# ULTRA LINK

Linking computers to the real world

## DESCRIPTION

### General

The Model 333 provides UTC time (universal coordinated time) and date information based on the United States Atomic Clock Standard as broadcast by WWVB operated by the National Institute of Standards and Technology (NIST).

All WWVB broadcast information including the date, time, flags and signal strength are available on the unit's display and via an RS232 interface. WWVB signal strength is also indicated on an analog meter.

### Functional

The unit consists of two elements: the antenna/ receiver and the decoder.

The antenna incorporates a high quality ferrite loopstick which is factory tuned for maximum sensitivity and selectivity.

The receiver uses baseband amplification with crystal bandpass filtering. This is followed by a demodulator which provides a digital output corresponding to received signal data.

The display unit uses a microprocessor to decode WWVB time code signals using synchronous bit detection. This processor also correlates received WWVB information to provide accurate time used to set the onboard real-time clock (RTC).

The RTC counters are driven by a precision quartz reference for continuous accurate timekeeping.

Time, date and receiver status information is available on a 2 X 16 line alphanumeric display.

The RS232 interface provides communication of time, date and flags to external computing devices.

Analog signal conditioning is used on receiver AGC signals for indication of WWVB signal strength.

Power circuitry provides internal operating voltages and maintenance of onboard rechargeable standby batteries.

### Physical

Both units are contained in polystyrene enclosures. The receiver can be located for maximum reception and the decoder display unit may be located for convenient viewing. Receiver, RS232 and power inputs are by rear panel connectors.
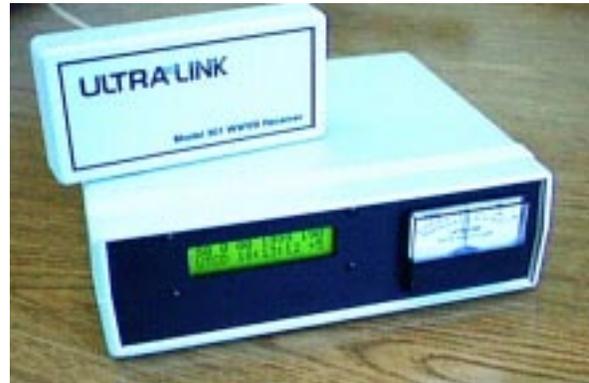


## FEATURES

- Backlight LCD display
- Analog field strength meter
- Display of all received WWVB information including leap year, leap second, daylight savings and UTC correction flags
- Internal clock for loss of signal periods
- 0.01 second accuracy
- RS232 interface with ASCII formatted data
- 1 pulse per second BNC and DCE output
- AC powered using wall mounted transformer
- Battery backed-up RTC with onboard recharger

## APPLICATIONS

- Accurate UTC clock
- Computer time synchronization
- Facilities time standard
- Laboratory clock
- WWVB field strength monitoring
- WWVB transmitted code monitoring

# OPERATION

## General

Displays are located on the Model 333 front panel as shown below:
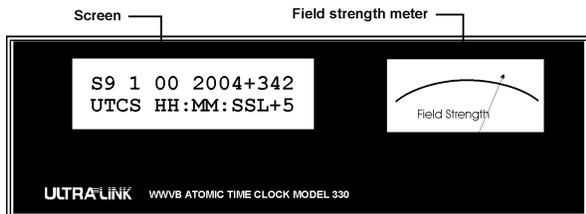


**Field strength meter -** Analog meter indicating signal strength in "S" units.

**Screen -** A two line by 16 character display shows date, time, flag and receive status information. Information format follows:
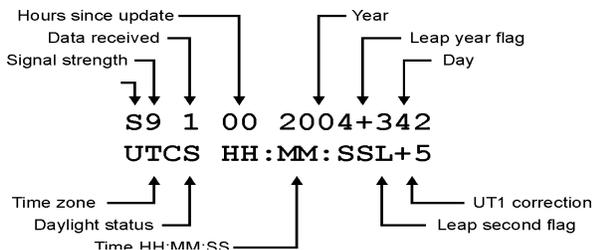


*Receive status -* Indicates receiver synchronized (S) or reception noisy (N).

*Signal strength -* Indicates peak signal strength in "S" units. If signal strength over S9 it is followed by a "**+**".

*Data received -* Indicates value of last second's data bit = **0**, **1**, **2** (mark) or **3** (unknown).

*Hours since update -* Indicates time since last WWVB synchronization as follows:

      **Lk** - Locked to WWVB

      **00** to **23** - hours since last update

      **1d** to **7d** - days since last update

*Year -* Indicates received year corrected to reflect proper century - valid from 1990 to 2089.

