

- 3.2.1.8 Frequency Difference
- 3.2.1.9 Phase Difference
- 3.2.1.10 Hysteresis Voltage
- 3.2.2 Output Option Selection Screen
- 3.2.3 Brightness & Contrast
- 4. Touch Screen Calibration
- 5. Installation
  - 5.1 EMC Installation Requirements
  - 5.2 Case Dimensions and Panel Cut-out
  - 5.3 Wiring
  - 5.4 Auxiliary Supply
  - 5.5 Fusing
  - 5.6 Earth / Ground Connections
- 6. Connection Diagrams
- 7. Specification

#### 5.4 Auxiliary Supply

The instrument should ideally be powered from a dedicated supply, however it may be powered from the signal source, provided the source remains within the limits of the chosen auxiliary voltage.

#### 5.5 Fusing

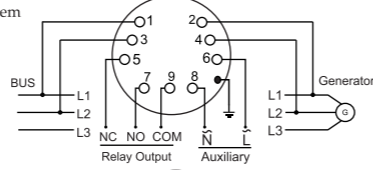
It is recommended that all voltage lines are fitted with 1 amp HRC fuses.

#### 5.6 Earth/Ground Connections

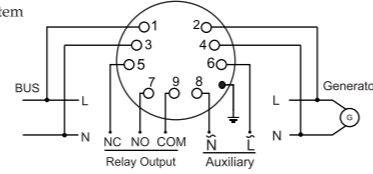
For safety reasons, the case must be earthed via one or more of the mounting studs.

#### 6. Connection Diagrams

Three Phase System



Single Phase System



#### Isolation

Dielectric voltage withstand test between circuits and accessible surfaces

2.2 kV RMS 50 Hz for 1 minute between all electrical circuits

#### Environmental

Operating temperature: -10 to +55 °C  
 Storage temperature: -20 to +65 °C  
 Relative humidity: 0 .. 95 % Non-condensing  
 Warm up time: 3 minute (minimum)  
 Shock: 15 g in 3 planes  
 Vibration: 10 .. 150 .. 10 Hz, 0.075 mm amplitude  
 Enclosure ( front only ): IP 54 as per IEC 60529

#### Enclosure

Style: 115mm x 115mm ANSI  
 Material: Thick Steel Sheet EDD grade CR material  
 Terminals: Screw-type terminals  
 Depth: < 114 mm  
 Weight: 0.750 kg Approx.

#### Standards

EMC Immunity: IEC 61326-1:2012, Table 2  
 Immunity: IEC 61000-4-3, 10V/m - Level 3 industrial Low level

#### Safety

IEC 61010-1-2010, permanently connected use

IP for water & dust: IEC 60529

Pollution degree: 2

Installation Category: III

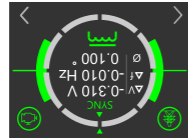
## Operating Manual

# SYNCHROSCOPE



Measured Parameters	Units of Measurement
Generator Voltage	Volts
Generator Frequency	Hertz
BUS Voltage	Volts
BUS Frequency	Hertz
Voltage Difference, ΔV	Volts
Frequency Difference, Δf	Hertz
Phase Difference, ∅	Degrees

Table 1:

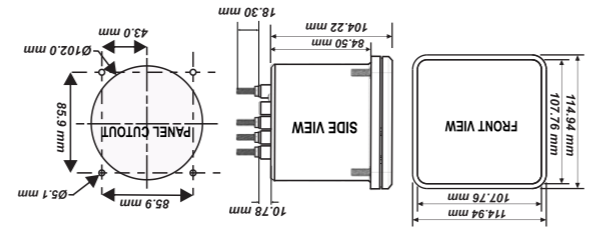


The instrument is used for indication of synchronization between two independent systems used for the measurement of important electrical parameters, namely AC Voltage, Frequency and Phase Difference of two alternators for synchronization. The instrument integrates accurate measurement of technology with 320x240 Pixels touch screen TFT LCD display. The front panel has a 3.5" Touch Screen through which the user can move across the available measurement readings and configure the product settings.

**1. Introduction**  
 This instrument is a panel mounted 115x115mm Digital Synchronizing system used for the measurement of important electrical parameters, namely AC Voltage, Frequency and Phase Difference of two alternators for synchronization. The instrument integrates accurate measurement of technology with 320x240 Pixels touch screen TFT LCD display. The front panel has a 3.5" Touch Screen through which the user can move across the available measurement readings and configure the product settings.

