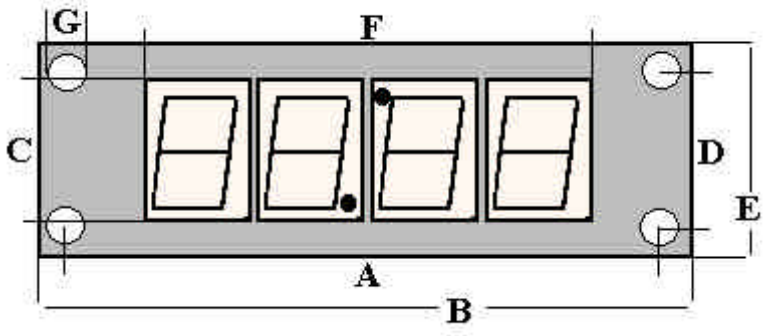
Enhanced LED display Clock Module
BTCM401

General Description

The BTCM401 module is an LED display clock module primarily designed for integration into user systems. Designed to provide maximum flexibility and ease of integration into systems requiring a time clock the unit requires only the addition of 3 user selectable spst switches and a +5 volt supply for the simplest configuration. All of the on board features can be programmed via the switches or via the RS232 format serial bus. With RS232 ascii time stamp output, selectable display format, power saving features, alarm output, backup battery and clear high visibility LED display the module is suitable for integrating into a wide variety of end user products. Features include:

1. Four digit 0.6 inch high efficiency Red LED display
2. Header for switches (users choice of switch) for programming of clock functions
3. User selectable 12/24 hour format
4. User selectable display on request or permanently on
5. User selectable colon output - flash or always on
6. Accurate crystal controlled timebase
7. Programmable via Ascii strings on RS232 format bus.
8. Ascii format time output via RS232 bus every minute
9. Input for battery backup for maintaining clock during power downs
10. Alarm output for triggering external circuits on alarm time
11. Brightness control allows full control of LED's via an external pot or LDR
12 Single +5 volt supply with low current consumption

Configuration



Dimensions

BTCM401

A = 94 mm
B = 100 mm
C = 18 mm
D = 31 mm
E = 37 mm
F = 50 mm
G = 3.2 mm
Depth = 20 mm

Pinout

2	4	6	8	10	12	14	16
Txd	Rxd	Vcc	Brt	0V	alarm	ondem	+5 in
Hours	Mins	Mode	Vcc	0V	+5 in	- batt	+ batt
1	3	5	7	9	11	13	15

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Pin Functions

Pin 1: *Hours/function set.* Input pin. This pin is connected to one side of a single pole single throw switch that when pushed takes the input to a low state. A pull-up is provided on the pin. When in the active (low) state the hours will increment at a rate of 1 per second or (depending on the mode) allow toggling of the 12/24 hours or flash/permanent colons.

Pin 2: *Transmit data*. Output pin. This pin is a TTL level output on which the ascii time data is sent in RS232 format every 1 minute. The pin normally resets in a high state.

Pin 3: *Minutes set.* Input pin. This pin is connected to a switch in the same manner as the hours input pin. It increments the minutes when the appropriate mode is selected.

Pin 4: *Receive data*. Input pin. This pin receive the RS232 format data at a TTL level which programmes the internal time registers and control functions. It idles in a high state driven from the host.

Pin 5: *Mode pin*. Input pin. As per the hours and minutes pin this pin is connected to a single pole switch. It allows the scrolling of the programming modes. When the switch is released the selected programming mode is entered into.

Pin 6 and Pin 7: *VCC.* Output pin. Internal system voltage which is provided for the microcontroller and LED driver circuitry.

Pin 8: *Brightness.* Input pin. The voltage on this pin controls the brightness of the LED display. It directly modulates the LED current and so can be used with an external potentiometer or LDR display to control LED brightness. Jumper 2 connects this pin directly to VCC giving maximum brightness.

Pin 9 and 10: *0V.* System ground

Pin 11 and Pin 16: *+5 V input*. Power input. This pin is the positive system voltage. It is connected directly to the anodes of the LED display (assuming JP1 is made) and via a diode to the remainder of the circuits. All LED currents flow through this pin.

