APPLICATION AND COMMISSIONING
MANUAL FOR NUMERICAL BIASED
DIFFERENTIAL PROTECTION RELAY
TYPE - MIB202

EASUN REYROLLE LIMITED
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APPLICATION

The MIB202 is micro-controller based Numerical Biased Differential Protection Relay with inbuild Current Amplitude and Vector Group Compensation features and also with Instantaneous Differential Highset Element for two winding Power Transformer and AutoTransformers.

MIB202 relay, which can be used to operate for internal faults, like phase to phase, phase to earth and inter turn faults in the Transformers.

The same relay, we can use for 1A or 5A CT input on both LV & HV side.

The relay has supervisory components and self-monitoring features give high confidence of serviceability.

1.0 BIASED DIFFERENTIAL PROTECTION:

The currents entering and leaving the transformer are measured, taking in to the Power Transformer vector grouping and transformation ratio. Software interposing current transformers can be applied to each set of current inputs to correct for any magnitude and vector mismatch and to remove zero sequence components where necessary. They are then summed to form an operate signal which is applied to a three part biased differential characteristic on a phase by phase basis. The relay is provided with triple slope characteristics.

1. Initial Differential setting
2. Differential Bias slope
3. Differential Bias slope limit

1.1 INITIAL DIFFERENTIAL SETTING:

This is the value of current, expressed as a percentage of the chosen current rating, at which the relay will operate with zero bias current. Its setting would normally be the same as that for the differential bias slope value.

Setting Range:
- 10% to 50% of In in steps of 5%
1.2 DIFFERENTIAL BIAS SLOPE:

Some unbalance current will appear in the differential circuit of the relay for predictable reasons, e.g. due to the transformer tap position and to CT errors. The current will increase with increasing load or through fault current in the transformer so, to maintain stability, the biasing current must increase proportionately. The bias slope expresses the current to operate the relay as a percentage of the biasing (restraint) current. The differential bias slope setting chosen must be greater than the maximum predictable percentage unbalance.

Setting Range:
bS - 10% to 70% of In in steps of 5%

1.3 DIFFERENTIAL BIAS SLOPE LIMIT:

This setting defines the upper limit of the bias slope and is expressed in multiples of nominal rated current. A setting value must be chosen which will cover the maximum through fault current of the transformer. This setting gives more stability during CT saturation for heavy through fault.

Setting Range:
SL - 200% to 2000% of In in steps of 100%

2.0 DIFFERENTIAL INSTANTANEOUS HIGHSET OVER CURRENT:

This is an unbiased, instantaneous element in the differential circuit with a range of settings expressed as percentages of the nominal current rating. If the feature is not required, the OFF setting should be selected. If it is required, it must be set to a value in excess of any predictable differential current, i.e. the differential current under maximum through fault conditions with the transformer tap changer in its extreme position and the differential current due to magnetizing inrush. The highset should be set as low as possible but not less than the maximum three phase through fault current and not less than the maximum magnetizing current.

Setting Range:
H - OFF, 400% to 2500% of In in steps of 100%
3.0 MAGNETIZING INRUSH RESTRAINT:

Second Harmonic quantities are calculated from the signal $I_1 - I_2$ to provide an inhibit signal to prevent the protection operating for magnetizing inrush conditions. Magnetizing inrush on any phase will inhibit all three phases.

4.0 INTERPOSING CT MULTIPLIER (HV AND LV SIDE):

This range of settings enable the effective ratio of the HV & LV CT's to be adjusted.

Setting Range:
Ah & Al - 0.50 to 2.50 in steps of 0.01

5.0 HV INTERPOSING CT CONNECTION:

An equivalent interposing CT connection can be selected from this range of settings. The settings define the LV and HV winding configuration. E.g. Yd, followed by the angular position of the LV phasor with respect to the HV phasor. The angular position is described by the hour - hand position on the twelve-hour clock face, e.g. Yd1 or Yd11. In each setting, this is followed by the same angular relationship expressed in degrees. The complete Yd1 setting will therefore read Yd1, $-30^\circ$ and Yd11 will read Yd11, $30^\circ$.

Setting Range:
Vh - Yy0, Yy2, Yy4, Yy6, Yy8, Yy10, Yd1, Yd3, Yd5, Yd7, Yd9, Yd11, Ydy0 and Ydy6

6.0 LV INTERPOSING CT CONNECTION:

As the HV connection but now applied to the LV CT's.

