PROGRAMMABLE DUAL CHANNEL REGULATED POWER SUPPLY

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Abstract**—** A power supply is an electrical device that supplies electric power to an electrical load. The primary function of a power supply is to convert electric current from a source to the correct voltage, current and frequency to power the load. As a result, power supplies are sometimes referred to as electric power converters. Basically, we used to work on the device with a certain knob in it, due to the inaccurate outcomes. To overcome that issue, we came up with an idea that instead of using knobs we replace it with keypad to get accurate results. Programmable Power Supply is a versatile instrument with facility to interface with PC. The front panel with keypad makes it user friendly. It can be set to use as a Constant Voltage and Constant Current source. With low ripple and excellent Line and Load regulation and it is fully protected against over load, over voltage, over current, over heat and short circuit.

Keywords—* *Arduino uno, LCD and Key Pad.

I. INTRODUCTION

A power supply is an electrical device that supplies electric power to an electrical load. The primary function of a power supply is to convert electric current from a source to the correct voltage, current and frequency to power the load. As a result, power supplies are sometimes referred to as electric power converters. Basically, we used to work on the device with a certain knob in it, due to the inaccurate outcomes. To overcome that issue, we came up with an idea that instead of using knobs we replace it with keypad to get accurate results. Programmable Power Supply is a versatile instrument with facility to interface with PC. The front panel with keypad makes it user friendly. It can be set to use as a Constant Voltage and Constant Current source. With low ripple and excellent Line and Load regulation and it is fully protected against over load, over voltage, over current, over heat and short circuit. Power supplies are categorized in various ways, including by functional features. For example, a regulated power supply is one that maintains constant output voltage or current despite variations in load current or input voltage. Conversely, the output of an unregulated power supply can change significantly when its input voltage or load current changes. Adjustable power supplies allow the output voltage or current to be programmed by mechanical controls (e.g., knobs on the power supply front panel), or by means of a control input, or both. An adjustable power supply is one that is both adjustable and regulated. An isolated power supply has a power output that is electrically independent of its power input; this is in contrast to other power supplies that share a common connection between power input and output.

Scientech 4078P Programmable DC Power Supply is a versatile instrument with facility to interface with PC. The front panel with keypad and cursor, makes it user friendly. It can be set to use as a Constant Voltage and Constant Current source. With low ripple and excellent Line and Load regulation, Scientech 4078P is fully protected against over load, over voltage, over current, over heat and short circuit.

II. LITERATUR SURVEY

The power supply industry dates back to the early 1920s, when crude devices were first developed to serve as "B" battery eliminators to power radios in both the commercial and consumer markets as shown in below fig 1.1.

Fig 1.1: 1926AD for Motorola Battery Eliminator

The market for separate power supplies evaporated around 1929, when most radios manufactured included a built-in power supply. The need for stand-alone power supplies remained relatively small in the 1930s and into the 1940s. The dominant technology during this period consisted of vacuum tube linear regulators. Power supplies used vacuum tubes for both the power and control elements. Typically, a voltage regulator (VR) tube, the predecessor to today's zener diodes, was used to produce a stable reference. Control was pretty much limited to the manual twisting of knobs. In those days we did not care too much about dissipation. Under normal circumstances, vacuum tubes ran pretty hot -- and unless the plate of the tubes glowed red, or glass started to melt, no one worried much about it. In the mid-1940s, three companies set up shop in a relatively obscure community in Queens,
New York. These companies, who eventually became leaders in the industry, were Lambda, Sorenson and Kepco. While all three companies exist today, only Kepco maintains its independence and original ownership and continues to operate out of Queens, New York.

