**TECHNICAL LITERATURE & INSTALLATION INSTRUCTION**

# F3MPR1

## MICROCONTROLLER BASED MOTOR PROTECTION RELAY


minilec®

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(version -2, DT-02/10/10)

# INDEX

## 1. INTRODUCTION:

Thank you for selecting and purchasing minilec make F3MPR1. It is micro-controller based motor protection relay. It uses state of the art digital technology to measure various parameter of the motor and take corresponding corrective actions. The system consists of hardware design to provide high degree of accuracy and reliability. The micro-controller based protection ensures high accuracy and disturbance free operation.

Packing of your F3MPR1 will include following –

1. F3MPR1 unit
2. CT 20 or CT 50 or CT5 or CT 2.5 or CT 1
3. Serial converter (RS232- 485) (if required).
4. Mounting clamp
5. Cable connecting CT module to F3MPR1 ( 2.5 meters)
6. Installation manual.
7. Software CD. (if required).

### FUNCTIONS:

| SR.NO | PROTECTIONS | SR.NO | FEATURES |
|---|---|---|---|
| 1 | Under Current | 1 | Password Protection |
| 2 | Over Current | 2 | Full load Current settable |
| 3 | Over load | 3 | CT Primary selection |
| 4 | Current Unbalance | 4 | IDMTL curve time selection |
| 5 | Current Single Phasing | 5 | Start up delay settable |
| 6 | Phase reverse | 6 | Contact outputs for Trip for Motor |
| 7 | Lock rotor | 7 | All parameter can be bypassed except overload (after bypass, make aux supply OFF & then ON.). |
| 8 | Earth fault | 8 | Current parameters with multi attempt reset mode |
| 9 | Winding Temperature. | 9 | LED indication for error |
| | | 10 | Status mode shows current & Earth fault current |
| | | 11 | All parameter Programmable Trip delay |
| | | 12 | LCD display with front key |
| | | 13 | Operation on separate AC Auxiliary supply (90-270VAC/DC) |
| | | 14 | Default Factory setting of parameter |
| | | 15 | Direct RS 485 output |

### ASSUMPTION TO BE CONSIDERED DURING SETTING PARAMETER OR DURING ANY WORKING CYCLE:

1. A default password is 0000. After receipt of unit change the password and keep it in safe hand.
2. Auto exit option is enabled during setting mode in which for more than 30 second if user does not press any key then controller save current setting and exit from setting mode.
3. The factory setting is done for all parameter by assuming that minilec CT 20 is used with full load current of motor 8A. For any other specification of motor set corresponding CT primary ratio & full load current.
4. An IDMLT characteristic is always enabling during Motor ON.
5. For current fault such as UC, OC, UNBALANCE of current, SP of current, multi attempt mode is used to reset the fault, which is as follows.
   1st attempt = 1 minute, Auto reset
   2nd attempt = 2 minute, Auto reset
   3rd attempt = 3 minute, Auto reset.
   After third attempt error is latched & going to manual reset & waiting for user response.
6. Power ON indication is continuously ON when supply is present. It will be in flashing state if any protection is bypassed

**CT SELECTION:** Minilec has provided different CT as per HP rating of motor. Customer can select proper CT as per following chart.

| H/P | SELECT CT | CURRENT RANGE |
|---|---|---|
| Up to 0.5 HP | CT 1 | 0.4 – 1 Amp |
| Up to 1.5 HP | CT 2.5 | 1 – 2.5 Amp |
| 1.5 -3 | CT 5 | 2 – 5 Amp |
| 5 -12.5 | CT 20 | 8 – 20 Amp |
| 12.5- 35 | CT 50 | 20- 50 Amp |

## 1. OPERATING MODES

### STEPS TO ENTER IN SETTING MODE: -

1. After giving the power supply to the unit message on LCD display is:

| MINILEC<br>F3MPR1 |
|---|

2. Second message on display assume that system supply is absent and all faults are By Pass.

| MOTOR OFF<br>HEALTHY CONDITION |
|---|

1. After the above messages press **MENU** key. You will get message

| Setting Mode<br>PASSWORD |
|---|

2. Press **ENTER** and you will get message on display

| ENTER PASSWORD<br>0000 |
|---|

3. Type the password using Up/Down keys (▲/▼). To go to second digit press **ENTER** key. If you confirmed after setting password, press **ENTER,** now you are enter in setting mode.

   Setting mode has following menu. You can see this mode on LCD display by pressing **UP (** ▲) key. You can select particular mode and can set parameters as per requirements.

| | | |
|---|---|---|
| SET CURRENT | START UP DELAY | UNDER CURRENT |
| OVER CURRENT | REVERSE PHASING | UNBALANCE CURRENT |
| SINGLE PHASING | LOCK ROTOR | EARTH FAULT |
| WINDING TEMP | NEW PASSWORD | FACTORY SETTING |

4. Select any one of the mode by pressing (▲ / ▼). For entering in particular menu press **ENTER** key

**CURRENT PROTECTION:**

**MULTIATTEMPT MODE -**

In motor protection relay error occur by current is major issue, causes motor damage. Special treatment required for Under Current, Over Current, Current Unbalance, Current Single phasing. In F3MPR1 we have given Multiattampt feature for these faults. If any mentioned fault occurs first time, then unit trip and give message" WAIT 1 MIN "In this period unit will not start in any case. After 1 MIN. F3MPR1 start motor and check the input condition, if till fault present it will again trip the motor and give message "WAIT 2 MIN".and enter in 2nd attempt and wait for 2 min. If F3MPR1 till found faulty input condition after 2 MIN. then unit start 3rd attempt and give Message "WAIT 3 MIN". After 3rd attempt if F3MPR1 found faulty input condition then it will enter in manual reset. Unit will not start until user can reset the unit manually. In between Multiattampt, if input condition found healthy the F3MPR1 will start the motor.

