

# **USER'S MANUAL**

## **AMF**

This document contains the latest technical information about AMF. The unit is tested against latest "MTE" Standard Model PRS400.3 having basic accuracy of 0.02%, traceable upto International Standards derived using appropriate ratio techniques.

The product, AMF is sophisticated electronic equipment, and the user is advised to read this User's Manual carefully before attempting to install or operate the equipment.

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## **Introduction**

The digital meter AMF is a micro-controller based unit which automates generator starts and stop action during mains failure and make change over of both mains and generator contactors. It also measures voltage, current and frequency and display it on 20 x 4 LCD. It has 12 LED for different indications. All programmable parameters are password protected and are stored in a Non Volatile Memory and thus all information is retained in the event of complete loss of battery power. AMF can be operated in “AUTO”, “QAUTO” or “MANUAL” control mode. The unit features a non-erasable incremental “DG run hour” and “maintenance hour”. This information is also kept in a non-volatile memory and is retained during loss of battery power. This unit is meant for use in three phase four wire systems. The “CT ratio” is site selectable.

### **The Main features Available in this Model**

- Accuracy Class 1
- Displays voltage, frequency and current.
- Large 20 X 4 Backlit LC Display
- CT Ratio field programmable
- 12 LED for different indication
- Supports MANUAL, AUTO and QAUTO control mode
- Displays Generator (DG) Run Hour and Maintenance Hour
- DG Maintenance Warning
- Low Battery Warning
- Generator Over Current Alarm
- Generator Trial Fail Alarm
- DG Fault Alarm
- DG test mode
- Over Volt indication
- Under Volt Indication
- Automatic Contactor Control

## Technical Specifications

Parameters			
Type	Name	Statistics	
INPUT	Three Phases and Neutral of a 3P4W		
	Voltage	Direct Voltage Input : Up to 300V L-N Burden : 0.5VA	
	Current	Secondary Current Input: 5A or 1A (Site Selectable) CT Ratio : Site Selectable Range of Reading : 5 – 5000A Burden : < 1.0VA Overload : 5A CT = 6A RMS Continuous 1A CT = 1.2A RMS Continuous	
	Power Supply	9-36V DC	
OUTPUT	Relay	Six Relays(NO) Switching Voltage : Max. 250 VAC Switching Current : 6 A (Resistive load) Expected Mechanical Life : >1X10 <sup>7</sup> switching operations Expected Electrical Life : > 5X10 <sup>4</sup> switching operations	
MEASUREMENT	True RMS Basic Parameters	Voltage (Volts L-N )	VL-N Accuracy : 1.0% of Reading
		Current (Amps IR, IY, IB)	Accuracy : 0.25 % of Reading
		Line Frequency	45 to 55 Hz, Accuracy : 0.3% of Reading

### MISCELLANEOUS

Parameters		
Type	Name	Statistics
Dimensions	Bezel	144 X 144 mm
	Panel Cutout	138 X 138 mm
	Depth of installation	55 mm
	Display	20 X 4 Backlit LCD
	Operating temp	10°C to 50°C
	Weight	0.58 Kgs (Approx.)
	Operating Current Range	0.4% to 120% of CT primary

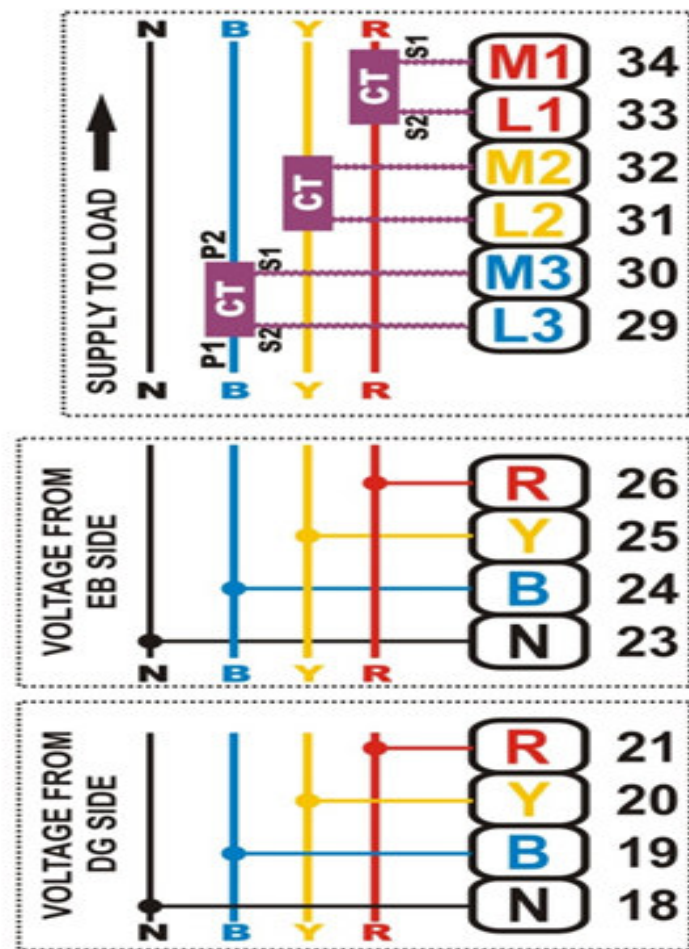
## Installation and Commissioning

The AMF supports following 3P4W installation mode:

### 3P4W Mode Installation

Follow these steps to install / commission the unit.

