# Contents

## Chapter 1: Frame Overview

## Chapter 2: 5300BH Battery Holder

## Chapter 3: 5300CA Control Assembly Module

# Chapter 4: 5300ET Electronic Timer Module

# Chapter 5: 5300 Master Oscillator Module

# Chapter 6: 5300MB Modem Board

## Chapter 7: 5300 RI Reference Interface Module

## Chapter 8: 5300CD Clock Driver Module

# Chapter 9: 5300CD-24 Clock Driver Module

# Chapter 10: 5300PS Power Supply

# *Chapter 1*

## *Frame Overview*

# 1.1 Introduction

The CSD-5300 Clock System Driver is designed to be a central source of time for broadcast or computer facilities. It operates as a high stability stand alone clock. If required, it will automatically update its time from a central standard. The CSD-5300 unit provides the following outputs:

3. SMPTE/EBU Serial Time Code, 600 Ω bal.

4. SMPTE/EBU Serial Time Code, Low Z bal.

5. Serial BCD Time

6. 1 Hz

7. 60/50 Hz

8. 2-phase, 12/24 VDC Impulse Drive

9. Parallel BCD Time

10. 1 MHz / 100 kHz (jumper selectable)

11. 5 MHz Sine Wave, 75 Ω, 2 Vp-p

12. Time Markers, 600 Ω bal.

13. Time Markers Present

14. Time and Date, ASCII 300 baud, Bell 103 Modem (on demand)

15. Time and Date, ASCII RS232 300 baud (on demand)

# 1.2 Specifications

**Inputs**

**External Reference**

| | |
|---|---|
| Frequency | 5 or 10 MHz |
| Level | 2 Vp-p ±3 dB |
| Impedance | 75 Ohms, loop-through |

**External Strobe**

| | |
|---|---|
| Input | contact closure or logic level falling edge |
| Logic levels | TTL compatible |

### Outputs

**SMPTE /EBU Time Code**

| | | |
|---|---|---|
| Format | | SMPTE/EBU (nondrop frame) |
| Output 1 | Level | +10 dBm nominal unloaded, -3 dB into 180 Ohms |
| | Impedance | Low-Z, balanced |
| Output 2 | Level | +4 dBm nominal |
| | Impedance | 600 Ohms, balanced |

**RS232 Interface**

| | |
|---|---|
| Interface type | data set |
| Baud rate | 300 |
| Parity | none |
| Data format | 8 bits, 1 stop bit |

**BCD Parallel Time**

| | |
|---|---|
| Data format | BCD parallel frame count, seconds, minutes and hours |
| Level | 5 volt logic levels |
| Drive capability | 4000 Series, CMOS outputs. |

**BCD Serial Time**

| | |
|---|---|
| Data format | BCD serial frame count, seconds, minutes and hour with related clock and latch pulses |
| Clock format | data valid on falling edge of clocks |

**BCD Serial Time (Cont.)**

| | |
|---|---|
| Latch format | active low pulse at end of frame |
| Level | 5 volt logic levels |
| Drive capability | HC CMOS outputs (LSTTL compatible) |

**Marker Beeps**

| | |
|---|---|
| Frequency | 1200 Hz (1000Hz for EBU) |
| Duration | 0.3 second |
| Timing | 1 pulse on the hour, double pulse on the half hour with 0.3 sec. spacing. Separate enable for each signal. |
| Level | 8 dBm nominal |
| Impedance | 600 Ohms balanced |

**Tone Present**

| | |
|---|---|
| Output | High during tone output |
| Level | +5 V logic levels |
| Drive capability | HC CMOS output (LSTTL compatible) |

**Reference Outputs**

| | |
|---|---|
| Output 1 Frequency | 5 MHz |
| Level | 2 Vp-p |
| Impedance | 75 Ohms |
| Output 2 Frequency | 100 kHz / 1 MHz square wave (jumper selectable) |
| Level | 5 volt logic levels |
| Drive capability | HCCMOS output (LSTTL compatible) |

**1Hz, 60Hz/50Hz**

| | |
|---|---|
| Frequencies | 1Hz, 60Hz/50Hz square waves |
| Level | 5 volt logic levels |
| Drive capability | HC CMOS output (LSTTL compatible) |

**Time Valid**

| | |
|---|---|
| Output | active high |
| Level | 5 V logic levels |
| Drive capability | HC CMOS output (LSTTL compatible) |

**Telephone Interface**

| | |
|---|---|
| Format | Bell 103 compatible, originate and answer modes |
| Modem | autoanswer, autodial with speaker and volume control |
| Dialing capability | up to 25 digits, DTMF, pulse or combination with programmable interdigit delay. |
| Receive sensitivity | -50 dBm |
| Transmit level | -10 dBm |
| Connector | modular jack, compatible with RJ11, RJ12 and RJ13 type jacks |

**Impulse Drive**

| | |
|---|---|
| System | 2-phase, +12/24 VDC |
| Maximum load | 25 impulse clocks |
| Drive protection | current limiting |
| Clock correction after power failure or shorted outputs | automatic |

**Performance**

| | |
|---|---|
| Oscillator aging | <5 parts in 108 per month |
| Oscillator stability with 10% line voltage variation | <1 part in 108 |
| Oscillator stability with temperature change from 0° to 50°C | <1 part in 108 |
| Oven warm up time | <20 minutes |
| Time acquisition accuracy | |
|    Over telephone line | <1 ms of source * |
|    Using external strobe | <20 µs of strobe |
| Compensation for telephone line loop delay | automatic |
| Detection of asymmetric loop | automatic with user definable parameters |
| External standby battery capability | unit fully operational |
| Internal standby battery capability | timekeeping only for over 8 hours (no outputs enabled). |

*\* Under normal telephone line operating conditions. Operation in extraordinary conditions cannot be guaranteed.*

**Temperature Range**

| | |
|---|---|
| Operating | 0-50°C |
| Performance | 5-40°C |

**Electrical**

| | |
|---|---|
| Line Voltage | 95/135 VAC |
|   Frequency | 60 Hz/50Hz |
|   Power Consumption | 20 VA |
| External standby battery Voltage | 20-26 V |
| Power Consumption | 15 W |

**Mechanical**

| | |
|---|---|
| Height | 44 mm (1.75 inches) |
| Width | 483 mm (19 inches) |
| Depth from mounting surface | 290 mm (11.5 inches) |
| Overall depth | 320 mm (12.5 inches) |
| Weight | 5.7 kg (12.5 lbs.) |

*Specifications and designs are subject to change without notice.*

# 1.3 Installation

The CSD-5300 Clock System Driver is carefully inspected, tested and calibrated before shipment to ensure stable and trouble-free service. Please check the unit for any visible damage which may have been caused during transit. Ensure that the modules have remained properly seated in the mounting frame.

## 1.3.1 Mounting Requirements

The CSD-5300 unit requires 44 mm (1.75 inches) of standard 483 mm (19 inches) rack space. The minimum depth required behind the mounting surface is 290 mm (11.5 inches).

## 1.3.2 Cooling Requirements

The Clock System Driver is designed to meet specifications in an ambient temperature range of 5°C to 40°C. No special provisions for cooling are necessary, but care should be taken to prevent excessive heat rise in closed, unventilated equipment racks.

## 1.3.3 Power Supply

The power consumption of the CSD-5300 unit is 20 VA based on the normal module complement at nominally 95/135 VAC, 60 Hz/50 Hz. The driver is equipped with a detachable power cord and a resettable circuit breaker.

## 1.3.4 Internal Battery Supply

The CSD-5300 unit is equipped with an internal battery pack. In case of a power failure, only the time keeping circuitry is kept operational and all outputs are disabled.

The battery pack contains three 9 Volt batteries. If primary batteries are used, type MN1604 alkaline batteries or equivalent, are recommended. With this type of battery, the circuitry will operate for over 8 hours.

If secondary batteries are to be used, resistors can be added to the battery pack to allow charging.

**NOTE:** **To prevent discharging of the internal battery supply, the battery pack is removed for shipment.**

### 1.3.5   External Battery Supply

Provision is made to allow the connection of an external, user supplied, 24 Volt battery if operation of the entire unit is required during AC power failures. The connecting terminal block for the external battery is located on the rear panel.

### 1.3.6   5300ET Electronic Timer Configuration

The DIP switch on the front of the 5300ET module is used to configure many of the operational parameters of the CSD-5300 unit. All switches enable their corresponding function when in the up position. The DIP switch is connected as follows:

**Switch**

| | |
|---|---|
| 1 | Input HMS offset / AUX offset |
| 2 | Keyboard beep enable |
| 3 | Telephone system mode access enable |
| 4 | Telephone answer enable |
| 5 | Half hour tone enable |
| 6 | Hour tone enable |
| 7 | Impulse clock driver enable |
| 8 | Auto Change/Normal Mode Selection |

For further details on the functions, please refer to the operation section of this manual.

### 1.3.7    Rear Panel Connections

**Telephone Line**

The telephone line connector is a standard 6-position, 4-wire modular jack, compatible with either wall or floor RJ11, RJ12 and RJ13 type jacks.

