



JUNE 2009

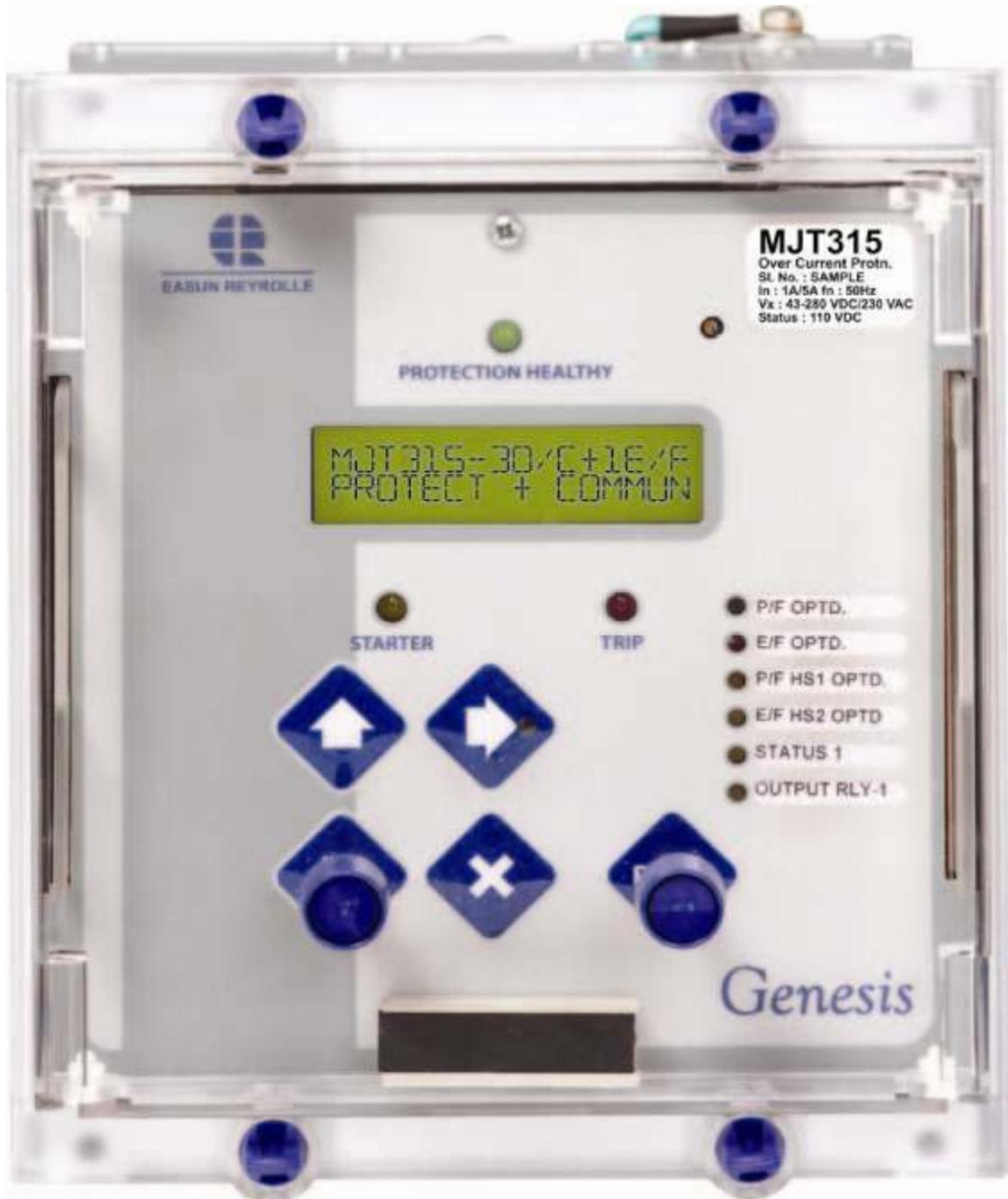
**APPLICATION AND COMMISSIONING
MANUAL FOR NUMERICAL OVER
CURRENT & EARTH FAULT
PROTECTION RELAY
TYPE – MJT 315**

EASUN REYROLLE LIMITED

ISSUE NO : Ist Issue

DATE OF ISSUE : 17 - 06 - 2009

DEPARTMENT : Applications Support



MJT315
Over Current Protn.
Sl. No. : SAMPLE
In : 1A/5A fn : 50Hz
Vx : 43-230 VDC/230 VAC
Status : 110 VDC


EASUN REYROLLE

PROTECTION HEALTHY

MJT315-30/C+1E/F
PROTECT + COMMUN

STARTER

TRIP

- P/F OPTD.
- E/F OPTD.
- P/F HS1 OPTD.
- E/F HS2 OPTD.
- STATUS 1
- OUTPUT RLY-1

Genesis

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CHAPTER 1 - APPLICATION

1.1. INTRODUCTION

The type MJT315 numeric over current protection relay combines the power and flexibility of microprocessor technology. A wide range of protection elements, characteristics and true RMS measurements are available. Moreover, supervisory components and self-monitoring features give high confidence of serviceability.

MJT 315	Three Pole Over Current and Earth Fault Relay with two High set elements
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1.2. MULTIPLE CHARACTERISTICS

MJT315 relay is suitable for various inverse characteristics and also for definite time lag characteristic, any one of them selectable at site independently for phase and earth fault.

1.2.1 Standard Inverse characteristic (SI 3 or SI 1)

SI 3 theoretical operating time is 3 seconds at 10 time's current setting at time multiplier setting (TMS) 1.000. Theoretical operating time of the standard inverse characteristics – SI 1 is 1.3 seconds at 10 time's current setting at TMS 1.000.

1.2.2 Very Inverse Characteristic (VI)

VI curve is suited to networks where there is a significant reduction in fault current as the distance from the source increases. The operating time is shorter for large fault currents and increases at a greater rate as the fault current decreases. This permits the use of the same time multiplier setting for several relays in series.

1.2.3 Extremely Inverse Characteristic (EI)

EI is very much useful to grade the relay with the fuse and applications where short duration transient over currents occurs. E.g. Motor starting or reacceleration.

1.2.4 Long Time Inverse Characteristic (LTI)

LTI is generally used for Standby Fault protection for Neutral / Ground Earthing Resistor. The same characteristics can be used to guard against overheating / over loading protection, when it matches with thermal characteristics of the motor, generator, transformer or capacitor banks.

1.2.5 Definite Time Lag Characteristic (DTL)

DTL is used for grading the system where source impedance determines fault current level and the fault current does not vary to a considerable amount down the length of the line.

1.3. DC TRANSIENT FREE HIGHSET

On transmission lines or transformer feeders where the source impedance is small compared with the protection circuit, to reduce the tripping time at high fault level the highset instantaneous over current & earth elements are used in addition to the inverse time over current & earth element. MJT 315 relay is provided with two stages of highset elements in both phase fault and earth fault. First stage of highset element is having DTL characteristic and second stage of highset element is

instantaneous element. Depending upon the point on wave switching of the fault and the X/R ratio of the system, the initial current may have DC offset. The highset over current unit being instantaneous one, it should not over reach due to initial DC offset current though it may exceed the highset pick-up value. The MJT 315 relay is provided with the DC transient free highset elements, which will not over reach for DC transient condition.

1.4. RESET TIME DELAY

The increasing use of plastic cables, both, conventionally buried types and aerial bundled conductor types have given rise to the number of "pecking" or "flashing" intermittent faults on distribution systems. At the fault position, the plastic melts and temporarily reseals the faulty cable for a short time, after which the insulation fails again. The same phenomenon has occurred in joint boxes where an internal flashover temporarily reseals.