Setting Range:
VL - Yy0, Yy2, Yy4, Yy6, Yy8, Yy10, Yd1, Yd3, Yd5, Yd7, Yd9, Yd11, Ydy0 and Ydy6
7.0 TYPICAL RELAY SETTING CALCULATION

Power Transformer Details:

Voltage = 132 / 33KV
Rating = 60MVA
Tap Changer = +5% - 15%
Vector Group = Yd1

Current Transformer Details:

CT Ratio
   For HV Side = 300/1
   For LV Side = 1200/1

Calculation:

HV rated current = 60MVA / (132 * 1.732)
                 = 262.4A.
CT ratio for HV side is 300/1
LV rated current = 60MVA / (33* 1.732)
                 = 1049.76A
CT ratio for LV side is 1200/1
Mean tap value = [(+5) + (-15)] / 2 = -5%
HV current at -5% tap = (60MVA) / (1.732 * 132KV *0.95)
                      = 276.2A
HV Multiplier = 300 / 276.2 = 1.086 = 1.09
LV CT secondary current = 1049.7 / 1200
                        = 0.87475A
So the LV multiplier = 1200 / 1049.7 = 1.143
                      = 1.14

Initial Setting = 200mA (20%) or
                2 times of maximum spill current
                whichever is greater.

Bias setting = 20%
2 times of maximum tap change %
Bias Slope Limit = 4 times of full load current

HV ICT vector connection = Yd1, 30
LV ICT vector connection = Yy0, 0
HV ICT multiplier = 1.09
LV ICT multiplier = 1.14
# 8.0 Interposing CT Selection Guide