Input connections are made with use of insulated ring lugs. Ensure a minimum spacing of 0.21 inches (5.5mm) between uninsulated parts of adjacent ring lugs. Numbering is clearly marked in the plastic moulding, choice of cable should meet local regulations. Tighten terminal nuts to 2Nm (1.5 ft/lb) only. Cable used for input and Auxiliary supply should have current rating of 1A and voltage rating no less than highest circuit voltage connected to meter.

#### 5.3 Wiring



#### 5.2 Case Dimension and Panel Cut Out

**3.** To protect the product against permanent damage, surge transients must be limited to 2kV pk. It is good EMC practice to suppress differential surges to 2kV at the source. The unit has been designed to automatically recover in the event of a high level of transients. In extreme circumstances it may be necessary to temporarily disconnect the auxiliary supply for a period of greater than 5 seconds to restore correct operation.  
**4.** ESD precautions must be taken at all times when handling this product. The current inputs of these products are designed for connection in to systems via Current Transformers only, where one side is grounded.

After successful calibration, the same procedure for REPEAT the calibration after system reset to hold screen for 1 sec Touch screen to continue. Repeat the procedure for the remaining 3 corner circles. Touch screen to continue.

Follow the instructions displayed. Press & hold the center of the filled RED circle for at least 2 seconds. Release when message for release is being displayed. For accurate results try to touch the center of the filled circle.

**4. Touch Screen Calibration**  
 This instrument is able to perform calibration to ensure the proper operation of the units touch screen functionalities. The calibration procedure will correct the problem of out of tolerance touch screen malfunction. Note that errors corrected by this calibration procedure are specific only to touch screen calibration. Touch the screen to continue.  
**IMPORTANT:** Performing touch screen calibration. Press & hold the center of the filled circle. Touch screen to continue. Repeat the procedure for the remaining 3 corner circles. Touch screen to continue.

Figure 1 shows whether Generator is fast (has higher frequency) or slow (has lower frequency) as compared to the BUS which is indicated on the screen. This indication becomes important particularly when the frequency difference between the Generator and BUS becomes greater enough to make the pointer rotate unnaturally (abnormally).

When Δf is positive, then Generator is said to be fast and when Δf is negative, the Generator is said to be slow which is also indicated on the screen as shown in Figure 1.

**Direction of rotation:** Clockwise rotation indicates that Δf is positive and counter-clockwise rotation indicates that Δf is negative.

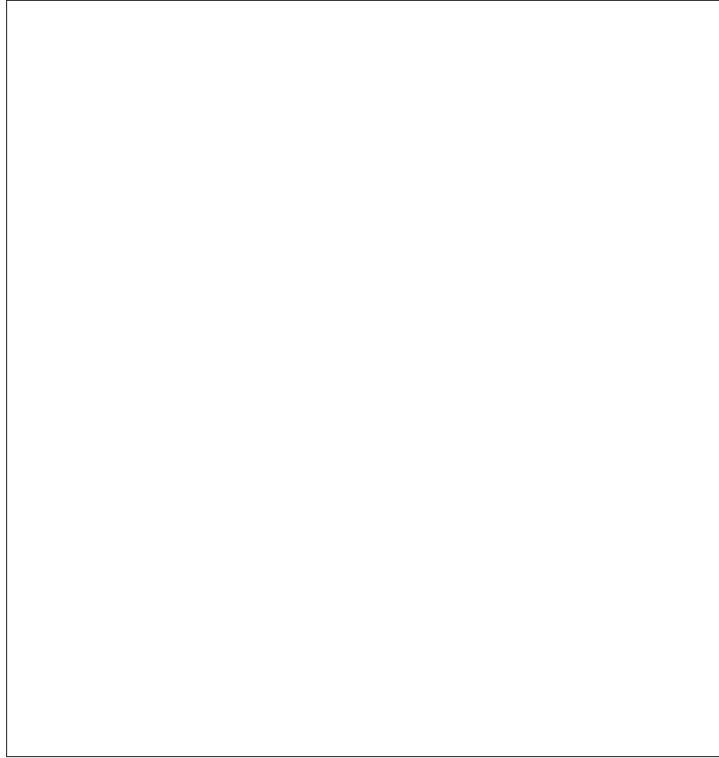
**Speed of rotation:** Δf of 1Hz is indicated by single rotation around the circle in 10 seconds and so on.