The behavior of different types of over current relays under flashing fault condition is compared in Fig. 1. The repeating process often caused electromechanical disc relays to "ratchet" up and eventually trip the faulty circuit provided that the reset time of the relay was longer than the time between successive flashes. Early electronic IDMTL relays with instantaneous reset features were not at all effective in dealing with this condition and only tripped after the flashing fault had developed into a solid permanent fault.

To overcome this, MJT 315 relay has a reset time setting which can be user programmed to be either instantaneous or delayed from 1 to 60 seconds.

On the other hand, on overhead line networks, particularly where reclosers are incorporated in the protected system, instantaneous resetting is desirable to ensure that, on multiple shot reclosing schemes, correct grading between the source relays and the relays associated with the reclosers is maintained.

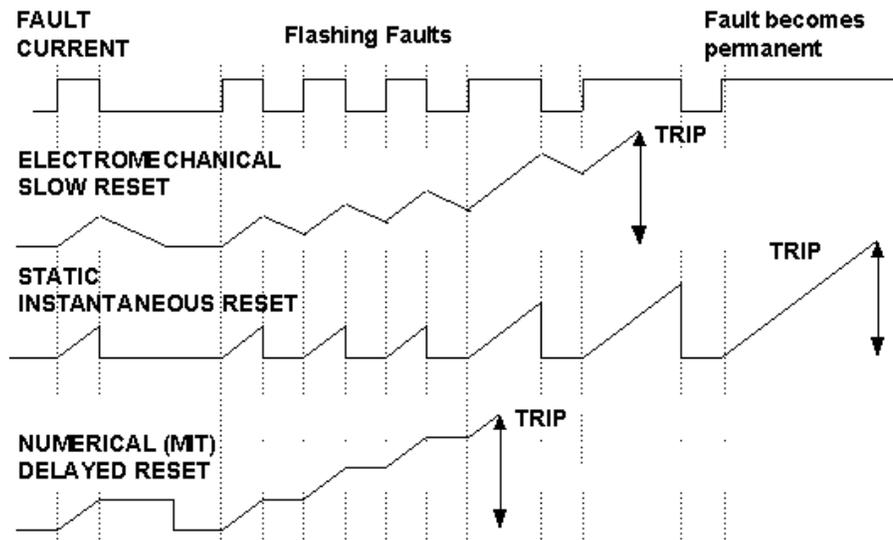


Fig 1: Flashing Fault Protection

1.5. SIMPLE BUSBAR PROTECTION

For a simple radial system, where there is one incoming and several outgoing feeders, with MIT Relays simple busbar protection can be applied as shown in fig 2. The optional starter output relay with one changeover contact can be used for this application.

The break contacts of the starter output of the outgoing feeders can be connected in series (so that any fault on the outgoing feeder, the trip circuit is not energized) and this combination is connected in series with the normally open repeat contacts of the starter output of the incoming feeder.

The above combination trips the incoming feeder with minimum delay for a bus fault. The repeat contact if necessary has to give a small time delay to avoid racing of contacts. When there is a line fault say at line D, Starter contact of 'D' opens and hence there is no Bus trip. When there is a bus fault, N/O contact of 'A' closes and there is a trip.

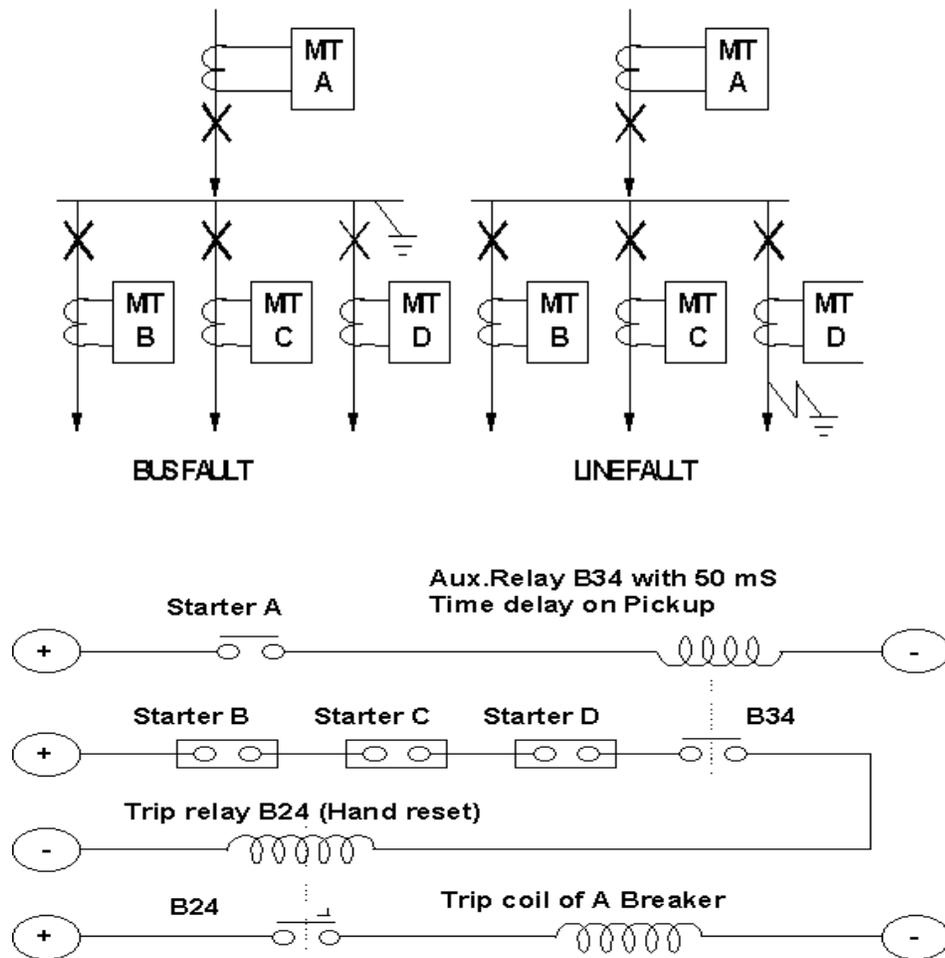


Figure 2. Simple Busbar Protection Scheme

Thus same MJT 315 Relay can be used for simple Bus bar protection in addition to the normal duty of protecting the distribution feeders. This is an economic form of Bus bar protection, which can be used, where dedicated form of Bus bar protection cannot be justified.

1.6 CAPACITOR BANK PROTECTION

The TRUE RMS measurement of the MJT 315 Relay makes it very much suitable for protection of capacitor banks to guard against the faults in the capacitor and the leads between the circuit breaker and units.

1.7. ROUGH BALANCE SCHEME

Where a dedicated transformer differential protection is not economically justified the MJT 315 relay can be used in the differential circuit of the transformer current balance protection. See fig 3. Since the relay is having lower settings down to 5% even on the phase fault elements, suitable setting can be adopted for this scheme. It may be necessary to change the setting during tap changing of the transformer. The magnetic inrush current while charging the transformer will not affect the relay function as the relay is set for time delayed operation.

