OPERATION MANUAL

GPS SYNC CURRENT INTERRUPT TIMER

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GPS SYNC CURRENT INTERRUPT TIMER

INTRODUCTION

This sophisticated device can be applied all over the world for coordinating simultaneous on-, off-switching of cathodic protection stations. It's unique accuracy is guaranteed by the continuous reception of satellite broadcast signals.

The unit is an On/Off timer with Real Time clock, which is synchronized by GPS clock. Functions of timer are controlled by a real time clock. i.e. user can automatically start and stop timer on any day, at any time.

It is a specially designed Timer for carrying out ON/OFF CP surveys using the current interruption technique. This Timer switches the Contactor in the C.P unit ON & OFF to switch the output current from the unit ON & OFF.

The Timer has built-in real time clock with advanced Microcontroller based circuitry to provide a wide variety of programming. It has a single line OLED display & an 8 key keypad for ease of programming and for displaying the information about various modes & time periods.

The Real Time clock in the timer can be synchronized to GPS clock. This feature enables current interruption surveys using multiple timers with complete synchronisation of start/stop and ON/OFF timing cycles.

The timer has facility for programming of the ON & OFF cycle time of DC current interruption from 1 sec to 9999 sec. The start & stop of the timing cycle is also programmable and is controlled by the built-in real time clock in the Timer. i.e. user can automatically start and stop timer on any day, at any time.

The timer always works in 'Daytime operation' mode with 'Automatic Night Sleep' feature. The Time set in the Timer is for daily operation and it repeats the program cycle every day till the 'off' date.

For example if 'on' time is 09.00 on day 11.03.09 and off time is 18.00 on day 23.11.09, then timer will run from 09.00 Hrs. to 18.00 hours every day from 11/03/09 to 23/11/09. During the sleep hrs i.e. from 18.00 to 09.00, the timer will remain OFF and the Rectifier will feed un-interrupted current to the pipeline.

Salient Features

- A bright white dual line OLED display with Control Backlight
- Eight keys for setting parmeters.
- Lithium battery backed Real time clock.
- Permanent NVRAM storage for programme.
- Facility to synchronise timer with GPS clock.
- External Start / Stop & Reset facility
- One Relay output rated 230 V / 5A
- High timing accuracy of ± 2PPM.
- Power Failure Compensation
- Greenwich Time (GMT) Correction all over the world

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1.0 WHAT IS GPS

The global positioning system is a satellite-based navigation system consisting of a network of 24 orbiting satellites that are eleven thousand nautical miles in space and in six different orbital paths.

The satellites are constantly moving, making two complete orbits around the Earth in just under 24 hours. One can receive satellite signals anywhere in the world, at any time. The biggest benefit over previous land-based navigation systems is GPS works in all weather conditions.

The GPS signal contains a 'pseudo-random code', ephemeris (pronounced: ee-fem-er-is) and almanac data. The pseudo-random code identifies which satellite is transmitting—in other words, an I.D. Code.

Ephemeris data is constantly transmitted by each satellite and contains important information such as status of the satellite (healthy or unhealthy), current date, and time.

This Satellite Clock information is as accurate as Atomic Clock and this is used as Time Source for our Timers achieving the most accurate synchronisation possible.

The convential Electronic clock has limited time accuracy. Most commonly used Industrial Real time clock claim accuracy of ±15 seconds per month i. e. ½ second per day. Thus if on/off switching is for 1 second each, two such timers can remain synchronised for not more then 48 hours !