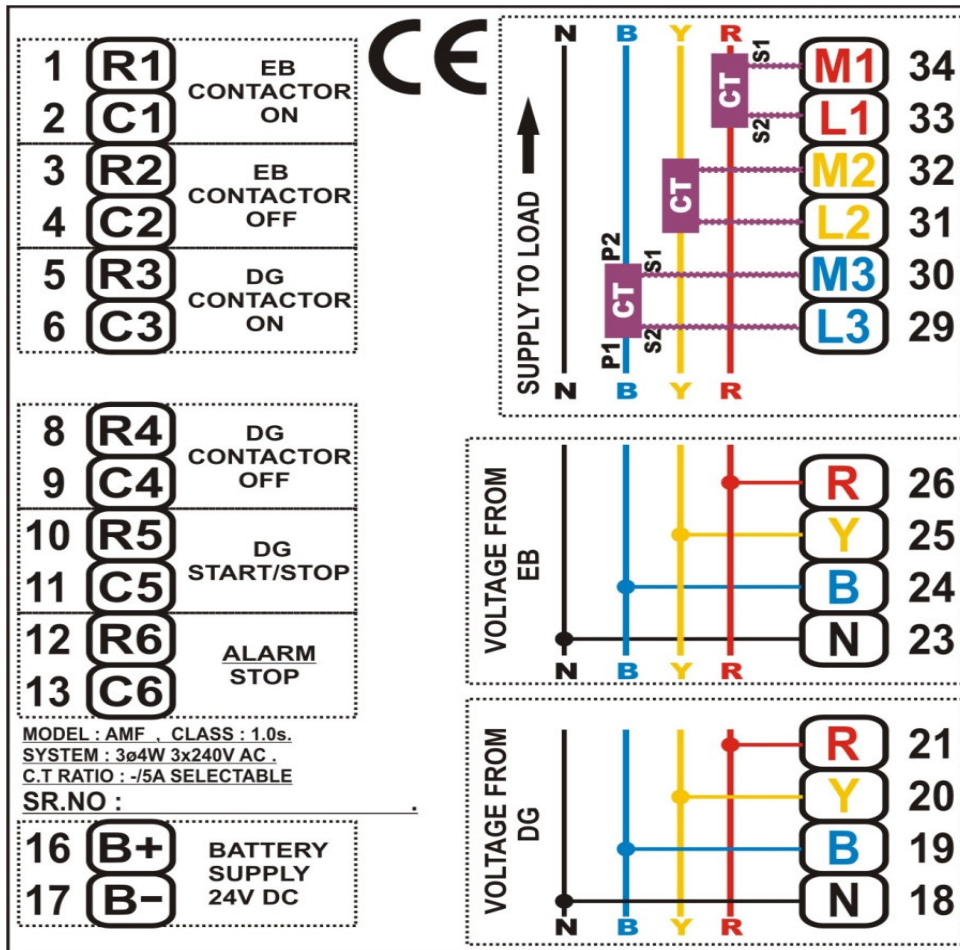
1. Push the unit into the panel and mount using the clamps provided. Connect the Battery supply to the terminals marked B+ and B-. The Battery supply range is 9- 36 VDC.



2. Connect the three phases from Electricity Board (EB/MAINS) with the phase sequence being R-Y-B to the terminals marked R (26), Y (25) and B (24) respectively as shown in above connection diagram. Make sure that the three phases coming to the unit come through control fuses of 1.0 Amp rating. This will protect the electronics inside from damage due to severe overvoltage or phase faults in the system.
3. Connect the neutral of Electricity Board (EB/MAINS) to the terminal marked N (23) of EB (Mains) side.

4. Connect the three phases from Generator (DG) with the phase sequence being R-Y-B to the terminals marked R (21), Y (20) and B (19) respectively as shown in above connection diagram. Make sure that the three phases coming to the unit come through control fuses of 1.0 Amp rating.
5. Connect the neutral of Generator (DG) to the terminal marked N (18) of DG side.
6. Connect the two wires from the R-phase CT to terminals marked M1 & L1 such that S1 from CT goes to M1 on the unit. Connect the two wires from the Y-phase CT to terminals marked M2 & L2 such that S1 from CT goes to M2 on the unit. Connect the two wires from the B-phase CT to terminals marked M3 & L3 such that S1 from CT goes to M3 on the unit.
7. If there is very little current or no current in the CT circuits, the unit may show '0.0'. This will go away as soon as the current builds up in the CTs, above 0.4 % of rated CT.
8. Connect EB ON Contactor to RELAY1 marked as R1 & C1 of terminal 1 and 2.
9. Connect EB OFF Contactor to RELAY2 marked as R2 & C2 of terminal 3 and 4.
10. Connect DG ON Contactor to RELAY3 marked as R3 & C3 of terminal 5 and 6.
11. Connect DG OFF Contactor to RELAY4 marked as R4 & C4 of terminal 8 and 9.
12. If DG START/STOP requires only single NO contact RELAY then connect DG start/stop connections to RELAY5 marked as R5 & C5 of terminal 10 and 11. If DG START/STOP requires different RELAYS then connect **DG START** connections to RELAY5 & DG STOP connections to RELAY 6 marked as R6 & C6. In this case, ALARM RELAY functionality will be disabled.
13. If DG START/STOP requires only single NO contact RELAY then connect Alarm to RELAY6 marked as R6 & C6 of terminal 12 and 13. If DG START/STOP requires 2 different RELAY then ALARM RELAY functionality will be disabled.
14. There are separate relay connections provide for each contactor. Connect Neutral direct to contactor & connect Phase to "C". Connect "R" to contactor.
15. Switch on the three phase supply as well as Battery volts. The unit will come alive and display power information such as factory name for about two seconds and then, it will display the first page of Run Mode.
16. Now, the unit needs to be programmed for the various parameters which are field programmable. For this refer to next section "OPERATIONAL DETAILS"

17. The unit is ready for operation.



**Connection Scheme**



## Operational Details

The AMF is a versatile meter, with all the features needed to implement with a robust electrical measurement system. It can be configured to suit most control needs.

This is achieved by making as many parameters field programmable, as much as possible.

This unit can be operated with two modes:

1. Programming Mode: For setting /resetting various programmable parameters.
2. Run Mode: For viewing various measured parameters.

After supplying power (9 VDC -36 VDC) to the battery inputs the unit displays immediately power receiving information such as Factory name and then, enters into first page of Run Mode such as shown below.