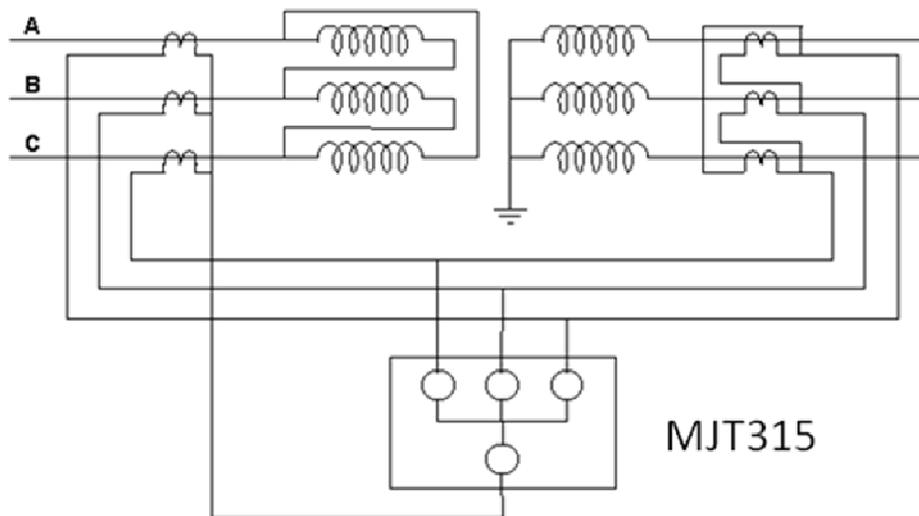


Figure 3. Rough Balance Scheme

1.8. LIGHTLY LOADED SYSTEMS

The lower range of the current setting available in the phase fault setting makes the relay suitable for lightly loaded system. The setting can be changed to higher value when the system load is upgraded.

CHAPTER 2 -INSTALLATION

2.1. UNPACKING

On receipt, remove the relay from the carton box in which it was received and inspect it for obvious damage. It is recommended that the relay is not removed from the relay case. To prevent the possible ingress of dirt, the sealed polythene bag should not be opened until the relay is to be used.

If damage has been sustained, please inform **Easun Reyrolle Ltd.**, for necessary action.

2.2. STORAGE

When the relay is not required for immediate use, it should be returned to its original carton and stored in a clean dry place.

2.3. HANDLING

The relay's electronic circuits are protected from damage by static discharge when the relay is housed in its case. When relay is withdrawn from the case, static handling procedures should be observed:

- Before removing the relay from its case the operator must first ensure that he is at the same potential as the relay, by touching the case
- The relay must not be handled by any of the relay terminals at the rear of the chassis
- Ensure that anyone else handling the relay is at the same potential

As there are no user serviceable parts and adjustable user settings inside the relay, there should be no requirement to remove any modules from the chassis. If any modules are removed or tampered with, then the guarantee will be invalidated.

2.4. MOUNTING

Mount the relay using two mounting straps and one earth strap. Ensure that an earth wire is connected to the earth strap from the earth terminal 23. Terminal 23 should be directly connected to the system ground.

Only settings or trip details can be accessed via the pushbuttons when the cover is fitted. To change the settings the front cover has to be removed. Sealing arrangement is provided in one of the four knurling screws fitted on the cover. Sealing can be done using a sealing wire. Thus mechanical interlock is provided to avoid unauthorized setting change.

CHAPTER 3 - COMMUNICATION

The communication interface complies with IEC 60870-5-103 or MODBUS RTU with 2 wire RS485 physical layout.

COMMUNICATION PORT - RS 485

Normal shielded twisted pair cable should be used for communication. The relay can be connected directly if the data terminating equipment (Master) has RS 485 port in it, otherwise a RS485 to RS232 converter is required. Maximum distance between the master and the slave should be limited up to 1200 meters.

COMMUNICATION PROTOCOL

Protocol defines a message structure that controllers will recognize and use, regardless of the type of networks over which they communicate. It describes the process a controller uses, to request access to another device, how it will respond to requests from the other devices, and how errors will be detected and reported. It establishes a common format for the layout and contents of message fields. This relay supports IEC 60870-5-103 protocol.

IEC 60870-5-103 PROTOCOL

The communicative interface complying with IEC 60870-5-103 has two distinct features.

1. Standard features, for example, Spontaneous Events, Metering, active group change and General Interrogation as defined in IEC 60870-5-103.
2. Private commands to access additional features, for example, active group change and altering the relay settings.

Transmission Rate

Different baud rates are provided for flexibility of the user. They are

- 19200,
- 9600,
- 4800
- 2400 bits per second (BPS)

All the above baud rates can be used for the maximum distance (1200 meters) specified by the RS 485 standard.

Parity

Defines the method of transmission as using EVEN parity. However, in some instance an alternative may be required. The relay allows the setting of parity to

- EVEN
- NONE
- ODD

Address

Up to 32 relays can be connected to a master. The address of the relay must be set to a value between 1 and 254 inclusive before communication can take place. All relays must have a unique address. Address 255 is reserved as a global broadcast address. Communication ON / OFF setting is also provided.

CHAPTER 4 – GUIDELINES FOR SETTING

4.1 HUMAN MACHINE INTERFACE (HMI)

The user friendly HMI provided on the front panel has following features:

1. LCD display - To display settings, readings, fault records etc...
2. Green LED - Protection healthy indication
3. Orange LED (STARTER) - Starter indication
4. Red LED (TRIP) - Trip indication,
5. Red LED (in ⇌Key) - Sub Menu ON indication
6. Up↑ Key - Scrolling up/ increasing value when submenu is ON.
7. Down↓Key - Scrolling down/ decreasing value when submenu is ON.
8. Sub menu key ⇌ - To change settings. When submenu LED is ON, then the user can edit the sub menu by scrolling using up/down keys. When sub menu LED is OFF, then the user returns to the main menu. Now using up/down key the user can scroll through the main menu.
9. X Key - Enter / Reset / Cancel / To check Version/ Pass-code
10. Configurable LEDs (Red 2nos & Orange 4nos)

4.2 SETTING INSTRUCTIONS

4.2.1 How to operate HMI

- ◆ Remove the front cover by unscrewing the four knurling screws.
- ◆ Apply DC voltage between the terminals 13 and 14.
- ◆ Connect terminal 15 to earth.
- ◆ When the relay powers up, it takes few seconds, to complete the self-checking process.
- ◆ Then the protection healthy LED becomes ON.
- ◆ When the screen becomes blank, press the↓key, the display shows,

MJT 315 – 3 O/C +1 E/F PROTECT+COMMUN
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- ◆ Use key to scroll down. For each key press, the main menu displays each of the settings in the order shown below.

GROUP ACTIVE				G1		
PF CURRENT	G1=100		G2=100			
PF CHARACTERISTIC	G1=NI 3		G2=NI 3			
PF TIME(MULT)	G1=1.000		G2=1.000			
PF HIGHSET 1	G1=OFF		G2=OFF			
PF HS1 TIME	G1=0		G2=0			
PF HIGHSET 2	G1=OFF		G2=OFF			
EF CURRENT	G1=80		G2=80			
EF CHARACTERISTIC	G1=NI 3		G2=NI 3			
EF TIME(MULT)	G1=1.000		G2=1.000			
EF HIGHSET 1	G1=OFF		G2=OFF			
EF HS1 TIME	G1=0		G2=0			
EF HIGHSET 2	G1=OFF		G2=OFF			
RESET TIME	G1=0		G2=0			
STATUS CONFIG S1-S8						
OUTPUT CONFIG X H.RESET R1-R6						
LED CONFIG X H. RESET L1-L6						
TIME	Hours	Min	Sec			
	10	55	15			
DATE	Day	Month	Year			
	22	11	05			
COMMUNICATION	ON					
	Baud rate	Parity	Address			
	9600	EVEN	001			
Instruments						
P/F C.T RATIO	300 / 1					

E/F C.T RATIO	300 / 1
r =0.000	y=0.000
b=0.000	e=0.000
R =00.00	Y=00.00
B=00.00	E=00.00
FAULT DATA 1	
FAULT DATA 2	
FAULT DATA 3	
Clear all FAULT DATA	
PASSWORD	NONE

4.3 TO CHANGE THE SETTINGS

To change the settings, press the submenu key. The sub menu key \Rightarrow can be pressed **only when starter /Trip LED is not glowing**. When starter LED is glowing, **no setting change can be done**.