1. **SET CURRENT**:
   a. Select the SET CURRENT OPTION from setting parameter by using **ENTER** key.
   b. After pressing **ENTER** display will show you

| CTS PRIMARY & TURNS<br>XX XX |
|---|

   Set the primary current & no of turns by using ▲ / ▼ key. Then press **ENTER** and you will get message

| USER CT PRIMARY<br>CURRENT. = XXXXX Amp |
|---|

   Set the user CT primary current by using ▲ / ▼ key. If external CT not used then keep it as 00000.

| CURRENT<br>IDMTL CHAR. = XX Sec |
|---|

   Set the full load current by using ▲ / ▼ key.

   c. After pressing **ENTER** LCD will display

| CURRENT<br>IDMTL CHAR. = XX Sec |
|---|

   Set the IDMTL CHAR. As per requirements.

   d. By pressing **ENTER** key you will come out of this mode.

2. **START UP DELAY:**
   a. Select the START UP DELAY Parameter from setting mode by using **ENTER** key.
   b. After that, on pressing **ENTER** key you will enter in START UP DELAY mode setting. Display will show

| START UP DELAY<br>DELAY TIME = XXX Sec |
|---|

   c. If you want to set the setting of START UP DELAY Parameter then use ▲ / ▼ keys.
   d. After setting the parameters by pressing **ENTER** key you will come out of this mode.

**NOTE:** During start up delay, fault condition is ignored for set time. Hence one has to decided start up delay setting depending on the application. Start up delay is not applicable for earth fault, winding temperature and reverse phasing.

**3. UNDER CURRENT :**

a. Select the UNDER CURRENT parameter from setting mode by using **ENTER** key.
b. After that you will enter in UNDER CURRENT mode setting. Display will show

| UNDER CURRENT |
|---|
| BYPASS = NO |

If the UNDER CURRENT is bypass further setting of UC is not displayed.

c. After pressing **ENTER** you will see

| UNDER CURRENT |
|---|
| TRIP SETT. = XX % |

d. You can set % trip setting using ▲ / ▼ keys. After % trip setting press **ENTER.** Now display will show you

| UNDER CURRENT |
|---|
| TRIP DELAY = XX Sec |

e. Set the trip delay by using ▲ / ▼ key.
After setting the parameters by pressing **ENTER** key you will come out of **UNDER CURRENT** mode.

**4. OVER CURRENT**:
a. Select the OVER CURRENT Parameter from setting mode by using **ENTER** key.
b. Setting procedure of OVER CURRENT is same as UNDER CURRENT setting.
c. You will get TRIP SETTING and TRIP DELAY as a setting parameter for this mode.
**d. It is recommended to set over current % trip setting lower than lock rotor % trip setting.**

**5. UNBALANCE CURRENT**:
a. Select the UNBALANCE CURRENT Parameter from setting mode by using **ENTER** key.
b. Setting procedure of UNBALANCE CURRENT is same as UNDER CURRENT setting.
c. You will get TRIP SETTING and TRIP DELAY as a setting parameter for this mode.

**6. SINGLE PHASING**:
a. Select the SINGLE PHASING Parameter from setting mode by using **ENTER** key.
b. Setting procedure of SING LE PHASING is same as UNDER CURRENT setting, except percentage trip limit.
c. You will get only TRIP DELAY as a setting parameter for this mode.

**7. REVERSE PHASING**:
a. Select the REVERSE PHASING parameter from setting mode by using **ENTER** key.
b. Setting procedure of REVERSE PHASING is same as UNDER CURRENT SETTING except percentage trip limit and trip delay.

**8. LOCK ROTOR:**
a. Select the LOCK ROTOR Parameter from setting mode by using **ENTER** key.
b. Setting Procedure of LOCK ROTOR is same as UNDER CURRENT setting.
c. You will get TRIP SETTING and TRIP DELAY as a setting parameter for this mode.
**d. It is recommended to set lock rotor % trip setting higher than over current % trip setting.**

**9. EARTH FAULT:**
a. Select the EARTH FAULT Parameter from setting mode by using **ENTER** key.
b. Setting procedure of EARTH FAULT is same as UNDER CURRENT setting.
c. You will get TRIP SETTING and TRIP DELAY as a setting parameter for this mode.
d. Option is provided to select 1A or 5A. Hence select as per secondary of Ext CBCT.

**10. WINDING TEMP:**
a. Select the WINDING TEMP Parameter from setting mode by using **ENTER** key.
b. Setting procedure of WINDING TEMP. is same as per UNDER CURRENT setting.
c. You will get RESET TYPE and TRIP DELAY as a setting parameter for this mode.

**11. NEW PASSWORD SETTING OPTION:**
a. Select this NEW PASSWORD Option from setting mode by using **ENTER** key.
b. After pressing **ENTER,** you will get message on LCD

| ENTER NEW PASSWORD<br>0000 |
|---|

You can set your new password using ▲ / ▼ keys. To shift to next digit press **ENTER** key.