<table>
<thead>
<tr>
<th>Power Transformer Vector Group</th>
<th>HV Interposing CT Selection</th>
<th>LV Interposing CT Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yy0, YNy0, Yyn0, YNyn0, Yd0, Yndy0, Ydyn0, YNdyn0</td>
<td>Yd1,30°</td>
<td>Yd1,30°</td>
</tr>
<tr>
<td>Yd1, YNd1</td>
<td>Yd1,30°</td>
<td>Yy0,0°</td>
</tr>
<tr>
<td>Yd1, YNd1 + Earthing Transformer</td>
<td>Yd1,30°</td>
<td>Ydy0,0°</td>
</tr>
<tr>
<td>Yy2, YNy2, Yyn2, YNyn2, Yd2, Yndy2, Ydyn2</td>
<td>Yd3,90°</td>
<td>Yd1,30°</td>
</tr>
<tr>
<td>Yd3, YNd3</td>
<td>Yd3,90°</td>
<td>Yy0,0°</td>
</tr>
<tr>
<td>Yd3, YNd3 + Earthing Transformer</td>
<td>Yd3,90°</td>
<td>Ydy0,0°</td>
</tr>
<tr>
<td>Yy4, YNy4, Yyn4, YNyn4, Yd4, Yndy4, Ydyn4</td>
<td>Yd5,150°</td>
<td>Yd1,30°</td>
</tr>
<tr>
<td>Yd5, YNd5</td>
<td>Yd5,150°</td>
<td>Yy0,0°</td>
</tr>
<tr>
<td>Yd5, YNd5 + Earthing Transformer</td>
<td>Yd5,150°</td>
<td>Ydy0,0°</td>
</tr>
<tr>
<td>Yy6, YNy6, Yyn6, YNyn6, Yd6, Yndy6, Ydyn6, YNdyn6</td>
<td>Yd7, -150°</td>
<td>Yd1,30°</td>
</tr>
<tr>
<td>Yd7, YNd7</td>
<td>Yd7, -150°</td>
<td>Yy0,0°</td>
</tr>
<tr>
<td>Yd7, YNd7 + Earthing Transformer</td>
<td>Yd7, -150°</td>
<td>Ydy0,0°</td>
</tr>
<tr>
<td>Yy8, YNy8, Yyn8, YNyn8, Yd8, Yndy8, Ydyn8, YNdyn8</td>
<td>Yd9, -90°</td>
<td>Yd1,30°</td>
</tr>
<tr>
<td>Yd9, YNd9</td>
<td>Yd9, -90°</td>
<td>Yy0,0°</td>
</tr>
<tr>
<td>Yd9, YNd9 + Earthing Transformer</td>
<td>Yd9, -90°</td>
<td>Ydy0,0°</td>
</tr>
<tr>
<td>Yy10, YNy10, Yyn10, YNyn10, Yd10, Yndy10, Ydyn10, YNdyn10</td>
<td>Yd11, -30°</td>
<td>Yd1,30°</td>
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<tr>
<td>Transformer Configuration</td>
<td>HV Side Connection</td>
<td>LV Side Connection</td>
</tr>
<tr>
<td>---------------------------</td>
<td>--------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>Yd11, YNd11</td>
<td>Yd11,-30°</td>
<td>Yy0,0°</td>
</tr>
<tr>
<td>Yd11, YNd11 + Earthing Transformer</td>
<td>Yd11,-30°</td>
<td>Ydy0,0°</td>
</tr>
<tr>
<td>Dy1, Dyn1</td>
<td>Ydy0,0°</td>
<td>Yd11,-30°</td>
</tr>
<tr>
<td>Dy1, Dyn1 + Earthing Transformer</td>
<td>Ydy0,0°</td>
<td>Yd11,-30°</td>
</tr>
<tr>
<td>Dy3, Dyn3</td>
<td>Ydy0,0°</td>
<td>Yd9,-90°</td>
</tr>
<tr>
<td>Dy3, Dyn3 + Earthing Transformer</td>
<td>Ydy0,0°</td>
<td>Yd9,-90°</td>
</tr>
<tr>
<td>Dy5, Dyn5</td>
<td>Ydy0,0°</td>
<td>Yd7,-150°</td>
</tr>
<tr>
<td>Dy5, Dyn5 + Earthing Transformer</td>
<td>Ydy0,0°</td>
<td>Yd7,-150°</td>
</tr>
<tr>
<td>Dy7, Dyn7</td>
<td>Ydy0,0°</td>
<td>Yd5,150°</td>
</tr>
<tr>
<td>Dy7, Dyn7 + Earthing Transformer</td>
<td>Ydy0,0°</td>
<td>Yd5,150°</td>
</tr>
<tr>
<td>Dy9, Dyn9</td>
<td>Ydy0,0°</td>
<td>Yd3,90°</td>
</tr>
<tr>
<td>Dy9, Dyn9 + Earthing Transformer</td>
<td>Ydy0,0°</td>
<td>Yd3,90°</td>
</tr>
<tr>
<td>Dy11, Dyn11</td>
<td>Ydy0,0°</td>
<td>Yd1,30°</td>
</tr>
<tr>
<td>Dy11, Dyn11 + Earthing Transformer</td>
<td>Ydy0,0°</td>
<td>Yd1,30°</td>
</tr>
</tbody>
</table>

**Notes:**

1. Y or y denotes an unearthed star connection on the HV or LV side of the transformer respectively.
2. YN or yn denotes an earthed star connection on the HV or LV side of the transformer respectively.
3. D or d denotes a delta connection on the HV or LV side of the transformer respectively.
INSTALLATION

1.1 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.

1.2 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.

1.3 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.

1.4 MOUNTING

Mount the relay using 2 nos. mounting straps and 1 no 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.

### 2.1 CURRENT TRANSFORMER TAP SELECTION

MIB202 relays are suitable for 1A or 5A application. However the relays are internally wired for either 1A or 5A as per the customer requirement. Internal wiring are to be changed (Faston crimp connections) for changing the relay rating from one to other.

To ensure the current rating of the relay, check the connection of CT wires connected to the bottom TB (Terminal Block) at the rear of the chassis as per the following table:

#### For 1A

<table>
<thead>
<tr>
<th>Phase</th>
<th>Terminal No. of TB</th>
<th>Ferrule No. of CT Wire(Black)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HV Side</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>1</td>
<td>1A</td>
</tr>
<tr>
<td>B</td>
<td>3</td>
<td>3A</td>
</tr>
<tr>
<td>C</td>
<td>5</td>
<td>5A</td>
</tr>
<tr>
<td>LV Side</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>7</td>
<td>7A</td>
</tr>
<tr>
<td>B</td>
<td>9</td>
<td>9A</td>
</tr>
<tr>
<td>C</td>
<td>11</td>
<td>11A</td>
</tr>
</tbody>
</table>