4.3.1 ACTIVE GROUP

Press \downarrow key to get ACTIVE GROUP setting. Press \Rightarrow submenu Key, Red LED in the key is lit to indicate that the sub menu is activated.

The options available in the sub menu are

- G1
- G2

GROUP ACTIVE	G1
--------------	----

When the display shows, group active = G1, the relay permits to change the settings in-group G1 only.

GROUP ACTIVE	G2
--------------	----

Now the display shows, group active = G2, the relay permits to change the settings in-group G2 only.

PF CHARACTERISTICS

Press \downarrow key repeatedly to get PF Characteristics menu, press \Rightarrow submenu Key, Red LED in the key is lit to indicate that the sub menu is activated. Pressing \downarrow or key \uparrow repeatedly the sub menu will scroll down in the following order on the display.

- NI 1.3
- NI 3

- VI
- EI
- LTI and
- DTL

PF CHARACTERISTIC	G1=NI 3	G2=NI 3
-------------------	---------	---------

4.3.3 PF CURRENT

Press \downarrow key repeatedly to get PF Current menu, press \Rightarrow submenu Key , Red LED in the key is lit to indicate that the sub menu is activated. The current setting is available from 5% to 250%. The setting can be increased/ decreased in steps of 1% by pressing up/down keys respectively.

PF CURRENT	G1=100%	G2=100%
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4.3.4 PF TIME MULTIPLIER

Press \downarrow key repeatedly to get PF time multiplier setting menu, press \Rightarrow submenu Key , Red LED in the key is lit to indicate that the sub menu is activated.

The time multiplier setting depends on the characteristic selected.

- For IDMTL characteristics the time multiplier setting varies from 0.025 to 1.600. The setting can be increased/ decreased in steps of 0.001 by pressing up/down keys respectively.
- For DTL the time setting varies from 0.00 to 20.00 seconds. The setting can be increased/ decreased in steps of 0.01 seconds by pressing up/down keys respectively.

PF TIME(MULT)	G1=1.000	G2=1.000
---------------	----------	----------

4.3.5 PF HIGHSET1 CURRENT

Press \downarrow key repeatedly to get PF Highset1 setting menu, press \Rightarrow submenu Key , Red LED in the key is lit to indicate that the sub menu is activated. The Highset1 current setting is available from 5% to 3000%. The setting can be increased/ decreased in steps of 1% by pressing up/down keys respectively. It can also be put OFF.

PF HIGHSET 1	G1=OFF	G2=OFF
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4.3.6 PF HIGHSET1 TIME

Press \downarrow key repeatedly to get PF Highset 1 time setting menu, press \Rightarrow submenu Key , Red LED in the key is lit to indicate that the sub menu is activated. The Highset1 time setting varies from 0.00 to 20.00 seconds. The setting can be increased/ decreased in steps of 0.01 seconds by pressing up/down keys respectively.

PF HS1 TIME	G1=0.00	G2=0.00
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4.3.7 PF HIGHSET2 CURRENT

Press ↓ key repeatedly to get PF Highset2 setting menu, press ⇨ submenu Key , Red LED in the key is lit to indicate that the sub menu is activated. The Highset2 current setting is available from 50% to 3000%. The setting can be increased/ decreased in steps of 50% by pressing up/down keys respectively. It can also be put OFF.

PF HIGHSET 2	G1=OFF	G2=OFF
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4.3.8 EF CHARACTERISTICS

Press ↓ key repeatedly to get EF Characteristics menu, press ⇨ submenu Key ,Red LED in the key is lit to indicate that the sub menu is activated. Pressing ↓ or ↑ key repeatedly the sub menu will scroll down in the following order on the display.

- NI 3
- NI 1.3
- VI
- EI
- LTI and
- DTL

EF CHARCTERISTIC	G1=NI 3	G2=NI 3
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4.3.9 EF CURRENT

Press ↓ key repeatedly to get EF Current menu, press ⇨ submenu Key, Red LED in the key is lit to indicate that the sub menu is activated. The current setting is available from 5% to 250%. The setting can be increased/ decreased in steps of 1% by pressing up/down keys respectively.

EF CURRENT	G1=100	G2=100
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4.3.10 EF TIME MULTIPLIER

Press ↓ key repeatedly to get EF time multiplier setting menu, press ⇨ submenu Key , Red LED in the key is lit to indicate that the sub menu is activated.

The time multiplier setting depends on the characteristic selected.

- For IDMTL characteristics the time multiplier setting varies from 0.025 to 1.600. The setting can be increased/ decreased in steps of 0.001 by pressing up/down keys respectively.
- For DTL the time setting varies from 0.00 to 20.00 seconds. The setting can be increased/ decreased in steps of 0.01 seconds by pressing up/down keys respectively.

EF TIME(MULT)	G1=1.000	G2=1.000
---------------	----------	----------

4.3.11 EF HIGHSET1 CURRENT

Press \downarrow key repeatedly to get EF Highset1 setting menu, press \Rightarrow submenu Key, Red LED in the key is lit to indicate that the sub menu is activated. The Highset1 current setting is available from 5% to 3000%. The setting can be increased/ decreased in steps of 1% by pressing up/down keys respectively. It can also be put OFF.

EF HIGHSET 1	G1=OFF	G2=OFF
--------------	--------	--------

4.3.12 EF HIGHSET1 TIME

Press \downarrow key repeatedly to get EF Highset 1 time setting menu, press \Rightarrow submenu Key , Red LED in the key is lit to indicate that the sub menu is activated. The Highset1 time setting varies from 0.00 to 20.00 seconds. The setting can be increased/ decreased in steps of 0.01 seconds by pressing up/down keys respectively.

EF HS1 TIME	G1=0	G2=0
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4.3.13 EF HIGHSET2 CURRENT

Press \downarrow key repeatedly to get EF Highset2 setting menu, press \Rightarrow submenu Key , Red LED in the key is lit to indicate that the sub menu is activated. The Highset2 current setting is available from 50% to 3000%. The setting can be increased/ decreased in steps of 50% by pressing up/down keys respectively. It can also be put OFF.

EF HIGHSET 2	G1=OFF	G2=OFF
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4.3.14 RESET TIME

Press \downarrow key repeatedly and get EF reset time menu. To set the reset time, press \Rightarrow submenu Key , Red LED in the key is lit to indicate that the sub menu is activated. The reset time setting is available from 0 second to 60 seconds. It can be set in steps of 1 seconds. The reset time can be increased by pressing \uparrow key and decreased by pressing \downarrow key.