MAINS	GENERATOR
Vr = 230.0	Vr = 230.0
Vy = 230.0	Vy = 230.0
Vz = 230.0	Vz = 230.0

Now, the unit can be operated by pressing following keys:



Use  and  to change to following pages:


Ir = 0.00	FREQ=50.00
Iy = 0.00	Batr=24.0
Ib = 0.00	Mode:Manual

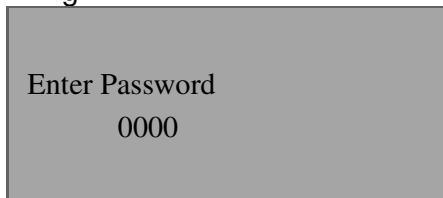
DG RunHour: 0000:00
Mnt Hour : 0000:00
Alarm: No Fault









(For information about these display parameters refer to RUN MODE)

## Programming Mode

The unit is designed with a secure default password, "1947". The password is also changeable from 0000 to 9999 according to user's desire (see in the section, programmable, "Changing a Password" page 18).

To enter into Programming Mode, press  in Run Mode for about five seconds and then, the display will show with a four digits of zeros of which first digit, zero will be blinking.

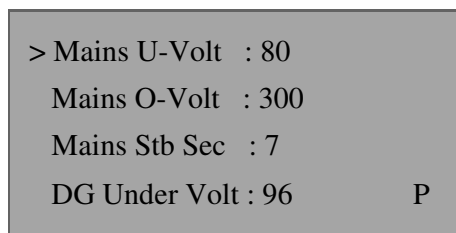


To enter the password, press  key one time which will alter into first digit, 1 and press  key to shift into second digit. Press  again nine times to alter into 9, press  key again to shift into 3<sup>rd</sup> digit and press  key four times to alter into 4 and then, press  key to shift into 4<sup>th</sup> digits and press  key seven times to alter into 7. After entering the default password, press  key to enter into Programming Mode. 'P' shows blinking in each page which indicates Programming Mode.







## Setting Mains U-Volt, Mains O-Volt, Mains Stable Sec and DG Under Volt






To set the above parameters, follow the below instructions:

After entering the programming mode, the unit shows an arrow onto Mains U-Volt by default with the following page.



To set the above parameters follow the below steps:

1. After entering the password such as steps before, the unit enters into Programming Mode and shows an arrow onto "Mains U-Volt" by default as shown in above page.
2. Press  key which will start blinking the Arrow (>) and the parameter can now be set by pressing  and  keys. Set the desired parameters and then, press  key to confirm the setting that will also stop blinking arrow (>).
3. Press  key to enter into the next parameter "Mains O-Volt" and press  key again which will start blinking the arrow (>). Select the desired "Mains O-

- Volt” by pressing  and  keys as steps before and press  key again to confirm.
4. Set “Mains Stb Sec” and “DG Under Volt” with same steps.
  5. If the setting is completed, press  for about five seconds to return into Run Mode. Otherwise, press  key to set for next parameters such as before.

### **Mains U-Volt**

This parameter set the lower voltage limit of Mains/ EB (Electricity Board) below which if one or more phase voltage remains up to “Mains Stb Sec” then the load will be lifted from Mains/EB, if load is already on Mains/EB or it would not be shifted to it. This can be set from 80 to 230 volts.

### **Mains O-Volt**

This parameter set the Upper voltage limit of Mains/EB above which if one or more phase voltage remains up to “Mains Stb Sec” then the load will be lifted from Mains (EB), if load is already on Mains (EB) or else it would not be shifted to it. This can be set from 240 to 300 volts.

### **Mains Stable Sec**

This parameter set the duration required for considering Mains (EB) stable or unstable.

If all the three phase voltage are above “Mains U-Volt” and below “Mains O-Volt” for this much duration then the Mains (EB) would be considered as stable.

If one or more phase remains out of this band (less than “Mains U-Volt” and/or greater than “Mains O-Volt”) for this much duration then Mains (EB) would be considered as unstable and load will be lifted from Mains (EB) if load is already on Mains (EB) or it would not be shifted to it.

This parameter can be set from 5 to 30 seconds.

### **DG Under Volt**

This parameter set the lower voltage limit of DG below which if one or more phase voltage remains up to “DG Stable Sec” then the load will be lifted from DG if load is already on DG else load would not be switched on it. Also “AL1” led would glow indicating this case and LCD would display “DG Fault! “ (For information about “DG Alarm” refer page 22)

This parameter can be set from 80 to 230 volts.

### **Setting DG Over Volt, DG Stable Sec, CT Primary and CT Secondary**

In the above Programming Mode, press  key till the unit enters into the following display and then, set them as steps before.

```
> DG Over Volt : 300
  DG Stable Sec : 10
  CT Primary    : 500
  CT Secondary  : 5      P
```

### DG Over Volt

This parameter set the upper voltage limit of DG above which if one or more phase voltage remains up to “DG Stable Sec” then the load will be lifted from DG if load is already on DG else load would not be switched on it. Also” AL1” led would glow indicating this case and LCD would display “DG Fault!” Alarm in RUN MODE.

This parameter can be set from 240 to 300 volts.

### DG Stable Sec

This parameter set the duration required for considering DG stable or unstable. If all the three phase voltages are above “DG Under Volt” and below “DG Over Volt” for this much duration then the DG would be considered as stable.

If any phase remains out of this band (less than “DG Under Volt” and/or greater than “DG Over Volt”) for this much duration then DG will be considered as unstable and load will be lifted from DG if load is already on DG or it would not be shifted to it.

Also “AL1” led would glow indicating this case and LCD would display “DG Fault!” Alarm in RUN MODE.

This parameter can be set from 5 to 30 seconds.

### CT Primary

This parameter is used for defining primary of the CT used for measuring the load current. It is selectable from 1/5 to 5000.

Hold ▲ / ▼ for increasing/decreasing CT Primary continuously.

### CT Secondary

This parameter is used for defining secondary of the CT used for measuring load current. It is selectable by 1 OR 5.

### Setting Crank ON Sec, DG Build Sec, Crank Trials and BTRY Low Volts

In the above Programming Mode, press ▼ key till the unit enters into the following display and then, set them as steps before.

```
> Crank ON Sec : CONT.
  DG Build Sec : 12
  Crank Trials  : -
  BTRY Low Volt: 9      P
```

### Crank ON Sec

AMF supports following two types of generator START/STOP relay options.