The CSD-5300 unit is prepared for connection to RJ11 type telephone jacks. If connection to RJ12 or RJ13 type jacks is desired, a jumper must be added on the 5300MB Modem Board module.

The jumper is positioned between relay K2 and transistor Q3 and adjacent to the edge connector pins of the 5300MB module.

**IMPORTANT:**

1. **Never install telephone wiring during a lightning storm.**
2. **Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.**
3. **Never touch uninsulated telephone wires or terminals unless telephone line has been disconnected at the network interface.**
4. **Use caution when installing or modifying telephone lines.**

**Impulse Drive Output (3-position barrier strip)**

Up to 25 impulse clocks may be connected to the impulse drive connector.

**Time Code Output**

The SMPTE/EBU Time Code output is available from either of two 3-position terminal blocks. The upper of the two connectors is a low impedance balanced output, capable of +10 dBm unloaded, dropping 3 dB into 180 Ohms. The lower connector is a 600 Ohm balanced output at +4 dBm nominal.

Since clocks such as the LEITCH DAC-5000 Series Digital Analog Clocks bridge high impedance inputs, a large number of clocks may be connected in parallel to this output. However, for purposes of fault isolation, it is recommended that some form of distribution, such as that provided by the LEITCH ADA-800 Series Audio Distribution Amplifiers, be used when connecting more than 20 clocks to the system.

**Auxiliary Output**

The CSD-5300 unit uses a female 37-pin D connector on the rear panel for auxiliary outputs and external strobe input. The connector is wired as follows:

| Pin | | Pin | |
|---|---|---|---|
| 1 | Ground | 21 | Tone present |
| 2 | Time valid (active high) | 22 | Impulse clocks stopped |
| 3 | 1 Hz | 23 | Serial time data |
| 4 | 60 Hz/50 Hz | 24 | Frame Bit 0 |
| 5 | Serial time clock | 25 | Frame Bit 2 |
| 6 | Frame Bit 1 | 26 | Frame Bit 4 |
| 7 | Frame Bit 3 | 27 | Seconds Bit 0 |
| 8 | Frame Bit 5 | 28 | Seconds Bit 2 |
| 9 | Seconds Bit 1 | 29 | Seconds Bit 4 |
| 10 | Seconds Bit 3 | 30 | Seconds Bit 6 |
| 11 | Seconds Bit 5 | 31 | Minutes Bit 1 |
| 12 | Minutes Bit 0 | 32 | Minutes Bit 3 |
| 13 | Minutes Bit 2 | 33 | Minutes Bit 5 |
| 14 | Minutes Bit 4 | 34 | Hours Bit 0 |
| 15 | Minutes Bit 6 | 35 | Hours Bit 2 |
| 16 | Hours Bit 1 | 36 | Hours Bit 4 |
| 17 | Hours Bit 3 | 37 | Serial Time Latch |
| 18 | Hours Bit 5 | | |
| 19 | 100 kHz/1MHz | | |
| 20 | External Strobe input (active low) | | |

All outputs from the auxiliary output connector are 5 Volt logic level signals.

The signals on pins 6 to 18 and 24 to 36 give the time in parallel BCD format. The output consists of frame count, seconds, minutes and hours. This output changes 30 times a second to reflect the new frame count. The time information output refers to the present frame, and is updated approximately 100ms before the start of each new frame. As an example, 100µs before noon the output will change from 11 59 59 29 to 12 00 00 00.

Three output signals are used to give the time in serial format. The Serial Time Data output on pin 23 contains the time information which is sent out 30 times a second. The data is sent in the same order as in the time code output, i.e. frame count, seconds, minutes and hours, with the LSB sent first. As in the time code output, the time data refers to the upcoming frame. The Serial Time Clock output on pin 5 goes high at the start of each data bit, and falls 208 µs

later. Data should be taken as valid on the falling edge of clock. The Serial Time Latch signal, on pin 37, pulses low approximately 100 ms before the end of each frame. This signal can be used by external circuitry to latch in the serial time data.

As an example, two frames before noon, the serial data output will be 11 59 59 29. During the frame immediately before noon, the serial data output will be 12 00 00 00.

The 1 Hz and 60 Hz/50 Hz outputs on pins 3 and 4 respectively are square waves. These signals are synchronous with the time output of the unit. At the top of each second, both outputs fall. Therefore, these outputs can be used to latch the correct time edge.

The 100 kHz/1 MHz output, on pin 19, is derived from the time base of the unit, but is independent of the time output. The output frequency on this pin is selected by the 100 kHz/1 MHz jumper on the 5300MO module.

The Time Valid output is high when the unit has valid time information. The Impulse Clocks Stopped output is high when the unit has stopped the impulse drive output. The Tone Present output goes high for the duration of any hour or half-hour marker tone output.

When a new time is being input, a 5 Volt logic-level falling edge input or a contact closure on the External Strobe line will synchronize the unit to the external time source. Only the first edge is taken for each separate time input operation. In other words, the unit will not continually accept synchronizing information from a pulse train. Refer to the Operation section of this manual for further information on the use of the External Strobe input.

To lessen the radiation of radio frequency energy and ensure compliance with Part 15 of the FCC rules, it is recommended that a shielded cable such as Belden 9519 be used for connections to the auxiliary output connector.

**RS232 Connector**

The RS232 interface uses a 25-pin female D connector on the rear panel of the CSD-5300 unit. Two communication ports are provided via this connector. One is for the standard terminal interface while the second accommodates the optional 5300RI Reference Interface module. Both ports may be connected at the same time, but only one will operate at a time. The 5300RI has priority.

The connector is wired as follows:

**Pin**

| | |
|---|---|
| 1 | Protective Ground |
| 2 | Serial Data In |
| 3 | Serial Data Out |
| 4 | Request to Send In |
| 5 | Clear to Send Out |
| 6 | Data Set Ready Out |
| 7 | Signal Ground |
| 8 | Data Carrier Detect Out |
| 12 | Carrier Detect |
| 13 | Clear to Send |
| 14 | Transmit Data |
| 16 | Receive Data |
| 18 | Data Set Ready |
| 19 | Request to Send |
| 20 | Data Terminal Ready |
| 22 | Ring Detect |
| 23 | Speed |

**Marker Beep Output**

The time marker beep output is available from a 3-position terminal block. The output is 600 Ohms balanced at +4 dBm nominal.

The marker beeps are enabled by the DIP switches located at the front of the 5300ET module.

**External Reference Input**

The external reference input loop bridges 75 Ohms. The input level must be 2 Vp-p 3 dB. The choice of 5 MHz or 10 MHz as the external reference is made by the 5 MHz/10 MHz jumper on the 5300MO module.

**Reference Output**

The reference output is 5 MHz at 2 Vp-p into 75 Ohms.

## 1.3.8   Calibration

The only part of the CSD-5300 unit requiring calibration is the 5300MO Master Oscillator module. Please refer to the 5300MO circuit description of this manual for further details.

# 1.4  Operation

The CSD-5300 Master Clock System Driver can be controlled from either the front panel, an RS232 interface or over the telephone line.

## 1.4.1  Front Panel Control

The front panel constitutes the simplest and most readily available operational control.

The outside portion of the front panel contains the 6-digit time display, the external reference LED and the impulse clock correction mode LED. The 6-digit time display is duplicated in the inside portion of the front panel, which also contains 11 control mode push buttons, each identified by a number, a plus and a minus selection LED and operation instructions.

To select any of the control modes, press the shift button at the same time as the control mode button. The outside display will then go off while the inside display will show the number corresponding to the control mode that has been selected and a cursor. The number ensures correct selection of the mode while the cursor indicates that the system is ready to accept new information. A 30 second period is available to enter new information. If during this period no information has been entered, the CSD-5300 unit will cancel the control mode and will revert to its original status. After selecting the new information, press <SHIFT/ENTER>, i.e. press the shift button at the same time as the enter key to enter the information and to end the control mode.

If an error is made when selecting new information, the error can be deleted by pressing <SHIFT/CANCEL>, i.e. pressing the shift and cancel buttons simultaneously. This will cancel the control mode also but it will not affect any information previously contained in the unit.

On power-up, the two front panel displays and the impulse clock correction mode LED will flash. This indicates that no time information has been provided to the CSD-5300 unit. Upon entering the time, the flashing will stop.

The control modes operate as follows:

**Input Time**

The Input Time button is the first control mode of the inside panel. It is used to manually set the time of the unit. Upon selecting this mode, a cursor and the number 2 (corresponding to this mode) should appear in the inside display. The time is then entered in hours, minutes and seconds by pressing the buttons corresponding to the desired numbers.

Two options for synchronizing the CSD-5300 unit to the new time are available:

1. The first option consists in simply pressing <SHIFT/ ENTER> after the new time has been selected. The unit will start operating with the time provided at the instant the enter button is pressed.

2. The second option is provided for customer applications. It uses the external strobe input from pin 20 of the Auxiliary Output Connector located at the back of the CSD-5300 unit. The strobe input detects an external contact closure (active low). When said closure occurs, the clock will switch to the time provided.