RESET TIME	G1=0	G2=0
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4.3.15 STATUS CONFIGURATION

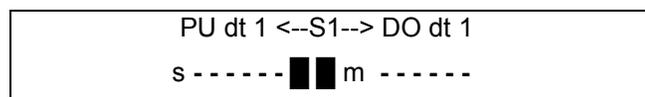
Press \downarrow key repeatedly and get status configuration for S1 to S8, press side arrow key, sub menu key,

BLKFUN<--S1-->RLY -----■-■■-----

Press side arrow sub menu key again, Red LED in the key is lit to indicate that the sub menu is activated. The user has to press the sub menu key multiple times to enter into appropriate character position and set the options.

Character Positions	Function	User options
1 to 7	<p>BLOCKING FUNCTIONS (character positions 1-6)</p> <p style="text-align: center;"> ↓↑ ↓↑ ↓↑ ↓↑ ↓↑ ↓↑ ↓↑ ↓↑ ↓↑ ↓↑ ↓↑ ↓↑ ↓↑ </p> <p> 1 - P/F Char (IDMTL/ DTL) 2 - P/F High-set 1 3 - P/F High-set 2 4 - E/F Char (IDMTL/ DTL) 5 - E/F High-set 1 6 - E/F High-set 2 </p>	<p>different inhibit functions with code.</p> <p>For character positions, (1 to 7) the following options are available by pressing up/ down arrow</p> <p style="margin-left: 40px;"> DASH - No inhibit 1 - Inhibit </p>
8	Select between Inverted and Non-inverted status inputs	<p>1 - Inverted inputs DASH - Non-inverted inputs</p>
9	Change group	<p>1 - G1 select 2 - G2 select (3 - if trip circuit supervision is given)</p>
(11 to 16)**	<p>OUTPUT RELAY CONFIGURATION (character positions 11-16)</p> <p> RLY1 RLY2 ↓↑ ↓↑ ↓↑ ↓↑ ↓↑ ↓↑RLY 3 RLY4 RLY5 RLY 6 </p> <p>For the given status input, the preset output contacts will operate.</p> <p>Even multiple contacts can be operated with a single status input.</p>	<p>For Character positions, (11 to 16)** the following options are available.</p> <ul style="list-style-type: none"> ● 1. The contact will operate for the status input. ● Dash. The contact will not operate for the status input. ● 0 (Zero). Reset the output contact for the status input.

Press side arrow sub menu key again, Red LED in the key goes off. Press down key to get the **Status1 Pick up/ drop off time delay menu**



Press the side arrow key to set the Pick up time delay. Use up/down arrow keys to set the time delay. Press the side arrow key again to edit the drop off delay. Use up/down arrow keys to set the time delay.

CHARACTER AND SUB MENU OPTIONS

Character Positions	Function	User options (Delay time in Sec)
1	Minute (or) second	Select whether the time delay is set in minutes or seconds
2-5	Pick up delay	10 ms (0.01 Sec) to 999.99 min
6	Dash	-
7	Display S for Sec	-
10-14	Drop off delay	10 ms (0.010 Sec) to 999.99 min
15	Dash	-
16	Display S for Sec	-

Further pressing down key remaining 7 status will appear

4.3.16 OUTPUT CONFIGURATION

On pressing down arrow from STATUS INPUT VIEW menu, the user gets into O/P RELAY CONFIG menu. The user has to press side arrow key to enter. The red LED in the side arrow button will be OFF. In the sub menu, the side key LED will be functional.

Self, Hand / Elect Reset o/p - - - - -

Each output relay can be assigned to multiple protection functions.

O/P RELAY CONFIG → TO VIEW		
MENU 1	↓↑	Self, Hand/ Elect reset O/P
MENU 2	↓↑	PF Starter O/P Rly
MENU 3	↓↑	PF Char O/P Rly
MENU 4	↓↑	PF Highset1 O/P Rly

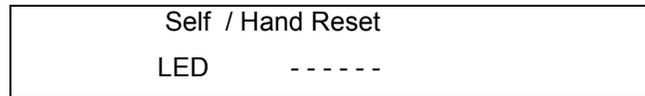
Press side arrow to enter

MENU 5	↓↑	PF Highset2 O/P Rly
MENU 6	↓↑	EF Starter O/P Rly
MENU 7	↓↑	EF Char O/P Rly
MENU 8	↓↑	EF Highset1 O/P Rly
MENU 9	↓↑	EF Highset2 O/P Rly

** Protection healthy is not user configurable. So no user settable options will be provided.

4.3.17 LED CONFIGURATION

Press down key repeatedly and get LED configuration for L1 to L6, press side arrow key sub menu key,



Press side arrow key again, Red LED in the key is lit to indicate that the sub menu is activated.

CHARACTER AND SUB MENU OPTIONS

Character Positions	Function
1	Led1 hand reset/self reset
2	Led2 hand reset/self reset
3	Led3 hand reset/self reset
4	Led4 hand reset/self reset
5	Led5 hand reset/self reset
6	Led6 hand reset/self reset

Press side arrow key again, Red LED in the key goes off to indicate that the sub menu is deactivated. Press down key then rest of the LED menu appears as follows

Character Positions	Function
S1	NO LED
S2	NO LED

S3	NO LED
S4	NO LED
S5	NO LED
S6	NO LED
S7	NO LED
S8	NO LED
P/F STARTER	NO LED
P/F CHARACT	NO LED
P/F HIGHSET1	NO LED
P/F HS1 TIME	NO LED
P/F HIGHSET 2	NO LED
E/F STARTER	NO LED
E/F CHARACT	NO LED
E/F HIGHSET1	NO LED
E/F HS1 TIME	NO LED
E/F HIGHSET 2	NO LED
OUTPUT Rly1	NO LED
OUTPUT Rly2	NO LED
OUTPUT Rly3	NO LED
OUTPUT Rly4	NO LED
OUTPUT Rly5	NO LED
OUTPUT Rly6	NO LED

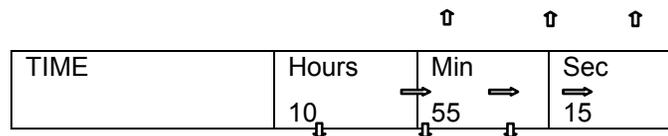
4.3.18 TIME

Press  key repeatedly and get the time menu. Time is displayed as HOURS: MINUTES: SECONDS, in 24 hours fashion. To set the time press  submenu Key , Red LED in the key is lit to indicate that the sub menu is activated. Now hour can be increased/decreased by using UP arrow key or Down arrow key. Press the side arrow submenu Key, for the second time to edit the minute setting. Press the side arrow submenu key, for the third time to edit the seconds setting.

To set the hours setting only, press submenu key once. The sub menu LED glows. Now increase or decrease the setting by pressing up/down keys. Now press submenu key thrice. Now the sub menu key goes off. Now press **X** key, to save the settings.

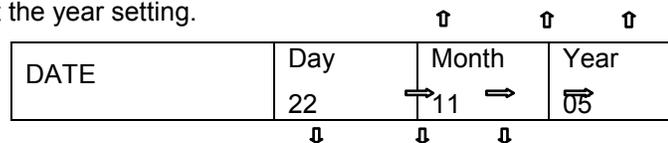
To set the minutes setting only, press submenu key twice. The sub menu LED glows after one press itself. Now increase or decrease the setting by pressing up/down keys. Now press submenu key twice. Now the sub menu key goes off. Now press **X** key, to save the settings.

To set the seconds setting only, press submenu key thrice. The sub menu LED glows after one press itself. Now increase or decrease the setting by pressing up/down keys. Now press submenu key once. Now the sub menu key goes off. Now press **X** key, to save the settings.