- 1) Generator that requires single RELAY for starting and stopping it.  
In this type of generator all cranks are given by generator circuit internally. This device will simply short RELAY5 (NO contact) for starting it. For stopping DG RELAY5 would be open.  
In this type of DG select “Crank ON Sec” as CONT.

- 2) Generator that requires cranks on different RELAYs for starting and stopping it. In this type of DG all crank pulses are given by this device. This device will short RELAY5 for “Crank ON Sec” duration and then open RELAY5 after this duration. If minimum voltages are not building up after “DG Build Seconds” then next crank would be given to it depending on “Crank Trials”. To stop DG, this device will give crank on RELAY6.

In this type of DG select “Crank ON Sec” from 2 to 10 seconds.

Depending on the DG under use select the desired parameter.

This can be set as CONT (continuous) /2 to 10 seconds depending on the type of DG used.

Note: Device will be reset when different value type (CONT from 2 -10 or 2 to 10 from CONT) is selected than active parameter.

### **DG Build Sec**

This parameter set the duration up to which DG is allowed to build up minimum voltage. After giving crank on RELAY5 or shorting RELAY5 depending on type of DG used (refer “Crank ON Sec” above), it will wait for this much duration.

- 1) If “Crank ON Sec” is set as “CONT” then after shorting RELAY5 this device will wait up to “DG Build Sec”. If after this duration DG does not build up any voltage then “GTF” led would glow indicating Generator trial fail Alarm in RUN Mode display. Also RELAY6 would be shorted for external alarm.
- 2) If “Crank ON Sec” is selected from 2 to 10 then RELAY5 will be shorted for “Crank ON Sec” .After completing this duration RELAY5 would be open. This device will then wait up to this “DG Build Sec”. If after this duration DG does not build any voltage then again the crank pulse would be given depending on “Crank Trials” and this device will again wait for this much duration for allowing DG to build some minimum voltage. If after attempting maximum “Crank Trials” DG does not develop some minimum volts then the “GTF” led would glow indicating “Generator Trial Fails” Alarm in Run mode. After this no more cranks would be given to start DG until Alarm is acknowledged.

This parameter can be set from 2 to 60 seconds.

### **Crank Trials**

This parameter is defined only if “Crank ON Sec” is not set as “CONT”. This parameter will set the maximum allowed cranks to start DG on RELAY5.If generator does not start even after this much attempts then the “GTF” led would glow and no more cranks would be given to start DG.


This can be set from 3 to 9 trials.

### **BTRY Low Volt**

This parameter will set the limiting voltage for low battery warning Led (LB) indication.

This parameter can be set from 9 to 30 volt.

### **Setting DG No Load Sec, DG Cool Sec, DG Over Amps and Resetting Run Hr**

In the above Programming Mode, press  key till the unit enters into the following display and then, set such as steps before.

```
> DG No Load Sec : 16
  DG Cool Sec    : 18
  DG Over Amps   : 5000
  Reset Run Hr   : NO
```

#### **DG No Load Sec**

This parameter set the duration up to which DG would run on No load after the mains has come back before switching off DG. This can be set from 2 to 300 second.



#### **DG Cool Sec**

This parameter set the duration up to which DG will not be started after it has been switched off even though mains are not present. Only after completing this duration, DG will be started. After Power up from Battery supply AMF, it does not do any relay action for “DG Cool Sec” time. This parameter can be set from 5 to 60 seconds.

#### **DG Over Amps**

This parameter defines the limiting current allowed by the load to be drawn from DG. When the load in on DG and if it draws more current than this set parameter for continuously up to 10 seconds than load will be lifted from DG and “GOC” (Generator over current) Led would glow and display will show “DG Over Amps” Alarm in RUN MODE. DG will run without load up to “No load Sec” duration and then it would be switched off.

Now, if in this “No load Sec” duration Alarm is acknowledged then the load would be shifted back to DG. If Alarm is not acknowledge then the DG would be stopped and it would not be started until the Alarm is acknowledged.

Hold  /  for increasing/decreasing this parameter continuously.

This parameter can be set from 50 to 5000 ampere.

#### **Reset Run Hr**

AMF has an internal counter which will count DG running time. It is incremented at each second. It can count maximum up to 65,500 running hours of DG. It is displayed in hour: minute format in Run Mode. To clear this counter select “YES” in this parameter and press enter key. The counter will start from zero.

### **Setting Test Mode, DG Mnt. Hr, Brker Pulse and Resetting Mnt. Hr**

In the above Programming Mode, press  key till the unit enters into the following display and then, set such as steps before.

> Test Mode	: 60	
DG Mnt. Hr	: 60	
Reset Mnt.Hr	: NO	
Brker Pulse	: 9	P

### Test Mode

This parameter is used for entering Test Mode. In this mode the device would start DG and run it up to one minute.

If DG does not start then GTF led would glow and Test mode would be finished.

If DG while running becomes unstable then AL1 led would glow indicating dgFault and test mode would be finished. While test mode is in progress then no load switching RELAY action would be done by the device. Finishing Test mode, only after some initial start up time the control action would be resumed.

Enter Test Mode only when load is on EB (Mains).

Test mode is not available in following cases:

1. DG is already running
2. RELAY 5 is ON, before giving TEST command
3. "AL1" or "GTF" led glowing

For more information refer "TEST Mode Description".



This can be set as YES/NO.

### DG Mnt. Hr

This parameter will set the maintenance time of DG for Generator Maintenance Warning indication on GMW LED.

After DG runs for this much time from last reset, "GMW" led will glow indicating that DG requires maintenance.

This parameter can be set from 30 to 1000 Hours.

Hold  /  for increasing/decreasing Mnt. Hour continuously.

### Resetting DG Mnt. Hr

To generate maintenance warning, this device will run internal counter based on DG runs (incremented at each second).

This parameter will clear the "DG Maintenance Hour" counter. Also the "GMW" LED would stop glowing if it was glowing before.

This parameter can be set as YES/NO.

### Brker (Contactor) Pulse

This device supports two type of contactor switching.

#### 1) PULSE type


In pulse type contactor switching this device gives pulse to contactors to start or stop Breaker. This parameter defines the duration of the pulse of contactors connected on RELAY1 (EBON), RELAY2 (EBOFF), RELAY3 (DG ON) and RELAY4 (DG OFF).

