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Advanced Real Time Clock Using IRIG-B from GPS

Siva Subramanian.S[1], Roshini.G[2], Vinothini.M[2]

Faculty, Department of Electronics and Instrumentation Engineering, Adhiyamaan College of Engineering, Hosur, Tamil Nadu, India[1]

UG Student, Department of Electronics and Instrumentation Engineering, Adhiyamaan College of Engineering, Hosur, Tamil Nadu, India[2]

ABSTRACT:IRIG time codes are a set of standard specifications originally developed by the Inter-Range Instrumentation Group to transmit very precise time via a pulse rate.The IRIG system used for the time track and both are stored with the test data on Recorders namely ITRs at missile test ranges. The IRIG-B code with a 100 bits per second signalling rate and a 1 kHz carrier sine wave, on voice grade channels it was ideal for recording. Due to limitation of bandwidth of these voice-grade channels (delay with time and phase shifts with time), the IRIG-B code was reliable to provide one millisecond resolution and accuracy which is equal to one period of the (1 kHz) carrier signal. In this Project our aim is to synchronize the system which can be configured with a GPS receiver to receive accurate time from GPS satellite signals and generate the IRIG-B signal as required by the equipment.

KEYWORDS: Power supply, CPU Board, LED Display, MAX 232, System Interface.

I. INTRODUCTION

The time synchronization is the best value seen by the power grid is a single, complex and interconnected system. What happens in one part of the grid affects operation. observing, and haply controlling, these interactions requires a means to compare what is happening at one place and time with that happening at other places and times. Precise time and high-speed communications in the sub shelter (station) are the enabling technologies which make this practical. Manual synchronization which is being used now-a-days have some delay, which may cause some problems. To eradicate this, synchronization is done by using IRIG-B signals from GPS.

II. BLOCK DIAGRAM

The modulated signal from the GPS receiver is being connected to the IRIG-B board by means of coaxial cable to the bnc connector. The modulated and unmodulated signals are selected by using jumper as required. When the unmodulated signal is received, it is then transmitted to the opto-coupler. The signal from the opto-coupler is given to the interrupt pin of Hitachi controller. The signal is being

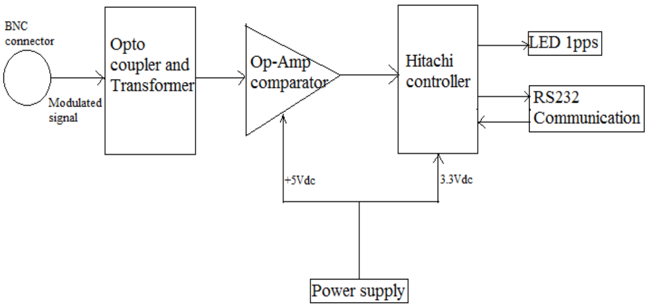

Fig. 1 Block Diagram of IRIG board

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Decoded by the controller and transmit via RS232 Communication. When modulated signal is received it is passed through transformer with ratio 1:1, where the signal is being limited to an amplitude of exact 5v,this signal is send to the OP-AMP comparator where the signal is compared with the default value of about 1.3Vdc.When the amplitude of the signal is greater than 1.3Vdc ,output is produced. The signal is being decoded by the controller and transmit via RS232 Communication

III. IRIG TIME FORMATS

Parallel time codes are defined in IRIG Standard 205-87, IRIG Standard Parallel Binary and Parallel Binary Coded Decimal Time Code Formats.

A. General Description

- Time code A has a time frame of 0.1 sec with an index count of 1 ms. and contains time-of-year and year information in a binary coded decimal format, and seconds-of-day in straight binary seconds.
- Time code B has a time frame of 1 second with an index count of 10 ms and it contains time of the particular year and year information in a BCD format, and seconds-of-day in SBS.
- Time code D has a time frame of 1 hour with an index count of 1 minute and contains time-of- year information (days and years) in a BCD format.
- Time code E has a time frame of 10 seconds with an index count of 100 milliseconds and contains time-of-year and year information of the certainyear in a BCD format.
- Time code G has a time frame of 0.01 seconds with an index count of 0.1 ms and contains time-of year information in days, hours, minutes, seconds, fractions of seconds and year information in a binary coded decimal format.
- Time code H has a time frame of 1 minute with an index count of 1 second and contains time-of-year information in the form of days, hours, and minutes in a binary coded decimal BCD format.
- *Pulse Rise Time:* The specified pulse (dc level shift bit) rise time shall be obtained between the 10 and 90 percent amplitude points.