After setting new password press **ENTER** and you will get,

| CONFIRM PASSWORD<br>0000 |
|---|

After confirmation presses ENTER key you will get.

| Your Password<br>Change Successfully |
|---|

c. After this press enter key to save new password and to exit from this mode.

**12 FACTORY SETTING:**

a. Select FACTORY SETTING option from setting mode by using **ENTER** key.

b. If you want to set factory setting then press **ENTER,** you will get message on LCD

| To Set Fact. Sett<br>Press 'ENTER.' Key |
|---|

On pressing **ENTER** you get,

| Factory Setting<br>Activated! |
|---|

c. After this by pressing **ENTER** key you will come out of this mode.

**THREE PHASE CURRENT AND EARTH FAULT** :

a. To see the three-phase current press UP key. You will enter in status mode and message on LCD,

| Status Mode<br>MOTOR PARAMETER |
|---|

b. On pressing **UP** key you will see three phase current like,

| R- ph | Y- ph | B- ph |
|---|---|---|
| 00.0A | 00.0A | 00.0A |

c. After three phase currents on pressing **UP** you will get E.F.Current as,

| E.F.Current<br>00.00 Amp |
|---|

a. After observing all these parameters on pressing **MENU** you will come out of this mode.

**POWER SAVING MODE:**

a. If any key not presses more than 5 Min. LCD backlight OFF. ( in status mode or program mode display backlight will ON continuously).

**TROUBLE SHOOTING:**

1. Check auxiliary supply as mentioned on the unit.
2. Check all wiring and connections. There should not be any loose contacts.
3. Check indication on LCD. If any indication on LCD, check the condition as per the indication follows.

a) Phase failure indication: Check following condition

- I Check for phase loss.
- II Check the unbalance between the phases. Do the setting as per the unbalance and wait till it normalizes.

b) Phase Reverse indication : check following condition.

- I Check the Phase sequence if it is incorrect. Correct the same.

c) Under current: Check following condition

- I The motor is drawing less current than setting
- II Either change the setting or wait till it normalized.
- III Or make the proper current settings (near to full load current).

d) Over current : Check following condition

- I The setting current might be less than the actual current so change the setting.
- II Your motor is drawing excessive current i.e. it is overloaded.

e) Earth fault indication: Check following condition

- I The leakage current to the earth might be greater than that of the setting. Change the setting to acceptable level.
- II. Wait till the fault current is normalized.

f) Winding over heating: - Check following condition.

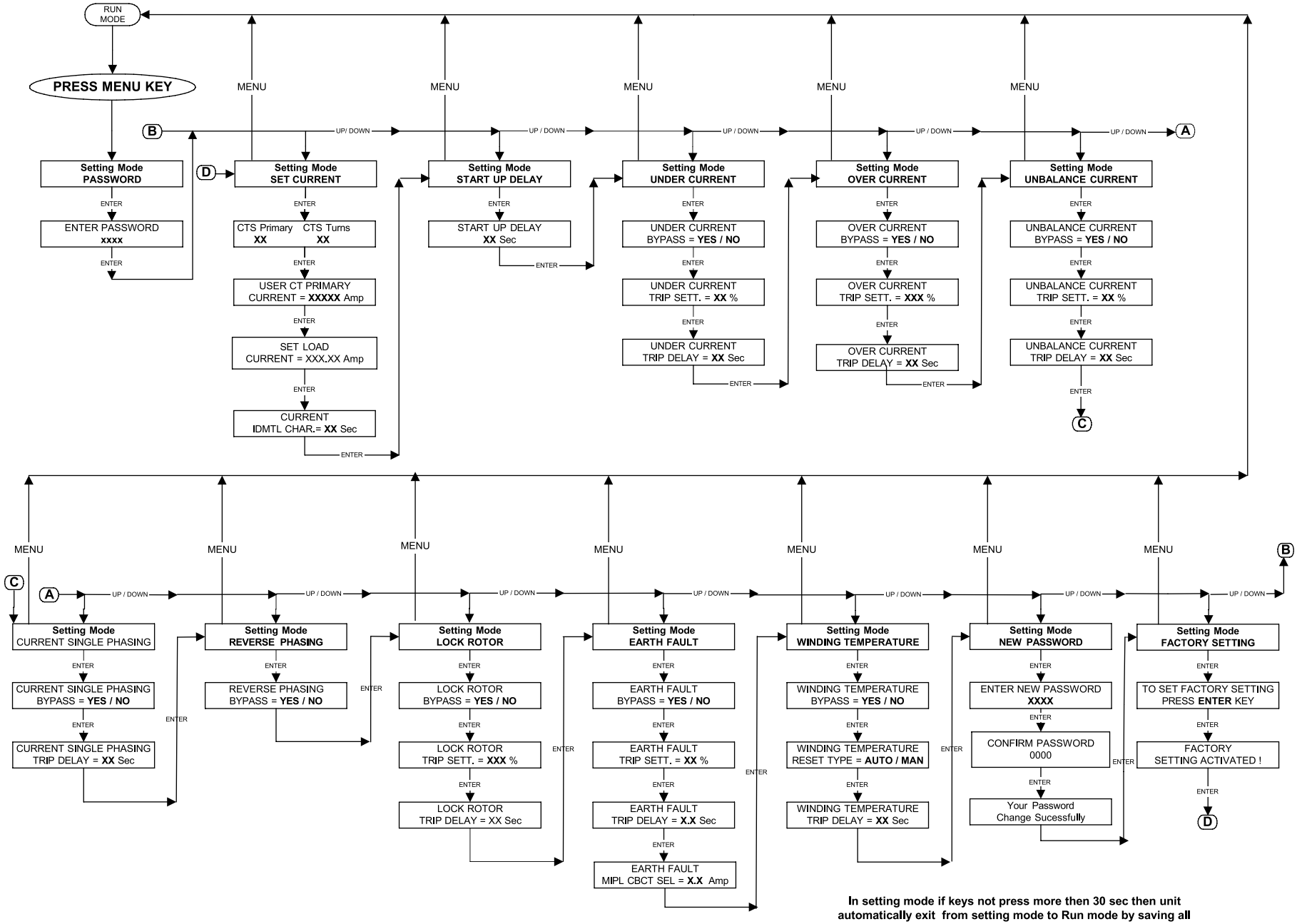
- I. Check the resistance between the terminal T1 (+ve) & T2 (- ve) .The resistance should be less then 4KΩ.connect the resistance to these terminal which should be greater than 39Ω and less than 4kΩ.(Approximately 1k2).
- II. If thermistors are connected to above-mentioned terminal & if the resistance is greater than 4kΩ it mean the motor winding temperature is increased. Wait till it normalizes.

