



Linking computers to the real world

WWVB Receiver/Decoder with RS232 Interface

DESCRIPTION

General

The Model 325 provides accurate time and date information referenced to the United States Atomic Clock Standard. The unit receives VLF (very low frequency) radio signals 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 via a RS232 interface.

Physical

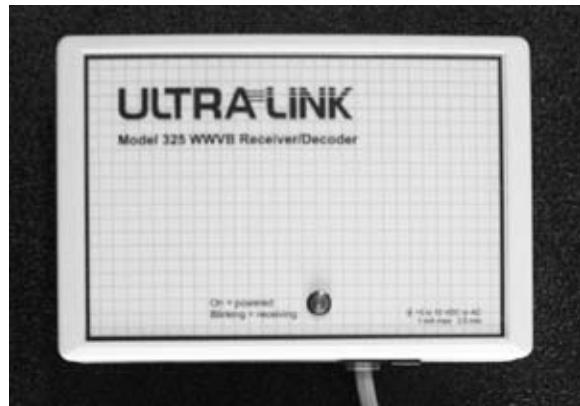
The Model 325 is housed in an enclosure for mounting in a convenient indoor reception location. Connection to the host computing device is via a "modular" cable with adapters available for both DB9 and DB25 RS232 connectors. The modular connection cable can be up to 100 feet in length.

Functional

The receiver incorporates a high quality ferrite loopstick antenna, factory tuned for maximum sensitivity and selectivity. The receiver uses baseband amplification with crystal bandpass filtering. A demodulator provides a digital output corresponding to received signal data.

A microcomputer processes WWVB signals, maintains an accurate real time clock and hosts the serial communication interface. Received data is correlated over time to set an internal real-time clock (RTC). The RTC is driven by a precision quartz crystal for continuous accurate time reference.

Power circuitry provides internal operating voltages and maintenance of on board rechargeable standby battery.



FEATURES

- RS232 serial ASCII communication protocol
- Leap year, leap second and daylight savings flags
- 1 pulse per second output
- +/- 1 millisecond relative accuracy possible
- RS232 or externally powered
- Internal clock for loss of signal periods
- Crystal filter for maximum selectivity
- Tuned loopstick antenna for maximum sensitivity

APPLICATIONS

The M325 can be used as precision time reference for the following:

- Personal computers
- Security/entry systems
- Data acquisition systems
- Timers/sequencers
- Telephone systems

OPERATION

Commands and Responses

All operation is by RS232 serial data port. Commands are by a single ASCII character sent to the unit. A carriage return is not required after each command. Invalid characters are ignored.

Time data is read by sending a "T".

RS232 data is a 34 byte string beginning with (cr)(lf) followed by an ASCII string as follows:

(cr)(lf)R5_1C00L2004+342UTCS_HH:MM:SSL+5

Data above is defined as follows (underline is space):

Chr 3,4 - Signal readability from R1 to R5 (1 is unreadable, 5 is good).

Chr 5 - Space

Chr 6 - Indicates value of previously received data bit = **0**, **1**, **M** (mark) or **?** (unknown).

Chr 7 - Station ID Indicates reception from **Colorado** or **Hawaii**.

Chr 8,9 - Indicates hours since last WWVB time and flag code update - 00 to 99.

Chr 10 - **L** indicates the receiver is currently phase locked to WWVB, Blank if unlocked (poor reception).

Chr 11,12, 13, 14 - Indicates received year corrected to reflect proper century - valid from 2000 to 2099.

Chr 15 - Blank if not leap year, + if leap year.

Chr 16,17,18-Shows number of the current day in the year - 000 to 365/6

Chr 19, 20, 21 - Indicates displayed time as **UTC**

Chr 22 - Standard/daylight status indicated 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.

Chr 23 - Space

Chr 24,25 - Time hours **00** to **24**

Chr 26 - Delimiter Upon time/date validation, time delimiters change from (sp) to colons (:).

Chr 27,28 - Time minutes **00** to **59**

Chr 29 - Delimiter - see above.

Chr 30,31 - Time seconds **00** to **59**

Chr 32 - Leap second flag - Changes from (sp) to +/- during month preceding leap second adjustment.

Chr 33,34 - UT1 correction (+/- .1 second increments).

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

The units ID and software revision is read by sending an "**I**". This returns a 10 byte ID string:

(cr)(lf)ULM325.B

Initialization

When powered up, the decoder initiates a reset cycle which lasts one second. RS232 commands sent during the reset cycle will be ignored. Once power is connected the Model 325 will become active and operation is commenced.

The Model 325 may be reset by removing power for a few seconds.

Time Synchronization

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

Time validation may take from a few minutes to hours depending on reception conditions. Once time and flags have been validated, time re-synchronization and flag validation is continuous.

INSTALLATION

Power

Power for the Model 325 may be derived from any of the following sources:

- +5 to +15 VDC or AC to the 2.5 mm dia. jack
- +5 to + 15 VDC or AC to the modular jack pin 1
- RS232 from RTS(+) and RXD(-) signal lines

Serial (RS232) Interface

A 6 pin modular jack is used to connect to all operating signals. Signal pin connections are as follows:

Pin	Signal
1	Power (see above)
2	RXD (in)
3	GND
4	TXD (Out)
5	RTS
6	1 PPS (DCD)

Note: If RS232 powered and 1PPS signal not required, a 4 pin modular cable may be used.

Receiver Location

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.

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).

Orient the antenna/receiver for steady blinking of the power/signal LED. After final orientation secure receiver to prevent inadvertent movement (double sticky tape is OK).

In some areas of the country the signal may not be available 24 hours a day. In these cases setup and initial reception are usually best done at night. The unit is designed to keep accurate time during marginal reception periods after time is initially acquired.

SPECIFICATIONS

Operational

Transmitter received	WWVB
Receive frequency	60 kHz
Transmitter location	Ft. Collins, Colorado USA
	Barking Sands, Kauai, Hawaii, USA
Modulation type	10 dB carrier reduction
Receive bandwidth	7Hz @ 3dB points
S/N @ 50uV/meter	14 dB average daylight background
Reception	Est >23 hours/day @ 50 uV/meter
	signal strength with background noise only (electrically noise free environment)
Time acquisition	Approximately 5 minutes for complete time and flag validation under noise free signal reception conditions
Clock absolute accuracy	+/- 0.015 sec upon reception .015 sec/hour drift during loss of signal periods
Clock repeatability	+/- 2 milliseconds when "L" indicated
Date range	Indicates correct year from 2000 to 2099
Serial baud rate	9600
Serial protocol	8,1,N
Receiver enable	Continuous
1 PPS signal	50% duty cycle. Low to high transition indicates beginning of second

Physical

Data cable	4 or 6 wire modular (telephone) cable up to 250' maximum length.
Size	5.4" L X 3.6" W X 1" Tk
Weight	1.0 Lb
Construction	Polystyrene enclosure

Electrical

Power	+5 to + 12 V AC/DC - 3 mA or RS232
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Environmental

Operating temperature	+10 to +35 C
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ORDERING INFORMATION

Order Model 325 - Includes 25' modular cable and DB9 RS232 mating connector.

Options include:

5 VDC power supply with 2.5 mm jack

50'.100' modular cable

Modular to DB25 connector

Special data formats and signal outputs available. Contact factory for information.

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