#### For 5A

<table>
<thead>
<tr>
<th>Phase</th>
<th>Terminal No. of TB</th>
<th>Ferrule No. of CT wire(Black)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HV Side</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>1</td>
<td>1B</td>
</tr>
<tr>
<td>B</td>
<td>3</td>
<td>3B</td>
</tr>
<tr>
<td>C</td>
<td>5</td>
<td>5B</td>
</tr>
<tr>
<td>LV Side</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>7</td>
<td>7B</td>
</tr>
<tr>
<td>B</td>
<td>9</td>
<td>9B</td>
</tr>
<tr>
<td>C</td>
<td>11</td>
<td>11B</td>
</tr>
</tbody>
</table>

Following are the steps to change the current rating of the relay from 1A to 5A.

1) Identify LV & HV side phases terminal from number strip on bottom terminal block at the rear of the chassis.
2) The black colour wire “9A” is inserted to 9th terminal of TB.

3) First, carefully lift the PVC boot of the wire by means of a tool (like nose pliers) to expose terminal 9A.

4) Hold the crimp by means of the same tool at the crimp point and lift to remove from the fixed terminal. Remove the “9B” wire from the terminal parking rack (fixed on terminal block) and insert the crimp of “9B” wire on to the terminal No.9 by means of the tool. Insert "9A" wire back to the terminal parking rack.

5) Ensure proper insertion of “9B” wire by pulling the wire by hand and the wire should not come off the terminal.

6) Push the boot of “9B” wire, to completely cover the crimp.
   Same procedure in reverse is to be followed to change from 5A to 1A using appropriate wire numbers

**2.2 HUMAN MACHINE INTERFACE (HMI)**

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

1. Six digit, 7 segment LED display (First two digits are Red colour and other four digits are Green colour). First two digits (Red) displays the main menu or type Element operated when selected for Setting mode or Trip indication respectively. Remaining four digits (Green) displays Sub menu or "Trip" indication respectively.

2. Green LED - Protection healthy indication

3. Red LED (HIGHSET) - Highset trip indication

4. Red LED (TRIP) - Trip indication

5. Red LED (in ⇒ Key) - Sub Menu

6. ↑ Key - Up scrolling

7. ↓ Key - Down scrolling

8. ⇒ Key - Sub menu
3.0 SETTING INSTRUCTIONS

3.1 How to operate HMI

♦ Remove the front cover by unscrewing the four knurling screws.

♦ Apply DC supply. Terminals 22, 24 and 23 are for positive, negative and earth respectively as per relay rating. When the relay powers up it takes few seconds to complete the self-test routine.

♦ Ensure Protection Healthy LED (Green) is ON and busy indication appears on the LED display unit. Wait until the busy indication goes off.

♦ Press \( \uparrow \) or \( \downarrow \) key \( nn; b20 \) is displayed

\( nn; b20 \) Represents MIB 202 relay

♦ Press \( \downarrow \) key repeatedly scrolls down the Factory setting Main menu in the following order on the display:

- Initial setting in % of nominal rating
- Bias slope setting in %
- Slope limit setting in % of Restraining current \((I_1+I_2)/2\)
- Current Amplitude correction setting for HV windings
- Current Amplitude correction setting for LV windings
- Vector group compensation setting for HV windings
UL Y40 - Vector group compensation setting for LV windings

H OFF - Highset setting

3.2 DIFFERENTIAL INITIAL SETTINGS

Setting Range: 10% to 50% in steps of 5% (The setting refers to % of rated nominal CT secondary rating)

Pressing ↓ key \(\text{20}\) (represents initial setting is 20% of rated nominal current) display will appear, press ⇒ key (Submenu LED On) to get the Sub menu. Pressing ↑ or ↓ key changes the current setting in 5% increment or decrement. Upon selecting the desired setting, once again press the ⇒ key (Sub menu LED goes OFF) to return to the main menu.

3.3 DIFFERENTIAL BIAS SLOPE SETTINGS

Setting Range: 10% to 70% in steps of 5% (Restraining characteristics)

Pressing ↓ key \(\text{65} \text{ 20}\) (represents slope setting is 20%) display will appear, press ⇒ key (Submenu LED On) to get the Sub menu. Pressing ↑ or ↓ key, change the bias characteristic percentage setting 10% to 70%. Upon selecting the desired setting, once again press the ⇒ key (Sub menu LED goes OFF) to return to the main menu.