4. Apart from the above-mentioned observations if one of the indications continue then contact Minilec.

**8. ABBREVIATIONS USED IN SOFTWARE:**

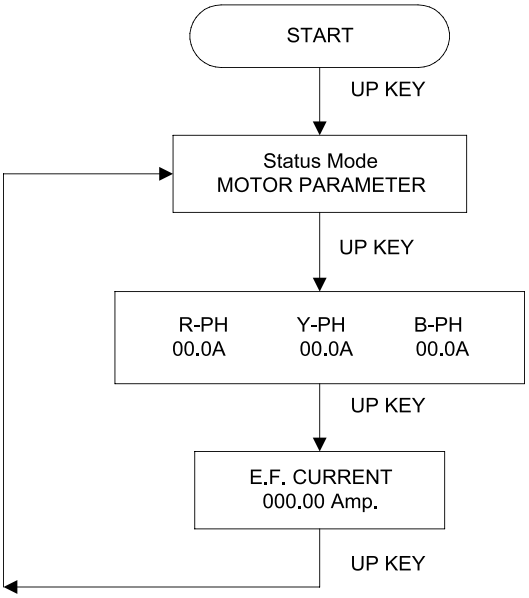
| | |
|---|---|
| Sett – setting | Man – manual |
| Auto – Automatic | SP – single phasing. |
| RP – Reverse phasing. | CT- current transformer. |
| CURR- Current | CHAR- Characteristics |
| UNBAL- Unbalance | EF- Earth fault. |
| TEMP- Temperature | UC- Under current |
| OC- Over current | CSP- Current single phasing. |
| IUB – Current unbalance | |

# SETTING MODE




**In setting mode if keys not press more then 30 sec then unit automatically exit from setting mode to Run mode by saving all parameter.**