Pin 12: *Alarm.* Output pin. This pin is connected to the collector of a 30 volt 100 mA open collector transistor and pulls to ground when the alarm time and the displayed time are equal.

Pin 13: *Battery negative.* Power input. This pin is the negative connection for the backup battery. The backup battery is a 9 volt source.

Pin 14: *On demand.* Power input. This pin provides a direct connection to the anodes of the LED display allowing the user to connect a switch between this pin and +5 v in. When the switch is made the LED's illuminate. It can be bypassed by JP1.

Pin 15: *Battery positive.* Power input. This pin is the positive battery connection of the backup battery 9 volt supply. Note only the internal circuitry is battery backed up. During outages of the +5 v the LED's will not illuminate.

Programming modes

The clock has several modes in which it can operate. The normal mode is to display time in the format chosen during the programming. Pushing the Hours or minutes button during normal display will result in no action a programming mode must be selected first.

To set the time:

Push the ***MODE*** button and hold it. The display will show *L0*. Release the button. If *L0* is missed just hold down the button again until it cycles around. Once *L0* is showing on the LED display push the ***HOURS*** button and hold it. The hours will now begin to increment from 0 to 23. Note that all times are set in in 24 hour mode. When the correct hour is shown release the button and hold down the ***MINUTE*** button. This will increment from 00 to 59. When the minute button is released the time mode is returned too.

To set the alarm:

Push the ***MODE*** button and hold it. The display will show *L1*. Release the button. If *L1* is missed just hold down the button again until it cycles around. Once *L1* is showing on the LED display push the ***HOURS*** button and hold it. The hours will now begin to increment from 0 to 23. Note that all times are set in in 24 hour mode. When the correct hour is shown release the button and hold down the ***MINUTE*** button. This will increment from 00 to 59. When the minute button is released the time mode is returned too. The alarm is now set. Once the clock reaches that time (it doesn't matter if the clock is displaying in 12 hour mode the alarm is based on 24 hour mode) the alarm output will be triggered on for a period of 1 minute.

To set 12/24 hour display mode:

Push the ***MODE*** button and hold it. The display will show *L2*. Release the button. If *L2* is missed just hold down the button again until it cycles around. Once *L2* is showing on the LED display push the ***HOURS*** button and hold it. The display will now toggle between *12* and *24* at about a 1 second interval. Releasing the button when *12* is showing will select *12* hour mode. Similarly releasing the button when *24* is showing selects a *24* hour style display. Once the hour button is released normal time mode is displayed.

To set colons flashing (1Hz) or permanently on:

Push the ***MODE*** button and hold it. The display will show *L3*. Release the button. If *L3* is missed just hold down the button again until it cycles around. Once *L3* is showing on the LED display push the ***HOURS*** button and hold it. The display will now toggle between P and H at about a 1 second interval. Releasing the button when *P* is showing will select permanent colons mode. Similarly releasing the button when *H* is showing selects a flashing cursor display.Once the hour button is released normal time mode is displayed.

Note that if the mode button is pushed inadvertently then the normal display can be returned to by simply toggling to *L4* and releasing the button. All data then remains the same.

RS232 format communications - Programming and time display functions

Programming

The clock can be programmed via an RS232 format (TTL level) serial asynchronous communication bus. The programming is carried out by sending a series of ascii characters to the clock unit. The format is as follows:

 # 2 1 5 5 2 2 0 0 X Y

Start Time Hours Time Minutes Alarm Hours Alarm Minutes Colon Format

The start can be any non numeric character. Typing a non numeric character during the programming string results in the pointer returning to the start and thus the whole string must be re-entered.

X can be 0 or 1. If it is 0 then the colons remain permanently on. If it is a 1 then the colons flash.

Y can be 0 or 1. If it is 0 then 12 hour display format is selected. If it is a 1 then 24 hour format is displayed.