The speed of rotation of the pointer around the circle indicates the magnitude of Δf and the direction of rotation indicates whether Δf is positive or negative.

The frequency difference between the Generator and the BUS is also indicated by object (5), which is the WHITE pointer that rotates around the circle (Object (6)).

④ gives the numerical value of the frequency difference between the Generator and the BUS. That is, Δf = fGEN - fBUS. If Generator Frequency is greater than BUS Frequency, then Δf is a positive value and similarly, it is negative if the Generator Frequency is less than the BUS Frequency.

#### 2.1.3 Frequency Difference Indication



<b>Reference conditions for Accuracy :</b>	
Reference temperature	23 °C ± 2 °C
Input Voltage	Rated Value ± 2 %
Input frequency	50 or 60Hz ± 2%
Input waveform	Sinusoidal (distortion factor 0.005)
Auxiliary supply voltage	Rated Value ± 1 %
Auxiliary supply frequency	Rated Value ± 1 %
<b>Nominal range of use of influence quantities for measurands</b>	
Input frequency	Rated Value ± 10 %
Temperature	0 to 50 °C
Auxiliary supply voltage	Rated Value ± 10 %
Auxiliary supply frequency	Rated Value ± 10 %
Temperature Coefficient	0.05% / °C for Voltage
(For Rated value range of use 0... 50 °C )	
Error change due to variation of an influence quantity	2 * Error allowed for the reference condition applied in the test.
<b>Display</b>	
TFT LCD	3.5" Graphical LCD, resolution 320x240 pixels Approx. 0.2 seconds
Update	
<b>Controls</b>	
User Interface	Resistive Touch screen
<b>Relay Contact</b>	
Contact Rating	240 VAC, 5A
<b>Standards</b>	
Safety	IEC 61010-1 , Year 2010
IP for water & dust	(IP 54 for front) IEC 60529
Pollution degree	2
Installation Category	CAT III 300V

<b>7. Specification :</b>	
<b>System</b>	
Single Phase/ Three Phase	
<b>Inputs</b>	
Nominal input voltage range (AC RMS)	100 - 500 V
Max continuous input voltage	600 V
Max short duration input voltage	2 x Nominal Value (1s application repeated 10 times at 10s intervals) <0.8 VA approx. 45 Hz - 66Hz
Nominal input voltage burden	
Frequency measuring range	<0.8 VA approx. 45 Hz - 66Hz
<b>Auxiliary</b>	
Standard nominal Auxiliary supply voltage	100 - 500 V AC - DC
a.c. supply frequency range	45 to 65 Hz
a.c. supply burden	9.1 VA approx.
d.c. supply burden	7 W approx.
<b>Operating Measuring Ranges</b>	
Voltage	100-500 V
Frequency	45 .. 66 Hz
<b>Accuracy</b>	
Voltage difference	± 1 % of Nominal value
Frequency difference	±0.15 Hz
Phase difference	± 2°

# INDEX

## Touch Screen Digital Synchroscope Meter Installation & Operating Instructions

Section	Contents
1.	Introduction
2.	Measurement Reading Screens
2.1	Main Screen
2.1.1	Voltage Level Indication
2.1.2	Voltage Difference Indication
2.1.3	Frequency Difference Indication
2.1.4	Phase Difference Indication
2.1.5	Synchronization Indication
2.2	GEN Parameters Screen
2.3	BUS Parameters Screen
3.	Programming
3.1	Password Protection
3.1.1	Change Password
3.2	Menu selection
3.2.1	System Parameter Selection Screen
3.2.1.1	PT Primary Value
3.2.1.2	PT Secondary Value
3.2.1.3	BUS Voltage Lower Limit
3.2.1.4	BUS Voltage Upper Limit
3.2.1.5	GEN Voltage Lower Limit
3.2.1.6	GEN Voltage Upper Limit
3.2.1.7	Voltage Difference

The status of the alternators are indicated by the color of the symbols making the process user friendly. The symbols and their respective colors section 2.1.1 - 2.1.5. For two AC alternators to be paralleled, they must be synchronized first and this is achieved when corresponding

1. RMS Voltage,  
2. Frequency, and  
3. Phase  
are same. This is achieved by making these three parameters equal in the same order.

**2.1.1 Voltage Level Indication**  
The instrument provides the provision of deciding a voltage band for the individual inputs, namely BUS and Generator. This band lies between a Lower Limit and an Upper Limit which is settable by the user (Section 3.2.1.3 - 3.2.1.6). If the voltage of either of the alternator lies outside the band, then synchronization would not happen.

