

BRG Mega Digital Clock



Installation and Operation Manual

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Operation

The BRG Mega clock is based on super bright LED technology coupled with a very capable microprocessor. The Mega microprocessor is able to store the user's configuration in duplicate. If the configuration becomes corrupt by someone configuring the display incorrectly, the original customer configuration can be instantly restored. The Real Time Clock includes a quartz crystal as the standard time base and is accurate to a few minutes per year. An optional ultra-high precision oscillator is available that is accurate to a few seconds per year. For absolute accuracy, several time receiver options are available including, Ethernet employing Network Time Protocol, BRG Wireless radio receiver, PC serial interface, IRIG-B, and SMPTE receivers.

Real Time Operation –

The Mega Real Time Clock employs a clock circuit with battery backup. The clock circuit will maintain time for about ten years without power. When you receive your new clock and apply power, you will see the clock already running. To correct the time, simply press and hold either the Up or Down buttons. The time will increment or decrement faster and faster as the buttons are held.

Mega Clock Processor Configuration Menu

Processor Type

Two types of processors are typically used in BRG digital clocks, Tiger and Mega. The Tiger processor is usually found in timers, counters, and more complex display configurations. The Mega processor is used where other features are needed that are not available in the Tiger processor, or displays not requiring features found in the Tiger processor. The Mega processor is available in general clock as well as special timer configurations. The factory will install the processor type most appropriate for the customer's requirements. The menu will indicate the type of processor used. Once in the menu system, if the Mega processor uses leading zeros and the Tiger processor does not. If the Mega is configured as specialized timer, then some of the clock functions will not be available. If Mode 10 does not display a value when access is attempted through the menu, then the Mega is configured as a specialized timer.

When the Mega is displaying real time, simply press the Up button to advance the time, or the Down button to decrement the time. The longer the buttons are held down, the faster the time will change. Press the Mode button to enter modes listed below.

First Menu Level Mode Number	Value Range	Mode Description and Instructions
<u>Menu Selection</u>	Operating Value.	<ol style="list-style-type: none"> 1- Press and hold the Mode button for 3-4 seconds, or until 01 appears on the display. If the customer's configuration was previously saved to secondary memory, all segments on all displays will illuminate while the mode button is held down. 2- Once in the menu system, use the Up and Down buttons to move to the desired parameter address. 3- Once at desired parameter address, press the Mode button once to display the parameter value. 4- Use the Up and Down buttons to change the parameter value. 5- Press the Mode button to return to the parameter address or press the Timer Control button to save any changes and exit the menu system. 6- To exit the menu system, press the Timer Control button, or use the Down button and move to parameter address 00. The clock will return to normal display mode.
0. Change Time	00:00 to 23:59 or 12:00 AM to 12:00 PM	Simply press the Up button to advance the time, or the Down button to decrement the time. The longer the buttons are held down, the faster the time will change. Press the Mode button to enter modes listed below.

First Menu Level Mode Number	Value Range	Mode Description and Instructions
1.	01 to 31	<p><u>Day of the Month</u> Pressing the Up button advances the days, pressing the Down button decrements the days. Be sure to use valid day for any specific month. For example, do not enter a day of 30 for the month of February.</p>
2.	01 to 12	<p><u>Month</u> Pressing the Up button advances the month, pressing the Down button decrements the month.</p>
3.	00 to 50	<p><u>Year</u> Pressing the Up button advances the year, pressing the Down button decrements the year.</p>
4.	0-4	<p><u>Blinking Colon</u> To enable the blinking colon, first disable Follow Master Clock by setting Mode 6 to 00, then set Mode 4 to 01 to enable the blinking colon. If the clock is connected to a master clock using sync wire, the master clock may be configured to control the blinking colon of all secondary clocks. See also Mode 5 and Mode 41.</p> <p>0=solid colon with no leading zero, 1=blinking colon with no leading zero 2=no colon with no leading zero 3=no colon with leading zero (display modes 2, 5, 17) 4=solid colon with leading zero (display modes 2, 5, 17) 5=disable blinking sync indicator 6=Blink colon if serial sync (Ethernet, PC, Wireless) is lost. 7=Blink colon if serial sync (Instaset) is received.</p>
5.	0,1	<p><u>12/24 Hour Display Format</u> 0=12 hour display format (default), 1=24 hour display format</p>
6.	0,6	<p><u>Sync Format</u> Select from various optional sync methods.</p> <p><u>0=(default) Synchronous three wire circuit-</u> This mode was formerly assigned to value 2 in firmware versions prior to version 4.2. When a voltage is applied to the control line for 8 seconds, the hours will remain unchanged, the minutes will set to 58 and the seconds will set to 02. When a voltage is applied to the control line for 14 seconds, the hours will be set to 5 am or 5 pm (depending on which the current time is closest to), the minutes set to 58 and the seconds set to 08.</p> <p>American: A4015D10 ATS: CC2000 Series digital clocks Cincinnati: D10 and D12 Dukane: 24SS Series Edwards: 010 IBM: 57, 62, 67, 77, 82 and 87 Series</p>

First Menu Level Mode Number	Value Range	Mode Description and Instructions
7.	-15-15	<p>Lathem: SS12 Series Simplex: 2310-92xx, 57 and 77 Series Stromberg: 3000</p> <p><u>0=RS422</u> – Serial Wire Sync See also Mode 4=6 and Mode 4=7</p> <p><u>When Mode 17 does not equal zero, down timer commands from a wireless master clock are ignored.</u></p> <p><u>0=Ethernet</u> – Ethernet UPD or NTP synchronization See also Mode 4=6 and Mode 4=7</p> <p><u>Digital Radio Control</u> 1= receive (default) 2= transmit (also set Mode 13=1 to enable transmit mode) 3= repeater mode (also set Mode 13=1 to enable transmit mode) <u>See also Mode 12, Mode 13 and Mode 42</u></p> <p><u>6=Run timer continuously</u> – (Optional - only available on the Mega Timer) This mode is typically used when display hours or days only. The timer starting value can be changed using the Timer Control button.</p> <p><u>Display Intensity</u> 1=mininum intensity, 15=maximum intensity (default), 0=enable auto-brightness (if installed) -1 to -15 alters the effect of auto-brightness (if installed),</p>
8.		<p><u>Adjust Time Received for Daylight Saving Time</u> 0=disabled 1=enabled (default) Removes daylight saving time from serial time data received. By default, the clock expects to receive local serial time updates. If daylight saving time is active, then the time received will be decremented one hour. The hour will be restored when the time is displayed. If daylight saving time is not active, the time will be displayed as it is received, in addition to any time zone offsets.</p>
9.		<p><u>Wireless Countdown Timer Configuration</u> 0=disabled 1 (default) - 9 = clock countdown timer address</p> <p>This mode is used to configure wireless countdown timers. The master clock can send a command to countdown from 1 to 9 minutes.</p> <p><u>Temperature Calibration</u></p>