4.3.19 DATE

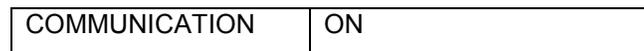
Press \downarrow key repeatedly and get the date menu. Date is displayed as DATE: MONTH: YEAR. To set the time press \rightleftarrows submenu Key, 3mm LED in the key is lit to indicate that the sub menu is activated. Now date can be increased or decreased by using the up/down arrow keys. Press the submenu Key, for the second time to edit the month setting. Press the side arrow submenu key, for the third time to edit the year setting.



To edit

4.3.20 COMMUNICATION

Press \downarrow key repeatedly and get the communication menu. Press \rightleftarrows submenu Key, Red LED in the key is lit to indicate that the sub menu is activated. Communication can either be made ON or OFF by scrolling using up/down arrow keys.



When communication is OFF, baud rate, parity and address settings are not displayed.

4.3.21 BAUD, PARITY, ADDR

The baud rate, parity and address are displayed only when communication is ON. Press \downarrow key repeatedly and get this menu. Press \rightleftarrows submenu key, 3mm LED in the key is lit to indicate that

the sub menu is activated. Now Baud rate can be edited. Press ⇐⇒ submenu key, repeatedly for the second and third time respectively to edit parity and address.

Baud rate can be set as

- 2400
- 4800
- 9600 or
- 19200

Parity can be set as

- EVEN
- ODD or
- NONE

The relay address can be set between 1 to 254. Scroll using up/down arrow keys to increase/decrease the values.

Baud rate	Parity	Address
9600	EVEN	001

4.3.22 INSTRUMENTS

Press ↓ key repeatedly and get this menu. The instrument readings are displayed in this menu.

Press ↓ key repeatedly and get E/ F C.T Ratio menu. The ratio can be selected from 5 to 10000 for Primary current and 1 or 5 for Secondary current.

The user can not edit this menu. The user can only view the measured secondary current r, y, b, e poles and primary current R,Y,B,E poles.

Instruments	
r =0.000	y=0.000
b=0.000	e=0.000

Instruments	
R =00.00	Y=00.00
B=00.00	E=00.00

4.3.23 FAULT DATA

Press  key repeatedly and get this menu. **The user can not edit this menu.** This menu gives a summary of 3 recent faults. The fault data menu displays Date & time of fault, Active Group, current reading of all four poles at the time of fault, starter/ trip, IDMTL/ DTL/ H1/ H2 operated

FAULT DATA1	29/10/05 10:05:12.552 G2 R PHASE IR=12.20 IDMTL (S)H1(T); Y PHASE IY=12.24 IDMTL (S) H1(T); B PHASE IB=12.28 IDMTL (S) H1(T); EARTH-FAULT IE= 12.32 IDMTL (T) H1(T)
FAULT DATA2	27/10/05 12:56:22.341 G1 R PHASE IR=2.00 IDMTL (S)H1(T); Y PHASE IY=2.04 IDMTL (T); B PHASE IB=2.02 IDMTL (T); EARTH-FAULT IE= 1.98 IDMTL (T)
FAULT DATA3	27/10/05 12:56:22.341 G1 R PHASE IR=2.00 IDMTL (S)H1(T); Y PHASE IY=2.04 IDMTL (T); B PHASE IB=2.02 IDMTL (T); EARTH-FAULT IE= 1.98 IDMTL (T)

In fault data1,

IDMT(S) – indicates that IDMT starter is raised.

IDMT(T) – indicates that IDMT Trip is raised.

H1(S) – indicates that Highset1 starter is raised.

H1(T) – indicates that Highset1 Trip is raised.

H2(T) - indicates that Highset2 Trip is raised.

4.3.24 CLEAR ALL FAULTS

Press  key repeatedly and get this menu. Press  submenu key, and scroll up or down. The menu has yes/ no option. Setting this menu to yes, clears the fault data.

Clear all FAULT DATA

4.3.25 PASSWORD

Press  key repeatedly and get this menu. Press the submenu key once to edit the first character and repeatedly press the submenu to edit successive characters. When password is NONE, the user can view as well as edit the settings. When password is other than NONE,

   	
PASSWORD	N O N E
	 

To save the settings, press submenu key repeatedly and make the submenu LED OFF. Now press

 key to save the settings.

4.4 SAVE/CANCEL SETTINGS

4.4.1 SAVING THE EDITED SETTINGS

1. Ensure all the chosen settings are as per requirements.
2. **Ensure starter/ trip LED is not ON.**
3. Go to corresponding menu and enter into the appropriate sub menu by pressing ⇨
(Ensure LED is ON).
4. Use ↓ or ↑ keys, to edit the present setting.
5. When required new setting appears on the screen Press ⇨ key, again so that the LED is OFF. Now press X key to save the required new setting.
6. The display goes blank. This indicates that settings have changed.
7. Scroll to the particular menu and ensure that the setting changes have been stored.

4.4.2 TO CANCEL SETTING CHANGES WHILE EDITING

While the particular setting is being edited (using ↓ or ↑ key) with submenu LED ON, by pressing X key, the previous setting of this particular menu is restored.

Note: If submenu key is pressed again and submenu LED is OFF, then on pressing X key Settings will be saved.

4.5 RESET TRIP LED

To reset the trip LED, press the **RESET** button. The trip LED can be reset only when starter LED is not glowing.

CHAPTER 5 – COMMISSIONING

5.1. REQUIRED TEST EQUIPMENTS

- ◆ 500V insulation test sets.
- ◆ Variable secondary injection current source rated 10A or greater.
- ◆ Time interval meter
- ◆ Primary injection equipment
- ◆ A DC supply with a nominal voltage within the working range of the relays DC auxiliary supply ratings

5.2. INSPECTION

Ensure that all connections are tight and in accordance with the relay wiring diagram and the scheme diagram. Check if the relay is correctly programmed and the relay is fully inserted into the case.

5.3. APPLYING SETTINGS

The relay settings for the particular application should be applied before any secondary testing is started.

5.4. PRECAUTIONS

Before testing commences, the equipment should be isolated from the current transformers and the CTs to be short-circuited, in line with the local site procedures. The tripping and alarm circuits should also be isolated, where practical. Also, ensure that trip links are removed. Ensure that correct DC auxiliary voltage and polarity is applied. See the relevant scheme diagrams for the relay connections.

5.5. TESTS

5.5.1. Insulation

Connect together all relay CT terminals and measure the insulation resistance between these terminals and all the other relay terminals connected together to earth.

Connect together the terminals of the DC auxiliary supply (only +ve and -ve) and measure the insulation resistance between these terminals and all other terminals connected together to earth. Connect together all the output relay terminals and measure the insulation resistance between these terminals and all other terminals connected together to earth. A minimum value of 2.5 to 3 Meg ohms can be considered as satisfactory value.

5.5.2. Secondary Injection

Select the relay configuration and settings for the application. Note that the MJT315 relay can be connected either as 1A or 5A-rated device. The user should check this before commencing secondary test.

5.5.2.1. Pick Up And Reset

The test checks accuracy of the current settings for the relay's main over current characteristics. Apply single-phase current into one of the current inputs. Slowly increase the current until the starter LED (yellow) operates and record the pick up current in Table 1. Reduce the current until the LED goes off and record this as the reset level. Repeat this test for each pole. Check that all the pick up current levels are measured within $104\% \pm 4\%$ or $\pm 10\text{mA}$ of the applied setting. Check that the reset levels are $\geq 94\%$ of the setting.