#### 2) CONTINUOUS type

In continuous contactor switching this device shorts the RELAYs EBON or EBOFF and DGON or DGOFF to switch it ON/OFF. This type of the contactor switching is **CONT.**

This parameter is programmable from 2 to 20 /CONT. This duration is in Second.  
Note: Device will be reset when different value type (CONT from 2 -20 or 2 to 20 from CONT) is selected than active parameter.

### Setting SCO and CO delay

In the above Programming Mode, press  key till the unit enters into the following display and then, set them as steps before.

```
> SCO delay      : 60
  CO delay       : 60
  Control MODE   : AUTO
  Change Pswrd  : 0000
```

#### SCO delay


This parameter defines the source change over delay.

It is the delay between lifting load from EB (Mains) and switching load to DG and similarly, the delay between lifting load from DG and switching load to EB (Mains).

If the source of load is being changed from EB (Mains) to DG then after lifting load from EB (Mains) only after completing SCO delay time period, the load will be switched to DG.

Similarly if the load is being switched from DG to EB then after lifting load from DG only after completing SCO delay time period, the load will be switched to EB.

This parameter is programmable from 1 to 60 second.

**Note:** If “Breaker Pulse” is selected as CONT then pressing the  while arrow (>) is on “SCO delay” then arrow (>) would go to “Control MODE” and “CO delay” will be skipped.

#### CO delay

This parameter defines the change over delay for contactor switching if “CONT” is selected in “breaker Pulse” parameter.

This parameter defines following:

The delay between switching off **EBON RELAY** and switching on **EBOFF RELAY**. Similarly, delay between switching off **EBOFF RELAY** and switching on **EBON RELAY**.

The delay between switching off **DGON RELAY** and switching on **DGOFF RELAY**. Similarly, delay between switching off **DGOFF RELAY** and switching on **DGON RELAY**.

This parameter is programmable from 1 to 60 second.

Note: If the Breaker mode is selected as “CONT” then only will this parameter be selectable.

### Setting Control Mode

This parameter defines the control mode of AMF.

It has three options:

- 1) MANUAL
- 2) AUTO
- 3) QAUTO



Note that the device gets reset when a different mode is selected then already active mode.

#### Device function in MANUAL Mode

In this mode of operation AMF does not do any control action as well as will not generate new ALARM.

1) It displays following parameters:

- Voltage of EB(Electricity Board/MAINS)
- Voltage of DG(Generator)
- Frequency of EB (MAINS) if present else DG
- DG Run Hour
- DG Maintenance Hour
- Alarm previously not acknowledge

2) Following Warning are available in this mode:

- GMW
- LB

3) Following Warning LEDs will glow, if they were glowing in AUTO mode and not acknowledge before entering MANUAL mode.

- AL1
- GTF
- GOC

4) Following control actions are not available in this mode:

- START/STOP DG.
- Contactor Switching

The above control action is available in AUTO or QAUTO mode only.

5) RELAY 6 will continue previous Alarm (if RELAY 6 is not used to stop DG) if it is not acknowledge in AUTO/QAUTO mode.

6) DG Test Mode is not available in this mode.

#### Device function in AUTO Mode

1) It displays following parameters:

- Voltage of EB(Electricity Board/MAINS)
- Voltage of DG(Generator)
- Frequency of source connected to Load
- DG Run Hour
- DG Maintenance Hour
- Alarm of DG Trial Fail, DG Over Amps or DG Fault!

2) Following Warnings are available in this mode:

- GMW
- LB

3) Following Alarms are available in this mode:

- AL1
- GTF
- GOC

3) Following LED Indication are available in this mode:

- LEB
- LDG
- OV
- UV
- TEST

4) Following control actions by this device are available in this mode:

- START/STOP DG
- Contactor Switching
- Alarm on RELAY6 if DG START/STOP is done by only RELAY5.

5) DG Test Mode is available in this mode.







#### Device function in QAUTO Mode

The device function in this **Quick AUTO** mode is same as in **AUTO** mode with only following difference:

When the load is on Mains (EB) and if voltages are unstable then without lifting load from Mains (EB) the device will start DG. After DG gets stable, the load will be lifted from Mains (EB) and switched to DG.

If there is “dg Fault” or “GTF” or “GOC” then load will be lifted from Mains (EB) if it gets unstable and DG would not be started until Alarm is acknowledge.

### **Changing Password**

Password is changeable from 0000 to 9999. To change the password, press  key to enter the Arrow onto “Change Psword” and then, press  keys that will start blinking with first digit, “0” which shows the password can be changed. Set any digits from 0 to 9 by pressing  key and press  key to shift into next digits and set four digits with the same steps. In case, any set digit is necessary to change again, press  key till the desired digit is blinking and then set as before steps. After setting the four digits, press  again to confirm it.

-----

## Run Mode

In the run mode, various parameters measured/calculated by the meter are displayed on different pages on a 20X4 LCD Display.

When ▲(UP) or ▼(Down) Key is pressed in this Run mode then following pages will be displayed.

### Run Mode display in 3P4W

MAINS	GENERATOR
Vr = 230.0	Vr = 230.0
Vy = 230.0	Vy = 230.0
Vz = 230.0	Vz = 230.0

MAINS: Electricity Board supply voltages  
GENERATOR: DG voltages

This page shows all the phase to neutral voltages for MAINS as well as GENERATOR with the resolution of one digit in there corresponding column. Vr , Vy and Vb denote phase to neutral voltage of R-phase ,Y-phase and B-phase.

---

Ir = 0.00	FREQ=50.00
Iy = 0.00	Batr=24.0
Ib = 0.00	Mode:Manual

The second page shows

- 1) Current drawn by the load of R-phase, Y-phase and B-phase (i.e. Ir, Iy and Ib) in first column.
- 2) FREQ: This parameter shows the frequency of DG or EB (Mains) depending on the control mode.  
If AUTO/QAUTO is set in Control Mode then this parameter shows the frequency of the source from which load is powered on.  
If MANUAL is set in Control Mode then this parameter shows the frequency depending on the following cases:
  - If only EB (Mains) volts are present then frequency of EB (Mains) is displayed.
  - If only DG volts are present then frequency of DG is displayed.
  - If both EB (Mains) and DG are present then frequency of EB (Mains) is displayed.