First Menu Level Mode Number	Value Range	Mode Description and Instructions
10.	0,1,2,3, 16-47, 48-55	<p>0=disabled (default) 10=enabled – This mode is used when calibrating temperature sensors. It will display the Fahrenheit temperature in tenths of a degree. The display will return to normal temperature display mode when the power to the clock is cycled.</p> <p><u>Daylight Savings Time Automatic Switching</u> (unavailable on the Mega Timers)</p> <p>0 = disabled 1 = U.S. daylight saving time (default), 2 = UK daylight saving time, 3 = US daylight saving time rule (NEW).</p> <p>When this feature is enabled, the time will automatically switch between standard and daylight saving time.</p>
11.	-12 to +12	<p><u>Time Zone Offset</u> (unavailable on the Mega Timers)</p> <p>-12 to 12, 0=default</p> <p>This feature allows adjusting time received over a serial sync line to the local time. 30 minute offsets are not available.</p>
12.		<p><u>Digital Radio Channel Selection</u></p> <p>This mode determines the radio channel to be used. (ver. 5.1 or later)</p> <p>20 = (default) U.S. / Canada - radio channel - scan all channels in receive mode</p> <p>16-47 - U.S. / Canada - radio channel - scan all channels in receive mode 48-55 U.S. / Canada - radio channel - scan all channels in receive mode</p> <p>56-87 – U.S. / Canada - no channel scanning– includes +40 offset 88-95 - Australia / New Zealand – no channel scanning– includes +40 offset</p> <p>Transmit and Repeat mode always uses fixed channel assignments.</p> <p>Repeaters use both odd and even channels; therefore, it is recommended to configure Mode 12 to use only even channel numbers in case multiple repeaters are deployed. The repeater will receive on the channel specified in Mode 12 and transmit on the next higher channel.</p> <p>Setting this mode to a channel less than 60 will cause the radio to scan all available channels while in receive mode (Mode 6=1).</p>

First Menu Level Mode Number	Value Range	Mode Description and Instructions
13.		<p>BRG data radios incorporate DES data encryption developed for the U.S. Government. This two key secure communications method prevents changing or reading communications data, and other interference. This secure communications method provides accurate, secure and reliable communications.</p> <p><u>See also Mode 6, Mode 13 and Mode 42</u></p> <p><u>Serial Transmit</u> 0=disabled (default) 1=enabled <u>See also Mode 6, Mode 12 and Mode 42</u></p>
14.	1-3	<p><u>Display Operating Mode</u> 1=real time clock (default), 2=Up timer, short or long duration – (Optional) 3=Down timer, short or long duration – (Optional)</p> <p>Real Time Adjustment – Press the up or down buttons to change the hours and minutes. The seconds will set to zero when changing the time. Holding the buttons down will cause the value to change faster.</p> <p>Optional Timer Value Adjustment - Momentarily press the Timer Control button. The first display will be at half brightness, all other displays will blank out. If only one display is used, it will go to half brightness. Press the up and down buttons to adjust the value. Holding the buttons down will cause the value to change faster and faster. Momentarily press the Timer Control button again to move to the next display. When the last display is adjusted, press the Timer Control button again to return to normal operation. All displays will return to the same brightness. Set Mode 6 = 6 to run the timer continuously. The Start/Stop/Reset buttons are disabled in the continuous run mode.</p> <p>If power is lost, the display will blank out, but the timer will hold the last time. When power is restored, the last time will be displayed. The timer may need to be adjusted if the power was out for an extended time.</p> <p>Optional Timer Button Operation (disabled if Mode 6=6)-</p> <p><u>When the timer is stopped</u> –</p> <ol style="list-style-type: none"> Pressing the Start button will start the timer running. Pressing the Reset button will reset the values to 0. <p>The right decimal point will light when the timer is stopped.</p> <p><u>When the timer is running</u> –</p> <ol style="list-style-type: none"> Pressing the Start button will pause the timer. Pressing the Stop button will pause the timer. If the timer is configured to continuously run (Mode 6=6), then pressing the

First Menu Level Mode Number	Value Range	Mode Description and Instructions
15.		<p>Stop button will reset the time back to the starting value and continue running from that point. The right decimal point is off when the timer is running.</p> <p><u>When the timer is paused –</u> 1. Pressing the Start button will star the timer. 2. Pressing the Stop button will reset the values to 0. The right decimal point will light when the timer is paused.</p> <p><u>Leading Zero on Selected Display Modes</u> 0=disabled, 1=enabled</p> <p>When enabled, leading zeros will appear on display modes 2, 5, and 17.</p>
16.	-999-999	<p><u>Temperature Adjustment – Channel 1</u></p> <p>0=default</p> <p>This value is used to adjustment the temperature reading up or down in tenths of a degree Centigrade.</p>
17.	-999-999	<p><u>Temperature Adjustment – Channel 2</u></p> <p>0=default</p> <p>This value is used to adjustment the temperature reading up or down in tenths of a degree Centigrade.</p> <p><u>When Mode 17 does not equal zero, down timer commands from a wireless master clock are ignored.</u></p>
18.	1-4	<p><u>Number of Four Digit Displays Installed</u> 1-4, 2=default,</p> <p>This value determines how many four digit displays are installed. Double and four sided displays may use a value of 1 to set all four sides to the same display. Other combinations are possible.</p>
19.	N/A	<p><u>Displays the software version number of the clock.</u></p>
20.	1-99	<p><u>Sets various display modes for the first display</u> The following modes are available:</p> <p>1 - ssxx – seconds left justified 2 - hh:mm – hours and minutes (default) 4 - nnnn – four digit year 5 - mm/dd – month and day</p>

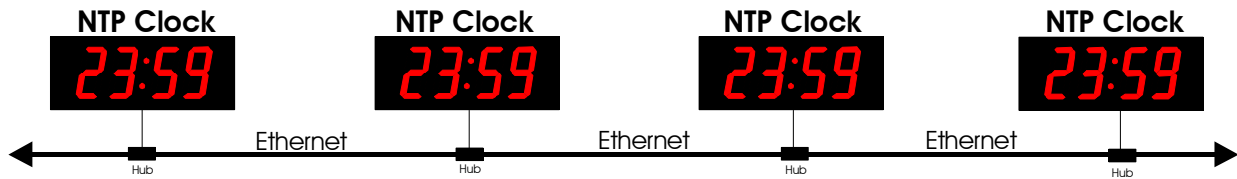
First Menu Level Mode Number	Value Range	Mode Description and Instructions
		9 - xxxx – blank display 12 - mm:ss – minutes and seconds 13 - xssx – seconds centered 17 - dd/mm – international date format – day/month 20 - hh:mm – hours and decimal minutes 21 - nnnn – timer days (-9999 – 9999) – (Optional) 22 - nnnn – timer hours (-9999 – 9999) – (Optional) 24 - nnoF – degrees Fahrenheit – Channel 1 25 - nnoC – degrees Centigrade – Channel 1 26 - nnoF – degrees Fahrenheit – Channel 2 27 - nnoC – degrees Centigrade – Channel 2
21.	1-99	<u>Sets various display modes for the second display.</u> See Mode 20 for available display modes. The default display format is 13.
22.	1-99	<u>Sets various display modes for the third display.</u> See Mode 20 for available display modes. The default display format is 2.
23.	1-99	<u>Sets various display modes for the fourth display.</u> See Mode 20 for available display modes. The default display format is 2.
28.	0-99	<u>Rotating Display Delay for Cycle Position 1 (Ver. 2.0 or later required)</u> 4 = (default) Up to 3 display formats may be cycled or rotated. This mode setting determines the time in seconds each display format is displayed. See Modes 31 through 36 to assign the desired display formats. For example, to display hours and minutes on display 1 and a temperature alternating between degrees F and degrees C on display 2, using temperature sensor port 1, then set Modes 31=2, 32=2, 34=24 and 35=25.
29.	0-99	<u>Rotating Display Delay for Cycle Position 2 (Ver. 2.0 or later required)</u> 4 = (default) Up to 3 display formats may be cycled or rotated. This mode setting determines the time in seconds each display format is displayed. See Modes 31 through 36 to assign the desired display formats. For example, to display hours and minutes on display 1 and a temperature alternating between degrees F and degrees C on display 2, using temperature sensor port 1, then set Modes 31=2, 32=2, 34=24 and 35=25.
30.	0-99	<u>Rotating Display Delay for Cycle Position 3 (Ver. 2.0 or later required)</u> 4 = (default) Up to 3 display formats may be cycled or rotated. This mode setting determines the time in seconds each display format is displayed. See Modes 31 through 36 to assign the desired display formats. For example, to display hours and minutes on display 1 and a temperature alternating between degrees F and degrees C on display 2, using temperature sensor port 1, then set Modes 31=2, 32=2, 34=24 and 35=25.
31.	0-99	<u>Display Format – Display 1, Cycle Position 1</u> The display format will be displayed on display 1, in display cycle 1. See Mode 30 to adjust the time delay before switching display formats.
32.	0-99	<u>Display Format – Display 1, Cycle Position 2</u>