POLE	PICK-UP SETTING	MEASURED PICK-UP	PICK-UP ERROR	MEASURED RESET	RESET ERROR
PHASE A					
PHASE B					
PHASE C					
E/F					

TABLE 1

5.5.2.2. IDMTL / DTL Characteristics

This test checks the accuracy of the main time delay characteristics (IDMTL / DTL). Select the relay current setting characteristics and time multiplier settings as required and then inject a level of current which is a multiple of the relay setting.

A time interval meter should be connected to the correct output contact terminals. The timer should be started by the source and stopped by the relay trip contacts. Each pole should be tested. A secondary injection timing test circuit is illustrated in Fig. 4. The secondary injection test equipment should be made 'OFF', once the relay contact is closed

Table 2 shows theoretical value of each characteristic with time multiplier set to 1.000. Record the actual results in Table 3 and check that the measured times are within $\pm 5\%$ or $\pm 30\text{-msecs}$ of theoretical value.

CURVE	2xIs	5 xIs	10 xIs	20 xIs
SI 3	10.03	4.28	2.97	2.27
SI 1	4.39	1.87	1.3	1.0
EI	26.67	3.33	0.81	0.20
VI	13.50	3.38	1.50	0.71
LTI	120.00	30.0	13.33	6.32
DTL	*	*	*	*

* USER SETTING

TABLE 2

Pole	Characteristic (SI3,SI1,EI,VI LTI,DTL)	2xIs		5xIs		10xIs		20xIs	
		Delay	Error (±5%)	Delay	Error (±5%)	Delay	Error (±5%)	Delay	Error (±5%)
Phase A									
Phase B									
Phase C									
E/F									

TABLE 3

5.5.2.3. Highset

Program the current settings for the highset characteristics to the required level. Inject a level of current below the setting of the relay and then increase the current until the output operates. Record the pickup level for each pole in Table 4 and confirm that in each case it occurs within $100\% \pm 4\%$ or ± 10 mA of applied setting. When the highset setting is above the continuous thermal rating of the relay, care should be taken, such that the duration of the applied current should not damage the relay. Refer catalogue for thermal rating.

(i)	POLE	HIGHSET SETTING	MEASURED PICK-UP	ERROR
	PHASE A			
	PHASE B			
	PHASE C			
	E/F			

TABLE 4

5.5.2.4. Output Relays

MJT315 relay has six programmable O/P contacts. In this first contact is having change over contact arrangement and the remaining five contacts are normally open type. These are to be tested during secondary injection testing. In addition to this, one normally closed contact is provided for relay unhealthiness purpose.

3.5.3. Primary Injection

Primary injection tests are essential to check the ratio and polarity of the transformers as well as the secondary wiring.

Using the circuit shown in Fig.5 / Fig.7, check the current transformer ratio and CT phase to earth connection. Inject a current of sufficient magnitude .The secondary current is

$$I_s = \text{Primary current} / \text{CT ratio}$$

Use the circuit shown in Fig.6 / Fig.8 to check the current transformer ratio and the CT phase to phase connections. CT should also be tested for knee point voltage.

3.5.4. Putting Into Service

After completing all tests satisfactorily, the relay should be put into service as follows:

1. Make a final check of the secondary wiring and tightness of all terminal connections
2. Insert the DC supply fuse
3. Check the relay healthy indication/display
4. Replace the relay cover
5. Insert the trip links
6. Perform trip test by secondary injection
7. Remove all test connections

CHAPTER 6 – DRAWINGS

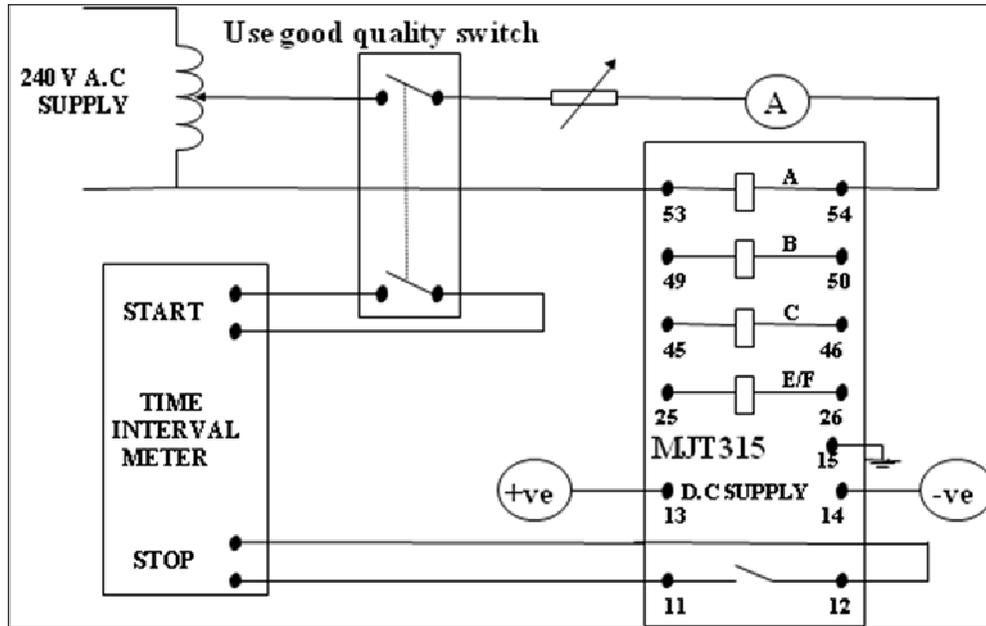


Fig 4 - Secondary Injection Timing Test Circuit (Terminals shown are for 1A rating)

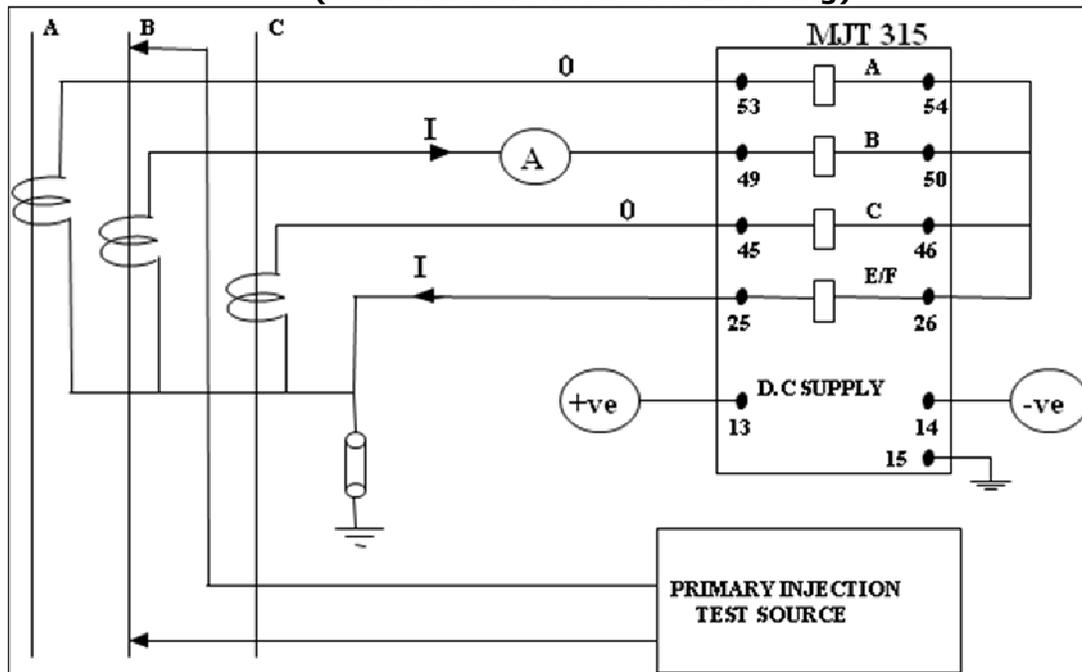


Fig 5 - Primary Injection Test Circuit (Phase To Earth) (Terminals shown are for 1A rating) Similar test shall be conducted on A & C phase CTs