Symbol ① indicates the voltage level of BUS and ② indicates the voltage level of Generator using the following color code:

RED: Alternator Voltage Absent  
GREEN: Alternator Voltage within user specified band  
YELLOW: Alternator Voltage outside the user specified band but not absent

**2.1.2 Voltage Difference Indication**  
③ gives the numerical value of the voltage difference between the Generator and the BUS. That is,  $\Delta V = V_{GEN} - V_{BUS}$ . If Generator Voltage is greater than BUS Voltage, then  $\Delta V$  is a positive value and similarly, it is negative if Generator Voltage is less than the BUS Voltage.

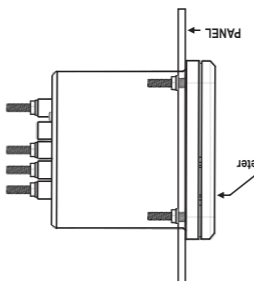
Error in calibration  
Touch screen to  
re-calibrate.

If the touch screen was not calibrated properly, calibration is being performed.

The meter should be installed in line with the requirements of the National Electrical Code (NEC) for USA or Canadian Electrical Code (CEC) for Canada.

These units are only for built in use, with terminals inaccessible to users after installation and should be mounted to an ANSI panel cut-out.

The case must be earthed via one or more of the mounting studs. Do not tighten the mounting nuts beyond the torque necessary to secure the meter to the panel.



24

As the front of the enclosure conforms to IP54 it is protected from water spray from all directions, additional protection to the panel may be obtained by the use of an optional panel gasket. The terminals at the rear of the product should be protected from liquids.

The instrument should be mounted in a reasonably stable ambient temperature and where the operating temperature is within the range -10 to 55 °C . Vibration should be kept to a minimum and the product should not be mounted where it will be subjected to excessive direct sunlight.

**Caution**

- In the interest of safety and functionality this product must be installed by a qualified engineer, abiding by any local regulations.
- Voltagess dangerous to human life are present at some of the terminal connections of this unit. Ensure that all supplies are de-energised before attempting any connection or disconnection.
- These products do not have internal fuses therefore external fuses must be used to ensure safety under fault conditions.

**5.1 EMC Installation Requirements**

This product has been designed to meet the certification of the EU directives when installed to a good code of practice for EMC in industrial environments, e.g.

- Screened output and low signal input leads or have provision for fitting in the event that RF fields cause problems.
- RF suppression components, such as ferrite absorbers, line filters etc., in EMC enclosures that protect against performing critical functions, in EMC enclosures that protect against electrical interference which could cause a disturbance in function.
- Avoid routing leads alongside cables and products that are, or could be, a source of interference.

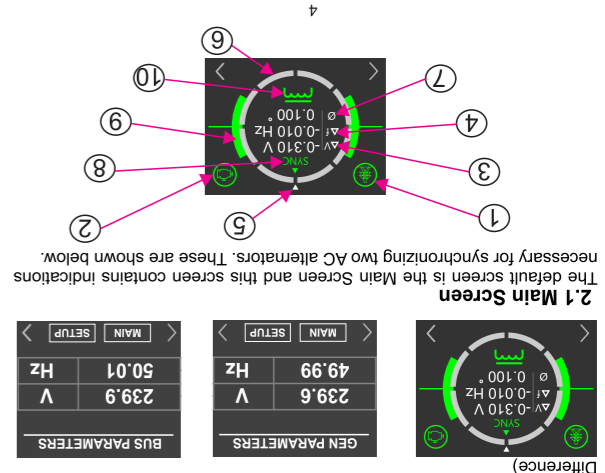
25

In normal operation the user is presented with the main measurement reading screen out of three different screens. These screens from particular submenu may be scrolled through one at a time in incremental order by touching the " > " key and in decrement order by touching " < " key on that screen.