- 3) Batr: This parameter displays supplied battery volts.
- 4) Mode: This parameter displays Control Mode of the device.  
AUTO/QAUTO/MANUAL.
- 
- 

```
DG RunHour: 00000:00
Mnt Hour   : 00000:00
Alarm: No Fault
```

This page displays DG Run hour in hour: minute format in first line, DG Maintenance Hour in hour: minute format in second line and various DG Alarm in third line.

---

## **DG Alarms**

This device generates various Alarms depending on the state of DG. It is indicated by led's and message in RUN mode display.

### **Cause of various DG Alarms**

---

#### **DG Fault!**

```
DG RunHour: 00000:00
Mnt Hour   : 00000:00
Alarm: DG Fault!
```

If any phase of DG is below "DG Under Volt" or above "DG Over Volt" for "DG Stable Sec" duration then "DG Fault" will be displayed.  
In this case "AL1" led would glow.

---

#### **DG Trial Fail**

```
DG RunHour: 00000:00
Mnt. Hour   : 00000:00
Alarm: DG Trial Fail
```

This warning is displayed in the following cases:

- 1) In case of “Crank ON Sec=CONT”, after giving Generator Start command by RELAY 5, if minimum voltage is not build up within “DG Build Sec” then GTF (Generator Trial Fail) Led would glow and display shows DG Trial Fail.
- 2) If “Crank ON Sec=CONT” is not selected, then after attempting maximum Crank Trials, if minimum voltage is not build up then GTF (Generator Trial Fail) Led would glow and display shows DG Trial Fail.

In this case “GTF” Led will glow.

---

## DG Over Amps

```
DG RunHour: 00000:00
Mnt. Hour   : 00000:00
Alarm: DG Over Amps
```

When load is on DG and if it draws more current than the “DG Over Amps” parameter continuously for more than 10 seconds then GOC (Generator Over Current) led would glow and display would show DG Over Amps. In this case “GOC” Led will glow.

---

## Acknowledging various DG Alarms

Following Alarms need acknowledgement for DG control action.

- DG Fault!
  - DG Over Amps
  - DG Trial Fail
- Generator will not be started until the Alarm is acknowledged.
  - Test mode is not entered if “DG Trial Fail” or “DG Fault!” is present.
  - Test mode is entered even if “DG Over Amps” Alarm is present.

To acknowledge this fault keep press  Key for two seconds until display shows No Fault as shown below.

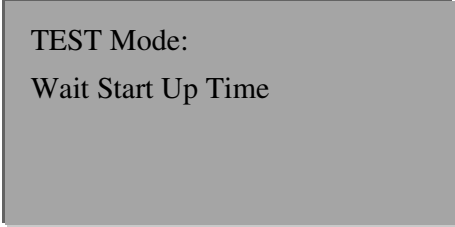
```
DG RunHour: 00000:00
Mnt. Hour   : 00000:00
Alarm: No Fault
```

**Now, Alarm is acknowledged**

## TEST Mode Description

### Test Mode display

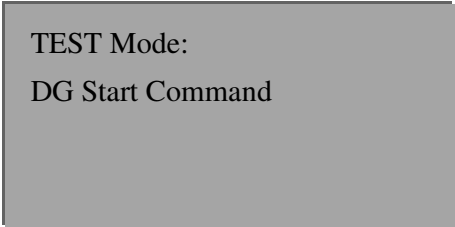
---



TEST Mode:  
Wait Start Up Time

Just after power up, if “Test Mode” is selected than the above screen is displayed. Start up time is equal to sum of “Cool Down Time” and either “Mains stable” or “DG stable” time whichever is higher.

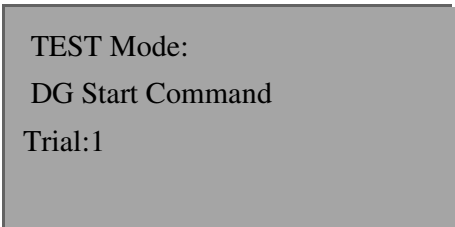
---



TEST Mode:  
DG Start Command

When start command is given to DG and when Crank ON Sec= CONT is selected then the above screen is displayed.

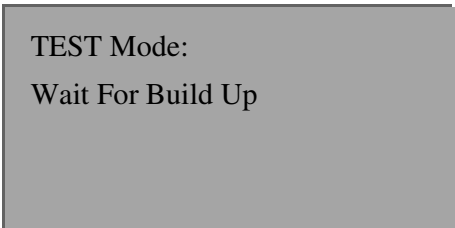
---



TEST Mode:  
DG Start Command  
Trial:1

When start command is given to DG and when Crank ON Sec = 2 to 10 is selected then the above screen is displayed. Trial indicates the attempt to start DG.

---



TEST Mode:  
Wait For Build Up

When start command is given to DG then it will display the above screen. This indicates the waiting period equal to “DG Build Sec” for allowing DG to build up some Voltage.

---

TEST Mode:  
Wait For Stable Time

When DG builds up some minimum voltage than the above screen appears. This indicates that it is checking for stable DG volts. Stable DG volts means all the three phase voltages are above “DG Under Volt” and less than “DG Over Volt” for up to “DG Stable Sec”.

---

TEST Mode:  
DG ON:  
Running For 1 Minute

If DG voltages are stable than the above screen appears. It indicates that DG is ON and is going to Run up to 1 minute. In TEST Mode, load will not be shifted to DG.

---

TEST Mode:  
DG Stop Command  
  
TEST Mode Finished

After running DG for 1 minute the above screen appears. It indicates that DG stop command is given and test mode is finished.

---

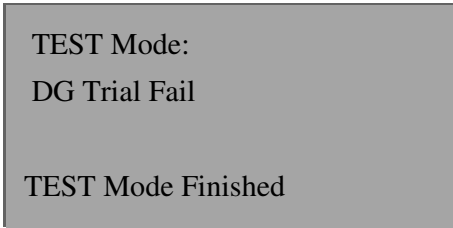
TEST Mode:  
  
  
TEST Mode Finished

The above screen appears when stop command is executed and test mode is about to exit.