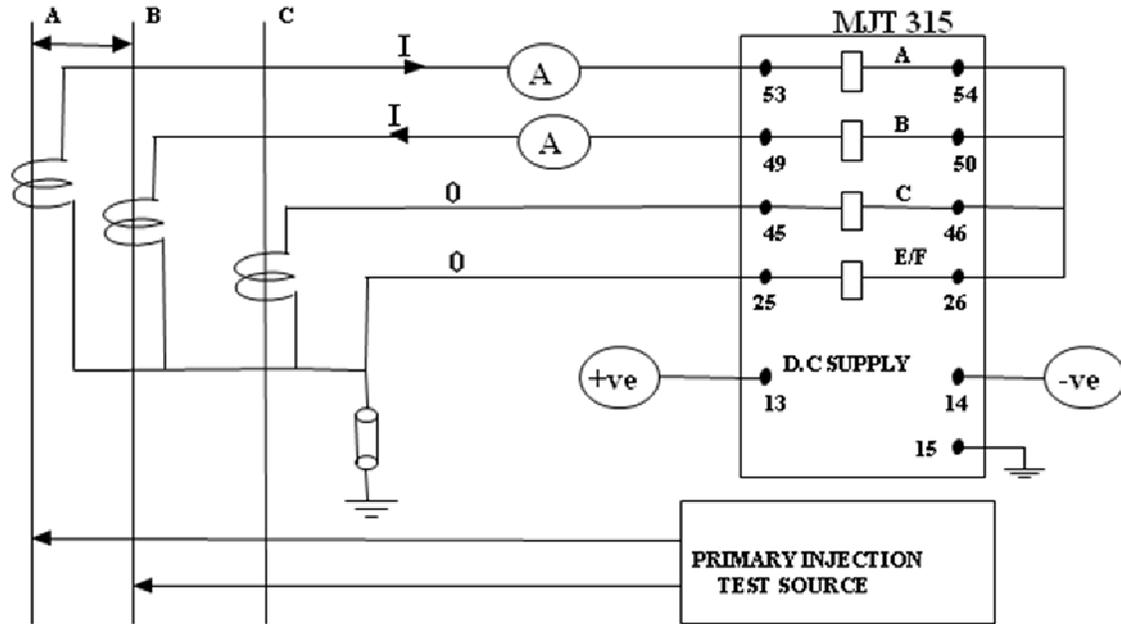
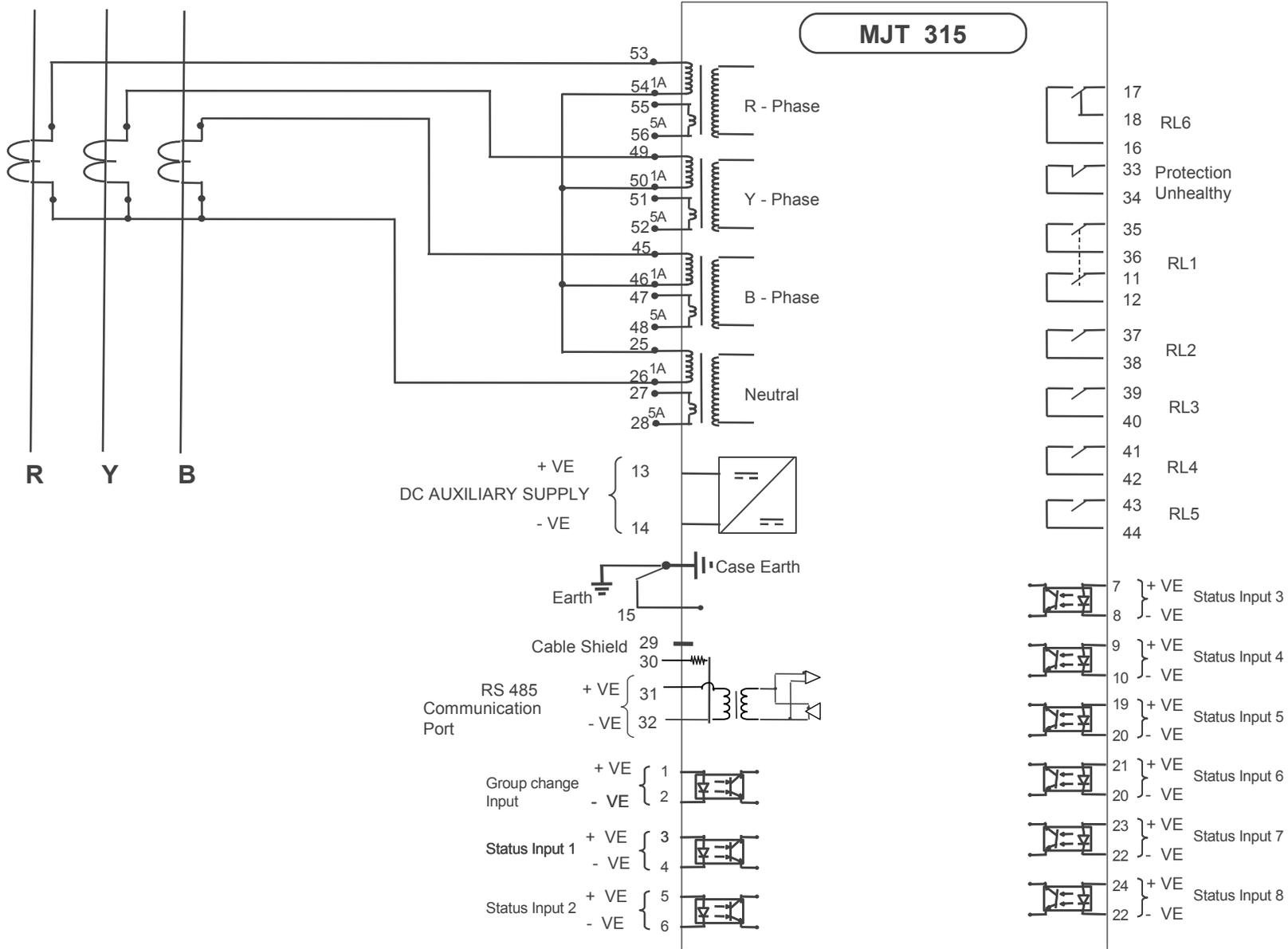


Fig 6 - Primary Injection Test Circuit (Phase To Phase)
 (Terminals shown are for 1A rating) Similar test shall be conducted on BC & CA phases

MJT 315



WIRING DIAGRAM FOR MJT 315 RELAY

Drawing No. :- CEDBW50002



EASUN REYROLLE LIMITED
HOSUR, INDIA.

REV.	No.	Sig.	DATE	No.	Sig.	DATE	No.	Sig.	DATE	DATE	30/06/07	CHECKED	G. Vivek	SUPERSEDES	SHEET
										DRAWN	K.Saravanan	APPROVED	S.Muthukrishnan		1 OF 1