**Screen 1 :** Main Screen (Voltage Difference, Phase Frequency)

**Screen 2 :** Generator Parameters (Voltage, Frequency)

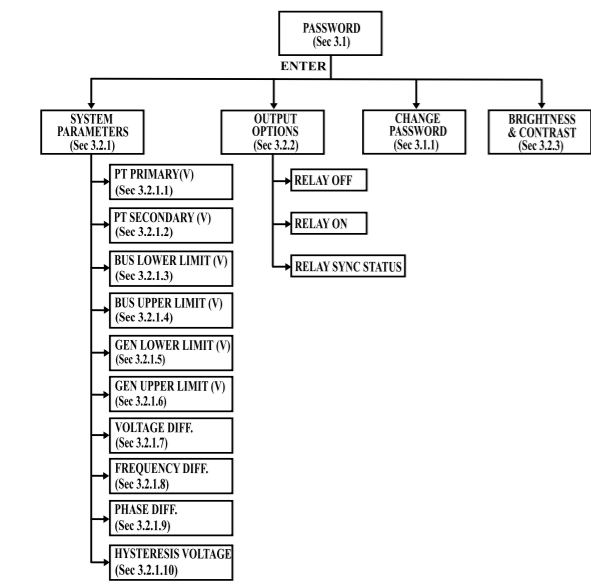
**Screen 3 :** Bus Parameters (Voltage, Frequency)



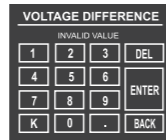
The default screen is the Main Screen and this screen contains indications necessary for synchronizing two AC alternators. These are shown below.

**2.1 Main Screen**

① Voltage Level Indication  
② Voltage Difference Indication  
③ Frequency Difference Indication  
④ Phase Difference Indication  
⑤ Synchronization Indication  
⑥ GEN Parameters Screen  
⑦ BUS Parameters Screen  
⑧ Password Protection  
⑨ Change Password  
⑩ Menu selection



Setup Parameter Screens



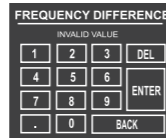
If value outside the range is entered, It will display "INVALID VALUE" followed by correct range of parameter.

The default value is 10V for PT Ratio 1.

**Note:** The range and limit will change as per the PT Ratio (PT Primary/PT Secondary). The range will be from 1\*PT Ratio to 100\*PT Ratio and default value will be 10\*PT Ratio.

3.2.1.8 Frequency Difference

This setting is for the maximum frequency difference between the Generator and the BUS above which synchronization will not be accepted. The valid range of frequency difference setting is 0.05 to 1.5 Hz.

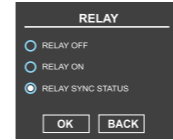


If value outside the range is entered, It will display "INVALID VALUE" followed by correct range of parameter.

The default value is 1 Hz.

3.2.2. Output Option Selection Screen

After entering in the "OUTPUT OPTIONS", the "RELAY" menu will appear and the list of following options will be displayed :-  
 1. RELAY OFF - The relay will turn off when this option is chosen.  
 2. RELAY ON - The relay will turn on when this option is chosen.  
 3. RELAY SYNC STATUS - If this options is chosen, then the relay will turn ON when synchronization is achieved and it will be OFF when synchronization is not achieved.



The relay ON/OFF indication in the third option is also given by the relay symbol (Section 2.1.5).

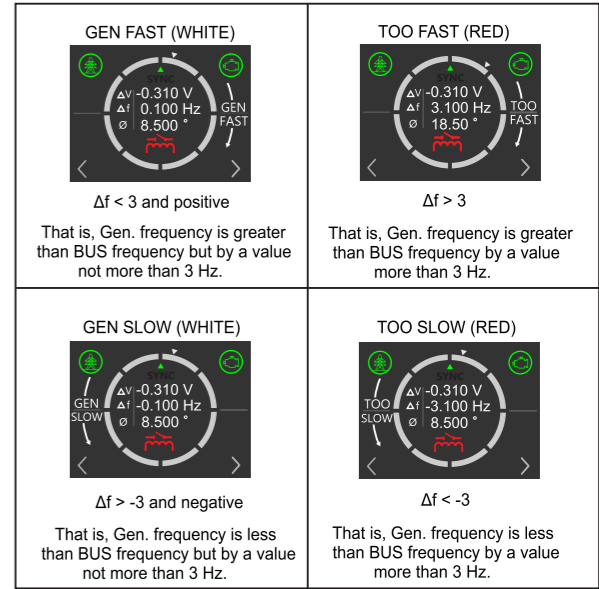


3.2.3 Brightness & Contrast

The brightness & contrast of the TFT LCD screen can be varied by the user by sliding the sliders. Touching the "OK" key will confirm the current brightness & contrast setting. Touching the "DEFAULT" key will set brightness and contrast as per default settings. Touching the "BACK" key will move back to the setup menu without making any changes.