*Leap year flag -* Blank if not leap year, + if leap year.

*Day -* Shows number of the current day in the year.

*Time zone -* shows date/time display time zone.

*Daylight status -* indicates winter/summer time as follows:

| | |
|---|---|
| **S** | Indicates standard time (STD). |
| **O** | Transition into DST from STD. Set at 0000Z on first DST day and changed to a **D** 24 hours later. |
| **D** | Indicates daylight savings time (DST). |
| **I** | Transition into STD from DST. Set at 0000Z on first STD day and changed to **S** 24 hours later. |

*Time -* Current time in hours, minutes, seconds .

*Leap second flag -* Changes from (sp) to +/- during month preceding leap second adjustment.

*UT1 correction -* UT1 adjustment (+/- .1 second increments).

**Power -** AC power is indicated by screen illumination.

## Connectors

Connection of power and various signals is made on the rear panel of the Model 333. Rear panel components and their function is shown below:
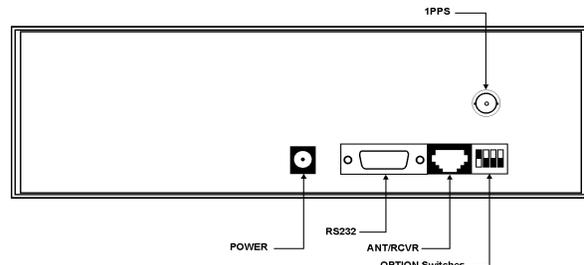


**Power -** 2.5mm dia jack mates with power cord on Ultralink supplied wall mounted power supply.

**RS232 -** 9 pin female "D" connector (DB9F) mates with RS232 cable to host computer using either DB9M or DB25F at host end. RS232 pin assignments are as follows:

| Pin | Signal |
|---|---|
| 1 | 1 PPS (DCE) |
| 2 | TXD (out) |
| 3 | RXD(In) |
| 5 | GND |
| 7 | RTS |

**Option switches -** 4 position dip switch provides installed option selection as follows:

1      Battery backup - on is enabeled
2-4    Reserved.

**ANT/RCVR -** RJ11 6/4 jack mates with 4-wire modular cable to connect to Ultralink antenna/receiver assembly. This cable is supplied with the antenna/receiver assembly.  RJ11 connector pinouts are as follows:

| Pin | Signal |
|---|---|
| 1 | Reserved |
| 2 | VCC |
| 3 | TCO |
| 4 | AGC |
| 5 | GND |
| 6 | Reserved |

Pin 1 is at the left with the locking tab facing down.

**1 PPS -** BNC female connector.

## OPERATION - *continued*

### Installation

The antenna/receiver unit is designed to be used indoors in a wood frame structure. Operation inside metal buildings or buildings with metal reinforcements may be marginal. Locate the receiver in a good reception area such as near a window or in an attic.

The antenna/receiver should be mounted with the long side horizontal. It may be mounted flat (table/shelf) or vertical (wall mounted). The antenna/receiver is directional with best reception obtained with the long side perpendicular to Fort Collins, Colorado.

Avoid locating near suspected interference sources such as:

Lamp dimmers            Fluorescent lamps
Electronic igniters     CRT monitors
Battery chargers        Switching power supplies
Motors                  Automobile ignition systems
Power lines             Nearby radio transmitters

> **Note:** Interference is diminished by the square of the distance (i.e., doubling the distance from the source will reduce its effect by 4).

Connect the antenna/receiver to the decoder/display unit using the modular cable supplied. This connection should be made before connecting the unit to power or turning on battery backup supply.

If longer modular cable length is required to move the receiver away from noise sources, use a modular cable with pin 1 to pin 1 connections (normal telephone modular cables are reversed) or use a telephone extension cable available from local sources which are normally wired with 1 to 1 connection.

For best reception, orient the antenna/receiver for maximum signal strength as indicated on the field strength meter. If the signal level is less than S8 move the antenna to a location where it improves.

After final orientation secure receiver to prevent inadvertent movement (double sticky tape is OK).

Connection to the power supply is by the 2.5mm power jack. A mating plug is on the cord attached to the wall mounted power supply furnished. Install power supply in a 120 VAC outlet before connecting to the unit.

Computer connection is by the DB9 connector. This cable may be up to 25' in length. A null modem cable is not required when connecting to a PC.