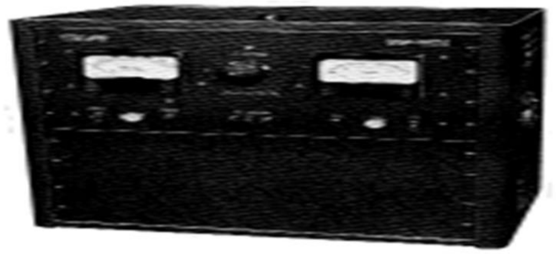

Fig 1.2: Model 700 Vacuum tube power supply, 0-350V, 0-750mA

Early Kepco Laboratories:

A milestone in the industry occurred in the 1950s when semiconductors were first introduced into the power supply design. As semiconductor designs increased rapidly in the market (transistors replaced tubes), concerns about dissipation and heat dominated the thinking of power supply designers. germanium transistors did not have the ability to glow in the dark, as did tubes, they simply melted and quit. Designers of these products suddenly had to take their thermodynamics seriously.

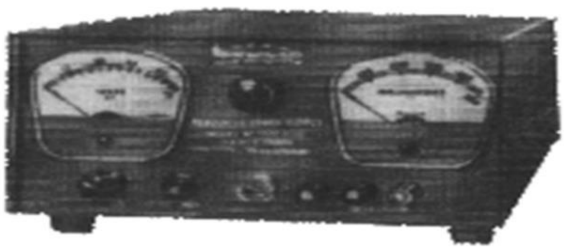

Fig 1.3: Kepco Type SC, the first "transistorized" power supply

Products using transistors(fig3) were limited to low voltage models at modest power levels or hybrid designs which used semiconductors in the control circuit and vacuum tubes in the power stage to make possible higher voltage products. In the 1950s, and early 1960s, power supply products adopting Mag-Amp (fig4) technology satisfied those applications requiring substantially higher power.

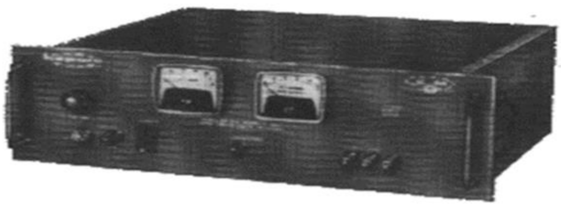

Fig 1.4: Kepco Type KM, A Mag-Amp Design

This same time period also brought us the concept of the first remotely programmable power supplies. A pioneer in this field was Dr. Kenneth Kupferberg, one of the founders of Kepco, who, in his career, was credited with 14 patents. In the 1960s, the world was still analog. Computers were still in their early phase of development. The big debate focused on analog computing [op amp control for simulation and modeling] and that strange concept, called digital computing. In this time frame, linear series pass power supplies were seen more as power amplifiers than a power source. This amplifier concept exploited the high gain and linearity of the transistors and created what were, in effect, high power operational amplifiers. As opamps, they were made to scale, sum, integrate, or manipulate signals. To accomplish this, power supplies were being produced which allowed access to all of the control nodes. Both input and feedback control elements could be removed and substituted by the user to permit manipulation of the output to satisfy many diverse applications. The 1960s also saw the introduction of true bipolar four quadrant source/sink units , and the concept of Ferro resonance for correction of source voltage variation in a highly reliable, low parts count package. In the 1970s, an energy crisis, which affected the entire industrial world, provided the switching power supply with an opportunity to re-surface and establish a significant position in the electronic marketplace.
The design and manufacture of switching power supplies can be traced back at least to the 1950s. At that time, these products were produced in huge quantities, mostly to replace vibrators. In those days, vibrators converted an automobile's 12V into high voltage d-c by mechanically switching (the first switch-mode power supply)! Later, germanium transistors were used to switch electrically.