TABLE 1

Format	Bit Rate	Index Count Interval
A	1 kpps	1 millisecond
B	100 pps	10 milliseconds
D	1 ppm	1 minute
E	10 pps	0.1 second
G	10 kpps	0.1 millisecond
H	1 pps	1 second

B. Control Functions

All time code formats retain a set of bits known as control functions (CF) for the encoding of various control, identification, and other special functions. The control bits might been programmed in any predetermined coding system. A binary 1 bit has duration equal to 0.5 of the index count interval, and a binary (0) bit has duration equal to 0.2 of the index count interval. Control function bits follows the position identifiers like $P_{5,}$ P_6 or P_7 for formats A, B, E, and G beginning at index count 50, 60 or 70 with one control Function bit per index count, except for each tenth bit which is a position identifier.

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TABLE II
NUMBER OF AVAILABLE CONTROL BITS IN EACH TIME CODE FORMAT

Format	Control Functions
A	18
B	18
D	9
E	36
G	27
H	9

Control functions are presently aimed for internal range use, but not for interring applications; therefore, no standard coding system exists. The including of control functions into a time code format as well as the coding system employed is an individual user defined option.

C. IRIG B

IRIG time code B (IRIG-B) is widely used in the industry (electrical power). IRIG-B has a pulse rate of 100 pulses-per-second with an index count of 10 ms over its one-second time frame. It contain time-of-year and year information in a BCD format, and (optionally) seconds-of-day in SBS.

IV. H8/3687 HITACHI MICROCONTROLLER

High-speed H8/300H central processing unit with an internal 16-bit architecture.

- Upward-compatible with H8/300 CPU on an object level. Sixteen 16-bit general registers.
- 62 basic instructions.
- Various peripheral functions:
- RTC (can be used as a free running counter)
- Timer B1 (8-bit timer)
- Timer V (8-bit timer)
- Timer Z (16-bit timer)
- 14-bit PWM
- Watchdog timer
- SCI (Asynchronous or clocked synchronous serial communication interface) × 2 channels.
- I2C Bus Interface (conforms to the I2C bus interface format that is advocated by Philips Electronics)
- 10-bit A/D converter

- On-chip memory
- General I/O ports
- I/O pins: 45 I/O pins (43 I/O pins for H8/3687N), including 8 large current ports (IOL = 20mA, @VOL = 1.5 V).
- Input-only pins: 8 input pins (also used for analog input.

TABLE III
INTERNAL MEMORY OF H8/3687

Product Classification	ROM	RAM
Flash memory version	56 kbytes	4 kbytes
Mask-ROM version	56 kbytes	3 kbytes

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V. HARDWARE AND SOFTWARE DESCRIPTION

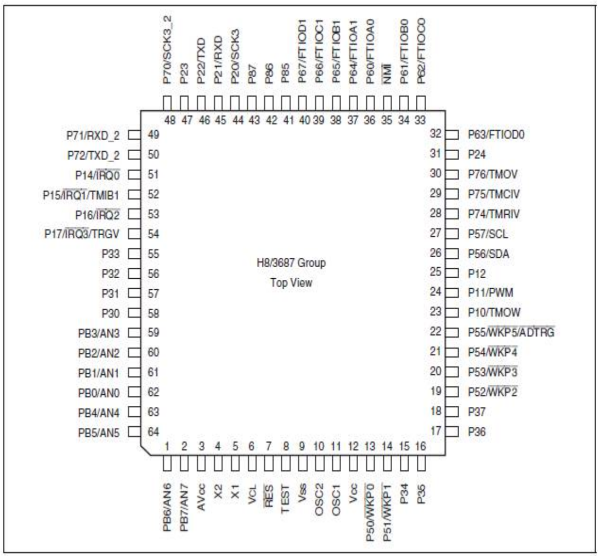

Fig. 3 pin diagram of H8/3687 controller

A.Power Supply Board

Adapter is used for converting 230Vac to 9Vdc/1A.9Vdc supply is feed as input to the power supply board. In the power supply board the 9Vdc is again drop down to 5Vdc using LDO regulator. This 5Vdc is used in front end section of modulated signal. The microcontroller operates with a voltage range of about 3.3Vdc.So the 5Vdc is again drop down to 3.3Vdc/1A.