3.4 DIFFERENTIAL BIAS SLOPE LIMIT SETTINGS

Setting range: 200% to 2000% of restraining current \((I_1+I_2)/2\) in steps of 100%.

Pressing ↓ key repeatedly and get SL 400 Main menu (represents slope limit setting of the bias characteristics is 400%), press ⇒ key (Submenu LED On) to get the Sub menu. Pressing ↑ or ↓ key changes the slope limit setting in 100% increment or decrement. Upon selecting the desired setting, once again press the ⇒ key (Sub menu LED goes OFF) to return to the main menu.
3.5 CURRENT AMPLITUDE CORRECTION SETTINGS

3.5.1 HV side ICT multiplier

Setting range: 0.50 to 2.50 in steps of 0.01.
Pressing key repeatedly and get Main menu (represents current amplitude correction setting of HV winding current input is 1.00), press key (Submenu LED On) to get the Sub menu. Pressing or key changes the current amplitude correction setting in 0.01 increment or decrement. Upon selecting the desired setting, once again press the key (Sub menu LED goes OFF) to return to the main menu.

3.5.2 LV side ICT multiplier

Setting range: 0.50 to 2.50 in steps of 0.01.
Pressing key repeatedly and get Main menu (represents current amplitude correction setting of LV winding current input is 1.00), press key (Submenu LED On) to get the Sub menu. Pressing or key changes the current amplitude correction setting in 0.01 increment or decrement. Upon selecting the desired setting, once again press the key (Sub menu LED goes OFF) to return to the main menu.

3.6 VECTOR GROUP COMPENSATION SETTINGS

3.6.1 Vector group compensation on HV windings

Settings available: Yy0, Yy2, Yy4, Yy6, Yy8, Yy10, Yd1, Yd3, Yd5, Yd7, Yd9, Yd11, Ydy0 and Ydy6
Pressing key repeatedly and get Main menu (represents Vector group compensation for HV winding is Yy0), press key (Submenu LED On) to get the Sub menu. Pressing or key changes the Vector group compensation setting desired by increment or decrement. Upon selecting the desired setting, once again press the key (Sub menu LED goes OFF) to return to the main menu.
3.6.2 Vector group compensation on LV windings

Setting available: Yy0, Yy2, Yy4, Yy6, Yy8, Yy10, Yd1, Yd3, Yd5, Yd7, Yd9, Yd11, Ydy0 and Ydy6

Pressing \( \downarrow \) key repeatedly and get UL Yy0 Main menu (represents Vector group compensation for LV winding is Yy0), press \( \Rightarrow \) key (Submenu LED On) to get the Sub menu. Pressing \( \uparrow \) or \( \downarrow \) key changes the Vector group compensation setting desired by increment or decrement. Upon selecting the desired setting, once again press the \( \Rightarrow \) key (Sub menu LED goes OFF) to return to the main menu.

3.7 HIGHSET SETTING

Setting range: OFF, 400% to 2500% of nominal current in steps of 100%.

Pressing \( \downarrow \) key repeatedly get \( \text{HIGHSET SETTING} \) Main menu (represents the highset element is OFF). Press \( \Rightarrow \) key (Submenu LED On) to get Submenu. Pressing \( \uparrow \) or \( \downarrow \) key, changes the highset setting by 100% of rated current. After selecting the desired setting, once again press the \( \Rightarrow \) key (Sub menu LED goes OFF) to get back the main menu.

4.0 ACCEPTANCE OF SETTINGS (ENTER)

For the relay to accept the above setting changes press \( \times \) key once, now the display goes off and the settings are updated. By pressing any key again \( \text{HIGHSET SETTING} \) indication will appear

Ensure all the chosen settings. In case of any changes required use Sub menu key and then do the changes and finally press enter \( \times \) key once.

ENSURE TO PRESS \( \times \) TO ACCEPT THE CHANGES
5.0 **TO CHECK THE RELAY VERSION**

Press \( \times \) key four times, example of relay version display is as follows:

\[ 202.00 \] Represent MIB 202-relay version 1

To get back the main menus press \( \uparrow \) or \( \downarrow \) key.