Ascii time output

The clock outputs the time in ascii format every minute. As the display changes on the LED's the ascii string is transmitted on the txd pin in RS232 format at TTL levels. It is always transmitted as 24 hour mode regardless of the display mode .The string has the following format:

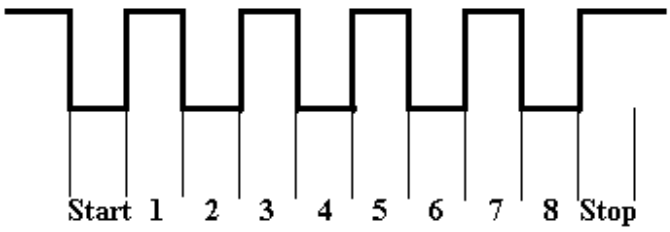
2 1 : 5 5 CR LF

Time hours Colon Time minutes Carriage return Line Feed

RS232 Communication parameters

The RS232 communication parameters are fixed at the following values for both transmit and reception of data.

2400 baud 1 start 1 stop 8 data bits no parity

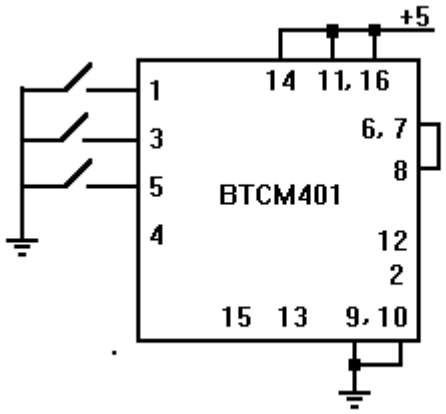


Electrical Characteristics

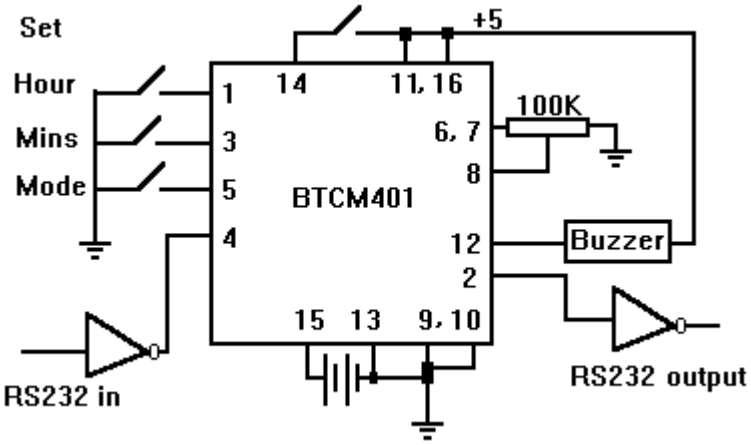
Parameter	Min	Typ	Max.	Units	Conditions
Supply voltage	4.75	5.0	5.5	V	
Voltage on LED's			5.5	V	
Backup battery voltage	8.0	9.0	10.0	V	
Power supply current		3	7	mA	LED's off
Power consumption			1500	mW	all 8's on LED vcc=5v
Input voltage logic 0 (VL)	-0.3		0.8	V	Vcc=5.0 volts
Input voltage logic 1 (VH)	2.2		Vdd	V	Vcc=5.0 volts
Switch current		240		uA	
Brightness input	0		Vcc	V	
Output sink current (seg off)			10	uA	Vout=3 volts
Output sink current (seg on)	0		10	uA	V brightness = 0V
Output sink current (seg on)	2		4	mA	V brightness = 2.2V
Output sink current (seg on)	7		10	mA	V brightness = 5.0V
Alarm output sink current	50	100	150	mA	V load = 5 volt
Alarm output VCE sat		0.35	0.5	V	I load = 10mA
LED Intensity matching			+- 20	%	
Clock input frequency		4.0000		Mhz	Vcc = 5 volts
Clock time drift		15	30	sec/month	temp=25 deg C
Baud rate		2400		baud	
Data input rise time			300	ns	
Data input fall time			300	ns	
Operating temperature	0		70	deg C	V+ = Vled = 5v

Typical Applications

Basic clock module with switch setting.



Full Clock module with RS232 communications, brightness control, backup battery, LED on/off switch and alarm buzzer



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