First Menu Level Mode Number	Value Range	Mode Description and Instructions
33.	0-99	<p>The display format will be displayed on display 1, in display cycle 2. See Mode 30 to adjust the time delay before switching display formats.</p> <p><u>Display Format – Display 1, Cycle Position 3</u> The display format will be displayed on display 1, in display cycle 3. See Mode 30 to adjust the time delay before switching display formats.</p>
34.	0-99	<p><u>Display Format – Display 2, Cycle Position 1</u> The display format will be displayed on display 2, in display cycle 1. See Mode 30 to adjust the time delay before switching display formats.</p>
35.	0-99	<p><u>Display Format – Display 2, Cycle Position 2</u> The display format will be displayed on display 2, in display cycle 2. See Mode 30 to adjust the time delay before switching display formats.</p>
36.	0-99	<p><u>Display Format – Display 2, Cycle Position 3</u> The display format will be displayed on display 2, in display cycle 3. See Mode 30 to adjust the time delay before switching display formats.</p>
40.	0,1	<p><u>Reverse Down Direction Timer at Zero</u> 0=disabled – timer stops at zero 1=enabled (default) – timer reverses at zero</p>
41.	0,1,2	<p><u>Reverse Decimal Point</u> 0=normal decimal (default), 1=reverse the position of the decimal point for discrete digit displays. 2=add colon to display modes 1 and 2 for discrete displays 3=turn on decimal when sync received, reset at midnight 4=turn on decimal when sync lost, , reset at midnight 5=turn on decimal when sync received, reset hourly 6=turn on decimal when sync lost, , reset hourly</p>
42.	0-99	<p><u>Digital Radio Group Number</u> 0-99 (5=default)</p> <p>This mode allows changing the digital radio group number. The current group number will not display. The group number is changed immediately upon exiting this mode.</p> <p><u>See also Mode 6, Mode 12 and Mode 13</u></p>
91.	NA	<p><u>Restart Clock</u> This command restarts the clock program from the beginning. Parameters are unchanged. If an Ethernet interface is attached, a reset of the interface will be performed.</p>
92.	NA	<p><u>Restore Factory Defaults</u> This command restores all factory default parameters and restarts the clock.</p>
93.	NA	<p><u>Restore User Defaults</u> This command restores the user parameter configuration previously stored using</p>

First Menu Level Mode Number	Value Range	Mode Description and Instructions
94.	NA	<p>Mode 94. If no parameters were previously stored using Mode 94, then this command will have no effect.</p> <p><u>Store user Parameters Into Secondary Memory</u> All configuration parameters are automatically stored into primary memory. This command stores the current clock configuration into secondary storage. If the primary clock configuration becomes unusable, the clock can be restored to the original user configuration using the command. This avoids the necessity to re-enter the user parameters again.</p> <p>To save the current clock configuration into secondary memory, once Mode 94 appears on the display, press the Mode button once and release. Then press and hold the Mode button until all display segment illuminate, then release. The clock will return to normal display Mode once the parameters are restored.</p> <p>If user parameters have been previously saved to secondary memory, all segments will illuminate on the menu display when the entering the menu system. All segments will appear as long as the Mode button is pressed, when first entering the menu system.</p>
95.	NA	<p><u>Illuminate All Display Segments</u> Pressing the Mode button momentarily will illuminate all display segments on all displays. Pressing the Mode button again will return to the menu.</p>
96.	NA	<p><u>Test Watchdog Timer</u> The Mega processor includes a hardware watchdog timer. If for any reason the clock becomes unstable for enters an endless program loop, the watchdog timer will automatically restart the clock. The watchdog timer operation may be tested by placing the clock into an endless program loop. Press the Mode button once to test the clock. Once the Mode button is release, the watchdog timer will reset the clock in two seconds and will return to normal display mode.</p>

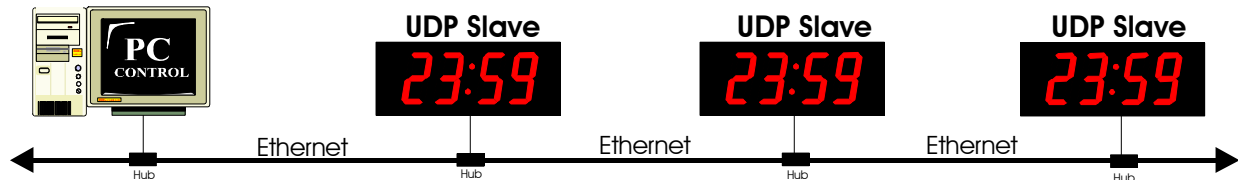
Ethernet Communications Option

NTP Time Synchronization



The NTP (Network Time Protocol) method allows each clock to obtain the time directly from Internet time servers, or from time servers on the local network.

UDP Time Synchronization and Control



Using UDP mode, a PC is used to broadcast control commands to all clocks on the subnet.

UDP (Universal Datagram Protocol) allows clocks to receive time and control commands from a PC. A control program for Windows is provided. The ethernet time distribution method may be combined with other sync methods such as power line sync to sync clocks in areas where network cable is unavailable.

NTP and UDP Time Synchronization:

The optional Ethernet interface allows connecting clocks to a computer network. Network Time Protocol (NTP) and Universal Datagram Protocol (UDP) are both available at the same time. Switching between the two communication methods is not required.

NTP is a uniform method of sending time over a computer network. By default, the clock will act as a client to public or local NTP time servers. The clock can also be configured to receive NTP broadcasts. NTP provides Universal Coordinated Time (UTC) to the clock. The clock implements offsets and daylight savings rules to display the correct local time.

UDP is a simplified time synchronization and clock control method available only on the local subnet. The UDP broadcast cannot communicate outside a local area subnet. UDP is commonly used to control and configure the clocks. The time can also be broadcast from a PC or clock to all clocks on the subnet.