## RUN / STATUS MODE

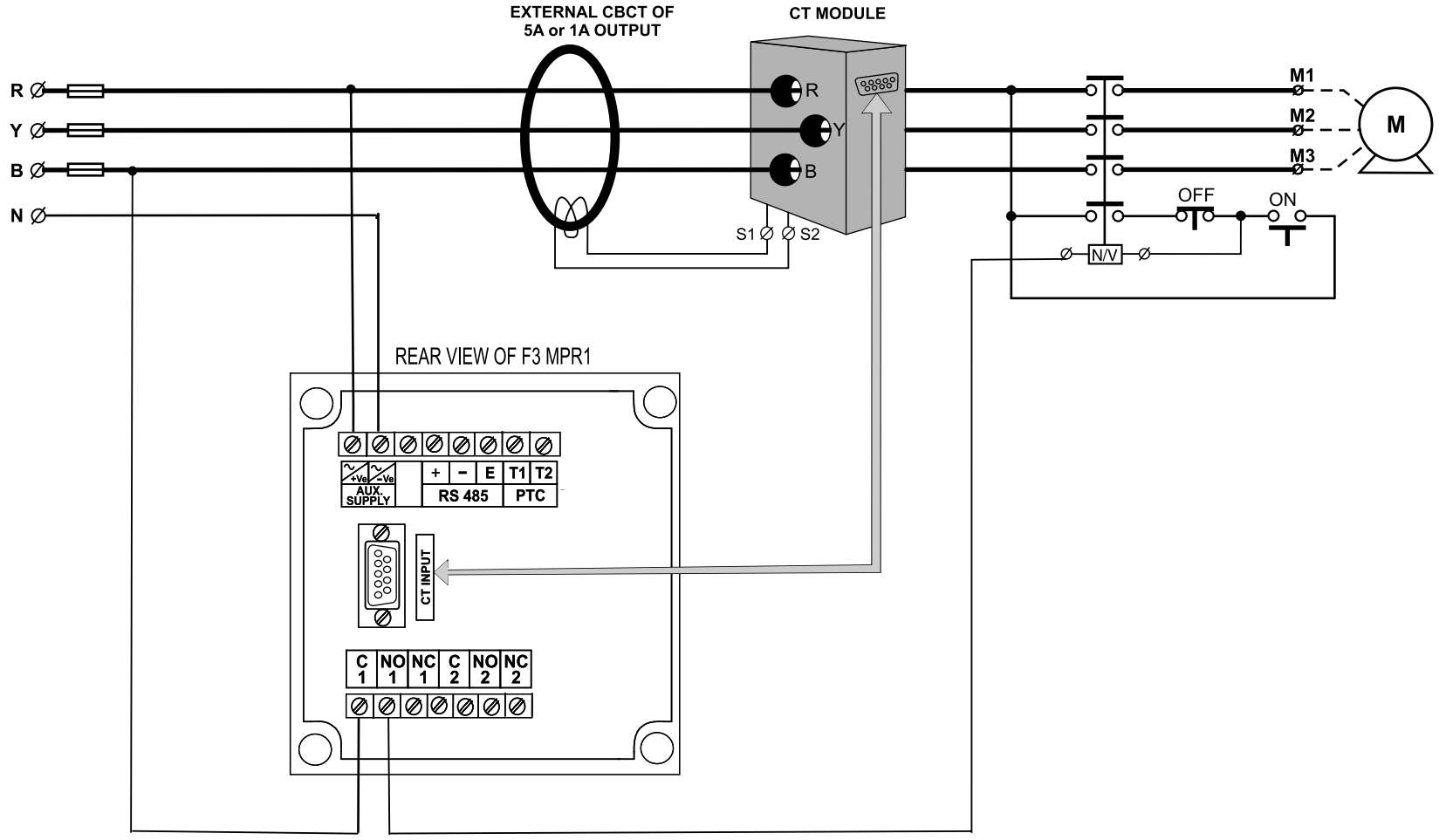


## GENERAL SPECIFICATIONS FOR μC BASED F3 MPR1

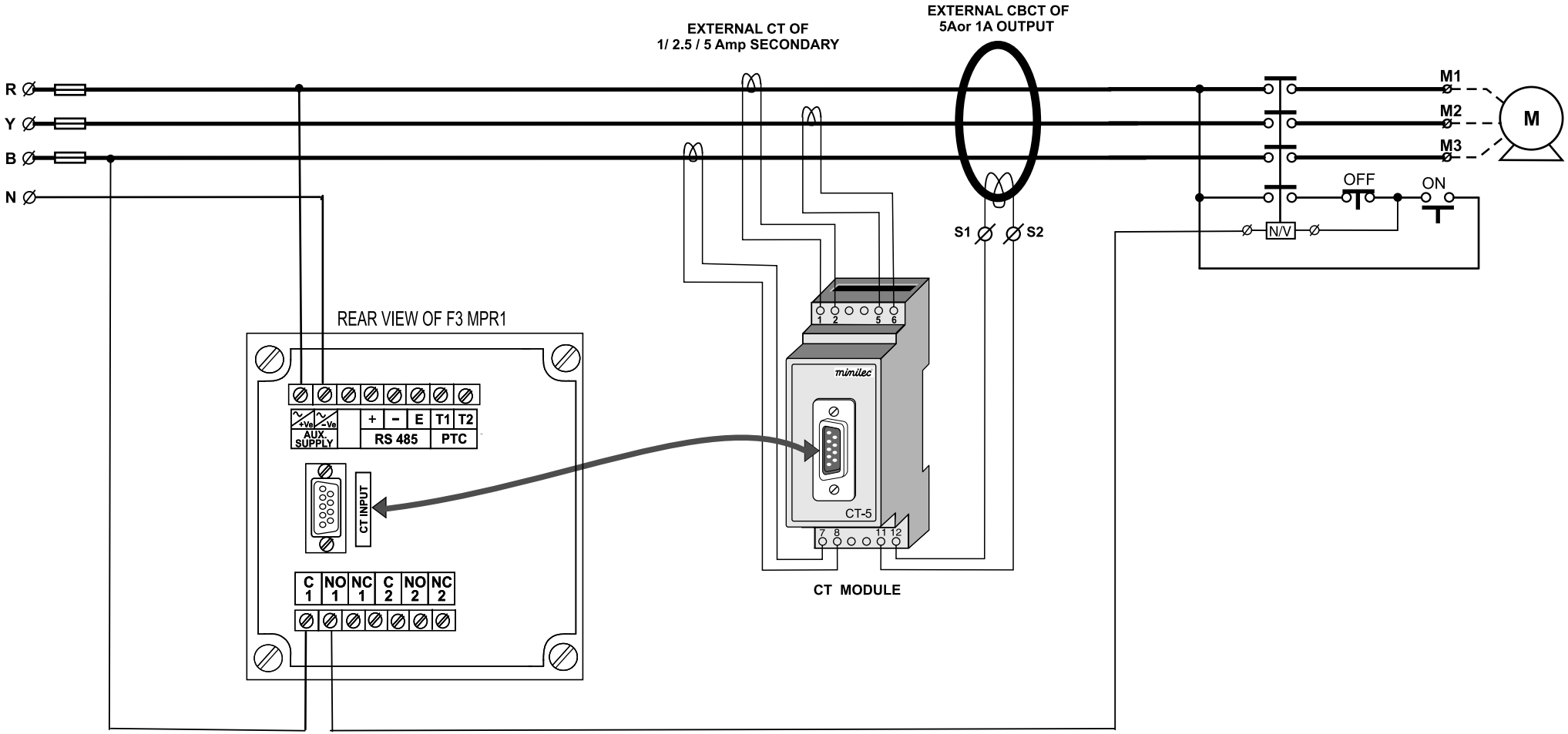
| SR. NO. | PARAMETER | DESCRIPTIONS |
|---|---|---|
| 1 | SYSTEM SUPPLY VOLTAGE | 220 - 440 VAC ± 20% |
| 2 | AUXILARY SUPPLY VOLTAGE | 90 - 270 VAC [FREQ.: 45 - 65 Hz] / DC |
| 3 | RELAY CONTACT | 2 CO |
| 4 | OUTPUT CONTACT RATING | 5 AMP, 230 VAC (RESTIVE) |
| 5 | PTC TEMPERATURE RANGE | 70 °C TO 180 °C |
| 6 | EXTERNAL CT FOR CURRENT PROTECTION | CT – 1 / 2.5 / 5 / 20 / 50 |
| 7 | EARTH FAULT CURRENT I/P | 10% TO 100% OF 1A / 5A [SELECTABLE] |
| 8 | SERIAL COMMUNICATION | PROVISION OF 485 O/P |
| 9 | INDICATIONS: | |
| | 1) POWER ON | POWER ON [STEADY ON] |
| | 2) TRIP | TRIP |
| 10 | DISPLAY | PROVISION OF (16 X 2) LCD DISPLAY |
| 11 | RESETTING | BY FRONT (UP + DOWN) KEYS |
| 12 | POWER SAVING MODE | AFTER 5 MINUTES (ONLY WHEN UNIT IS IN RUN MODE) |
| 13 | OPERATING CONDITIONS: | |
| | A) TEMPERATURE | 0 °C TO 60 °C |
| | B) HUMIDITY | UPTO 95% RH |
| 14 | ENCLOSURE | F3 SERIES ABS |
| 15 | MOUNTING DIMENTIONS: | |
| | A) OVER ALL (H x W x L) | (96 x 96 x 80) MM |
| | B) MOUNTING | PANEL MOUNTING |
| 16 | WEIGHT APPROX. | 400 GMS. |