### Input Date

The next control mode is the Input Date mode. The date is selected as year, month and day in the same manner as for the Input Time mode.

This mode also allows inspection of the date contained in the CSD-5300 unit prior to selecting a new date. Approximately 3 seconds after selecting this mode, the cursor and the number 3 will go off, and the date contained in the unit will be shown on the inside display. If the existing date is adequate, press <SHIFT/CANCEL> to end the mode without changing the date.

### Input Impulse Clock Reading

The Input Impulse Clock Reading mode is the next control mode of the inside panel. This mode is used to eliminate any discrepancy between the readings of the CSD-5300 unit and the impulse clocks connected to it. Upon selecting this mode, the impulse clocks are stopped. The time reading of the impulse clocks is then selected and entered in the same manner as for the Input Time mode. If there is a discrepancy between the readings, the impulse clock correction mode LED of the front panel will light steadily. This will indicate that the unit is acting to correct the discrepancy. The correction mode is carried out by either operating the impulse clocks at twice their normal speed or by stopping them until the time discrepancy is eliminated, whichever is faster. Once the time discrepancy is eliminated, the LED will go off and the clock drive will return to its normal speed.

In the case that no impulse clocks are connected to the clock driver, the impulse clock correction mode LED can be disabled by means of the DIP switch S7 located at the front of the 5300ET module. Switch S7 also stops any impulse clock connected to the unit.

**Time Offsets**

The next four control modes are time offsets. The first button is used for two offset modes, i.e. the hours, minutes and seconds offset and the auxiliary offset. To select either offset, DIP switch 1 located at the front of the 5300ET module should be set accordingly. To select the HMS mode, ensure that DIP switch 1 is its UP position.

This mode is basically used for leap seconds and for the spring and fall daylight saving/standard time change. Upon selecting this mode and before entering the time offset, selection of the plus or minus control should be made. This is done by pressing the shift button at the same time as the plus/minus button until the desired selection is made. The selection is then entered by pressing <SHIFT/ENTER>. Afterwards, the time offset is selected in the same manner as for the Input Time. The maximum offset allowed is 23 hours, 59 minutes, and 59 seconds.

Two options are available for implementing this offset. The change can be carried out immediately or it can be programmed to occur at any given time, e.g. at 3 AM when most time changes take place to avoid disruptions. To implement the change immediately, press <SHIFT/ENTER> and the offset will be carried out instantaneously. If a delay is desired, select the delay in hours, minutes and seconds and press <SHIFT/ENTER> and the offset will occur at the time selected.

The next control mode, that is the auxiliary offset, is used in applications where it is desired to show the time of a given time zone on one set of clocks and that of its time reference on another set of clocks. The auxiliary offset requires the use of clocks such as the LEITCH DAC-5000 Series which accept Time Code which has a user programmed constant offset inserted as user bits in the time code. Please refer to the Configuration of the Time and Control Code section of this manual for further details.

To select this mode, DIP switch 1 located at the front of the 5300ET module should be in the DOWN position. The mode is then selected in the same manner as the HMS offset with the exception that the auxiliary offset is done in 30-minute increments and the maximum offset allowed is 12 hours. The offset is implemented immediately.

The next control mode is the millisecond offset. This mode allows the clock to change instantaneously from 0 to 999 ms and is selected in the same manner as the hours, minutes and seconds offset. The change, however, is implemented immediately. This offset is basically used to synchronize the CSD-5300 unit to the beep tones of an external time transmission. If, for instance, the unit has an offset of half a second, diminishing offsets can be selected until it becomes synchronized with the time signal.

The fourth control mode provides an offset for the telephone line. This offset is basically used when the CSD-5300 unit is located in a Time Zone other than that of the Reference Standard from which the unit is updating its time via the telephone. If the time difference between the two locations is known, the unit can be programmed to subtract/add this time difference from the time received, so that the clock will maintain local time accurate to the Reference Standard Time.

Upon selecting this mode and before entering the offset, selection of plus or minus should be done and then the <SHIFT/ENTER> buttons pressed. Afterwards select the offset in hours, minutes and seconds and press <SHIFT/ENTER>. Then select the milliseconds offset and again press <SHIFT/ENTER> to end the control mode.

The CSD-5300 unit is also capable of automatically measuring loop-back delay and compensating for propagation delays through telephone lines and satellite telephone links. In cases where the propagation delay is known, it can be provided to the unit by entering a millisecond value to the Input Phone Offset mode and thus the correction will be done manually. It should be pointed out that when any value other than zero is entered, the automatic measuring of the loop-back delay and compensation capability of the unit will be disabled.

**Phone Now**

The last control mode of the inside panel is the Phone Now button. This control is used for setting up the CSD-5300N unit for the first time or to verify the accuracy of the display.

Upon selecting this mode and pressing <SHIFT/ENTER>, the unit will initiate an internal test diagnostics. If the test diagnostics is successfully completed, the unit will automatically dial the telephone number of the external standard. For details on how to input a telephone number, please refer to the Input New Telephone Number section of this manual. Once the external standard has been accessed, the time obtained and the unit reset itself, the new time will be immediately shown on the front display.

If, for whatever reason, the call is not successfully completed, the two front panel displays will flash to indicate that a new call is required. This will also create a P code in the Send Status function of the user mode. For further details, please refer to the User Mode section of this manual.

Whenever the Phone Now mode is selected, the call day counter for the automatic phone calls (please refer to the Input New Telephone Number section of this manual) will be reset.

## 1.4.2    RS232 and Telephone Line Control

The CSD-5300 Master Clock System Driver can also be controlled from either the telephone line or an RS232 interface. The RS232 interface may also be used to allow a computer to get time data from the unit. The unit is configured as a data set that plugs directly into video terminals at 300 baud, no parity, one stop bit. The telephone line capabilities are identical to the RS232 protocols with slight exceptions which will be described later.

The video terminal is normally connected locally for diagnostic use, time setting and setting up the characteristics of the unit. The telephone line, on the other hand, is basically used by third parties to obtain the time.

Two basic modes of RS232 and telephone line access are available. These are the user mode and the system mode.

### 1.  User Mode

Whenever the RS232 interface is connected, the CSD-5300 unit is automatically in the user mode. This mode allows access to five basic functions. It also includes a HELP menu which details the commands for the five basic functions. The menu is accessed by typing HELP and then pressing the carriage return. The following will appear on the screen:

```
T    (CR)  »   SEND TIME
D    (CR)  »   SEND DATE
L    (CR)  »   LOOP BACK
HU   (CR)  »   HANG UP
S    (CR)  »   SEND STATUS
```

The first function provides the time, the second provides the date, the third allows calculations of path delay if an external system is being called, the fourth disconnects the telephone line and the fifth provides the status of the unit. The five basic functions are accessed as follows:

Send Time function; type **T**, press carriage return and the time is sent to the terminal. Refer to the diagram below for the time sequence. The diagram shows the time request from the external device and the response of the CSD-5300 unit. Second boundaries are shown as /.

The time information is sent starting with a carriage return, timed so that the stop bit ends at the start of the next second. This is sent at the end of the second in which the time was requested. The time information is sent for three consecutive seconds in the following format. At the start of the second, the time of the next second is sent as HHMMSS. At the end of the second a carriage return is sent, timed as described above. This allows the carriage

return to function as a cue for the time information. After sending the time, the unit returns to user mode.

/Time Request     CR/ HHMMSS     CR/ HHMMSS     CR/ HHMMSS     CR/

## Time Request Diagram

- **Send Date function**: type `D`, press carriage return and the date is sent once to the terminal. The date is sent in the format YYMMDD and is followed by a carriage return. After sending the date, the unit returns to user mode.
- **Loop Back function**: type `L`, press carriage return and the CSD-5300 unit echoes any character sent to it and then returns to user mode. The loop delay can be calculated since the character that was sent would return after twice the path delay.
- **Hang Up function**: in the case the unit is connected to the telephone line, type `HU` and press carriage return and the unit will hang up the telephone.
- **Send Status function**: type `S`, press carriage return and the status will be sent to the terminal. There are four different codes to indicate the status of the CSD-5300 unit. G indicates that the unit is operating properly, D that the internal test diagnostics have failed, T that the unit has not been provided with the time and P that the last phone update failed.

The user mode has a 30 second time out when accessed via the telephone line. If after 30 seconds no valid commands have been entered, the CSD-5300 unit sends the time three times and then hangs up. In addition to protecting the unit from outside sources attempting to break in, the 30 second time out allows units with different levels of complexity to take advantage of this service. For instance, a computer with a basic modem which is not capable of using the full protocol can wait for the time out period and then receive the time. Other systems with a greater level of complexity can use the commands, calculate the loop delay and get the time with much greater accuracy.