Overview

Once the clock is connected to the network and power is applied, DHCP is used to automatically assign each clock an IP address on the network. Then, each clock will search the Internet or local area network for time servers. The correct time will display within a few minutes of obtaining a time server lock. The clock includes a list of 50 Internet NTP time servers. Local NTP time servers may also be used. The control software included with the clock, and available for download from the BRG web site, may be used to assign IP addresses for local time servers. Up to 10 local time servers may be assigned. Once all clocks are attached to the network and operating, simply send a command from the PC clock control program to assign a new local time server IP address. The new IP address will be assigned to all clocks on the subnet simultaneously.

UDP Ethernet Addressing:

This option uses UDP broadcast addressing (IP address 255.255.255.255) and will communicate using IP Port number 16000. If required, other IP port numbers may be changed.

PC Software:

The Clock Control Program for Windows and various software drivers are available for download from <http://www.brgprecision.com>. Use 6409 for both the user ID and password. The drivers may be used to send, receive and test time UDP transmissions.

Drivers:

Note that NTP (Network Time Protocol) is recommended for time distribution over the following software tools. These tools are provided for special applications.

GPSTimeSet.exe – This program may be used to broadcast time to clocks using UDP. It can optionally receive time from a GPS receiver and set the PC's time. The broadcast period is adjustable.

UDPxmit.exe – This program broadcasts the time and date once per second using the UDP method. Place this program in the startup directory, or autoexec.bat so it will start when the PC is power up. This program will run as long as the PC is running. To stop the service, close it from the Task Manager.

UDPrec.exe – This program expects to receive UDP time and date broadcasts from the local area network. Place this program in the startup directory, or autoexec.bat so it will start when the PC is power up. This program will run as long as the PC is running. To stop the service, close it from the Task Manager.

UDPrecTest.exe – This program is used to test for UDP time broadcasts. It displays IP address, data, and port information as time packets are received. Clicking on the Stop button will stop the program.

Configuring BRG Ethernet Clocks

Recommendations

BRG recommends that all new Ethernet clocks be set up in a test area for configuration and testing prior to installation. Some testing procedures require visibility of the clock display. In the event that problems are encountered after installation, knowing that the clocks functioned correctly in your test area greatly simplifies troubleshooting. If you have many clocks to set up, working with only one or two clocks at a time until they are all set up makes it easier to identify or isolate each clock.

Before You Start

1. Addressing-The default addressing mode for the NIC (network interface card) in BRG clocks is DHCP. Fixed IP addressing can be programmed into the clock using arp and telnet utilities. If you are going to use Fixed IP addressing, you will need the Clock IP address, Net mask, Gateway IP address, and optionally Name Server IP address. **Contact your IT department for the correct IP addresses for your network.**
2. NTP Time Server-If you want to use an Internet timer server and the clock will have access to the Internet through your firewall, the clock will automatically locate and sync with an Internet NTP time server after it acquires an IP address. The clock will access NTP timer servers through port 123. If you want the clock to only use your network NTP time server, you will need the IP address of your time server.

3. Connections-BRG clocks with the Ethernet option use a 10Base-T network interface card (NIC) that communicates in half-duplex mode. Your hub or switch must be compatible. Connections to a hub or switch are made with a standard straight through CAT-5 patch cable. **During set up, clocks must be connected to a computer on a local subnet through a hub or switch.**
4. The BRG Digital Control Program, available at our download website, is a useful tool for setting up and testing your clocks. This utility program allows you to discover the clock on your network, open telnet sessions, and test Ethernet connections. Go to : <http://www.brgprecision.com/userdoc.html> and download the **Serial/Ethernet Clock/Counter/Timer Control Program**. Use '6409' for both the user id and password to access this program from our website. Save this file to your desktop. If you have previous versions of this program on your computer, go to the Control Panel/Add or Remove Programs, and remove the existing BRG Digital Clock Controller program before installing the new version. Open the BRGDig.zip file and select the setup.exe to install the program. After installing the program, open the control program, and go to the Setup/Communications tab, select Ethernet mode, and then close the window.

DHCP Addressing

The factory default addressing mode is DHCP. If your network has a DHCP server, simply connect the clock to your network and the clock will acquire a leased IP address. The lease acquisition can be almost immediate or may take several minutes. You can use the BRG Digital Control program to determine the leased IP address by going to Setup/Clock IP Discovery. You may not see your clock listed in the discovery panel until it has acquired a lease or it may appear with an address of '0.0.0.0'. This is the default IP address for the NIC card which forces the NIC to operate in DHCP mode. You cannot telnet to the clock until it has acquired an IP address. Once the clock has acquired an IP address, you then select the clock from the discovery listing and click the telnet button to open a telnet session to the clock to set the operating mode and/or set fixed IP addresses in the clock.

Fixed IP Addressing

If your network has a DHCP server but you want to assign a fixed IP address, you can let the clock first acquire a leased IP address, discover the clock with the control program, and then telnet to the clock from the control program to set the fixed IP addresses using the telnet configuration utility.

If your network does not have a DHCP server, you will need to manually set the IP addresses. Fixed IP addresses can be programmed into the NIC using arp and telnet utilities from the DOS prompt.

ARP-Telnet IP Address Setup

In order to set up the clock over the Ethernet using the telnet configuration utility, the clock must first have an IP address programmed into it so you can connect to the clock through the telnet configuration utility. You can use the ARP (Address Resolution Protocol) commands from the DOS prompt to accomplish this. Setting a fixed IP address using the ARP utility requires the MAC (Machine Address Code) address from the back of the clock. The MAC address is a 12 digit code that uniquely identifies the clock from all other devices on the network. The ARP command will then associate this device's unique MAC address with an IP address.

1. Go to the DOS prompt (Start/All Programs/Accessories/Command Prompt)
2. Set the IP address using arp in following format:

```
arp -s [IP Address] [MAC Address]
```

 example: arp -s 192.168.1.199 00-90-c2-c5-ef-92
4. Telnet to the new IP address in the following format:

```
telnet [IP Address] 17001
```

 This command temporarily loads the IP address into the NIC. The telnet session will fail at this point and you can close the telnet window.

5. Ping the new address to test the connection to the clock by entering this command at the DOS prompt:
ping [IP Address]
example: ping 192.168.1.199

The ping command response should indicate several replies from your IP address. If ping is successful go to step 6.

If the ping returns a 'request timed out', then the IP address may not be correctly programmed into the NIC or there is duplicate entry in the arp -a listing. If you need to repeat this procedure, check the arp table with the arp -a command to see if your address is shown and not duplicated.

If duplicated, first delete the arp entry for your IP and MAC address with the arp -d [IP Address] command and then verify its removal with the arp -a command. Repeat starting with step 3. If the problem persists, contact your IT department to verify the correct IP address for your clock.

6. Now that you have a valid IP address for your clock you can use the telnet configuration utility to complete the fixed IP addressing process. At the command prompt enter:
telnet [IP Address] 17000
example: telnet 192.168.1.199 17000

Notice that the IP address for the NIC is not set at this point and must be changed with selection 3. Proceed to set the net mask, gateway, and name server as needed with selections 4, 5, and 6. **After you have made your updates, be sure to use the '98' selection to save your changes.** If you need to edit the NTP time server list, go to the 'Setup/NTP Timer Servers' section later in this document

Follow the instructions on the telnet configuration screen. Be sure to use the '98' command to save your changes.