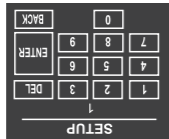
Figure 1



After entering the complete password user needs to confirm password by touching "ENTER" key. The BACK button would take the user to the Main Screen (Section 2.1).



Touching "1" key will display 1 in display area, similarly user can enter remaining 3 digits. For deleting any digit while entering password, user can touch "DEL" key.



Password protection can be enabled to prevent unauthorized access to set-up screens; default password is "0000". Password protection is enabled by selecting any four digit number. After releasing "SETUP" button Password protection screen is displayed. Screen consists of 0 to 9 digit keypad for entering the password" is similar to any calculator in touchscreen mobile. "Enter Password" is displayed on screen at start so that user can enter password using displayed keypad.

3.1. Password Protection

The following sections comprise step by step procedures for configuring the instrument for individual user requirements. To access the set-up screens touch on the "SETUP" button either in the "BUS PARAMETERS" screen, This will take the User into the Password Protection Entry Stage (Section 3.1).

3. Programming

This setting is for the maximum voltage difference between the Generator and the BUS above which synchronization will not be accepted. The valid range of voltage difference setting is 1 to 100 V for PT Ratio 1.

3.2.1.7 Voltage Difference

**Note:** The range and limit will change as per the PT Ratio (PT Primary/PT Secondary). The range will be from (GEN VOLTAGE LOWER LIMIT + 50\*PT Ratio) to 500\*PT Ratio and default value will be 500\*PT Ratio.

Upper limit cannot go below 100V in that case. If value outside the range is entered, It will display "INVALID VALUE" followed by correct range of parameter.

**Note:** For PT Ratio 1, the min. GEN voltage lower limit is 50V, so GEN voltage upper limit will be 500V.

The default value is 500V for PT Ratio 1.

Valid range of GEN Lower Voltage Limit setting value is from (GEN VOLTAGE LOWER LIMIT + 50) to 500 V for PT Ratio 1.

This screen is used to set the upper limit of the GEN voltage. This screen can be accessed only from System Parameters list menu. Here 0 to 9 digit input keypad is provided to set value of the lower limit of the GEN voltage & user can confirm this value with a simple touch "ENTER".

3.2.1.6 GEN Voltage Upper Limit



This screen is used to set the PT Secondary value. Parameters list menu. Here 0 to 9 digit input keypad is provided to set value of PT Secondary & user can confirm this value with a simple touch "ENTER".



Valid range of PT Secondary value is from 100V to 500V.

If value outside the range is entered, It will display "INVALID VALUE" followed by correct range of parameter.

The default value is 500V.

**Note:** When PT Secondary is changed, then the values of parameters of Subsection 3.2.1.3 to Subsection 3.2.1.7 and that of Subsection 3.2.1.10 will change to default as per PT Ratio (PT Primary/PT Secondary).

**Note:** The PT Primary and PT Secondary settings are used for the purpose of PT Ratio only.

This screen is used to set the lower limit of the BUS voltage. This screen can be accessed only from System Parameters list menu.

Here 0 to 9 digit input keypad is provided to set value of the lower limit of the BUS voltage & user can confirm this value with a simple touch "ENTER".

3.2.1.2 PT Secondary Value



This screen is used to set the PT Primary value. This screen can be accessed only from System Parameters list menu. Here 0 to 9 digit input keypad is provided to set value of PT Primary & user can confirm this value with a simple touch "ENTER".



Valid range of PT Primary value is from 100V to 692.8kV.

If value outside the range is entered, It will display "INVALID VALUE" followed by correct range of parameter.

The default value is 500V.

**Note:** When PT Primary is changed, then the values of parameters of Subsection 3.2.1.3 to Subsection 3.2.1.7 and that of Subsection 3.2.1.10 will change to default as per PT Ratio (PT Primary/PT Secondary).

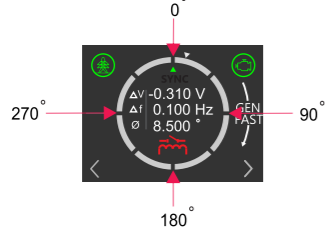
After entering in the "SYSTEM PARAMETERS". List of following parameters will be displayed :-

- 3.2.1.1 PT Primary Value
- 3.2.1.2 Secondary Value
- 3.2.1.3 BUS Voltage Lower Limit
- 3.2.1.4 BUS Voltage Upper Limit
- 3.2.1.5 GEN Voltage Upper Limit
- 3.2.1.6 GEN Voltage Lower Limit
- 3.2.1.7 Voltage Difference
- 3.2.1.8 Frequency Difference
- 3.2.1.9 Phase Difference
- 3.2.1.10 Hysteresis Voltage

### 2.1.4 Phase Difference Indication

Object ⑦ gives the numerical value of the phase difference between the Generator and the BUS.  $\emptyset$  is the phase angle calculated between corresponding zero-crossings by taking BUS as reference.  $\emptyset$  lies between 0 and 360°.