## 2. System Mode

The second basic mode of RS232 and telephone line access is known as the system mode. This mode allows access to the time setting capabilities of the CSD-5300 unit and will duplicate all of the functions of the front panel. In order to protect the unit against unwanted calls accessing and/or modifying the information contained in the unit, a password is required for RS232 access of the system mode. For telephone access, in addition to the password, the DIP switch S3 located at the front of the 5300ET module has to be enabled. The password consists of two parts. The first part is the word LEITCH. The second part is the serial number of the unit. The serial number of the unit consists of the year that the unit was manufactured plus a four digit number which is the individual number of the unit. This has the advantage that the password can be easily read from the front panel. Another advantage is that LEITCH Video, at

the request of the owner, is able to program the unit and run the test diagnostics program via the telephone. The owner can disable access to the unit by turning off the system access enable switch S3 of the 5300ET module.

To access the system mode, type LEITCH, press carriage return, type the serial number of the unit and press carriage return again. As with most computer systems the password is not echoed on the screen. A system mode prompt with the following message will appear on the display:

```
type HELP (CR) for menu
```

The following is the first question that appears:

```
do you want line feeds, yes, no?
```

This is provided for both intelligent and semi-intelligent video terminals and systems, some of which insert their own line feeds. For a basic system that inserts no line feeds, the answer is "yes".

Typing **help** and pressing carriage return will bring up the command menu. There are seventeen functions in the command menu. Each command is identified by a code on the left hand side of the screen, followed by a carriage return (CR) when required and a description of the command.

The following will appear on the screen:

```
M2          (CR)  »   INPUT NEW TIME
M3          (CR)  »   INPUT NEW DATE
M4          (CR)  »   IMPULSE CLOCK TIME
M5          (CR)  »   HOURS, MIN., SEC. OFFSET
M6          (CR)  »   MILLI SEC. OFFSET
M7          (CR)  »   TELEPHONE (HMS & MILLI SEC.)
AUX         (CR)  »   AUXILIARY OFFSET
PHONE#      (CR)  »   INPUT NEW PHONE NUMBER


HELP        (CR)  »   GIVES THIS MENU
TEST        (CR)  »   SELF DIAGNOSTICS
QUIT        (CR)  »   BACK TO USER MODE
HANGUP      (CR)  »   HANG UP TELEPHONE LINE
LF          (CR)  »   LINE FEEDS (Y/N)


P                     PLUS
M                     MINUS
C                     CANCEL
(CR)                  ENTER
```

The first six of the functions are identical to those of the front panel and operate in a very similar manner. To select any of the functions, first type its corresponding code and then, where indicated, press carriage return. Selection of the different functions is as follows:

**Input Time**

The Input Time function is the first available command of the help menu. To select this function type **M2** and press carriage return. A prompt will appear on the screen that reads:

```
ENTER NEW TIME

 HH MM SS
```

The time is then typed in hours, minutes and seconds and the carriage return pressed afterwards. If a typing error is made, press **C** (Cancel) and the error will be eliminated. However, to re-enter the time, the Input Time function has to be selected again.

As in the case of the front panel, two options for synchronizing the unit to the new time are available.

1. The first option consists in simply pressing the carriage return after the new time has been typed. The unit will start operating with the time provided at the instant the enter button is pressed.

2. The second option uses the external strobe input of the Auxiliary Output Connector to switch to the time provided in the same manner as described for the front panel.

### Input Date

The next function is the Input Date command. To select this function type `M3` and press carriage return. A prompt will appear on the screen that reads:

```
CURRENT DATE              ->(date contained in the unit)
ENTER NEW DATE            ->YY MM DD or CR
```

If the current date contained by the unit is acceptable, press carriage return and the message `EXIT DATE MODE` will appear on the screen. This indicates that the unit is back to system mode, and that the date has not been changed. If it is desired to alter the current date, type the new date as year, month and day and press carriage return. Again, a message showing the new date and the `EXIT DATE MODE` will appear on the screen to indicate that the change has been recorded and that the unit is back in system mode.

### Input Impulse Clock Reading

The Input Impulse Clock Reading function is the next command of the menu. To select this function type M4 and press carriage return. A prompt will appear on the screen that reads:

```
 ENTER TIME ON IMPULSE CLOCKS

 HH MM SS
```

As in the case of the front panel, the impulse clocks connected to the unit will stop upon selecting this function. The time reading of the impulse clocks is then typed and the carriage return pressed in the same manner as for the Input Time function. If there is a discrepancy between the readings, then the impulse clock correction mode LED of the front panel will light steadily to indicate that the unit is acting to correct this discrepancy. As for the front panel, the correction mode is carried out by either operating the impulse clocks at twice their normal speed or by stopping them until the time discrepancy is eliminated, whichever is faster. Once the time discrepancy is eliminated, the LED will go off and the clock drive will return to its normal speed.

**Time Offsets**

The next four functions are time offsets and they operate as described for the front panel.

The first function is the hours, minutes and seconds offset. It is selected by typing **M5** and then pressing the carriage return. The following prompt will appear on the screen:

```
 ENTER HMS OFFSET & TO OCCUR

 M/P & HH MM SS AT HH MM SS
```

First, selection of plus or minus is made. Type either P or M, as desired, and press carriage return. Then select the offset in hours, minutes, and seconds and press carriage return. The maximum offset allowed is 23 hours, 59 minutes, and 59 seconds as for the front panel.

Two options are available for implementing the offset. The change can be carried out immediately or it can be programmed to occur at any desired time.

To implement the change immediately, press the carriage return and the offset will be carried out instantaneously.

If it is desired to program the change at a given time, type the time in hours, minutes and seconds and then press the carriage return. The offset will occur at the time selected.

The next function is the millisecond offset. To select this function type **M6** and press carriage return. The following prompt will appear on the screen:

```
        ENTER MILLI SEC OFFSET

        M/P & MMM
```

Selection of plus or minus is made by again typing P or M, as desired, pressing the carriage return and then typing the desired offset (max. 999 ms) and pressing carriage return.

The third function provides an offset for the telephone line. To select it, type M7 and press carriage return. The following prompt will appear on the screen:

```
        ENTER PHONE OFFSETS M/P & HH MM SS

        & MMM
```

Again selection of plus or minus, hours, minutes, seconds, and milliseconds is made as previously described.

The next function is the auxiliary offset. It is selected by typing AUX and pressing carriage return. The following message will appear:

```
 ENTER AUX OFFSET (IN 30 MIN STEPS)


 M/P & HH MM
```

Selection of plus or minus and then the offset in 30-minutes increments and up to 12 hours is made as previously described.

### Input New Telephone Number

The next function is the Input A New Phone Number. The objective of this function is to allow several units to be arranged in a hierarchical system; i.e. a reference unit connected to a Cesium standard which can provide a standard time to several local units.

To select this function type **PHONE#** and press carriage return. A prompt will appear on the screen that reads:

```
     CALL DAY » XX
```

This message requests the desired frequency of calls to the reference unit in number of days. If the existing number of days is adequate, press carriage return. If it is desired to modify it, select the new number, press carriage return and the change will be recorded. Obviously, if zero is selected as the number of days, the unit will never call the reference unit.

After the call day has been entered, the following prompt will appear on the screen:

```
     CALL TIME -> XX XX XX
```

This message requests the time of the day in which the call is to be made. If the existing time of the day is adequate, press carriage return. If it is desired to modify it, select the new time in hours, minutes and seconds, press carriage return and the change will be recorded. Normally this can be set for the middle of the night when telephone trunks are more readily available and calls are cheaper. If there is no answer, e.g. the trunk is not available or the unit to which the call is being made is busy, it will hang up and wait a random period of time before recalling. A total of seven attempts will be made to contact the unit. If after the seventh attempt no contact has been made, the unit will indicate that the telephone update has failed by sending a P code to the Send Status function of the user mode. It will also reset the call day counter and therefore will wait the existing number of days before recalling again.

In the case of a power failure, the unit, after waiting for a period of 20 minutes to allow the crystal oscillator oven to warm, will phone automatically and reset the call day counter if the call day recorded is not equal to 00 days.

After the call time has been recorded, the following prompt will appear on the screen:

```
PHONE # -> XXXXX
```

This message requests for a telephone number. If the existing number is acceptable, press carriage return and the number will be kept. If a new telephone number is desired, type the new number and press carriage return. The unit will accommodate both dial pulse and DTMF as well as the delay required for a PBX to obtain an outside line. Three different codes are available to indicate the type of dial and the delay. These are P for pulse, T for touch tone and D for delay. To enter a new phone number, first indicate the type of dial, P or T. After, for instance, entering a P it will remain in pulse mode until a T is entered.

As an example, enter P1 T416 4459640. This would have the effect of pulsing a 1 and then dialing in DTMF the area code and the remaining seven numbers. If a PBX is available and, for example, it is desired to access an old model that accepts pulse only, P9 can be entered which will give pulse 9 for an outside line, then D3 which will provide a delay of 3 seconds for obtaining an outside line and then T followed by the number to call.

The phone number input routines will accept spaces and dashes. These can be entered to format the output so that the phone number is easily readable on the screen. The total number of characters of a phone number input routine, including T, P, and D, is twenty five.

**System Mode Menu**

The next command is the System Mode Menu function. When typing **HELP** and pressing carriage return, the system mode menu will appear on the screen.