Fig 1.5: Kepco Model BOP, Featuring Bipolar 4-Quadrant Power

The fundamental problem, which inhibited the advancement and greater use of this topology, was its relatively low frequency range (within the mid-audio spectrum) which caused these products to whistle annoyingly. The big breakthrough in the 1970s was the development of low loss ferrite (transformer core material), coupled with the readily available, higher speed silicon transistors that made possible the practical reality of high frequency products which could operate above 20KHz where they were inaudible. During this same decade, the high-gain series pass linear power supply was enhanced with a new level of intelligence, the ability to follow commands from a host computer on a standard communications bus. Digital control was being grafted onto the front end of linear power supply products. The very first interfaces consisted of resistor chains that were parallel with reed relays, to create BCD Digital control. Then came digital to analog conversion [DAC], for voltage control, and finally,

in mid-decade, the power supply industry adopted the instrumentation bus standard introduced by the Hewlett Packard Company as HPIB. This was adopted as IEEE-488 by the Institute of Electrical and Electronic Engineers, and later renamed GPIB by Instrumentation Manufacturers. Prior to this industry standard, the industry was limited to the RS232 serial bus which was very slow and restricted to relatively limited distances between controller and instrument. In Europe, this is known as the IEC bus.

The 1980s saw many new start-up companies enter the market producing switch-mode products. Many of these new companies were based in the Pacific Rim, first in Japan, and eventually shifting to Taiwan and Hong Kong.

During this decade, the quality and performance characteristics for switchers were substantially improved. Operating frequencies also increased from the 25-50KHz range, on up to 100KHz and even 1 Megahertz as FET's replaced bipolar transistors.

Here we are now, more than half way into the 1990s, and we have already experienced numerous developments. For example, this industry, driven by market demands, has produced switching products which operate at increasingly higher frequencies and are constructed utilizing surface mount technology (SMT), substantially reducing their physical size. We have seen these same products offering such features as wide range input, to accommodate source voltages worldwide, active power factor correction, to minimize harmonic distortion on power lines, and forced current sharing, to provide these products with the capability of fault-tolerant operation.

Modern fault-tolerant power systems typically employ a technique known as parallel N + 1 redundancy. The advantage of this method over the traditional paralleling scheme, is the ability to distribute power (current sharing) and minimize the stress on individual units. The popularity of the N + 1 redundant system approach with current sharing has increased so rapidly it has become a de facto standard in the industry.

Fig 1.6: Kepco Model HSP, N+1 Redundancy with Hot Swap

Fig 1.7: Kepco Model VXI-27, a VXI interface drives up to 27 remote power supplies

Another trend which has enjoyed increased interest, is that which is sometimes referred to as point-of-use stabilization; distributing the power at some intermediate voltage (48V, 150V,400V). This technique is also known as "distributed power." It relies on the use of a bulk supply to perform the conversion of a-c, from the mains, into d-c, which then, in turn, powers any one of a number of lower power d-c to d-c converters placed directly at the point of load. This technique of power distribution has lowered the system wire count resulting in more manageable harness sizes making the products easier to build and reducing their overall size. Power supplies are used in most electric equipment. Their applications cut across a wide spectrum of product types, ranging from consumer appliances to industrial utilities, from milliwatts to megawatts, and from handheld tools to satellite communications

Programmable Regulated Power Supply:

The Programmable Regulated Power Supply is a versatile instrument with facility to interface with PC. The front panel with keypad makes it user friendly. And LCD placed in the front panel makes outcome visible and keypad can be set to use as a Constant Voltage and Constant Current source. The previous version was a single channel Programmable Regulated Power Supply of voltage range (0 – 12 v) made by our seniors of academic year 2021-22 under the guidance of Prof. Lohit Javali.

This is website created with all the procedure and implementation part of our project in one place and also, stored project documents and the papers related to the project.

https://sites.google.com/view/programmableregulatedpowersupp

Fig 1.8 single channel Programmable Regulated Power Supply.