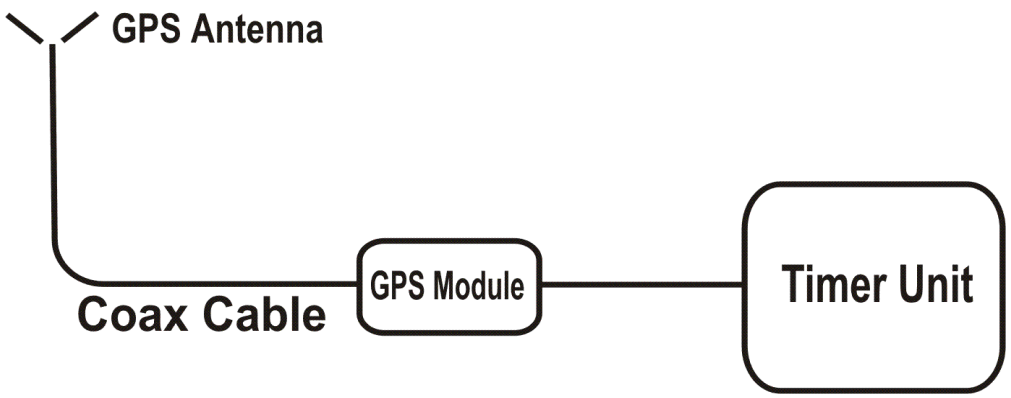
Further the clock accuracy depends on various factors like external temperature, aging of components etc. GPS uses the accuracy of Satellite clock which is a stable atomic clock. Atomic clocks are the most stable clocks in the world and do not suffer from external factors like temperature and ageing or environment. Thus the systems located miles apart can retain synchronisation over lifetime of the equipments!!!

System Configuration

The system consists of

1. GPS Antenna.
2. Coaxial cable with MCX connectors.
3. GPS Interface Module.
4. Timer with User Interface.

The block diagram is shown below



Timer unit communicates with GPS module retrieving the time information for synchronisation purpose. The time clock inside the timer is always maintained at same time as the Satellite clock. Another timer which is located at distance from this timer will also derive the time information from the satellite and thus both timers will always remain in synchronisation with each other with a time difference less than a few milliseconds.

2.0 KEYBOARD & DISPLAY

Timer has following keys -

[START]	To start timer manually.
[STOP]	To stop timer manually.
[UP]	To increment digits in programming & for menu item scroll upwards. Also UP key used to RESET in manual timer mode.
[DOWN]	To decrement digits in programming & for menu item scroll downwards.
[SET]	To Select SET mode.
[PROG]	To program timer parameters such as on/off timings, start/stop date, on/off interval, etc.
[TIME]	To set Time and Date of Real Time Clock.
[ENT]	For selection/save set parameter.

Timer has following 8 LEDs -

SET	When ON, Indicates Timer is in SET mode.
GPS	Timer is in GPS mode of operation
SYNC	If GPS mode is selected, timer is synchronized with Satellite clock.
RTC	Timer is in Internal RTC (Real Time Clock) mode.
PON	When ON, indicates Power ON for Timer
OFF	Indicates present cycle is 'off' time.
ON	Indicates present cycle is 'on' time.
AUTO	When ON, Indicates timer has been set for automatic operation.

Timer has a LCD display:

It shows the clock time and the date. Alternately, if the timer is in programmable mode it displays the timing in current cycle or it shows the menu options while programming.
The timer has LCD with control Backlight, if there is no key operation for 30 seconds then the backlight automatically goes off. The LCD backlight will light for next key operation.

3.1 Operation Brief

Timer has two modes of operation as far as clock timings are concerned. One is RTC mode and other is GPS mode. In RTC mode, timer will use internal clock of timer for real time operation. In GPS mode, satellite clock is used. If unit is unable to track satellite i.e. not in SYNC, then internal clock is used. In GPS mode, when timer is able to synchronise with satellite, internal clock is also updated accordingly.

3.2 On / Off timer operation in Auto mode

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Unit has on / off timer with on and off timings settable in seconds. It is possible to programme time and date when operation should start and also time and date when operation should stop. When set time is reached, on/off cycle will start automatically. In RTC mode, internal clock will decide the operation while in GPS mode; if unit is in SYNC, satellite clock will be used other-wise internal clock will be used.

4.0 KEYBOARD OPERATIONS

4.1 To Set Time and Date

[SET]	Set Mode: Choose Prog Time	SET LED On
[TIME]	Time 09:00 Date 19/11/2009	Display shows Current Date & Time on the LCD
[ENT]		Hours digits will flash
[UP/DOWN]		Change Hours as required
[ENT]		Saved set Hours & Minutes digit will flash
[UP/DOWN]		Change Minutes as required
[ENT]	Time 09:00 Date 19/11/2009	Saved set Time & Date digit will flash
[UP/DOWN]		Change Date as required
[ENT]		Saved set Date & Months digit will flash
[UP/DOWN]		Change Months as required
[ENT]		Saved set Months & Years digit will flash
[UP/DOWN]		Change Years as required
[ENT]	Time 09:00 Date 19/11/2009	Saved set Years and Display shows newly set Date & Time
[TIME]	LAT 19.056 N LOG 72.878 E	Display shows Latitude details on the upper line and Longitude details on the lower line
[TIME]		Exit to Main Screen

In GPS mode of operation, the timer will allow to set date and time.