---

## Test Mode Faults

---



TEST Mode:  
DG Trial Fail

TEST Mode Finished

If Crank ON Sec is set as CONT.

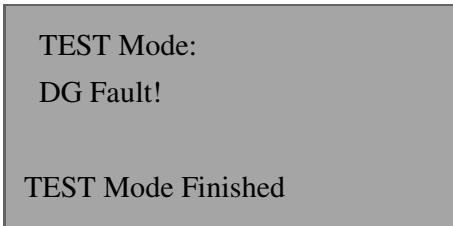
Then after giving DG Start Command and waiting up to build up time if DG does not build up any voltage than the above screen appears. It indicates that the Generator Trial fails. Also GTF led would start glowing.

If Crank ON Sec is set from 2 to 10

After attempting maximum Trials to start DG if it does not build up any voltage than the above screen appears. It indicates that the Generator Trial fails. Also GTF led would start glowing.

To run Test Mode again, Alarm has to be acknowledged.

---

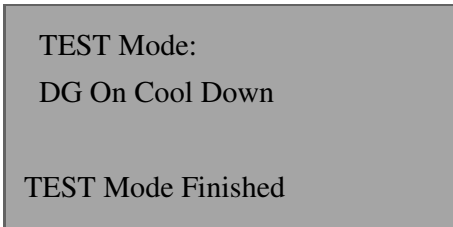


TEST Mode:  
DG Fault!

TEST Mode Finished

When DG is running and in that duration if one or more phase of DG rise above “DG Over Volt” and/or one or more phase of DG falls below “DG Under Volt” for up to “DG Stable Sec” then the above page appears

---



TEST Mode:  
DG On Cool Down

TEST Mode Finished

Above screen will appear when DG Cool Down Time is not finished and if Test mode is entered. So DG cannot be started. After this screen it would return to RUN Mode.

---



TEST Mode:  
DG Already Running  
  
TEST Mode Finished

When DG is already running and if Test Mode is entered than the above screen is displayed. It indicates that DG is already running and Test Mode is finished. After this it would return to RUN MODE.

---

TEST Mode:  
DG Fault Present  
  
TEST Mode Finished

When “Generator Trial Fail” or “DG Fault!” is present and if Test mode is entered than the above screen appears. It indicates that DG fault is present and Test Mode is finished. After this it would return to RUN Mode.  
To run Test Mode again Alarm has to be acknowledged.

---

TEST Mode:  
No DG Test Available  
In MANUAL Mode  
TEST Mode Finished

When Test Mode is entered in the “MANUAL” control mode than the above screen appears. It indicates that Test mode is not available in “MANUAL” mode and it would return to Run mode.

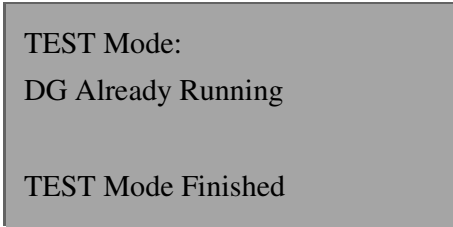
---

TEST Mode:  
DG Already Getting  
Started  
TEST Mode Finished

When DG is already getting started automatically by the AMF in AUTO/QAUTO

Mode and if Test Mode is entered than the above screen appears showing that DG is already getting started and Test Mode is Finished.

-----

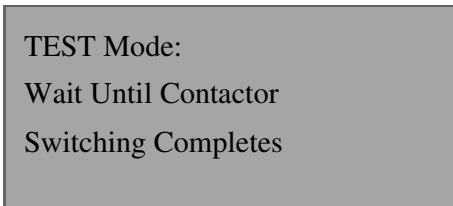


TEST Mode:  
DG Already Running

TEST Mode Finished

When DG is already running by the AMF in AUTO/QAUTO Mode and if Test Mode is entered than the above screen appears showing that DG is already running and Test Mode is Finished.

-----



TEST Mode:  
Wait Until Contactor  
Switching Completes

When entering Test Mode while the contactor switching is going on then the above screen is displayed. After contactor switching gets completed then the next message is displayed.

-----

## LED Indications

- 1) LEB: Load on EB (Mains)
  - 2) LDG: Load on DG
  - 3) UV: Under Volt
  - 4) OV: Over Volt
  - 5) GTF: Generator Trial Fail
  - 6) GOC: Generator Over Current
  - 7) GMW: Generator Maintenance Warning
  - 8) LB: Low Battery
  - 9) TEST: Test Mode
  - 10) AL1: DG Fault
  - 11) AL2: - (Future Use)
  - 12) AL3: - (Future Use)
- 

**LEB:** Load on EB (Mains).

In AUTO/QAUTO Mode, when the load is on EB (Mains) then LEB led would glow.

-----  
**LDG:** Load on DG.

In AUTO/QAUTO Mode, when the load is on DG then LDG led would glow.

-----

**UV:** Under Volt

When load is on EB (Mains) or DG in AUTO/QAUTO mode and if voltage of any one or more phase is/are below there Under Volt limit then UV led would glow.

When load is on EB(Mains), there is no DG Alarm (dgFault or GTF or GOC) and if voltage of one or more phase is/are above “Mains U-Volt” limit up to “Mains Stb Sec” then load will be removed from EB(if Control Mode is QAUTO then load will not be removed from EB) and DG will be started. Still OV led will be ON indicating the reason why DG is getting started. This led will be clear when load gets stable supply.

When load is on EB (Mains), there is some DG Alarm (dgFault or GTF or GOC) and if voltage of one or more phase is/are below “Mains U-Volt” limit then load will be removed from EB (Mains) and DG would not be started. Still UV led will be ON indicating the reason why load is removed from EB (Mains). This led will be clear when load gets stable supply.

When load is on DG and if voltage of one or more phase is/are below “DG Under volt” limit up to “DG Stable Sec” then load will be removed from DG. Still UV led will be ON indicating the reason why load is removed from DG. This led will be clear when load gets stable supply.