Using the BRG Digital Control Program

The control program is a very useful tool for setting up and testing the Ethernet connection to your clock. The Setup and Commands tabs will be used for Ethernet operations.

Setup/Communications

Select Ethernet UDP and deselect Serial Communications.

Once your clock has an IP address, you can enter the exact IP address into the UDP Clock Address Window to communicate exclusively with one clock. Entering 255.255.255.255 in the clock address will cause the control program to perform a UDP broadcast of subsequent commands to ALL clocks on the subnet. Please note that Broadcast commands will be blocked by any router on the network so these commands will only reach clocks on the subnet.

Setup/Clock IP Discovery

This function is probably the most useful for working with Ethernet clocks.

For initial discovery, Enter 16000 in the discovery port address window and enter all 255s in the starting and ending IP address range. The discovery command uses port 16000 for firmware version 5.4 and older. Port 16001 is used for firmware version 5.5 and later.

- Click the 'Locate All Clocks...' button to display the clocks on your subnet.

Your clocks will respond with their current IP and MAC address listed in the window.

If you are using DHCP and the clock has just been connected to your network, it may not display immediately or may respond with an IP address of '.0.0.0.0'. The all zero address is the default in the NIC and indicates that the clock has not yet acquired an IP address lease from your DHCP server.

If you have set a fixed IP address in the clock it should be shown in the window.

If there are several clocks on the subnet, you may not see all of your clocks listed every time the 'Locate...' button is pressed. Since the address range is set to all 255s, the locate command is a UDP broadcast to all clocks at once and sometimes collisions occur because all of the clocks respond at the same time. In this case, change your starting and ending IP address range to match the range of your fixed IP addresses or the address range provided by your DHCP server. The 'Locate...' button will now sequentially poll each of the addresses specified in the address range to avoid collisions.

For clocks manufactured after August 2004, enter 16001 in the discovery port address window and press the 'Locate All Clocks...' button. Clocks will now report the IP and MAC address and will also show the network name for the clock. The default name is 'BRG Clock' and can be changed through the telnet configuration utility to suit your layout or organization. Clocks built before this date will not respond to the 'Locate All Clocks...' command with the port setting at 16001 unless they have an updated NIC.

Clicking on a clock in the discovery list will uniquely select that clock for telnet and other control program commands. The selected clock's IP address will be shown at the bottom of other control program screens to identify the clock that the control program is sending commands to.

If you cannot discover the clock, perform these checks and procedures:

- 'Ethernet' must be selected and 'Serial' must be unselected in Setup/Communications tab of the control program.
- Clock must be on the same subnet as your computer.
- Verify that the hub/switch link light is on.
- Swap cables and couplers.
- Verify that the hub/switch is 10Base-T ½ duplex capable.
- Make sure the discovery address range includes the clock IP address. If the discovery address range is all 255s, all clocks should respond.
- If you do not have a DHCP server and you have not set a fixed IP in the clock, the clock may not respond to the discovery operation.
- Unplug the clock for few seconds to perform a cold boot and retest.

Setup/NTP Timer Servers

The NIC in the clock is preprogrammed with 10 Internet NTP time server IP address. Once your clock has an IP address it will attempt to contact the first NTP time server in the list. If your network firewall prevents the clock from reaching the Internet, you will need to direct the clock to your network NTP time server IP address. The fastest and easiest way to load your NTP timer server address is to use the Setup/NTP Time Servers tab in the control program. You can load the first address and then copy to the other 9 addresses with a single button click. This will load the NIC with your NTP time server address exclusively. To confirm the loading of these addresses, use the telnet configuration utility and select 7 to display the NTP time server address loaded into the NIC.

Testing Ethernet Connectivity and Clock Synchronization

If you want to test a single clock, select the clock on the Setup/Clock IP Discovery screen or enter the unique IP address in the Setup/Communications tab. If you want to test all clocks on a subnet, go the Setup/Communications tab and select the 255.255.255.255 IP address which will send subsequent commands to all clocks on the subnet.

Use the control program and select the Commands/Utility Commands tab. Click the 'ALL ON' button to illuminate all segments and test the lettering on the clock. Time displays will show all 8s and lettering displays will go through a test pattern. Click the 'RESET' button to stop the test and restart the clock. If the clock did not respond, the control program is not communicating with the clock.

The best way to test the clock's connection to a time server is to force the clock to an incorrect time setting and observe the clock to see if it will correct its time after re syncing with the time server. Ethernet clocks are configured to receive

UTC or ZULU time from the time server and then apply the appropriate time zone offset and Daylight Savings Time offsets to correctly display local time.

You can force the clock to an incorrect time by sending your local time from your PC to the clock. Go to the Commands/Utility Commands menu, select 'Local' time and click the 'SEND TIME' button. The clock should immediately jump forward or backwards several hours, depending on your local time zone offset. Unless you have changed the SNTP sample interval in the NIC from the default value of 1 minute, the clock should correct itself within a minute. If the clock re-synchronizes to the minute but does not show the correct hour, the time zone offset may have to be corrected in your clock. Contact Tech Support.

Time Synchronization Problems

If your clock is not synchronizing with an Internet NTP time server, check the following items:

- The clock must have a valid DHCP or fixed IP address.
- The NIC must be in the SNTP operating mode. Confirm using the telnet configuration utility and checking item 2.
- If you are using fixed IP addressing, the clock must have the correct gateway address to access the Internet. The gateway is the first router that the clock must go through to access other networks or the Internet. Confirm using the telnet configuration utility and checking item 5.
- Your network firewall must allow the clock to access the Internet through port 123.
- The clock must have the default NTP timer server IP address loaded into the NIC. Discover and select the clock using the control program, then go to the Setup/NTP Timer Servers tab and click the 'Load Defaults' buttons. You can confirm the loading of the default addresses by using the telnet configuration utility and selecting item 7 to display all NTP time server addresses.

If your clock is not synchronizing with a network NTP time server, check the following items:

- The clock must have a valid DHCP or fixed IP address.
- The NIC must be in the SNTP operating mode. Confirm using the telnet configuration utility and checking item 2.
- If you are using fixed IP addressing, the NIC must have the correct gateway if the server is on another network. The gateway is the first router that the clock must go through to access other networks. Confirm using the telnet configuration utility and checking item 5.
- The correct NTP timer server IP address must be loaded into the NIC. You can confirm the correct address by using the telnet configuration utility and selecting item 7 to display all NTP time server addresses.

Control Program Errors

You may sometimes receive an 'Address in Use' error when using the control program. If this happens, close the control program and go to the Task Manager in your computer. Pressing CTRL+ALT+DEL will bring up the Task Manager on Windows 2000 and XP operating systems. Go to the Processes tab and end the BRGDig process. Close the Task Manager and reopen the control program.

Technical Support

For BRG Technical Support, call 1-316-788-2000, 8am-5pm, Central time, or email www.support@brightclock.com.