4.2 To Set Programme

[SET]	Set Mode: Choose Prog Time	SET LED On
[PROG]	On Time 00.00 Off Time 18:00	Display relay ON & OFF Time

To Change ON & OFF Time press **[ENT]**,
else press **PROG** keys to go to next menu item.

To change ON & OFF time,

[ENT]		Hours digits of ON time will flash
[UP/DOWN]		Change Hours of ON time as required
[ENT]		Save set Hours & Minutes digits of ON time will flash
[UP/DOWN]		Change Minutes of ON time as required
[ENT]	On Time 00.00 Off Time 18:00	Save set Minutes of ON time and Hours digits of OFF time will flash
[UP/DOWN]		Change Hours of OFF time as required

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[ENT]			Save set Hours &
			Minutes digits of OFF time will flash
[UP/DOWN]			Change Minutes of OFF time as required
[ENT]	On Time	00.00	Save set Minutes of OFF time
	Off Time	18:00	& display shows new ON & OFF Time
[PROG]			To go for Next Menu

To go to next item

[PROG]	On Int	010.0	Display shows relay on &
	Off Int	010.0	off time intervals in seconds

To Change Relay ON and OFF Time interval press **[ENT]**,
else press **PROG** keys to go to next menu item.

To change Relay ON & OFF time Interval,

[ENT]			Milliseconds digit of ON time interval will flash
[UP/DOWN]			Change milliseconds of ON time Interval
[ENT]			Save set milliseconds &
			Seconds digits of ON time interval will flash
[UP/DOWN]			Change Seconds of ON time interval as required
[ENT]	On Int	010.0	Save set Seconds of ON time interval and
	Off Int	010:0	
[UP]			To go for OFF time interval
[ENT]			Milliseconds digit of OFF time interval will flash
[UP/DOWN]			Change milliseconds of OFF time interval
[ENT]			Save set milliseconds &
			Seconds digits of OFF time interval will flash
[UP/DOWN]			Change Seconds of OFF time interval as required
[ENT]	On Time	020.0	Save set Seconds of OFF time interval
	Off Time	010:0	& display shows new relay ON & OFF time interval
[PROG]			To go for Next Menu

To go to next item

[PROG]	On Dt	05/10/09	Display shows ON & OFF date of relay cycle
	Off Dt	30/11/09	

To Change Relay ON and OFF Date press **[ENT]**, else press **PROG** keys to go to next menu item.

To change Relay ON & OFF Date,

[ENT]			Date digit for relay ON will flash
[UP/DOWN]			Change date for relay ON
[ENT]			Save set date &
			Month digits for relay ON will flash
[UP/DOWN]			Change month for relay ON as required
[ENT]			Save set month &
			Year digits for relay ON will flash
[UP/DOWN]			Change year for relay ON as required
[ENT]	On Dt	05/10/09	Save set Year for relay ON and
	Off Dt	30/11/09	Date digit for relay OFF will flash
[[UP/DOWN]			Change date for relay OFF
[ENT]			Save set date &

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		Month digits for relay OFF will flash
[UP/DOWN]		Change month for relay OFF as required
[ENT]		Save set month &
		Year digits for relay OFF will flash
[UP/DOWN]		Change year for relay OFF as required
[ENT]	On Dt 05/10/09	Save set Year for relay OFF
	Off Dt 30/11/09	& display shows relay ON & OFF date
[PROG]		To go for Next Menu

To go to next item

[PROG]	Timer Mode	Display shows timer mode status
	Auto <YES> NO	Auto/Manual Timer

To Change Timer operational mode press **[ENT]**,
else press **PROG** keys to go to next menu item.

To change Timer Mode Status,

[ENT]		YES/NO option will flash
[UP/DOWN]		Change status of timer operational mode
		Set “YES” to enable Auto timer mode or
		“NO” to enable Manual timer mode
[ENT]	Timer Mode	Save set status
	Auto <YES> NO	& display shows new timer mode status
[PROG]		To go for Next Menu

To go to next item

[PROG]	GPS Mode	Display shows GPS mode status
	<ON> OFF	GPS Mode or RTC Mode

To Change Timer operational mode press **[ENT]**,
else press **PROG** keys to go to next menu item.