The phase difference between the Generator and BUS is also indicated by the position of the rotating pointer (object ⑤) around the circle (object ⑥). The permanent GREEN arrow at 12 o'clock indicates 0°.



In this way, the numerical value of  $\emptyset$  and the position of the pointer give both digital and analog experience to the user at the same time. Same stands true for frequency difference,  $\Delta f$  (Section 2.1.3).

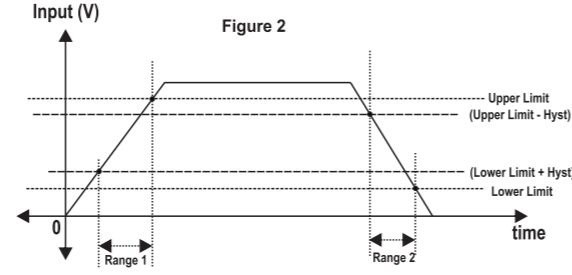
### 2.1.5 Synchronization Indication

When  $\Delta V$ ,  $\Delta f$  and  $\emptyset$  lie within the user defined allowed relaxed limits for synchronization (Section 3.2.1.7 - 3.2.1.9), the meter indicates synchronization in two different ways:

1. By glowing the text "SYNC" GREEN (object ⑧).
2. By introducing GREEN arcs (object ⑨) around the circle.

**Note:** The range and limit will change as per the PT Ratio (PT Primary/PT Secondary). The range will be from 1\*PT Ratio to 15\*PT Ratio and the default value will be 4\*PT Ratio.

In figure 2, when input voltage of the alternator is not in Range 1 or Range 2, then synchronization may happen, but relay will not turn ON.



### 3.2.1.9 Phase Difference

This setting is for the maximum phase difference between the Generator and the BUS above which synchronization will not be accepted. The valid range of phase difference setting is 3 to 20 degrees.

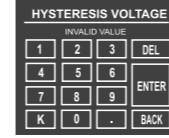


If value outside the range is entered, It will display "INVALID VALUE" followed by correct range of parameter.

The default value is 10 degrees.

### 3.2.1.10 Hysteresis Voltage

This screen allows the user to set Hysteresis for input voltage. Here a 0 to 9 digit input keypad is provided to set value of Hysteresis, & user can confirm this value with a simple touch on "ENTER" key. "BACK" key is used to go back to "SYSTEM PARAMETERS" menu.



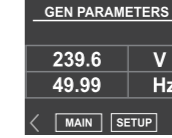
The allowable range is 1 to 15V for PT Ratio 1. If value outside this range is entered, it will display "INVALID VALUE" followed by correct range of parameter.

The default value is 4V for PT Ratio 1.

Object ⑩ is the symbol for Relay status (Section 3.2.2). It changes its state and color in the following manner:  
 1. Relay OFF and RED: The conditions for synchronization are not yet met.  
 2. Relay ON and GREEN: The conditions for synchronization are met.  
 \*A condition may arise when the indications ⑧ and ⑨ for sync are shown but relay ⑩ is not turned ON (Refer Hysteresis Voltage, Section 3.2.1.10).

### 2.2 GEN Parameters Screen

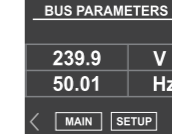
On the main screen, the navigation key at the lower right corner, that is, ">" key brings the user to the GEN Parameters Screen. This screen provides the value of Generator Voltage and Generator Frequency.



The user can access the SETUP menu by touching the "SETUP" key which takes the user to the password (for setup) screen (Section 3.1). Touching the "MAIN" key takes the user to the Main Screen. On touching the navigation key "<", Main Screen (Section 2.1) appears and on touching the ">" key, the BUS PARAMETERS Screen (Section 2.3) appears.

### 2.3 BUS Parameters Screen

On the main screen, the navigation key at the lower left corner, that is, "<" key brings the user to the BUS Parameters Screen. This screen provides the value of BUS Voltage and BUS Frequency.