**Self Diagnostics**

The next command of the system mode menu is the self diagnostics function. When typing TEST and pressing carriage return, the unit will enter a diagnostics cycle. The diagnostics cycle is the same to that performed when the unit calls an external source or on power up. The following will appear on the screen:

```
EEPROM TEST->    PASSED (or FAILED)

RAM TEST  ->     PASSED (or FAILED)

PGM TEST  ->     PASSED (or FAILED)

MODEM TEST ->    PASSED (or FAILED)

DIAGNOSTICS DONE.....
```

In the case the test diagnostics fail, please contact LEITCH's Service Department.

**Back To User Mode**

The Back To User Mode function is the next command of the system mode menu. When typing QUIT and pressing carriage return, the unit will return to the user mode.

**Hang Up the Telephone**

The next command of the menu is the Hang Up The Telephone Line function. When typing HANGUP and pressing the carriage return, the unit will hang up the telephone and will return to the user mode.

**Line Feeds**

The next command of the system mode menu is the Line Feeds function. When typing **LF** and pressing carriage return, the following message will appear on the screen:

```
DO YOU WANT LINE FEEDS? (Y/N) » Y or (N)
```

This command will alter the information provided when first accessing the system mode.

### Miscellaneous Commands

Four other commands are available in the system mode menu. These are

- C for cancel,
- CR for enter,
- P for plus, and
- M for minus.

When selecting any of these commands, it is not required to press carriage return. The commands are self-explanatory; therefore no further details are provided.

### Set Window

The Set Window function is not included in the system mode menu due to the fact that if these values are assigned incorrectly, all outgoing telephone calls would fail. All units are pre-programmed with the default prior to delivery.

The purpose of this function is to attempt to detect asymmetrical path delays when an external system is being called i.e. a call being placed via satellite in one way and via land line on the other. All calls received with a delay that falls within the values set by the window will automatically be rejected.

To access this function, type **SET** and press carriage return. The prompt WHAT? will appear on the screen. The purpose of this message is to protect the unit against unwanted modifications of the default. Then type **WINDOW** and again press carriage return and the following will appear on the screen:

```
*************** WARNING ***************

* IF DONE INCORRECTLY ALL OUTGOING   *

*      PHONE CALLS WILL FAIL         *

***************************************

ILLEGAL DELAY WINDOW IS BETWEEN XXXX AND XXXX

ENTER LOWER VALUE IN XXXX MILLI SEC.

»
```

Select the lower value of the window and then press the carriage return. If the existing value is adequate simply press carriage return and the value will be maintained.

Then, the following prompt will appear on the screen:

`ENTER UPPER VALUE IN XXXX MILLI SEC.`

`»`

The upper value of the window is then selected as previously described for the lower window, and the following will appear on the screen:

`ILLEGAL DELAY WINDOW IS BETWEEN` (new values selected)

`EXIT DELAY WINDOW MODE`

This message will indicate the new values contained by the unit and that this function is completed.

**Autochange / Normal Mode Selection**

DIP switch 8 at the front of the 5300ET module selects either the Autochange Mode when set in the up position or the Normal Mode of operation when set in the down position.

The Autochange Mode is selected in cases such as whenever a Clock Autochange system is used with two CSD-5300 drivers to provide continuity of impulse drives, time code signals, etc. In the case of a malfunction to the assigned Master Driver, the Clock Autochange will switch from one driver to the other. When the Clock Autochange Mode is selected, the success or failure of a telephone call to be carried through will not affect the Time Valid Line.

When the Normal Mode is selected, the success or failure of a telephone call to be carried through will affect the status of the Time Valid Line.

## 1.5 Operation Summary

### 1.5.1 Front Panel

The front panel constitutes the simplest and most readily available operational control. The following functions are available:

| | |
|---|---|
| Input Time | Press SHIFT/Input Time buttons simultaneously. Select the time in HH MM SS. Press<SHIFT/ENTER> to instantaneously input new time or strobe pin 20 of the Auxiliary Output Connector to synchronize the new time to an external source. |
| Input Date | Press SHIFT/Input Date buttons simultaneously. Inspect date of unit. If adequate, press <SHIFT/CANCEL> to end function. To alter existing date, select date in YY MM DD and press <SHIFT/ENTER>. |
| Input Impulse | Press the SHIFT/Input Impulse Clock Reading buttons simultaneously. Enter the readings of Clock Reading the impulse clocks and press <SHIFT/ENTER>. |
| HMS Offset | Set DIP switch 1 at front of 5300ET in the UP position. Press the SHIFT/HMS Offset buttons simultaneously. Select P or M and simultaneously press the SHIFT button. Press <SHIFT/ENTER>. Then select the offset (max. 23 h. 59 m. 59 s). To implement the offset instantaneously, press <SHIFT/ENTER>. If to occur at a certain time, enter the time and press <SHIFT/ENTER>. |
| Auxiliary | Set DIP switch 1 at front of 5300ET in the DOWN position. Press the SHIFT/AUX Offset buttons simultaneously. Select P or M and simultaneously press the SHIFT button. Press <SHIFT/ENTER>. Then enter the offset (in 30 minute increments and max. 12 h) and press <SHIFT/ENTER>. |
| Milliseconds | Press the SHIFT/Millisec Offset buttons simultaneously. Select P or M and simultaneously press the Offset SHIFT button. Press <SHIFT/ENTER>. Then enter the offset (0 to 999 ms) and press <SHIFT/ENTER>. |
| Telephone | Press SHIFT/Telephone Offset buttons simultaneously. Select P or M and simultaneously press the SHIFT Offset button. Then press <SHIFT/ENTER>. Enter offset & press <SHIFT/ENTER>. Select millisec offset & press <SHIFT/ENTER> |
| Phone Now | Press SHIFT/Phone Now buttons simultaneously, then <SHIFT/ENTER>. Upon completing the test diagnostics, the unit will automatically dial the telephone number provided. Please refer to System Mode section for details to input phone. To cancel this function, press <SHIFT/CANCEL>. |

## 1.5.2 RS232 And Telephone Line Control

**User Mode**

Whenever the RS232/telephone interface is connected, the unit is automatically in User Mode. The following functions are available in this mode:

| | |
|---|---|
| Send Time | Type T and press CR. The time will be provided for three consecutive seconds. |
| Send Date | Type D and press CR. The date will be provided once. |
| Loop Back | Type L and CR. The next character selected will be echoed. |
| Hang Up | Type HU and CR. The unit will hang up the telephone. |
| Send Status | Type S and CR. The status will be sent to the terminal. |

### System Mode

To access the System Mode, type LEITCH, press CR, type the serial number of the unit and press CR. The following functions are available:

| | |
|---|---|
| Line Feeds | Type LF and press CR. The message 'Do you want line feeds' will appear on the screen. Type Y for basic systems and N for systems which insert their own line feeds and then press CR. |
| Help Menu | Type HELP and press CR. The system menu will appear on the screen. |
| Input Time | Type M2 and press CR. The message, Enter New Time -> HH MM SS, will appear. Type the desired new time and press CR to input the time instantaneously or strobe pin 20 of the Auxiliary Output Connector. |
| Input Date | Type M3 and press CR. The message, Current Date -> YY MM DD Enter New Date » YY MM DD or CR, will appear. If the existing date is acceptable, press CR. If desired to change, type the new date and press CR. |
| Input Impulse Clock Reading | Type M4 and press CR. The message, Enter Impulse Clock Time » HH MM SS Clock Reading, will appear. Select the time and press CR. |
| HMS Offset | Type M5 and press CR. The message, Enter HMS Offset » M/P & HH MM SS & Time to Occur at HH MM SS, will appear. Select P or M press CR, type the offset (max. 23 hours, 59 min. and 59 sec.), press CR and either press CR to implement the change immediately or select the time when the change is to occur and press CR. |
| Milliseconds | Type M6 and press CR. The message, Enter Milli Sec Offset » M/P & MMM Offset, will appear. Select P or M, press CR, type offset (max. 999ms) and press CR. |
| Phone Offset | Type M7 and press CR. The message, Enter Phone Offset » P or M & HH MM SS & MMM, will appear. Select P or M press CR, type offset, press CR, type milliseconds offset and press CR. |
| Auxiliary | Type AUX and press CR. The message, Enter Aux Offset (in 30 min steps) » P or M & HH MM, will appear. Offset Select P or M, press CR. Then select the offset in 30-minute increments (max. 12 hours) and press CR. |
| Input New Phone Number | Type PHONE# and press CR. The message, Call Day -> XX, will appear. If the existing Phone number is adequate, press CR. If desired to change it, type the new number and press CR. The message, Call Time » HH MM SS, will then appear. If the existing time is adequate, press carriage return. If desired to modify it, type new time and press CR. Then, the message, Phone # » XXXXXX, will appear. If the existing number is adequate press CR. If desired to change it, type the new number (max. 25 characters) by indicating the type of dial (P for pulse and T for touch tone) and, if required, a delay in seconds (D and up to 9 sec.) Spaces and dashes are allowed. |
| Self Diagnostics | Type TEST and press CR. The unit will perform a diagnostics cycle and the results will appear on the screen. |
| Back to User Mode | Type QUIT and press CR. The unit will return to the User Mode. |
| Hang Up | Type HANGUP and press CR. The unit will immediately hang up the telephone. |

# 1.6    Configuration of the Time and Control Code

## 1.6.1    SMPTE Serial Time Code

The SMPTE Serial Time Code contains the time of the day in hours, minutes and seconds. Since time code was originally intended as a timing and control code for video tape recording, each second is divided into thirty equal parts that coincide with the picture frames of the associated video signal. Thus, each frame can be identified by a unique and complete code address. The time code output of the CSD-5300 is intended only to convey time-of-day information but a frame count is still included. Note that the time code output of the CSD-5300 is non-drop-frame and real time, not color time, and cannot be locked to a video signal.

