

Energy Management by Maximum Demand Controller

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Abstract – Every electrical system needs power as the supply. Power is rated at each and amount of energy is used to accomplish the work. Electrical power is measured in kwhr which is determine by $V \cdot I$. In the industries high power consumption than the contracted one can lead to severe penalties. Often there are power peak produce by the load co incidence that normally do not work in simultaneously. In order to avoid penalties one solution would be increase in the contracted power according to the maximum resister peak but on contract this will force to pay higher power than it is really needed. Another solution will be avoiding the consumption peaks through a vigilance element that a device of the risk situation or it can disconnect certain noncritical load such as air conditioning compressors lighting and fans. Maximum demand refers to the maximum amount of electrical energy that is being consumed at a given time.

The general purpose of maximum demand meter is to monitor and control the maximum power demand in order also can reduced the monthly electricity bill. By using the meter, the user do not have to worry that their electricity bill will increase thus have to pay lot of money on bills. Maximum power demand meter can benefit every user specially factories. The information and also knowledge that been used to produce the meter can benefit the society. Assembly language will be used to design a program for specific purpose which is to monitor and controlling power demand.

I- INTRODUCTION

Basic Operation of Maximum Demand Controller

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benefit every user specially factories. The information and also knowledge that been used to produce the meter can benefit the society. Assembly language will be used to design a program for specific purpose which is to be monitor and control power demand.

Maximum Demand

Maximum demand is the highest level of electrical demand monitor in a particular period usually for month period. In this section you will find information regarding maximum demand such as why TNB charges for it, how can you calculate MD? There is also a section on weather the MD can be excluded and steps to reduce MD charges.

What is Maximum demand?

Maximum demand value is the average from the instantaneous power during a define time interval, usually every 15 minutes.(time interval will depend on each country) .There are different methods to calculate this parameter.

Need of Maximum Demand Controller

As we have been advancing the goal to control the maximum demand is not to exceed the limit of contracted power. To achieve this goal we advice to install a system able to disconnect non critical load, On different time period and also avoid connecting load simultaneously to reduce the instantaneous power.

Non critical loads are those that do not affect the main production process or that are not essential such as

1. Lighting
2. Compressors
3. Air conditioning system
4. Pumps
5. Fans and extractors
6. Packaging machines
7. Shredders
8. Others.

What can we do to avoid maximum demand penalties on electricity bill?

To avoid the penalty for maximum demand we must ensure that this value never exceed contracted power. Usually in electricity bill the highest demand value recorded by the meter is compared to the contracted power, whenever this value is higher than the contracted power there will be an economic penalty.

What is power factor and power factor penalty?

In electricity there are two kinds of loads resistive load and inductive load. Resistive load where you get what you asked for. But in inductive load current is use to create magnetic field and is not really useful as it is not use for doing actual work. The ratio between actual work and the total energy supplied by the utility is called power factor.

How can we avoid power factor penalty?

Power factor efficiencies can be improved by switching over to efficient appliances that give more output per unit of energy use similarly we can switch to appliances that generates lesser inductive load. The other way to fix the problem is by installing capacitor bank.

What is demand chart and MDI penalty?

When we sign up for commercial electricity connection from a utility you have to specify the maximum demand that you need during the month if you exceed your maximum demand you have to pay penalty for the same. This is the MDI penalty that appear on the electricity bill

How can MDI penalty be avoided?

If your power factor is less than one you can improve your output KW per KVA supplied by improving power factor as mentioned above. This ensures that you are not wasting any KVA that is supplied to you by your utility. Another option of avoiding MDI penalty is by shifting your peak load to a time of day when your load is less , for example thermal storage system can help you to shift your air conditioning load from day time to night time.

Working concept

In energy management by maximum demand controller we use PIC controller by using this controller to monitoring the load and also calculate the voltage, current, total power, instantaneous power and time .In MD controller following basic concepts are as follows.

1. A 230 v, 50 Hz, ac supply is fed to step down transformer. This transformer step down the voltage 230/12v to power supply circuit.
2. Power supply circuit is directly fed to the microcontroller but micro controller require 5v dc supply so power supply circuit converted 12v to 5v dc
3. ADC is analog to digital converter which is inbuilt in micro controller
4. Driver IC is connected in between micro controller and relay it isolate 5v to 12 v supply.
5. Relays are used as a switch for sensing the fault and trip the load.
6. CT is a current transducer to measure the current as well as voltage in terms of phase and neutral and fed to the ADC.
7. PT is potential transformer to step down the voltage and given to the potential divider circuit through ADC.
8. LCD is liquid crystal display which shows all the parameters like voltage, current, instantaneous power, average power and time etc.