## DETAIL SPECIFICATIONS FOR μC BASED F3 MPR1

| PROTECTION PARAMETER | | TRIP SETTING RANGE | | | | RESET TYPE SETT. | | TRIP TIME DELAY | | LCD DISPLAY |
|---|---|---|---|---|---|---|---|---|---|---|
| | | RANGE | STEPS | FACT. | SETTING | FACT. | KEYPAD | FACT. | KEYPAD | |
| **START UP DELAY: -** | | 0 - 240 SEC | 1S FOR 0 - 60S, 10S FOR 61 - 240S | 10 SEC | KEY PAD | N.A. | N.A. | N.A. | N.A. | START UP DELAY |
| | | | | | | | | | | |
| 1) CT PRIMARY RATIO | | 1 / 2.5 / 5 / 20 / 50 | 1 / 2.5 / 5 / 20 / 50 | 20 A | KEY PAD | NA | NA | N.A. | N.A. | CT PRIMARY RATIO |
| 2) FULL LOAD CURRENT | | 40% - 100% OF CT PRIMARY | 10% | 40% | | | | | | FULL LOAD CURRENT |
| 3) OVERLOAD TRIP SETTING AS PER IDMTL CHAR. (SEC) | | 2 / 5 / 10 / 15 / 20 SEC | 2 / 5 / 10 / 15 / 20 SEC | 2 SEC | | MAN | NA | AS PER IDMTL CHAR | | OVER LOAD |
| 4) UNBALANCE TRIP SETTING | | 20% - 60% | 10% | 50% | | Multi Attempt | | 3 SEC | 1-10 SEC | CURRENT UB |
| 5) SINGLE PHASING | | N.A. | N.A. | N.A. | N.A. | | | 3 SEC | 1-10 SEC | CURRENT S.P. |
| 6] REVERSE PHASING | | N.A. | | | | MAN | NA | INSTANT | N.A. | REVERSE PHASING |
| 7] UNDER CURRENT | | 30% - 90% | 5% | 50% | KEY PAD | Multi Attempt | | 5 SEC | 1-60 SEC | UNDER CURRENT |
| 8) OVER CURRENT | | 300% - 800% | 100% | 500% | | | | 2 SEC | 2-25 SEC | OVER CURRENT |
| 9) LOCK ROTOR | | 200% - 800% | 100% | 600% | | MAN | N.A. | 2 SEC | 1-10 SEC | ROTOR LOCK |
| 10) EARTH FAULT SETTING | | 10% TO 100% | 10% | 30% | | MAN | N.A. | < 1 SEC | 0.5-10 SEC | EARTH FAULT |
| **THERMISTOR: -** | | | | | | | | | | |
| 1) PTC TEMP. RANGE | | 70 °C TO 180 °C | | | | | | | | |
| 2) PTC HEALTHY | | 50 Ω – 4 KΩ | N.A. | N.A. | N.A. | AUTO | AUTO / MAN | 10 SEC | 1-20 SEC | SENSOR HEALTHY |
| 3) PTC FAULTY | A) SHORT<br>B) OPEN | A) BELOW 50 Ω<br>B) ABOVE 5.6KΩ | | | | | | | | TEMP SENSOR FAIL |
| 4) PTC TRIP | | 4.1 KΩ – 5.5 KΩ | | | | | | | | TEMPARATURE HIGH |
| 5) RESET | A) 1/3 PTC<br>B) 6/9 PTC | A) 1.5 KΩ - 1.8 KΩ<br>B) 2.2 KΩ - 2.8 KΩ | | | | | | | | |
| | | | | | | | | | | |
| **SET ACCURACY** | | ±5 % OF SET VALUE | | | | | | | | |
| **DISPLAY ACCURACY** | | ±2% OF DISPLAY VALUE | | | | | | | | |