III. PROPOSED METHODOLOGY

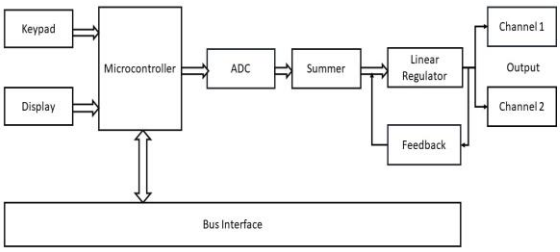

Fig 1.1 block diagram of Programmable Dual Channel Regulated Power Supply (PDCRPS)
Here transformer which is used to convert AC to DC. Then, unregulated DC enters into the linear regulator. Linear regulator is used to maintain a study voltage.
The resistance of the regulator varies in accordance with both input voltage and the load, resulting in the constant voltage output. However, a digital-to-analog converter (DAC, D/A, D2A, or D-to-A) is a system that converts a digital signal into an analog signal.

Microcontroller does this by interpreting data it receives from its I/O peripherals using its central processor. The temporary information that the microcontroller receives is stored in its data memory, where the processor accesses it and uses instructions stored in its program memory, we represented using Arduino uno as our microcontroller.
The Arduino Uno is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output pins that may be interfaced to various expansion boards and other circuits.

The Bus Interface provides the interface of 8086 to external memory and I/O devices via the System Bus. It performs various machine cycles such as memory read, I/O read, etc. to transfer data between memory and I/O devices. Here we make use of a keypad to take the input voltage value from the user after that it will be displayed on the LCD screen.

IV.RESULTS

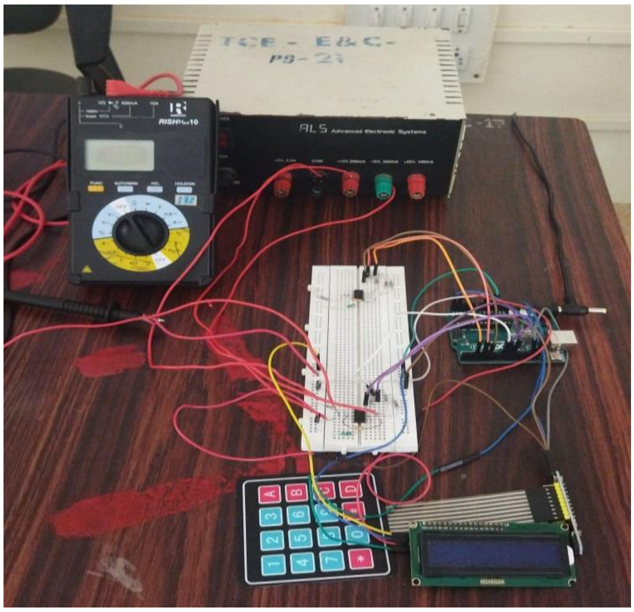

Fig 6.1: Over all connection of project

Arduino uno pins 9, 10, 11 connected with non-inverting summing amplifier. Firstly, each pin (9, 10, 11) are connected with the capacitor 100uF and resistance 10K ohm and connecting with resistance named as R1, R2, R3. Using the summing amplifier the three resistance R1, R2, R3 are summed and connected to the pin number 4 (power). The voltage inputs Va, Vb and Vc are applied to non-inverting input of the op-amp. As we see after connecting the parts we can see the voltage in the CRO itself. Here the given input from the keypad displayed on the LCD through Arduino uno we get the linear voltage but due to the usage of op-amp, resistors, capacitors etc they absorb voltage so we can’t get the accurate output voltage so below 3 tables (6.2, 6.3, 6.4 table) show you how the difference we get when we apply different input voltage through keypad.

V.CONCLUSION

“Programmable Dual Channel Regulated Power Supply” is a versatile instrument with facility of interface with PC. The front panel with keypad makes it user friendly. And LCD placed in the front panel makes outcome visible and keypad can be set to use as a Constant voltage and Constant Current source. Adjustable regulated power supply allows the output voltage to be programmed by mechanical controls like knobs keypads on the power supply front panel or by means of control input. The main concept of the project is to replace the knob by keypad to get accurate outcomes and we designed for 0-12 Volt which can be extended as per their requirement.

VI. REFERENCE

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