-----

**OV:** Over Volt

When load is on EB (Mains) or DG in AUTO/QAUTO mode and if voltage of any one or more phase is/are above there Over Volt limit then OV led would glow.

When load is on EB (Mains), there is no DG Alarm (dgFault or GTF or GOC) and if voltage of one or more phase is/are above “Mains U-Volt” limit up to “Mains Stb Sec” then load will be removed from EB (Mains) and DG will be started. Still OV led will be ON indicating the reason why DG is getting started. This will be clear when load gets stable supply.

When load is on EB (Mains), there is some DG Alarm (dgFault or GTF or GOC) and if voltage of one or more phase is/are above “Mains O-Volt” limit up to “Mains Stb Sec” then load will be removed from EB (if Control Mode is QAUTO then load will not be removed from EB) and DG would not be started. Still OV led will be ON indicating the reason why load is removed from EB (Mains). This will be clear when load gets stable supply.

When load is on DG and if voltage of one or more phase is/are above “DG Over Volt” limit up to “DG Stable Sec” then load will be removed from DG. Now, LDG led will stop glowing but still OV led will glow indicating the reason why load is removed from DG. This will be clear when load gets stable supply.

-----

**GTF:** Generator Trial Fail

This led indicates that the generator failed to start.

- 1) When the crank on Sec is selected as “CONT” then this device would short RELAY5 and wait until DG Build Sec(programmable parameter).After this period if DG does not build up any voltage than GTF led would glow indicating that generator failed to start.
- 2) When crank on Sec is selected from 2 to 10 than after giving maximum crank Trials if generator does not build up any voltage than GTF led would glow indicating that generator failed to start.

Generator would not be again attempted to start until Alarm is acknowledge.

---

**GMW:** Generator Maintenance Warning

This led will glow when DG maintenance time is reached up to programmed value (30 to 1000 Hours).It can be cleared by resetting DG Mnt. Hour.

---

**LB** : Low Battery

Indicate that voltage of device battery is less than the programmed value.

---

**TEST:** Indicate that device is in Test Mode for testing DG.

---

**AL1:** Indicate that one or more phase voltage of DG has remained less than DG Under Volt limit and/or greater than DG Over Volt limit up to DG Stable Sec.

AL2: - Reserved For Feature Use Only.

AL3: - Reserved For Feature Use Only.

---

Note: LEB, LDG, UV and OV LED's are active in “AUTO” or ”QAUTO” control mode only.

## **Alarm Action**

AMF provides external Alarm on RELAY6 if “Crank On Sec” = CONT is selected in which DG START/STOP only with RELAY5.

It shorts RELAY6 NO contact and provides alarm during following cases:

- 1) DG Fault!
- 2) DG Over Current
- 3) DG Trial Fail

To stop Alarm acknowledge it in RUN Mode.

## **AMF Control Action**

AMF takes various relay action depending on various conditions as described below:

**1) During power up:**

**AMF** will first give pulse to EBOFF and DGOFF RELAYs if the breaker pulse is selected from 2-20.

**AMF** will short EBOFF and DGOFF RELAYs if the breaker pulse is selected as CONT.

After this, AMF will not do control action for DG Cool Down Time + either Mains Stable Time or DG Stable Time whichever is greater.

1) If EB voltages are present and if all three phases voltages were greater than Mains/EB Under Volt limit and less than Mains/EB Over Volt limit for up to Mains/EB Stable Sec than load would be switched to Mains/EB.

2) If one or more phase of EB voltage is/are greater than EB Over Volt limit and/or less than EB Under Volt limit for up to EB Stable Sec than load would not be switched to EB.

a) Now, if some DG Alarm is already present (refer to “Causes of various DG Alarms” page) DG would not be started until Alarm is acknowledge. If EB (Mains) voltages are stable then load would be switched to EB (Mains).

b) If no DG Alarm is present then Generator start action would be done and load would be switched to DG.

## 2) During load on EB (Mains):

When load is on EB (Mains) and if one or more phase of EB (Mains) voltage is/are greater than “Mains O-Volt” limit and/or less than “Mains U-Volt” for up to “Mains Stb Sec” than load would be lifted away from EB (Mains).

If DG is already running on No Load then load would be switched to DG.

If DG is OFF and previous cool down period is completed then Generator start action would be done. If control mode is selected as QAUTO then load would not be lifted from EB (Mains) and Generator start action would be done. After DG gets stable load will be switched from EB (Mains) to DG.

If there is any DG Alarm (dg Fault or GTF or GOC) then load will be lifted from EB (Mains) and DG would not be started.

## 3) During load on DG:

If DG is unstable

When load is on DG and if one or more phase of DG voltage is/are greater than “DG Over Volt” limit and/or less than “DG Under Volt” limit for up to “DG Stable Sec” than load would be lifted away from DG and “DG Fault!” is set. Also “AL1” led would glow.

If DG is stable and EB (Mains) is stable

When the load is running on DG and if EB (Mains) comes back and is stable then load would be lifted from DG and it would be switched to EB (Mains). DG would run on No Load and afterwards it would be switched off.

## 4) During DG running on No Load and No fault present:

If EB (Mains) becomes unstable then load would be lifted away from EB (Mains) and it will be switched to DG.

## 5) During DG on Cool Down:

If EB (Mains) becomes unstable then load would be lifted away from EB (if

Control Mode is AUTO) and Generator start action will start only after completion of DG Cool Down duration.

**Unstable:** If one or more phases voltage is/are greater than DG/EB Under Volt and/or less than DG/EB Under Volt for up to DG/EB Stable Sec than it is considered as unstable.

**Stable:** If all three phase voltages are less than DG/EB Over Volt and greater than DG/EB Under Volt for up to DG/EB Stable Sec than it is considered as stable.

P.O No. : .....

Customer : .....

Sr. No. : .....

Routine and function tests conducted to relevant standards and our Specifications/Literature/O & M Manual.

Traceability: tested against "MTE" Standard Model PRS400.3 having basic accuracy of 0.02% traceable upto International Standards derived using appropriate ratio techniques.

Result of Test : .....

Remarks : .....

Test engineer : .....

Date : .....

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