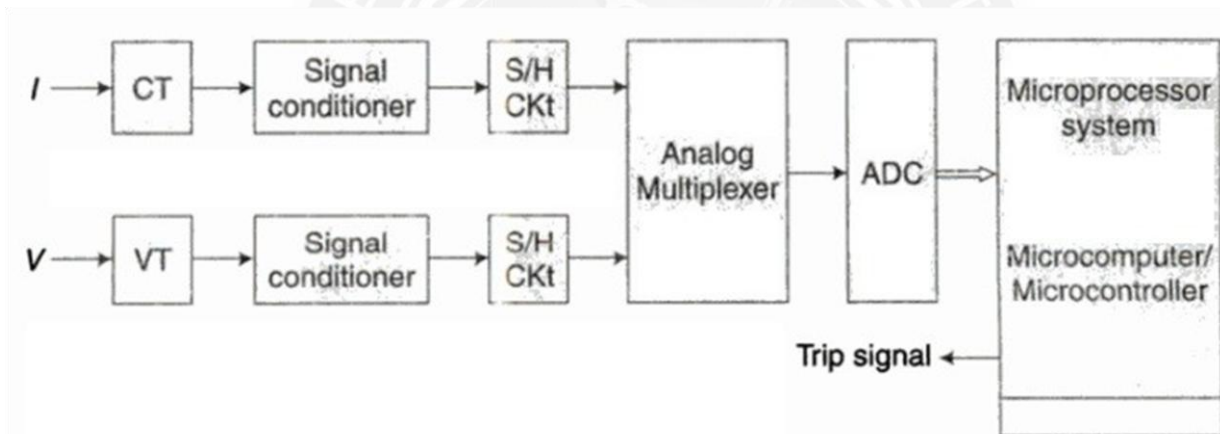


## 4.4 Block diagram of Numerical relays

### 4.4.1 Numerical Relay

- Numerical is the relay in which the measured AC quantities are sequentially sampled and converted into numerical data that is mathematically and/or logically processed to make trip decisions.
- Numerical relay is the latest development in the area of power system protection.
- The design and method of operation these relays are different from the conventional electromechanical relays.
- Numerical relays are based on numerical devices such as microprocessors, microcontrollers and digital signal processors etc.

### 4.4.2 Block diagram of Numerical relay



**Figure 4.1 Block diagram of Numerical relay**

[Source: "Switchgear and Protection" by Sunil S.Rao, Page: 830]

- 1 ➤ A relay using digital device like microprocessor for decision making based on digital numbers representing instantaneous values of the signals is called numerical relay, digital relay, microprocessor based relay or computer based relay.
- The voltage and current signals in the power system **are** brought down to suitable level using C.T and P.T.
- The signals from C.T and P.T are given to the antialiasing filters which are low pass filters. This removes the unwanted frequency components.

- The signals from the signal conditioning circuits are sampled using sample and hold circuit. With the help of analog multiplexer and ADC, the equivalent digital form of analog input signal is achieved.
- The analog multiplexer gives the facility to accommodate a larger number of input signals.
- The digital output of ADC is given to microprocessor where it is stored in the memory.
- This signal is processed with the help of numerical relaying algorithm and accordingly trip decision is made.
- The trip signal is digital signal hence converted to analog using digital to analog converter (DAC). This tripping analog signal is given to the trip coil of a relay.

#### 4.4.3 Characteristics

Compact design and lower cost due to integration of many functions in to one relay

High availability even with less maintenance due to integral self-monitoring

- No drift (aging) of measuring characteristics due to fully numerical processing
- High measuring accuracy due to digital filtering and optimized measuring algorithms
- Many integrated add-on functions, for example, for load monitoring and event/fault recording
- Local operation keypad and display designed to modern ergonomic criteria (Menu- driven human interfaces)