**Code Format**

Each code address consists of eighty bits, numbered 0 through 79. Each address starts at the clock edge before the first address bit (bit zero) which corresponds to the beginning of Line 5 in Fields I and III, as defined in EIA Standard RS170A.

The eighty bits of a code address are assigned as shown in Figure 1-1 on page 1-34 and grouped as follows:

- Eight binary groups consisting of 32 spare user bits.
- Eight time address groups consisting of 28 assigned addresses and four unassigned addresses (all unassigned bits are zeros).
- One synchronizing word consisting of sixteen bits.

The time address groups and the binary groups are arranged alternatively. This is to distinguish the information of a given combination of groups from that of the synchronizing word, which has a typical structure of twelve successive logic ones. If groups of the same type were together, it would be necessary to assign fixed zeros to two of the thirty two bits to prevent an occasional generation of a synchronizing word within the groups. This would reduce the available number of bits to thirty.

The binary groups are intended for storage of user's supplementary data in any fashion and without restrictions.
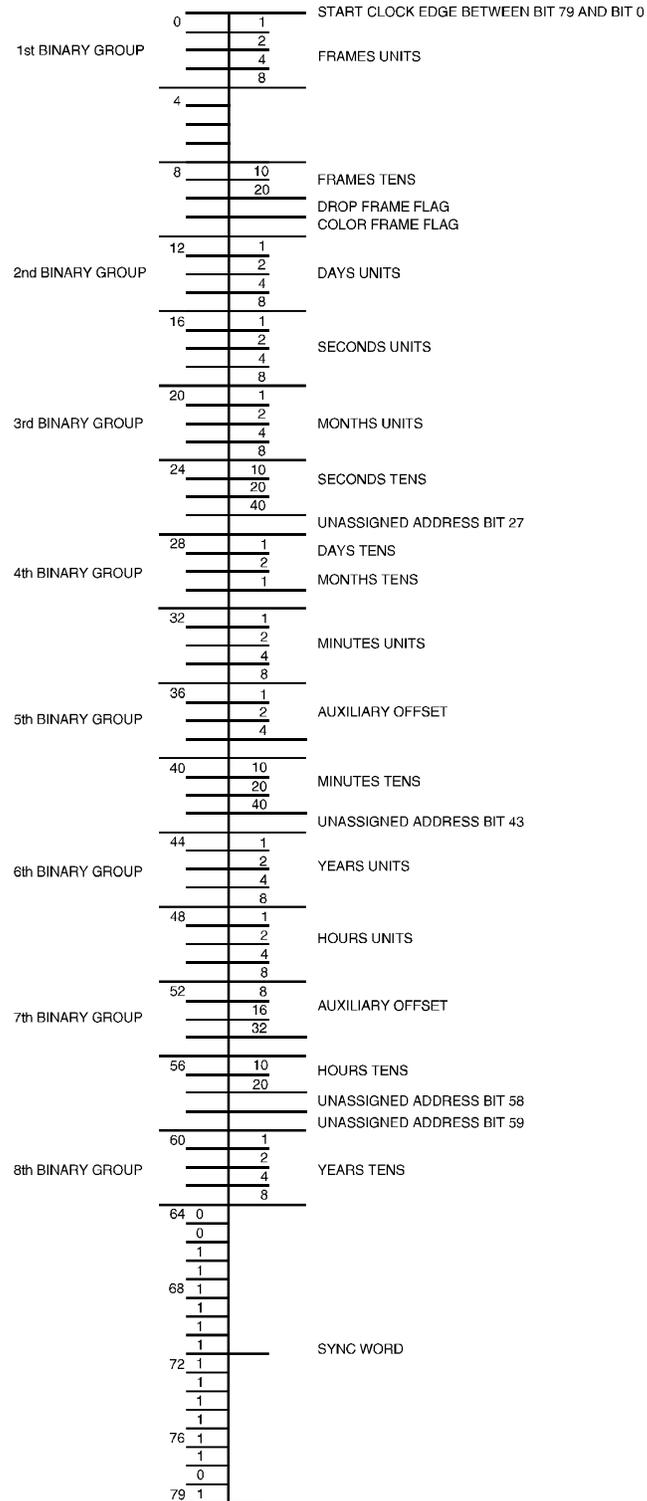
**Figure 1-1:  Assigning the eighty bits of a code address**

The time address groups use the 24-hour clock system and are based upon the Binary Coded Decimal (BCD) system. Conservation of bits is achieved due to the fact that the count of some addresses does not reach to 9 and, therefore, 4 bits are not always required.

## 1.6.2    Composition of the Time Address

The eight time address groups (see Fig.1) are arranged as follows:

Units Frames:            Bits 0-3; 4 bit BCD arranged 1, 2, 4, 8. Count 0-9.
Tens Frames:             Bits 8-9; 2 bit BCD arranged 1, 2. Count 0-2.
Unit Seconds:            Bits 16-19; 4 bit BCD arranged 1, 2, 4, 8. Count 0-9.
Tens Seconds:            Bits 24-26; 3 bit BCD arranged 1, 2, 4. Count 0-5.
Units Minutes:           Bits 32-35; 4 bit BCD arranged 1, 2, 4, 8. Count 0-9.
Tens Minutes:            Bits 40-42; 3 bit BCD arranged 1, 2, 4. Count 0-5.
Units Hours:             Bits 48-51; 4 bit BCD arranged 1, 2, 4, 8. Count 0-9.
Tens Hours:              Bits 56-57; 2 bit BCD arranged 1, 2. Count 0-2.
Units Days:              Bits 12-16; 4 bit BCD arranged 1, 2, 4, 8. Count 0-9.
Tens Days:               Bits 28-29; 2 bit BCD arranged 1, 2. Count 0-2.
Units Months:            Bits 20-23; 4 bit BCD arranged 1, 2, 4, 8. Count 0-9.
Tens Months:             Bit 30; 1 bit BCD. Count 0-1.
Units Years:             Bits 44-47; 4 bit BCD arranged 1, 2, 4, 8. Count 0-9.
Tens Years:              Bits 60-63; 4 bit BCD arranged 1, 2, 4, 8. Count 0-9.

The time address contains six reserved bits. Two of the bits, namely bit 10 and bit 11, are used for identification of the Drop Frame Flag and the Color Frame Flag. The remaining four bits, namely bits 27, 43, 58, and 59, are currently unassigned. Since the time code output of the CSD-5300 contains time-of-day information only, these six bits are set to zero.

The synchronizing word enables the reading device to set and control counters so that the originally encoded information can be retrieved. This makes the code self-contained.

## 1.6.3    Auxiliary Offset

If an auxiliary offset is in use, the value of the offset is contained in six of the user bits of the time code. In this way an auxiliary offset does not affect the time data as seen by standard time code readers. An auxiliary offset is encoded in 30-minute increments, to be added to the main time information contained in the time code. The CSD-5300 allows an auxiliary offset of up to 12 hours in either direction. For simplicity, this is encoded in the time code as an offset in the positive direction of up to 23 hours 30 minutes, or 47 half hour steps. This can be encoded in binary form in 6-bits. The information is split into two 3-bit groups. The 3 lower bits are encoded in bits 36, 37 and 38 of the time code, with bit 36 as the LSB. The 3 upper bits are encoded in bits 52, 53 and 54.

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# Chapter 2

## 5300BH Battery Holder

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# Chapter 3

## 5300CA Control Assembly Module

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# Chapter 4

## 5300ET Electronic Timer Module

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# Chapter 5

## 5300 Master Oscillator Module

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# *Chapter 6*

## *5300MB Modem Board*

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# Chapter 7

## 5300 RI Reference Interface Module

# 7.1 Introduction

The 5300RI Reference Interface is a plug-in module designed to connect the CSD-5300 Clock System Driver to an external reference of accurate time using an RS232 interface. The source of time can be either another CSD-5300 unit (connected by modem over the telephone lines), or a variety of radio receivers specifically designed to monitor radio broadcasts of precise time information. These radio broadcasts from stations WWV and WWVB (United States), MSF (UK), DCF77 (W. Germany), and others, are maintained by government agencies to provide a source of accurate time information.

When the 5300RI is connected to a modem, the CSD-5300 can phone a remote CSD-5300 to obtain the time or answer a call and provide the time to other units. The 5300RI is used in the same manner as a 5300MB Modem Board. Its use is transparent and appears to both user and caller as a 5300MB.