6.0 **TO CANCEL SETTING WHILE CHANGING (CANCEL)**

While the particular setting is being changed (using \( \uparrow \) or \( \downarrow \) key) with Submenu LED ON, by pressing \( \times \) key, the original setting is restored

7.0 **TRIP INDICATION AND RESETTING OF TRIP INDICATION (RESET)**

When the relay operates, "TRIP" LED indicates tripping. To find which element operated press \( \uparrow \) or \( \downarrow \) key. There is possibility for the following display after the trip,

\( r - T_r, P \) - Indicates r – phase trip
\( y - T_r, P \) - Indicates y – phase trip
\( b - T_r, P \) - Indicates b – phase trip
\( H_{rT_r}, P \) - Indicates Highset element of r – phase trip
\( H_{yT_r}, P \) - Indicates Highset element of y – phase trip
\( H_{bT_r}, P \) - Indicates Highset element of b – phase trip

Once the fault is cleared, press \( \times \) key twice to reset the trip indication.

The trip indication will be retained in Non - volatile memory during auxiliary DC power supply failure.

8.0 **METERING MODE FOR COMMISSIONING PURPOSE**

The relay includes metering function also to enable the commissioning people to verify their configuration and settings.
To enter into this mode, the sub menu \( \Rightarrow \) key has to be pressed for around 10 secs. After the time delay the relay front LED will display the following signals as in the order given below by pressing the \( \uparrow \) key.

- \( rH \ 0.00 \) Indicates HV winding r – phase line current
- \( rL \ 0.00 \) Indicates LV winding r – phase line current
- \( r1 \ 0.00 \) Indicates HV winding r – phase relay current after amplitude and phase angle (Vector group correction) correction.
- \( r2 \ 0.00 \) Indicates LV winding r – phase relay current after amplitude and phase angle (Vector group correction) correction.
- \( rb \ 0.00 \) Indicates r – phase restraining current
- \( rd \ 0.00 \) Indicates r – phase differential current
- \( yH \ 0.00 \) Indicates HV winding y – phase line current
- \( yL \ 0.00 \) Indicates LV winding y – phase line current
- \( y1 \ 0.00 \) Indicates HV winding y – phase relay current after amplitude and phase angle (Vector group correction) correction.
- \( y2 \ 0.00 \) Indicates LV winding y – phase relay current after amplitude and phase angle (Vector group correction) correction.
- \( yb \ 0.00 \) Indicates y – phase restraining current
- \( yd \ 0.00 \) Indicates y – phase differential current
- \( bH \ 0.00 \) Indicates HV winding b – phase line current
- \( bL \ 0.00 \) Indicates LV winding b – phase line current
b1 0.00  - Indicates HV winding b – phase relay current after amplitude and phase angle (Vector group correction) correction.

b2 0.00  - Indicates LV winding b – phase relay current after amplitude and phase angle (Vector group correction) correction.

bb 0.00  - Indicates b – phase restraining current

bd 0.00  - Indicates b – phase differential current

In order to come back from the metering mode to main menu (Protection setting), the same sub menu key has to be pressed for again 10 secs. This is true even the relay is tripped. After about 10 minutes, i.e. power save mode (During which the relay seven segment LED display goes off if none of the front keys are pressed) the relay will back to the main menu (Protection) mode for any key press after the relay went to power save mode.

**Note:** The above metering display values are refered to 1 Amps only. If 5 Amp relay is used, the obtained value has to be multiplied by a factor of 5 to read the input current value.
COMMISSIONING

1. REQUIRED TEST EQUIPMENT'S

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

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.

3. APPLYING SETTINGS

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

4. PRECAUTIONS

Before testing commences, the equipment should be isolated from the current transformers and the CT's 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. TESTS

5.1 INSULATION

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

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

Satisfactory values for the various readings depend upon the amount of wiring concerned. Where considerable multi-core wiring is involved a reading of 2.5 to 3.0 meg ohms can be considered satisfactory. For short lengths of wiring higher values can be expected. A value of 1.0 meg ohm should not be considered satisfactory and should be investigated.