II- LITERATURE SURVEY

A. Martins , H. Jorge , J. Mota, RParraho and A.Gomes “A PC- Based simulation packed for supporting End user demand side management strategies”. IEEE trans on power system, vol.pwrs6, no. 3 Aug 1991 -

Maximum demand charges are widely used by utilities as one of the forum of implementing peak clipping in the context of demand side management. A MD meter is installed in consumer premises are necessary for determining the power demand value which is the basis for applying the demand charge. The MD is the maximum of the value so obtained, usually monthly recorded the length of the demand period is established by each utility according to its own criteria.

S. Lee. C, Wikins , “ A practical approach to appliance load control analysis : A water heater case study” . IEEE trans .on Power Apparatus and System, Vol. PAS- 102, no.4 April 1983-

Maximum demand control is one of the end user options for implementing demand side management side practical. It is accomplished by installing a controlling device that sheds and restore supply to certain load, chosen by end user.

Mehta, V.K. Principles of power system New Delhi : S. Chand and Company ltd 2005.

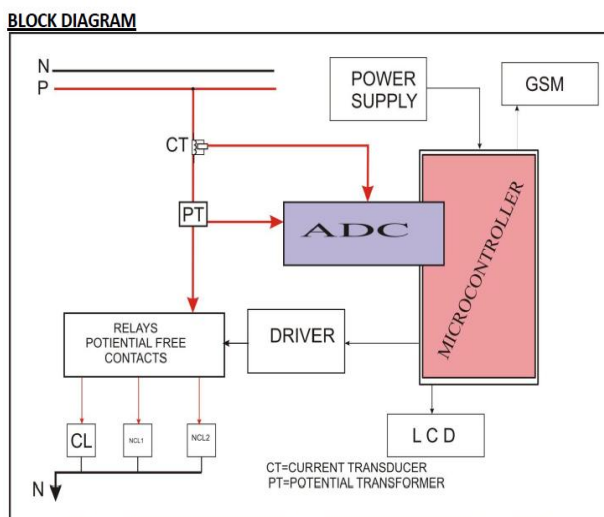
A rectifier is a electrical device that convert alternating current to direct current that flows only in one direction and this process is known as rectification. Rectifiers

have many uses including as component of power supplies and as a detector of radio signal. Rectifiers may be made of solid state diode, vacuum tube diode, mercury arc valve, and other components. The output from the transformer is fed to the rectifier it convert ac into pulsating dc.

H.Jorge, “analysis of algorithm for power demand limiting” (in Portuguese) department electrical engineering international report DEE – UC -006-91, faculty of science and technology-

A few fundamental classes of algorithm existing in commercial available MD Controller may be identified and great number of modified version is currently implemented with different degree of flexibility and effectiveness of control.

Block Diagram



COMPONENTS

- 1) **MICROCONTROLLER**- It is a 28 pin peripheral interface controller (PIC).
- 2) **ADC**- It is a analog to digital converter which convert voltage signal into machine language.
- 3) **CT**- It is a current transducer, which measure the voltage and current in terms of phase and neutral.
- 4) **PT**- It is a potential transformer, which step down the voltage.
- 5) **DRIVER IC**- It is used to isolate the 5v to 12v.
- 6) **CRYSTAL OSCILLATOR**- It provides the continuous clock pulse to the PIC controller.

APPLICATIONS

1. Process Control Industries.
2. Main Incomers in Substations.
3. Hospitals.
4. Hotels.
5. Corporate Offices.
6. Educational Institutes.
7. Small Single phase MD Controllers and be used for domestic purposes also.

ADVANTAGES

1. Better Utilization of available Power.
2. Avoid Penalty, Disconnection.
3. Improved Load Factor.
4. True RMS measurement.
5. Auto scaling from kVA to MVA.
6. Predictive control method adopted to optimize demand control.
7. Field programmable CT & PT ratios.
8. Demand profile generation for setting realistic demand targets.
9. Records peak demands with date & time.
10. Time of the day (TOD) facility.

FUTURE SCOPE

1. Primarily the MD Controller can be interfaced with the computer and the Maximum Demand can be monitored through the SCADA system itself.
2. The MD Controller can be made foolproof by using GSM technology.