When the 5300RI is interfaced to a WWV, a WWVB, or similar radio receiver, the CSD-5300 is able to access the external reference to obtain the time. The 5300RI can communicate with a variety of radio receivers having an RS232 interface. Since each receiver has its own protocol and format, the 5300RI has to be individually preprogrammed to meet the requirements of the receiver. Currently, the 5300RI will support the following radio receivers:

| Manufacturer/Model | Station | Frequency | Site |
|---|---|---|---|
| **Precision Standard Time Inc.** | | | |
| OEM-10, Model 1010 | WWV | 2.5, 5, 10, 15, 20 MHz | Colorado, USA |
| | WWVH | 2.5, 5, 10, 15, 20 MHz | Hawaii, USA |
| **Kinemetrics, True Time Div.** | | | |
| 60-DC | WWVB | 60 kHz | Colorado, USA |
| LF-DC | MSF | 60 kHz | U.K. |
| | DCF77 | 77.5 kHz | Germany |
| 468DC | GOES | | Geostationary satellite |
| **Radio Code Clocks, Cornwall, UK** | | | |
| RCC8000 (with type II Serial Interface) | MSF | 60 kHz | UK |

| Manufacturer/Model | Station | Frequency | Site |
|---|---|---|---|
| **Precitel 5300RC** | | | |
| | MSF | 60 kHz | UK |
| | DCF | 77.5 kHz | Germany |
| | France Inter | 162 kHz | France |
| **European Electronic Systems Essex, UK** | | | |
| M201 | MSF | 60 kHz | UK |
| | DCF77 | 77.5 kHz | Germany |
| | WWVB | 60 kHz | Colorado, USA |
| 468DC | WWV | 2.5, 5, 7.5, 10, 20 MHz | Colorado, USA |

**Trimble Navigation**

Acutime GPS Smart Rodal Antenna

Models 18636-62
(with TAIP ASCII Protocol)

5300 GPS                                                                    GPS Satellite

> **NOTE:** **Each receiver must be ordered for a specific transmitting station, and with an RS232 interface option. Please contact the respective manufacturer for details.**

## 7.1.1   Connections

The 5300RI plugs into the slot marked 5300MB/RI of the CSD-5300 frame. If the upper left slot is marked 5300MB only, the clock radio will not support the 5300RI module. Connections with modems or radio receivers are made via the 25-pin D connector labelled RS232, and are located at the rear panel of the CSD-5300. The secondary channel is used for this connection, leaving the primary channel (pins 1 to 8) available for connecting the CSD-5300 to a

terminal or computer as indicated in the Installation Section. The secondary channel is wired as follows:

| Pin | Signal | Direction |
|---|---|---|
| 1, 7 | Ground | - |
| 16 | Receive Data | in |
| 14 | Transmit Data | out |
| 19 | Request to Send | out |
| 13 | Clear to send | in |
| 20 | Data terminal ready | out |
| 18 | Data set ready | in |
| 12 | Data carrier detect | in |
| 22 | Ring detect | in |
| 23 | Signalling speed | in |

Connection between the CSD-5300 and the DB25 connector of the receiver/ modem requires the following cable interface:

| CSD-5300 | Hayes Smartmodems, STI OEM-10, 1010 Precite/Leitch 5300RC | Kinemetrics 60DC, LFDC | EES Model 201 | Radio Code Clocks | GPS-5300 Trimble Nav Acutime GPS 18636-62 |
|---|---|---|---|---|---|
| Male DB25 connector | Male DB25 connector | Female DB25 connector | Female DB25 connector | DB25 connector | Female DB25 connector |
| 1 | 1 | 1 | 1 | 1 | 1 |
| 7 | 7 | 7 | 7 | 7 | 7 |
| 16 | 3 | 2 | 2 | 2 | 3 |
| 14 | 2 | 3 | 3 | 3 | 2 |
| 19 | 4 | 4 | 5 | 4 | - |
| 13 | 5 | 5 | 4 | 5 | - |
| 20 | 20 | 20 | 6 | 20 | - |
| 18 | 6 | 6 | 20 | 6 | - |
| 12 | 8 | 8 | - | 8 | - |
| 22 | 22 | 22 | - | - | - |
| 23 | 12 | 12 | - | - | - |

### 7.1.2 DIP Switch Settings

Selection of the type of modem/receiver is made via the DIP switch located at the front of the 5300RI module.

| Switch | | | | Device |
|---|---|---|---|---|
| **1** | **2** | **3** | **4** | |
| UP | UP | UP | UP | Hayes Smartmodems; all models and compatibles |
| DOWN | UP | UP | UP | PSTI OEM-10, Mod 1010 receivers |
| UP | DOWN | UP | UP | Kinemetrics 60-DC, LF-DC, 468DC receivers |
| UP | UP | DOWN | UP | EES M201 receiver |
| DOWN | DOWN | UP | UP | Radio Code Clocks, RC8000, Precitel/Leitch 5300RC |
| DOWN | UP | DOWN | UP | Trimble Navigation Acutime GPS Receiver |

The ON LINE LED will illuminate when the CSD-5300 is in direct control of the 5300RI module, such as when testing the module, originating or answering a telephone call, or when accessing the radio receiver. The LED will flash off an on when a connected modem signals that the telephone is ringing.

The RECEIVE DATA LED lights up coincident with serial data received by the 5300RI. This includes data from the radio receiver connected to the RS232 port or instructions from the CSD-5300 processor. The LED will not flash when the CSD-5300 unit is on-line via a modem as the received data is then relayed to the CSD-5300 processor directly.

## 7.2 Trimble Navigation Acutime GPS Smart Rodal Antenna

**Models: P/N 18636-62 (WITH TAIP ASCII protocol) and compatibles**

### 7.2.1 Installation

Before installing read the manual accompanying your GPS receiver and become familiar with its proper installation usage and adjustment. Note that the ACUTIME receiver rodal antenna has special needs as to its location and requires several minutes to initialize its satellite tracking system before it is able to provide an accurate time.

### 7.2.2 CSD-5300 Configuration

The CSD-5300 must be set to call for the time as described elsewhere in this manual. The phone number entered is of no consequence. Note that the time obtained from GPS receiver is UTC standard time (Greenwich mean time) and will be offset with respect to the local time according to your geographical location (time zone) and

daylight saving time. This offset is not handled automatically and must be adjusted via the 5300 front panel controls.

### 7.2.3    Internal Call Sequence

During a call the CSD-5300 commands the ACUTIME receiver to switch to 300 baud communication by transmitting an ASCII command:

>SPT0300,8,1,N<

sent at 4800 baud (8 bits 1 stop no parity) which is assumed to be the default communication setup for the ACUTIME unit. All ASCII bytes sent at 4800 baud are separated by ten 300 baud high bits (about 34 ms). Thus an ACUTIME receiver will not be adversely affected whether it is set to 300 or 4800 baud to begin with. All communication will fail if the receiver is set to any other than the two mentioned baud rates. Baud rate setup is followed by a 2 second pause. All subsequent communication happens at 300 baud. Following the baud rate setup the receiver is told to turn off its periodic reporting of position information (part of its default power-up setup) by transmitting an ASCII command:

>FPV00000000<

After a further pause of 2 seconds the CSD-5300 starts its series of queries for time by sending the ASCII command:

>QTM<

to which, it expects an ASCII reply in the form:

>RTMaabbccdddeeffgggghhijjklllll;*zz<

where the lower case letters stand for ASCII characters (one for each) representing the variable sections of the message:

| | |
|---|---|
| aa | hours |
| bb | minutes |
| cc | seconds |
| ddd | milliseconds |
| ee | day of the month |
| ff | month |
| gggg | year AD |
| hh | GPS/UTC time offset (in seconds); ignored |
| i | current fix source; accepted values: 0,1,2,3 |
| j | number of usable satellites; accepted values: 03 or more |
| k | GPS/UTC offset valid flag; accepted values: 1 only |
| lllll | reserved; ignored |
| zz | checksum; ignored |

The time information is expected to coincide with the start bit of the first reply message byte. The time will be rejected as invalid if the value of any of the fields with specified acceptable range fall outside of this range. The time will only be accepted if three successive time queries yield times which are consistent with the internal oscillator of the 5300. This is a robustness measure. In practice time jitter on time query results is typically $\pm 10$ ms.

**NOTE:** **Following text reprinted by permission of Trimble Navigation.**

## 7.2.4   General Description

**GPS Acutime Antenna/Receiver assembly**

The GPS Acutime 6 channel self contained antenna-receiver is designed as a zero maintenance unit readily able to interface with a wide variety of equipment. The maintenance objective has been achieved by mounting the antenna and receiver board sub-assembly in a sealed white polycarbonate housing. Trimble's long experience in marine GPS has shown that the antenna seal joint is the weakest link, being subject to extreme shear forces when the housing is struck by green water or ice chunks breaking loose from masts or rigging. We have thus eliminated this source of potential problems in the GPS Acutime design. The GPS Acutime unit has a digital interface; the unit requires only a DC voltage source to operate, providing position, velocity and a 1PPS output every second together with a hex output of UTC time.