Power over Ethernet Option (PoE)

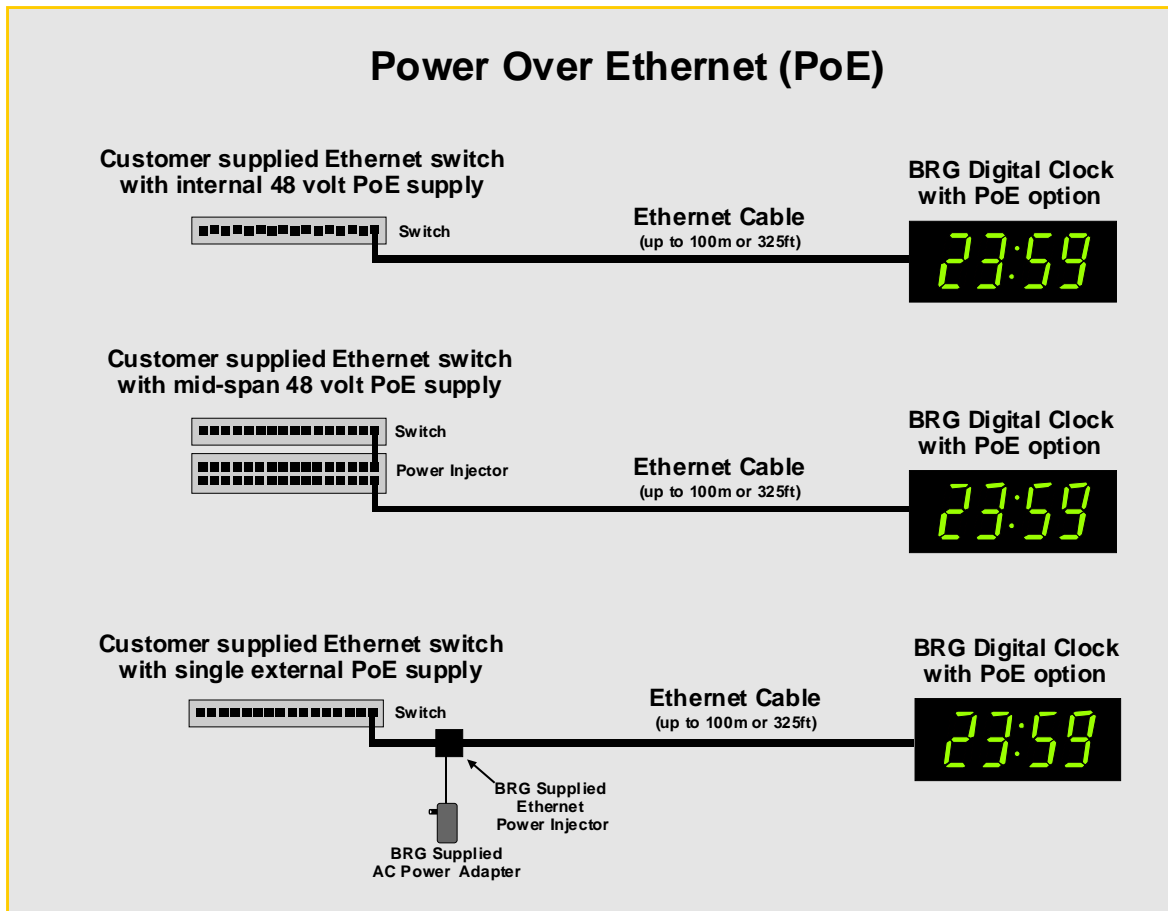
Power-over-Ethernet (PoE) is a network standard based on IEEE 802.3af that provides a means of delivering power to devices connected to the LAN. This technology eliminates AC electrical wiring, wall transformers, allows centralized UPS backup, and is fully compatible with both powered and non-powered Ethernet devices.

In addition to providing time synchronization and control over Ethernet, PoE enabled Ethernet cable provides power to the clock. System installers need run only a single Ethernet cable that carries both power and data to each clock. This allows greater flexibility placing clocks and, in most cases, significantly decreases installation costs. BRG clocks are fully compliant with the IEEE 802.3af standard for providing power over Ethernet. The clocks will work with older non-standard and passive power sources, as well as newer, auto-sensing PoE switches and mid-span power injectors.

Power-over-Ethernet begins with a Ethernet power source such as a PoE compatible Switch or a mid-span power "Injector". These devices insert power onto the Ethernet cable. The power source is typically installed in the "wiring closet" near the Ethernet switch or hub.

Clocks may be ordered as PoE compatible by adding the (P13) power option. This option adds the necessary circuitry to fully implement the IEEE 802.3af standard. PoE is able to supply a maximum of about 15 watts of power over the Ethernet cable. This means that not all clocks are candidates for PoE.

If the access point is not PoE compatible, BRG offers single port mid-span power injectors designed to provide power to a single clock (P14 power option). Multiport mid-span PoE power injectors are available from most network equipment vendors. The voltage injected is 48 volts DC at 0.35 Amps.



Serial Wire Synchronization

The RS-422 protocol used for wire sync communications greatly expands the practical possibilities of the serial bus. It provides a mechanism by which serial data can be transmitted over great distances (to 4,000 feet). This is accomplished by splitting each signal across two separate wires in opposite states, one inverted and one not inverted. The difference in voltage between the two lines is compared by the receiver to determine the logical state of the signal. This wire configuration, called differential data transmission, or balanced transmission is well suited to noisy environments. With balanced transmission, this potential difference will affect both wires equally, and thus not affect their inverse relationship. Twisted pairs of wire, which ensure that neither line is permanently closer to a noise source than the other, are often used to best equalize influences on the two lines. Errors can also be caused by high noise levels which affect one side of the receiver to a different extent than the other. To combat this, each receiver is generally grounded.

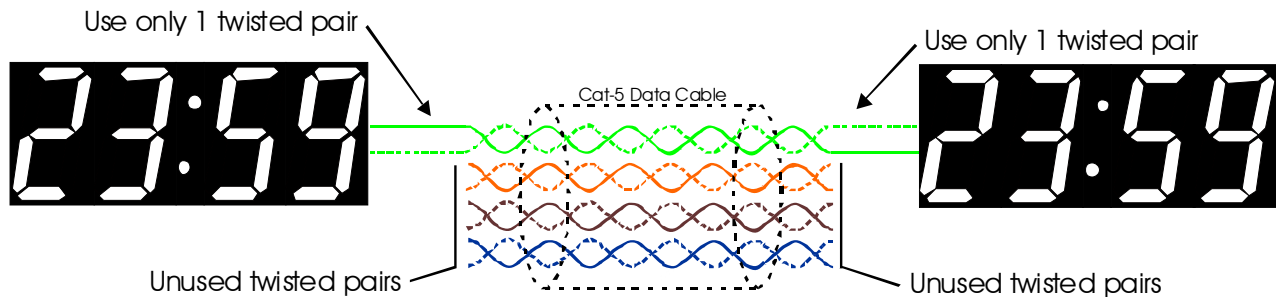
RS422 Serial Communications

BRG clocks utilized an industry standard RS422 buss transceiver that meets or exceeds ANSI Standards EIA/TIA-422-B and ITU Recommendation V.11. This device includes the following features for improved reliability: **USE ONLY RS422 VOLTAGES. DO NOT APPLY POWER VOLTAGES TO THE SYNC WIRING.**

1. Thermal Shutdown Protection
2. Positive and Negative Current Limiting
3. 60 mA Output Current
4. Automatic Noise Suppression

One BRG clock will drive up to 5 slave clocks when wired in parallel, or an unlimited number of clocks if they include an input, and output and are wired in series.