The user can access the SETUP menu by touching the "SETUP" key which takes the user to the password (for setup) screen (Section 3.1). Touching the "MAIN" key takes the user to the Main Screen. On touching the navigation key ">", Main Screen (Section 2.1) appears and on touching the "<" key, the GEN PARAMETERS Screen (Section 2.2) appears.

Touching on SYSTEM PARAMETERS will open the System Parameter Selection Screen.

- 3.2.3 BRIGHTNESS & CONTRAST
- 3.2.2 OUTPUT OPTIONS
- 3.2.1 SYSTEM PARAMETERS

After entering in the SUBMENU - SETUP, user will be asked to enter password & after input of correct password list of following parameters will be displayed on screen :-

### 3.2 Menu selection.

After confirming "PASSWORD CHANGED" is displayed on the screen which ensures successful "PASSWORD CHANGED" key to confirm.



After input of correct password, "PASSWORD ACCEPTED" is displayed & now user can enter the new 4 digit password.



**Note:** For PT Ratio 1, the min. BUS voltage lower limit is 50V, so BUS voltage upper limit cannot go below 100V in that case.

The default value is 500V for PT Ratio 1. Valid range of BUS Upper Voltage Limit setting value is from (BUS VOLTAGE LOWER LIMIT + 50) to 500V for PT Ratio 1.

This screen is used to set the upper limit of the BUS voltage. This screen can be accessed only from System Parameters list menu. Here 0 to 9 digit input keypad is provided to set value of the lower limit of the BUS voltage & user can confirm this value with a simple touch "ENTER".

**3.2.1.4 BUS Voltage Upper Limit**  
 Valid range of GEN Lower Voltage Limit setting value is from 50 (GEN VOLTAGE UPPER LIMIT - 50) V to 500V for PT Ratio 1. The range and limit will change as per the PT Ratio (PT Primary/PT Secondary). The range will be from 50\*PT Ratio to (BUS VOLTAGE UPPER LIMIT - 50\*PT Ratio) and default value will be 100\*PT Ratio.

**Note:** For PT Ratio 1, the max. BUS voltage upper limit is 500V, so BUS voltage lower limit cannot go beyond 450V in that case. If value outside the range is entered, it will display "INVALID VALUE" followed by correct range of parameter.

The default value is 100V for PT Ratio 1. Valid range of BUS Lower Voltage Limit setting value is from 50 (BUS VOLTAGE UPPER LIMIT - 50) V to 500V for PT Ratio 1.

**Note:** For PT Ratio 1, the max. GEN voltage upper limit is 500V, so GEN voltage lower limit cannot go beyond 450V in that case. If value outside the range is entered, it will display "INVALID VALUE" followed by correct range of parameter.

The range and limit will change as per the PT Ratio (PT Primary/PT Secondary). The range will be from 50\*PT Ratio to (GEN VOLTAGE UPPER LIMIT - 50\*PT Ratio) and default value will be 100\*PT Ratio.

This screen is used to set the lower limit of the GEN voltage. This screen can be accessed only from System Parameters list menu. Here 0 to 9 digit input keypad is provided to set value of the lower limit of the GEN voltage & user can confirm this value with a simple touch "ENTER".

**3.2.1.5 GEN Voltage Lower Limit**  
 Valid range of GEN Lower Voltage Limit setting value is from 50 (GEN VOLTAGE UPPER LIMIT - 50) V to 500V for PT Ratio 1. The default value is 100V for PT Ratio 1.

If value outside the range is entered, it will display "INVALID VALUE" followed by correct range of parameter. The range and limit will change as per the PT Ratio (PT Primary/PT Secondary). The range will be from 50\*PT Ratio and default value will be 50\*PT Ratio.

If Entered password is correct then "Password Accepted" is displayed on screen & user will enter into setup menu.

In this screen user first needs to enter the current password.

Change Password Option is the second last option in list of "SETUP" submenu, so can be accessed by a simple touch anywhere in "Change Password" row.

After wrong password is entered, user needs to touch "ENTER" key for trying another password.

If Entered password is wrong then "Password Rejected" is displayed on screen & user would need to re-enter the password.

**3.1.1 Change Password**  
 If Entered password is correct then "Password Accepted" is displayed on screen & user will enter into setup menu.

If Entered password is wrong then "Password Rejected" is displayed on screen & user would need to re-enter the password.