5.2 SECONDARY INJECTION

Select the required relay configuration and settings for the application. Note that the MIB202 relay can be connected either as 1A or 5A-rated device. The user should check this before commencing secondary testing. Please refer Sec. 2.1. in Installation.

a.) CHECKING THE BIAS CHARACTERISTIC

To check the bias characteristics using the simple single-phase test circuit shown in fig 1. The relay must be set as follows:

Initial setting is to be the same value as bias slope
   HV Interposing CT multiplier 1.00
   HV Interposing CT connections Yy0
   LV Interposing CT multiplier 1.00
   LV Interposing CT connections Yy0

The adjustable resistors in the test circuit should be chosen so that the injected current can be easily controlled over the range of 20 % to 250 % of In.

Refer to fig 1. With zero bias current (ammeter A1=0), inject operate current in to phase A. When the relay operates, shown by the LED "Trip" illuminating, record the value of the current indicated on ammeter A2.

Repeat the test with increasing bias currents up to 2.5 times the relay rating.
Record the results obtained in Table 2 and compare with the nominal values in Table 1.

Repeat the test for the other phases.

b.) Output relays

1. Trip – 1 N/O contacts (13 & 14, 15 & 16)
This contact to be used whiles testing the Bias characteristic and Highset of the relay.

2. Biased Differential - 1 N/O Contact (17 & 19)
This contact to be used whiles testing the Bias characteristic and of the relay.

3. Differential Highset – 1 N/O contact (17 & 20)
This contact to be used while testing the highset characteristic.

4. Protection Unhealthy - 1 N/C contact (17 & 18)

5.3 PRIMARY INJECTION

Primary injection is needed however to verify the secondary connection of a neutral CT relative to the phase CT's and the relay. In these circumstances primary current must be injected through the associated power transformer winding. It may be necessary to short-circuit another winding in order to allow current to flow. Refer Fig. 2

During these primary injection tests the injected current is likely to be small due to the impedance of the transformer. Measure the phase current and neutral spill current

5.3.1 CT Ratio and Polarity Tests

These tests check the ratio and polarity of the star connected CT's with or without a neutral CT and also their connections to the correct terminals of the MIB202 input modules.

5.4 PUTTING INTO SERVICE

After completing all tests satisfactorily, the relay should be put back 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.
7. Remove all test connections

---

**Fig 1** Circuit For Checking the Bias Characteristics
<table>
<thead>
<tr>
<th>Initial Settings</th>
<th>Bias Settings</th>
<th>Bias Current, Ammeter A1 Multiples of rated current In</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>10%</td>
<td>10%</td>
<td>0.10</td>
</tr>
<tr>
<td>20%</td>
<td>20%</td>
<td>0.20</td>
</tr>
<tr>
<td>30%</td>
<td>30%</td>
<td>0.30</td>
</tr>
<tr>
<td>40%</td>
<td>40%</td>
<td>0.40</td>
</tr>
<tr>
<td>50%</td>
<td>50%</td>
<td>0.50</td>
</tr>
<tr>
<td>-</td>
<td>60%</td>
<td>0.5</td>
</tr>
<tr>
<td>-</td>
<td>70%</td>
<td>0.5</td>
</tr>
</tbody>
</table>

**Table 1. Normal Operate Values**

<table>
<thead>
<tr>
<th>Initial Settings</th>
<th>Bias Settings</th>
<th>Bias Current, Ammeter A2 Amps</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>10%</td>
<td>10%</td>
<td>0.10</td>
</tr>
<tr>
<td>20%</td>
<td>20%</td>
<td>0.20</td>
</tr>
<tr>
<td>30%</td>
<td>30%</td>
<td>0.30</td>
</tr>
<tr>
<td>40%</td>
<td>40%</td>
<td>0.40</td>
</tr>
<tr>
<td>50%</td>
<td>50%</td>
<td>0.50</td>
</tr>
<tr>
<td>-</td>
<td>60%</td>
<td>0.5</td>
</tr>
<tr>
<td>-</td>
<td>70%</td>
<td>0.5</td>
</tr>
</tbody>
</table>

**Table 2. Operate values Measured on Ammeter A2**
Fig 2 Primary Injection Test Circuit
Note:

1. CT Circuits are shown connected to Relay 1A tap. For 5A tap remove wires and connect wires to terminal numbers 1,3,5,7,9 & 11 respectively.

2. Terminal No.23 (Earth) is to be connected directly to earthbar.