Common Cat-5 twisted pair data cable may be used to carry serial data between clocks. **DO NOT USE POWER WIRE OR NON-TWISTED WIRE AS DATA CABLE.**



Diagnostics –

With power applied to the clock, connect a red ohm meter lead to the red Input sync wire and the black ohm meter lead to the black Input sync wire. You should see a reading of 120 ohms. A lower resistance indicates a short in the sync wiring or clock circuit. A higher resistance indicates a disconnected sync wire or a problem with the clock's sync circuit.

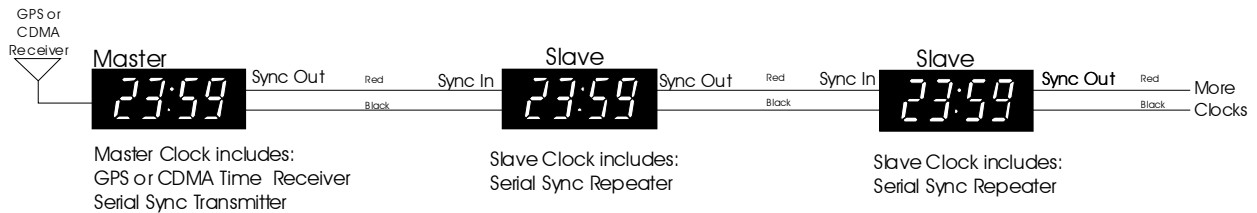
The sync output of the clock may be measured with a volt meter. There should be 5 volts when the meter's red lead is connected to the red Output sync wire, and the meter's black lead connected to the clock's black Output sync wire. If the clock is configured as a master to send sync data once per second, you will see a momentary voltage drop using an analog meter. Digital meters may not be fast enough to detect the sync pulse. If the clock is configured as a repeating slave, it will only send sync data when sync data is received. In other words, it is configured to repeat all sync data received.

LED sync detector –

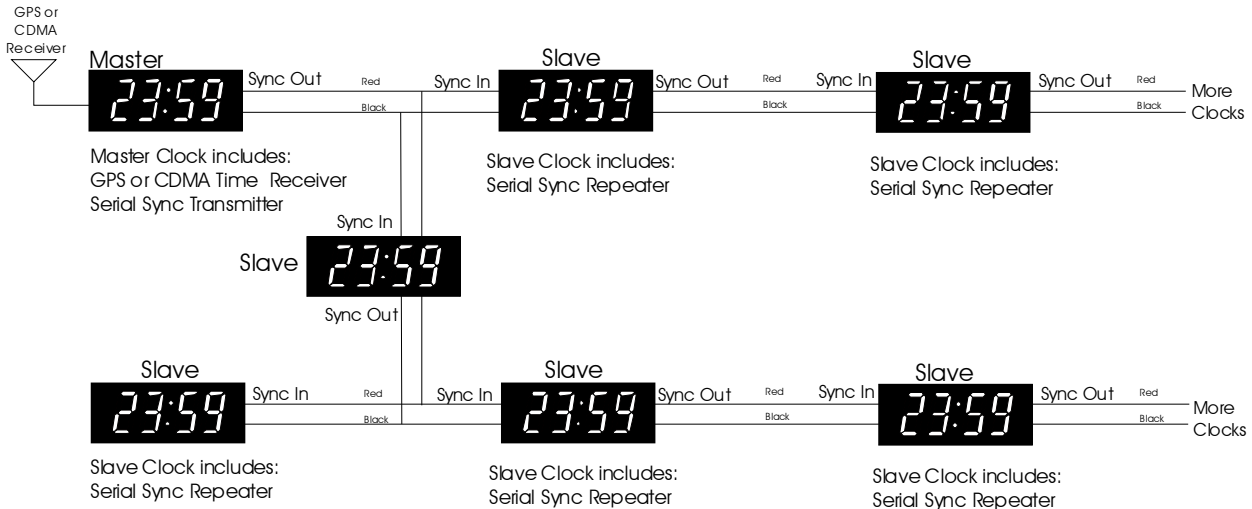
A common LED (light emitting diode) may be used to detect the presence and polarity of sync data. Connect the anode of the LED to the red Output sync wire and the LED cathode to the black Output sync wire. On most 5mm LED's, the anode lead is the longer of the two leads. The LED should continuously illuminate. If the clock is configured to transmit, the LED should blink off momentarily when the sync data is sent. If the LED polarity is reversed, the LED will remain off. When the clock sends sync data, the LED will blink momentarily.

Wired Synchronization Examples

The following example illustrates how all clocks may be synchronized to the master using only two wires. The slave clocks repeat the sync signal. Use Cat-5 twisted pair wire for up to 4,000 feet between any two clocks.



The following example illustrates how the sync wiring may be "T" or "Y" connected to supply more clocks. Any Sync Output may be split to supply two other clocks. This allows greater flexibility during installation.



PC USB / RS422 Adapter

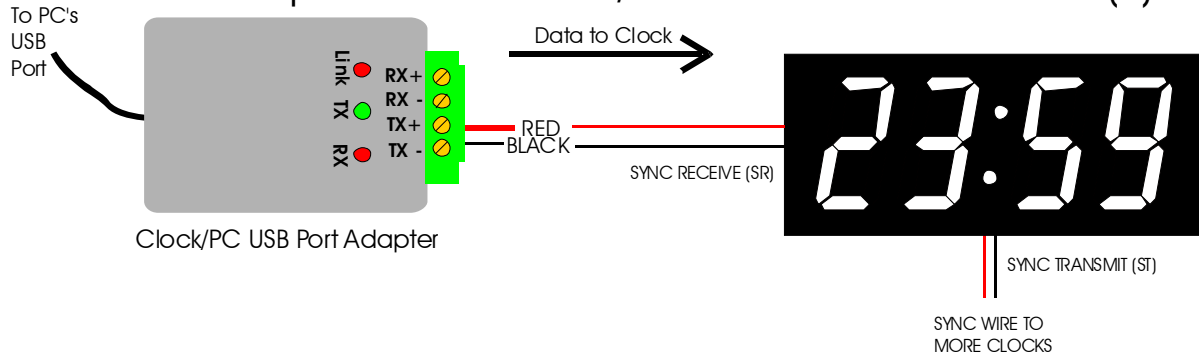
USB/422 Adapter

This option allows the clock to be set by PC or the PC to be set by the clock. A USB interface adapter is included for connecting the clock to a computer. Simply attach the adapter to the clock sync line and plug into the PC's USB port. A software CD is included for the Windows operating system. A driver is also included on the BRG Digital Clock controller software CD under the directory – USB Adapter Driver 2.0. The driver can also be downloaded from <http://www.brgprecision.com>. Windows will detect the USB connection and will direct you to insert the CD. Once connected, the time and date may be exchanged between the PC and clock(s). The scheduling program included with Windows can be configured to run the time send software anytime between once per minute and once a day, or longer. The serial sync options, ST and/or SR, are required. This will strip off daylight savings time and convert the local time to UTC time for use by the time zone display. One BRG clock will drive up to 5 slave clocks when wired in parallel, or an unlimited number of clocks if they include and input and output and are wired in series.