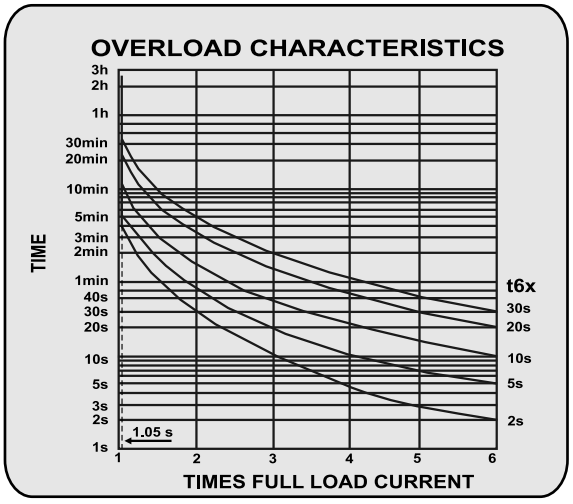



**EXTERNAL WIRING DIAGRAM WITH CT - 20 or CT-50 MODULE AND 5 Amp SECONDARY CBCT (PROTECTION CLASS 5P)FOR EARTH FAULT.**

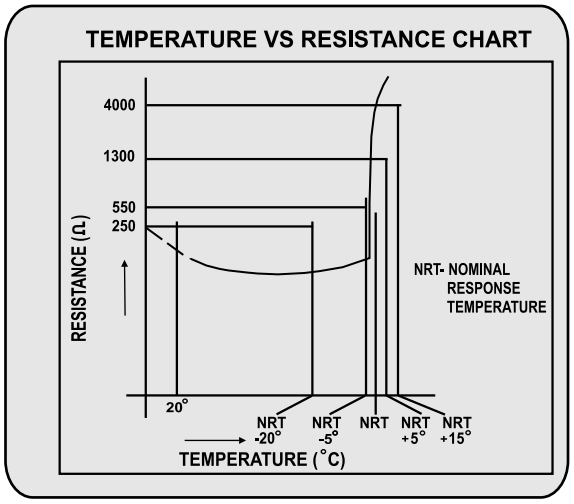


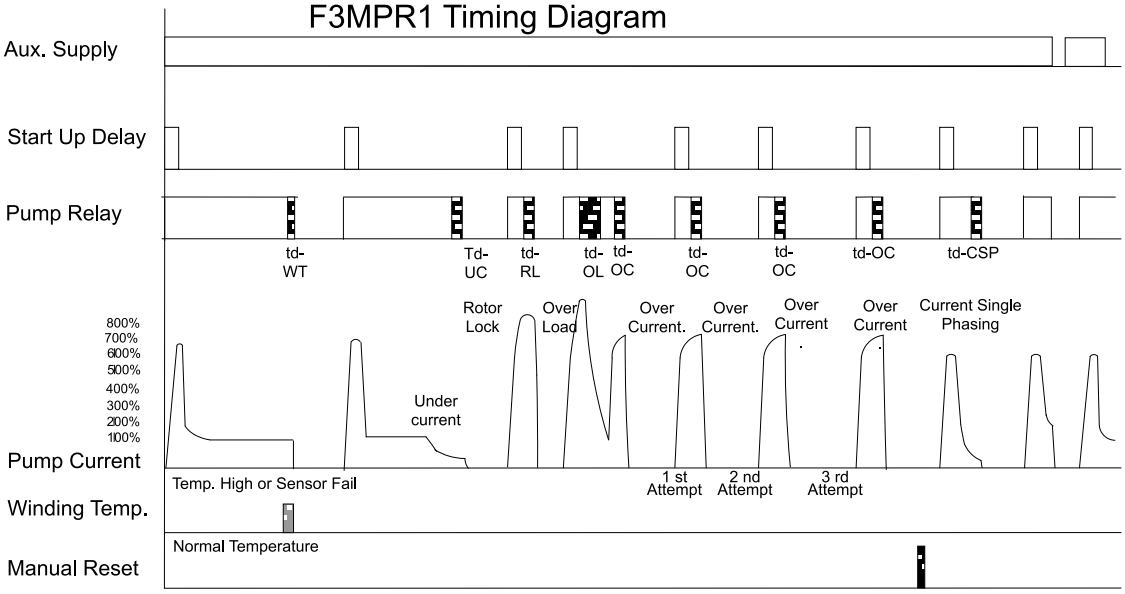

**EXTERNAL WIRING DIAGRAM WITH CT- 1, CT- 2.5, CT-5 MODULE AND 5 or 1 Amp SECONDARY CBCT (PROTECTION CLASS 5P)FOR EARTH FAULT.**