To change GPS Mode Status,

[ENT]		ON/OFF option will flash
[UP/DOWN]		Change status of GPS mode
		Set “ON” to enable GPS mode or
		“OFF” to enable RTC mode
[ENT]	GPS Mode	Save set status
	<ON> OFF	& display shows new GPS mode status
[PROG]		To go for Next Menu

In GPS mode after synchronisation to GPS, sync LED will glow.
For further details on GPS refer to section 5.1

To Synchronize other Timer (in RTC Mode)

This option will be enabled only in RTC mode,

[UP]	Go Sync	Display shows option to synchronize other timer
	Yes <No>	with this timer
[UP/DOWN]		Set “Yes” to Synchronized with other timer
		After synchronizing timer return to “No”
[ENT]		To end RTC sync
[PROG]		To go for Next Menu
[ENT]	Set Time Zone	Display shows Set GMT Time Zone
	Time + 05:30	
[ENT]	Set Time Zone	+/- setting will flash

	Time + 05:30	
[UP/DOWN]		Change desired setting of GMt
[ENT]		Saved +/- setting & first digit of GMT flash
[UP/DOWN]		Change desired first digit of GMT
[ENT]		Saved first digit & second digit of GMT flash
[UP/DOWN]		Change desired second digit of GMT
[ENT]	Set Time Zone	Saved second digit &
	Time + 05:30	display shows new timing zone
[PROG]		To go for Next Menu

User can repeat above steps to change any of the parameters.

To end programming,

[PROG]	Time	09:00	Programming is over and
	Date	19/11/2009	Display return to main screen

4.3 To view GPS details

[TIME]	Time	14:47:30	Display shows RTC time on upper line
	Time	14:47:30	and GPS time on the lower line
[PROG]			Press PROG twice to exit from this mode & display return to main screen

4.4 Manual Timer Operation

To operate timer manually, press

[START]	To Start timer
[STOP]	To Stop timer
[UP]	To Reset timer

This timer will provide manual timer operation in all following modes -

1) GPS with Auto Timer
2) GPS with Manual Timer
3) RTC with Auto Timer
4) RTC with Manual Timer

4.5 Auto Timer Operation

In Auto Mode, it is possible to programme the time and date when operation should start and also the time and date when operation should stop. When the set 'Start' time is reached, on/off cycle will start automatically. When the set 'Stop' time is reached, on/off cycle will stop automatically.

To set the timer in Auto mode, make 'enable' ON through the programming. The 'Auto' mode indicator LED will come ON. Set the ON Time, OFF time, Start Time/Date, Stop Time/Date as required. The Timer will now automatically start the Interruption cycle at the set 'start time/date'
and will end the cycle at the set 'stop time/date'. At the end of the cycle, the 'Auto' LED will go OFF.

4.6 Power Fail Compensation

During timer operation, it is likely that power fails for some interval. When power is back, the timer will automatically calculate the time lost and will start operation from the instant of power restoration such that it remains in synchronisation with other timers.

5.0 EXTERNAL SYNCHRONISATION OF THE TIMER CLOCK

5.1 SYNCRONISATION TO MASTER TIMER CLOCK

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In the field, when there are multiple such timers and their operation has to be synchronised, it becomes important to set their time accurately. Any one of the timer can be used to synchronize the clock time of others. This mode is useful when GPS synchronization is not available.

For external synchronisation, the timers are provided with a 9-pin D type connector at the back. Timers to be synchronised can be interconnected with a back-to-back cable. Maximum 16 such slave timers can be connected to one master at a time.

For synchronising with other timer,

1. Connect back-to-back 9 pin D cable between two units.

2. Keep both the unit in RTC mode by making **GPS Mode OFF**. In **SET** Mode, press **PROG** key. Go to GPS mode and press **ENT**. **GPS mode OFF** will be set.

3. In **SET** Mode, press **PROG** key. As explained in section 4.2, go to Sync option and press **ENT**. The other timer will now be synchronised with this timer.
   Note that GPS mode should be off. (GPS LED off and RTC LED on.)

5.2 SYNCRONISATION TO GPS

In GPS mode internal clock of timer synchronises with satellite clock. GPS antenna with cable is provided for this purpose.