Connection to the 1PPS TTL signal is by coax having a BNC male connector at the Model 333 end. This cable should not be longer than 10' (3 meters) without buffering.

### Initialization

Option Switch 1, located on the M333 rear panel, is backup battery enable. This is shipped in the "off" position and should be turned "on" when placing unit in service.

Once power is connected the Model 333 display will become active and operation is commenced. Operation is automatic with no operator input or adjustments required.

The decoder may be reset by removing power and disconnecting battery (setting Options Switch 1 to "off") for a few seconds. When powered up, the decoder initiates a reset cycle which lasts two seconds. RS232 commands sent during the reset cycle will be ignored.

### Time Synchronization

Upon initialization, time and flag fields are blank. The unit automatically verifies time, date and flag information. The time display progressively indicates validated time fields starting with seconds. Upon complete time/date correlation, time delimiters change to colons (**:**). Flag quality is shown after correlated flag values are received.

Once time and flags have been validated, time resynchronization and flag validation is continuous.

### RS232 Interface

Power for the RS232 circuitry is derived from the RTS signal line. The host RS232 communication program should allow a 10 milliseconds delay after making the RTS signal active, and flush it's UART's buffer before initiating RS232 communication.

Data is read by single ASCII character sent to the unit. A carriage return is not required after each command. Invalid commands are ignored.

Sending a **"T"** returns a 34 byte string beginning with (cr)(lf) followed by data exactly as shown on the LCD display as follows:

 **(cr)(lf)S9+1 00 2004+342UTCS  HH:MM:SSL+5**

The first character **(cr)** is the "mark" and is output within one millisecond of the time returned.

Sending an **"I"** returns the 10 byte ID string:

**(cr)(lf)ULM330.H**

# SPECIFICATIONS

**Operational**

Receiver

| | |
|---|---|
| Transmitter received | WWVB |
| Receive frequency | 60 kHz |
| Transmitter location | Ft. Collins, Colorado USA |
| Modulation type | 10 dB carrier reduction |
| Receive bandwidth | 7Hz @ 3dB points |
| S/N @ 50uV/meter (S9) | 14 dB average daylight background |
| AGC signal | 0.55 to 0.96V @ 0.007 V/dB 50 uV/meter (S9) = 0.72V |
| Reception | Est >23 hours/day @ 50 uV/meter signal strength with background noise only (electrically noise free environment) |

Decoder

| | |
|---|---|
| Time acquisition | Approximately 8 minutes for complete time and flag validation under noise free signal reception conditions |
| Clock absolute accuracy | +/- 0.015 sec during upon reception .015 sec/hour drift during loss of signal periods |
| Clock repeatability | +/- 2 milliseconds when "Lk" indicated |
| Display | 2 X 16 LCD alphanumeric character display with LED backlight |
| Field strength | Indicated in "S" units (approximately 5 dB/S unit), S9 is 50 uV/meter |
| Date range | Indicates correct year from 2000 to 2099 |
| RS232 baud rate | 9600 |
| RS232 protocol | 8,1,N |
| Receiver enable | Continuous |
| 1 PPS signal | 50% duty cycle TTL. Low to high transition indicates beginning of second |

**Physical**

| | |
|---|---|
| Receiver/decoder cable | RJ11-4/6 wired pin 1 to pin 1 - 300 feet maximum length |
| Data cable | DB9M -25 feet maximum length |
| Size | |
| Antenna/receiver | 5.2" L X 2.6" W X 1" H |
| Decoder | 8" W X 2.5" H X 7" D |
| Weight | 1.5 Lb |
| Construction | Polystyrene enclosures for both units |

**Electrical**

| | |
|---|---|
| Power | 120 VAC @ .04A primary converted to 5 V DC @ 300 mA with UL approved plug mounted power supply |
| Backup power | 3.6V NiCad rechargable with 24 hour backup for RTC and field strength metering. Display is not operational while running on backup power |

**Environmental**

| | |
|---|---|
| Operating temperature | +10 to +35 C |

# ORDERING INFORMATION

Order Model 333. Includes:

> Receiver with antenna
> Decoder with display and meter
> 14' modular connecting cable
> Wall mounted power supply
> 6' DB9M/F RS232 cable

For operation with computer having DB25 serial port requires DB9M/DB25F adapter (see price list).

For special applications, contact factory.

Made in the USA.

# ULTRALINK

Phone 775 782 9758
Fax 775 782 2128
Email info@ulio.com
Website www.ulio.com
Mail PO Box 1809, Minden, NV 89423
Ship 1547 Anthony Ct, Gardnerville NV 89410