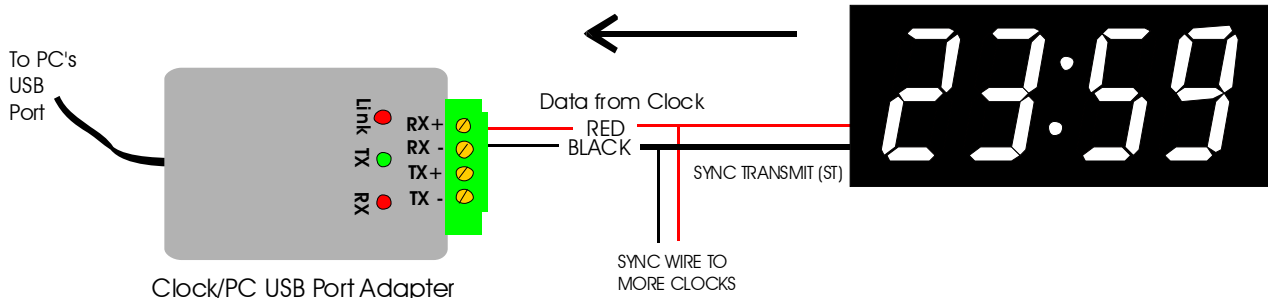
PC/Clock USB Interface Adapter package includes: USB Adapter, USB patch cable, software CD, installation and operating instructions (this sheet). **The USB adapter draws its' power directly from the USB port. No AC power module is required.**

PC / Clock USB Port Adapter

Example 1 - Send time/date from PC to CLOCK(S)



Example 2 - Send time/date from CLOCK to PC



PC Serial RS232/RS422 Adapter

Ic485-I Adapter

This option allows the clock to be set by PC or the PC to be set by the clock. A serial interface adapter is included for connecting the clock to a computer. Simply attach the adapter to the clock sync line and plug into the PC's serial port. Software is included for DOS, Windows 3.x, 95, 98, NT, ME, XP and 2000. Once connected, the time and date may be exchanged between the PC and clock(s). The scheduling program included with Windows can be configured to run the time send software anytime between once per minute and once a day, or longer.

RS422 Serial Communications

BRG clocks utilized an industry standard RS422 buss transceiver that meets or exceeds ANSI Standards EIA/TIA-422-B and ITU Recommendation V.11. This device includes the following features for improved reliability:

1. Thermal Shutdown Protection
2. Positive and Negative Current Limiting
3. 60 mA Output Current
4. Automatic Noise Suppression

One BRG clock will drive up to 5 slave clocks when wired in parallel, or an unlimited number of clocks if they include an input and output and are wired in series.

Diagnostics –

With power applied to the clock, connect a meter's red lead to the red Input sync wire and the black meter lead to the black Input sync wire. You should see a reading of 12 K ohms. A lower resistance indicates a short in the sync wiring or clock circuit. A higher resistance indicates a disconnected sync wire or a problem with the clock's sync circuit.

The sync output of the clock may be measured with a volt meter. There should be 5 volts when the meter's red lead is connected to the red Output sync wire, and the meter's black lead connected to the clock's black Output sync wire. If the clock is configured as a master to send sync data once per second, you will see a momentary voltage drop using an analog meter. Digital meters may not be fast enough to detect the sync pulse.

If the clock is configured as a repeating slave, it will only send sync data when sync data is received. In other words, it is configured to repeat all sync data received.

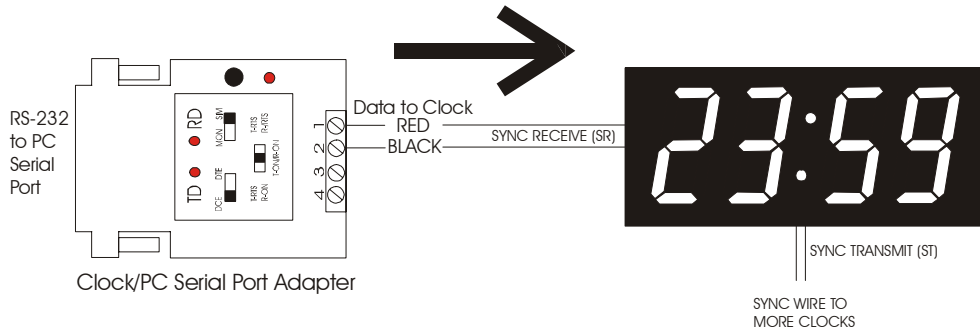
LED sync detector -

A common LED (light emitting diode) may be used to detect the presence and polarity of sync data. Connect the anode of the LED to the red Output sync wire and the LED cathode to the black Output sync wire. On most 5mm LED's, the anode lead is the longer of the two leads. The LED should continuously illuminate. If the clock is configured to transmit, the LED should blink off momentarily when the sync data is sent.

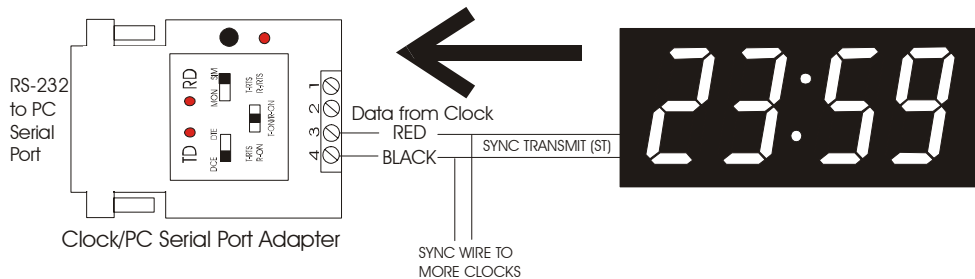
If the LED polarity is reversed, the LED will remain off. When the clock sends sync data, the LED will blink momentarily.

PC/Clock Serial Interface Adapter package includes: Serial Adapter, 9 to 25 pin adapter, software CD, installation and operating instructions (this sheet). **The serial adapter draws its' power directly from the serial port. No AC power module is required.**

Example 1 - Send time/date from PC to CLOCK(S)



Example 2 - Send time/date from CLOCK to PC



59th Minute Analog Master Clock Operation

Description

A single BRG digital clock may control 500 or more 59th minute analog slave clocks. 59th minute analog clocks are used for their increased reliability over older analog clock systems. The 59th minute analog clock contains a microprocessor that greatly reduces the power required compared to older clock designs. No relays, ratchets or pawls are used. All power and sync pulses to the analog clocks are provided over a simple three-wire circuit. The master clock sends minute and second correction impulses hourly. Additionally, at 5am and 5pm, the hour is corrected. In the event of a power outage, the master clock will continue to keep time up to ten years. When the power returns, the master clock will correct the analog clocks at the next regular sync interval. If continuous time display is required during a power outage, a simple off-the-shelf uninterruptible power supply (UPS) will provide many hours, if not days of operation for the entire system.

Installation

It is recommended to use 14 ga. to 16 ga. wire between the master clock and analog clocks. Any wiring layout may be used including star, “T”, and buss configurations. More wiring “legs” will reduce overall wiring resistance. All wiring should be in parallel. If the master clock needs to be removed for any reason, the slave clocks will continue to operate normally, although they will no longer receive correction pulses from the master clock.

If a single clock needs to be removed for any reason, unplug the connector plug from the analog clock’s pins. The master clock may remain powered. To return an analog clock to operation, plug the connector back onto the analog clock’s pins. The clock will be corrected at the next regular sync interval.