For synchronising with GPS

1. Connect the GPS Antenna provided with the unit to socket provided at the back.
2. Keep antenna facing sky to pick-up GPS signal.
3. Enable GPS mode in timer as per steps in 4.2.
4. Wait for sync LED to glow it will take 20-30 minutes to synchronies. First time synchronisation may take longer, up to 60 minutes.

Time Zone setting:

1. Switch off the Power Supply to the GPS Timer.
2. Press the ENT key (and keep it pressed).
3. Now switch on the Power Supply (while the ENT key is pressed.
4. You will see the following sequence:
   a. Starting
   b. Done
   c. Time Zone
      Time + 05:30
5. Press ENT key (the + sign will start blinking)
6. Press ENT again
7. 05 will start blinking
8. Set the hours using Up and Down arrow keys
9. Press ENT
10. 30 will start blinking
11. Set the minutes using Up and Down arrow keys
12. Once your Time Zone is Set, press the SET key.
13. You will return to the Main Menu

6.0 IMPORTANT INSTRUCTIONS

- The timer always works in 'Daytime operation' mode with 'Automatic Night Sleep' feature. The Time set in the Timer is for daily operation and it repeats the program cycle every day till the 'off' date.
  For example if **'ON'** time is 10.00 on day 12.04.01 and off time is 16.00 on day 14.04.01, then timer will run from 10.00 Hrs. to 16.00 hours every day from 12/4/01 to 14/4/01. During the sleep hrs i.e. from 16.00 to 10.00, the timer will remain OFF and the Unit will feed un-interrupted current to the pipeline.

- If **AUTO LED** is off, programme is disabled and timer will not start automatically.

- During **'ON'** time, the internal relay inside the Timer is in de-energised state.
- If power fails after timer has started operation automatically, timer will calculate time lost and adjust on / off time cycle automatically and continue operation in sync with original cycle/other timers on resumption of the power.
- If power fails before the start of Timer operation in Auto Mode and returns after start time has elapsed, but before stop time is over, then timer will be automatically disabled.
- While programming, if no key is pressed within 30 seconds, programming operation will be abandoned.
- Stop key is effective only if timer has been started manually. It has no effect in automatic operation.
- If Real Time Clock of timer is not getting updated, check Lithium CMOS Battery inside the instrument.

7.0 CONNECTOR & SYNC DETAILS

7.1

9 Pin D type Sync Input Connector Details (Female):

Pin 2 : Sync +ve
Pin 3 : Sync -ve
Pin 5 : Ground

7.2 PROTOCOL FOR SYNCHRONISATION:

9 Pin D type Connector

2 : "**A**" pin of RS-485 comm^{n} (Non-Inverting Receiver I/P & Non-Inverting Driver O/P)
3 : "**B**" pin of RS-485 comm^{n} (Inverting Receiver I/P & Inverting Driver O/P)
5 : GND
Settings : Baud Rate - 1200 bps, Parity – None, Data Bits - 8, Stop Bit – 1, Flow Control – None.

Sync Command details:

<02h><00h><01h><08h><seconds in BCD><minute in BCD><hours in BCD>
<day of week in BCD><date in BCD><month in BCD><year LSB in BCD>
<year MSB in BCD><03h>

e.g. date is 16th Nov 2009, day Monday and time is 08.30.10, data stream will be as:

<02h><00h><01h><08h><10h><30h><08h><01h><16h><11h><09h><20h><03h>

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TECHNICAL SPECIFICATIONS

Model	:	AC-82G
Type	:	Microcontroller based GPS SYNC CURRENT INTERRUPT TIMER
Display	:	16 X 2 OLED Yellow text with Black background
Indications	:	Eight LEDs for status indication
RTC Update	:	Battery Backup RTC by 3V Lithium CMOS Battery (CR2032)
Output	:	One control relay change-over contacts
Contact rating	:	10 Ampere @ 230 V AC (Res. Loads).
Memory	:	Non-Volatile (on EEPROM).
Settings	:	By means of Tact Switches on front panel.
Accuracy	:	± 2 ppm timing accuracy
Power Supply	:	230VAC,50Hz. 24 VDC (Optional)
Dimensions	:	96 x 96 x 120 mm.
Weight	:	Approximately 600 grams

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