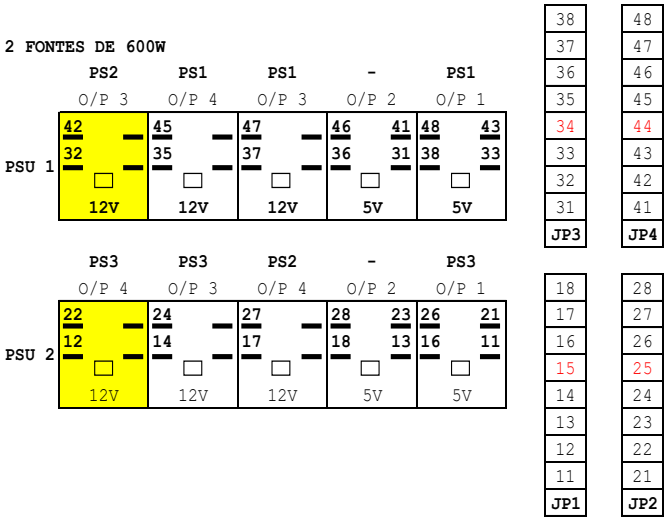

Figure 06 - Schematic of 2 converted power supplies.

Each power supply connection was verified by observing in the wiring diagram manual according to pinout 1 to 8, as it receives the MBH board on the connection bus JP1, JP2, JP3 & JP4. With the digital multimeter the slot voltages were checked and the results show what was expected, confirming that the voltages were the correct measurements. From this proposed modification, it was implemented in the functional test module, observed in the software the calibration readings, indicating that the PSU was calibrated correctly (figure 07).

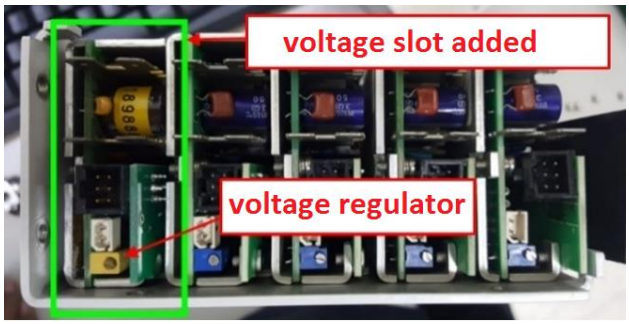

Figure 07 - PSU with five slots, 5V and 12V voltage slots.

In order for the machine to function properly when turning it on, all Chamber components (modules 1 and 2) must be in good working order including proper calibration of the PSU's in the functional test module, ie if any voltage is unregulated, it will not start the test program (DOS mode).

Being obtained a gain in reducing the temperature where the PSUs are. In the user manual one PSU operates from 0 to 70 °C, depreciation from 2.5% down to 50 °C and 70 °C, humidity from 5 to 95% without condensation, the three operating PSUs operate at a temperature of 37.9 °C, the change reduced the temperature to 33.9 °C. It had a lower temperature due to the three PSUs operating.

The usefulness of this conversion is exclusively for this equipment and helps in the speed and repair of the module, ensuring that there are no problems switching PSUs saving time in the production process, thus reducing the number of line stops. From this implementation, we seek alternatives to save on the purchase of similar material on the market with the power required for operation.

Conclusion

The major challenge for this work was to apply in practice the knowledge that was obtained during the undergraduate course in electrical engineering, developing the theoretical, scientific knowledge and skills acquired over time in the laboratory environment of the institution. The expectation that you could have applied the whole study, from idea to implementation, should be considered as a positive weight in working life, as through observations, analysis and diagnostics, practical tests and application, we were able to successfully convert the PSU.

Thus, a good working result of the functional test module was obtained in transforming the power supply from 400 W to 600 W. The results of the operation after conversion came from the study of the theoretical basis for functionality and practical application, where the idea of making the conversion was proposed, in which the original PSU makes available in the circuit configurations to be added a new voltage slot if necessary. , which was the case of our study. The management of the calibrations by the software showed data confirming the readings of the slots calibrated by the multimeter and confirming that the manual adjustment performed is correct.

Based on the existing structure and foreseeing as an improvement of application, the implementation was made with the benefit of reducing expenses on the purchase of the power supply, which also reduces the consumption of material used in the test module. product and increasing the amount of replacement and temperature reduction, which for the environment is important to reduce the heat generated by the operation of electronic equipment. Once satisfactory results and modification effectiveness have been confirmed, the stock material (SparePart) and the remaining PSUs of the modules used in the production process machines will also be implemented for 600 W power operation.

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