Design of Microcontroller based Moulded Case Circuit Breaker (MCCB) with Electronic Trip Unit

A.D. Kulkarni  T.Ananthapadmanabha K.Parthasarathy G.H. Kulkarni

Abstract—In recent years microcontrollers are being widely used in industrial automation and control. Microcontrollers are also introduced in power system protection schemes to overcome some of the drawbacks of conventional electromagnetic and solid-state relays.

In this digital relaying scheme the analog C.T outputs of different phases are taken and converted into digital outputs from analog to digital converter. These digital outputs are given to the microcontroller. The microcontroller is programmed in PL/M for different faults. The settings for different faults can be made by using operational keys and LCD display. This MCCB can be controlled remotely with a PC by communication protocols and RS-485 interface

Keywords: MCCB-Moulded Case Circuit Breaker, C.T(current Transformer), RTU(Remote Terminal Unit), PC(Personal Computer), PL/M(Programming Language/Machine Language), Long Time(LT)

I. INTRODUCTION

In the present days microcontroller based relays are widely used for automation and control. Because compared with conventional relays microcontroller based relays have the more advantages : i.e cost is less, reliability, efficiency, ….This microcontroller is the programmable microcontroller. For this microcontroller there is no need to connect the external ADC. It has the flash memory. The program can be erased and reprogrammed in flash memory using PL/M any number of times. To protect small range motors(2HP to 200HP) contactor module is used and for large motors MCCB’s are used. This micro for low voltages curve ‘x’ is break through in the field of low voltage motor protection. Curve X MCCB has built in electronics Overload sensing which eliminates the need for external bimetallic overload relay. Curve ‘X’ MCCB senses the overload/single phasing/phase reversal through is static circuitry but opens the motor feeder by activating an external contractor which is always available in a motor feeder circuit to clear overload faults, thus reducing the strain on the MCCB contacts but has user interface with multifunctional LCD display for operating keys. The communication interface between the relay and remote terminal is provided by RS=-485 port with MODVUS protocol .It comes with field fittable accessories and facilities [4-7].

The Design of this microcontroller based circuit breaker supports the under voltage release which is field fittable. This under voltage release, trips the circuit breaker not for contactor module. One more feature for this relay is Temperature sensing. Whenever the temperature rises beyond the threshold value, the Thermal relay circuit will give the trip signal to circuit breaker.

II. PROTECTION FEATURES

Long-time pickup:
The set point establishes the breakers nominal ampere rating, as a fraction of breaker rating.(Ir-LT multiplier*In).
The choices for LT multiplier are 0.4 to 1.0 times In in step of current In.
Long time delay:
This unit allows normal momentary overload without nuisance tripping. The choices are 0.2, 0.5, 1.0, 1.5, 2.0 and 3.0 secs.
Thermal Memory:
This function makes the trip unit to remember the thermal contents of previous overload for which breaker has not tripped. This thermal contents get automatically reset to the base level in 3 minutes.
Short Time pickup:
The short time pickup establishes the current at which short time trip is activated. Short time pick up is coupled with LT pickup and the choices are from 2 to 10 times the LT pickup setting.
Short Time Delay:
This function delays the breaker trip(definite time delay) on a short time trip. Choices are from 2 to 10 times the LT pickup setting.
Instantaneous tripping:
Instantaneous tripping causes an immediate breaker trip when the chosen current level is reached. In this protective there is no intentional time delay give for tripping the breaker an breaker trip.
Earth Fault:
This function sets the pickup current for ground fault protection. In the 3 pole breaker this gives 3 phase 3 wire protection and in 4 pole breakers it gives 3 phase 4 wire protection against the ground fault. This microcontroller based circuit digitally calculates the ground fault signal without use of external earth fault module. The various settings for ground fault pickup are 0.2-0.8 times the breaker rating in steps of 0.1. Fig. 1. gives the block diagram of Microcontroller based MCCB.

Fig 2. shows the block diagram of display unit. In this circuit breaker interface with PC. The main advantage of this interface is we can easily know which type of fault occur in the system. That will show in LCD display as well as in the computer. In this project interface is done by using RS-485. By using this interface we can control the 256 circuit Breaker/Contactor module with single computer.
III. CASE STUDY AND RESULTS

Flowchart

IV. CONCLUSION

The software designed has the different features like protection, metering communication interface. The protection features long time pickup, short time pickup, thermal memory, instantaneous and earth fault. The basic operation and processing of the analog input signals is as shown in block diagram. The user interface is provided with operating keys and LCD display. The communication interface between the relay and the remote terminal is facilitated with device drivers and networking protocols. This communication interface allows the end user to adjust all settings from a remote terminal. The different parameters are stored in non-volatile memory.

V. REFERENCES


Test Report For Contactor Module And Thermal Relay Interface

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