## OVER LOAD GRAPH




## TEMPERATURE VS RESISTANCE GRAPH

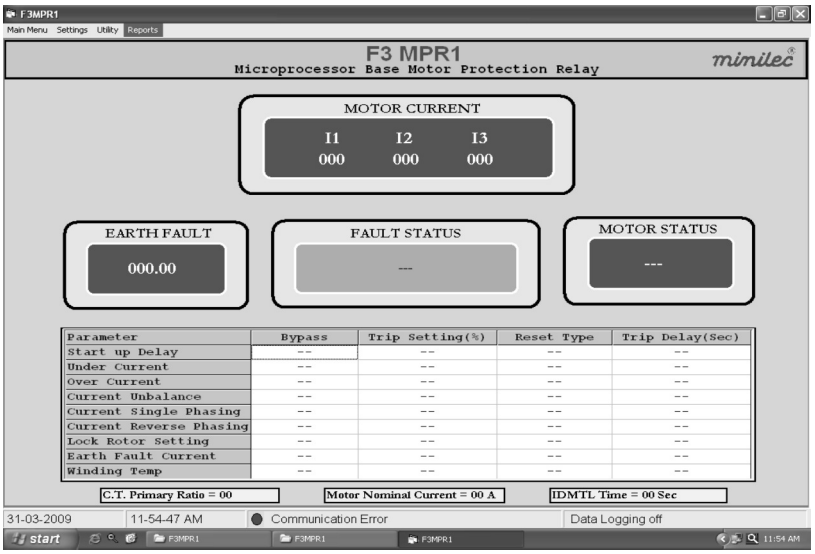


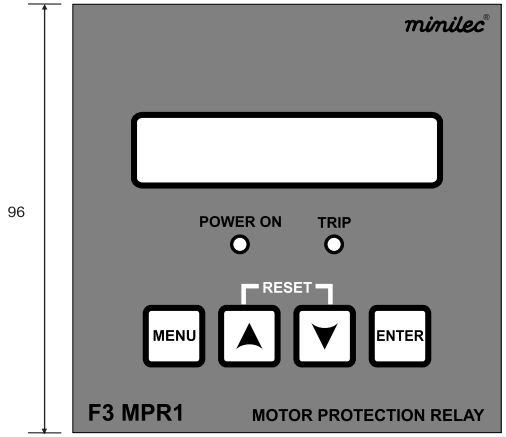



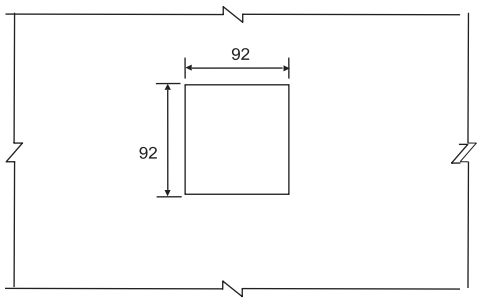

Abbreviations: td - Trip delay, WT - Winding temperature, UC - Under current, CSP - Current single phasing, OC - Over current, OL - Over load as per IDMTL.

**PC CONNECTION - ( RS 485 ):-**

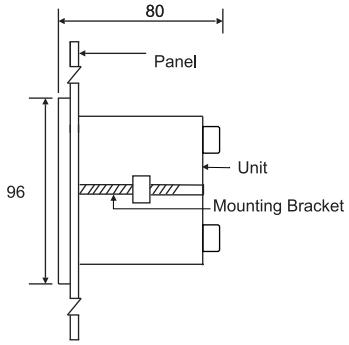
Your F3MPR1 comes with RS 485 output port . Just convert to Rs 232 by using serial converter . User can use this output to give signal to their PC with suitable software. Minilec can provide it`s standard software upon request at additional cost .Alternately user can also built their PC side software as per their requirements.



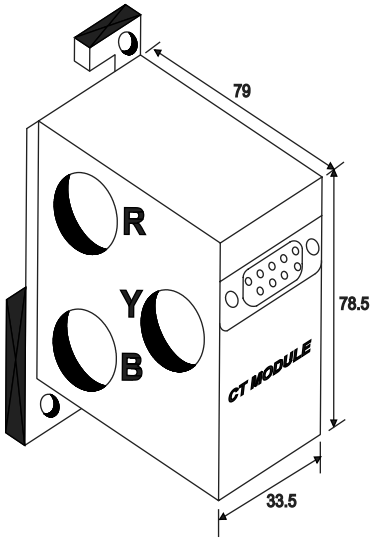


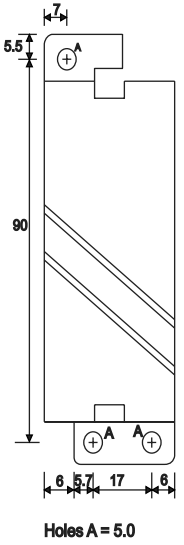




PANEL CUTOUT DETAILS BOTH VERTICAL & HORIZONTAL ARRANGMENT ARE SHOWN



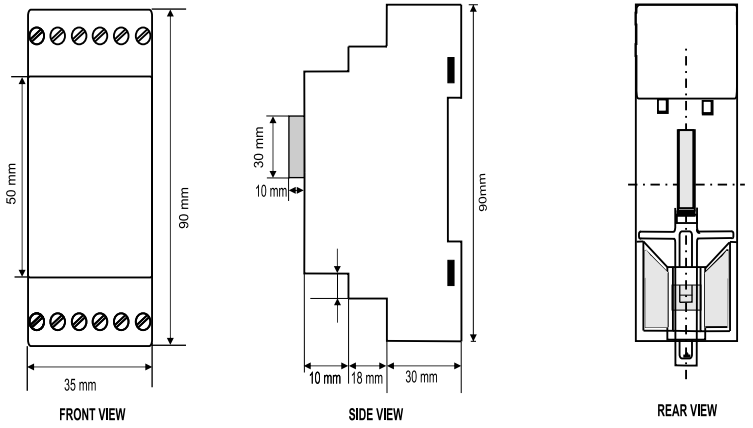

All Dimensions are in mm.




MOUNTING DETAILS FOR CT20 AND CT 50

All Dimensions are in mm.




MOUNTING DETAILS FOR CT1, CT2.5, CT 5

All Dimensions are in mm.

GENERAL ARRANGEMENT AND PANEL CUITOUT DETAILS