B.Optocoupler

Optocoupler/photocoupler/optical isolator, is a chip that transfers electrical signals given between two isolated circuits by using light. Opto-isolators prevent high voltages from affecting the system receiving the signal. Now a days available opto-isolators withstand input-to-output voltages up to 10 kV and voltage transients with speeds up to 10 kV/µs. A common type of opto-isolator consists of an LED and a phototransistor in the same opaque package.

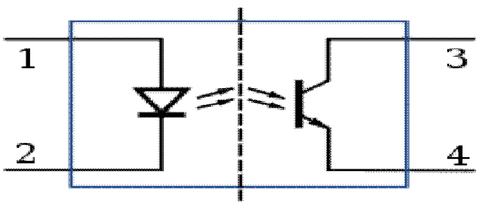

Fig. 4 Optocouple

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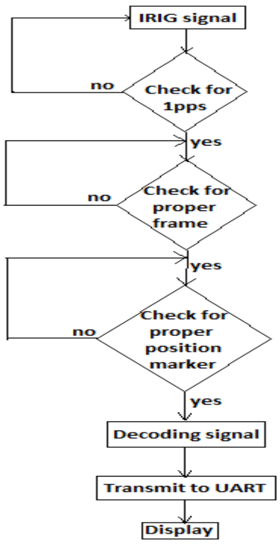
C.System Flow



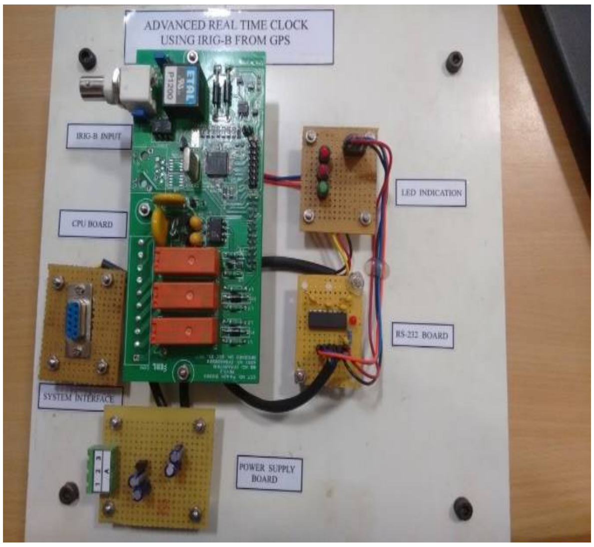


Fig. 4 System flow chart

Fig. 5 Photography of Hardware Kit

D.Output

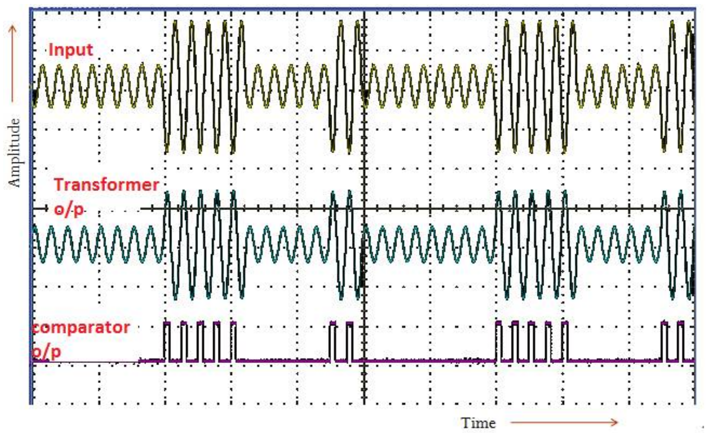


Fig. 5output

VI. APPLICATIONS

Application of time synchronization in electrical systems Time Synchronization is:

- SCADAs-Protocolization and registration
- Communication equipment-Communication processor
- Protection relays- Fault and performance analysis
- Fault recorders-Post mortem analysis
- Billing meters AMR - Tariff switching, load analysis
- IEDs, RTUs, SOE, Sensors- Protocolization + registration

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- Servers, Routers, Switches- security
- Frequency deviation - System stability

VII. CONCLUSION

Manual synchronization of devices which are geographically distributed is very difficult. Thus by using this project standard time is being used to synchronize devices which are geographically distributed. Thus by synchronizing time we can easily understand what happens in one part of the grid affects operation elsewhere. The time is needed to be Precise and communications is needed to be high-speed in the substation that enables this technologies practical. Manual synchronization which is being used now-a-days have some delay, which may cause some problems.

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