**Specifications**

Reaction time:                                  2.5 - 3.5 minutes (average)

                                                30 - 45 seconds with memory backup

Electrical I/O:                                 RS-232

Dynamic capability (Electrical only):

| Velocity | Acceleration | Jerk |
|----------|-------------|------|
| 400 m/sec | 4 g (39.2 m/sec$^2$ | 20 m/sec$^3$ |

**NOTE:   The unit will not give fully accurate 1PPS output unless it is installed in a static environment;**

Temperature:

    Operating:                                  -40° C to +71° C

    Non-operating:                              -55° C to +85° C

Humidity:                                       100% condensing

Prime Power:                                    10/32 VDC - 2 watts nominal. Inline fuse (3A Quick Blow - to be supplied by customer externally)

The GPS Acutime is compatible with both 12 and 24 volt DC systems. The GPS Acutime has an over-voltage protection circuit designed to trip at voltages exceeding 36 volts. Over-voltage conditions may cause the in-line fuse to blow. The protection circuit automatically resets upon removal of the over-voltage condition, but the fuse may need to be replaced.

## 7.2.5    Computer Interface — RS-232

For connection to the RS232 serial ports of most computers it is possible to wire the Acutime unit through an RS422-RS232 converter. It is also possible for short runs to use a single ended RS422 wired in the following manner to a DB-25S plug.

| Color | Function | DB-25S Pin |
|---|---|---|
| Violet | RX - | 14 |
| Brown | TX - | 3 |
| Orange | RX + | 2 |
| Yellow | TX + | 16 |
| Black | Ground | 7 (also power ground) |
| **DC Connection** | | |
| Red | | Power +ve |

This combination will operate both with and without the RS422-RS232 converter in most cases. The exceptions are found with computers having UARTS with marginal voltage thresholds.

**Standard Cable Arrangement - RS 232**

### I/O Cable Color Code

| Accutime Connection | Wire Color | Function |
|---|---|---|
| Pin 1 | Orange | RXD (Receive Data) |
| Pin 2 | Brown | RXD (DGPS corrections I/P) |
| Pin 3 | Yellow | TXD (Transmit Data) |
| Pin 4 | Violet | Signal Ground |
| Pin 5 | Blue | 1 PPS/Memory Backup |
| Pin 6 | Black | Power Ground |
| Pin 7 | Red | Power |

**NOTE:   1. Connector cable via standard Conxall screw fitting (Conxall P/N 6280-7SG-523) mounted in the base of the housing.**

**NOTE:   2. 1 PPS output is by pulldown of external voltage provided to open collector circuit through Pin 5. Pulse synchronized to the integer second on the falling edge. Leakage current of 100 micro amps nominal taken to maintain internal memory.**

### 7.2.6    Dimensions:

Spigot Mount Antenna/Receiver:        147 mm diam. x 100 mm high
                                      (5.8" diam. x 3.9"high) 3/4" 18637-XX
                                      Series NPT female spigot on bottom
                                      surface for mounting Volume 1700 cc
                                      maximum (103 cubic inches) including
                                      dead space around mounting spigot.

Weight:                               0.41 Kg (0.9 pound)

## 7.2.7    System Component Description

The Acutime GPS Antenna/Receiver system consists of 3 sub-assemblies, the
Antenna/Receiver board, a polycarbonate housing, and a 15 meter connecting
cable.

**Antenna:**

The antenna unit consists of a double dipole antenna element mounted together
with the Receiver Board in a heavy duty polycarbonate housing complete with
mounting cone (spigot mount).

**Receiver Board:**

The Board consists of the necessary hardware and firmware required for
satellite signal processing and solution computation. The receiver has six
processing channels, operating on the L1 frequency using the C/A code. Prime
DC power is supplied from an external source, with isolation against major in-
line interference. The power supply module can tolerate variations between 10
and 32 volts.

The GPS Acutime board receives the satellite signal through the antenna feed
line connector. The complete process, from signal processing to digital output
control, is performed by the components on the receiver board. The reference
oscillator is a high-stability crystal oscillator operating at 16.368 Mhz. The
synthesizer module generates several signals for use on the board. One output
is the local oscillator for the mixer. Two other frequencies are generated for use
by the custom integrated circuits (ICs) tracking hardware. An additional signal
is used as the microprocessor clock. The mixer has additional circuitry for
coupling in the antenna signal. the IF module processes the IF signal,
amplifying it and limiting its bandwidth. The resulting signal is fed to the
signal processing circuits.

The GPS tracking hardware is based on Trimble custom gate arrays. They
contain satellite tracking circuitry, plus support circuitry for the
microprocessor. The GPS Acutime has a single 16-bit microprocessor to
perform both functions.

The channel signal processing circuits contain hardware for tracking the GPS satellite signals and for extracting the carrier code information as well as the navigation data at 50 bits per second. The signal processor controls the operation of the tracking hardware. The receiver continuously tracks the four satellites used for a solution and the remaining channels track up to 4 other satellites. The signal processor uses the measurements and data to compute the GPS-based position and velocity solution. The navigation processor also controls the selection of which satellites are tracked and manages the orbital information data and almanac for all of the satellites.

**Radio Frequency Interface**

GPS Acutime is designed to be functionally compatible with the L1 GPS satellite navigation signals as described in the GPS Specification SS-GPS-300B and ICD-GPS-200. GPS Acutime operates with the experimental Block I satellites as well as the operational Block II satellites or a combination thereof.

## 7.2.8    Mechanical Interface - Antenna Mounting

Choose a location for the Acutime antenna/receiver as close as possible to vertical, which has a relatively unobstructed view if the horizon, and which will be safe from damage during normal operation of the host vehicle. Dense wood or metal structures will shield Acutime from satellite signals. Acutime can receive satellite signals through glass, canvas and thin fiberglass. If you plan to install Acutime in a partially enclosed environment, test the ability of Acutime to receive satellite signals before committing to a permanent mount. The Acutime unit is designed, however, to withstand the full rigors of the elements and can therefore be mounted in an exposed external location. The only limitation is that the unit's extended performance at temperatures below -40 degrees (C or F) is not warranted. The unit will perform also when partially snow covered providing the snow is dry; ice accumulations will eventually shut off performance, only if the ice sheet is continuous. The shape of the unit has however, been selected partially to minimize rain, snow and ice accumulation.

The Acutime antenna/receiver is an active head antenna. For optimal performance, avoid locating Acutime within two feet (60 cm) of other antennas, near high vibration areas like engine housings, or near radar installations. If there is a limitation on available mounting locations ensure at least that Acutime is positioned outside the radar's cone of transmission. Follow the same guidelines when installing the Acutime near satellite communication equipment (e.g. Inmarsat A or C) or microwave dishes. For best results, mount the Acutime below and at least ten feet (3 meters) away from satellite communication equipment.

If the unit is being mounted permanently in a microwave installation, e.g. for timing purposes, then care should be exercised to shield the unit from random

back-scatter from microwave dishes. Difficulties will be immediately apparent if the unit cannot lock on to satellites or shows a poor ability to track. Protection is afforded by use of a ground plane, a metallic shield which is mounted below the desired minimum viewing angle of the antenna unit. In extreme cases a cone shield extending up to a 10 degree horizontal viewing angle may be tried (make allowances for snow and rain drainage!). This takes advantage of the fact that low elevation satellites have lower signal/noise ratios due to increased ionospheric absorption and therefore are less desirable for timing purposes. Such a cone shield will not work well on a moving vehicle such as a vessel because of its rolling and pitching motion.

Acutime is designed for pole mount. The threaded socket at the base of Acutime will accept both 1" - 14 thread per inch (TPI) straight thread, and a standard 3/4" - 14 TPI (NPT) pipe thread. Acutime only requires hand tightening on the pole mount. For temporary installations on a metallic surface a magnetic mount may be used (Part No. 12920-00) together with an adapter (Part No. 17030) The adapter is threaded 5/8 11 (TPI), the standard survey instrument mounting thread.

The connector cable should be firmly secured to the support using cable ties so that there is little or no mechanical strain on the 7 pin connector.


**NOTE:** **Acutime is a valuable instrument and for permanent installations it may be prudent to drill and pin the Acutime mount to discourage theft and prevent accidental loosening. If Acutime is easily removed, store it in a secure location when not in use.**


## 7.2.9    Electrical Interface

**System Power:**

The Acutime electrical interface is via pins 6 (Ground) and 7 (Positive) on the 7 pin Conxall connector; these correspond to the black and red conductors respectively of the connecting cable. The power requirement is nominally 2 watts for a supply voltage of 12 Volts DC. The maximum voltage is 32 VDC. Input circuits are provided to protect Acutime inputs and outputs from off-nominal power conditions. The input is protected against over-voltage by means of an external client supplied 3A fast blow fuse. The power supply is set to blow this 26 VDC. If Acutime encounters low voltage conditions, it degrades gracefully and returns to full operation upon the restoration of power.

Lightning surge protection is built into the Acutime; the unit is tested to 25 kV on the antenna case, as well as 25 kV applied to each pin using an industry

standard test procedure of a 150 pF capacitor discharging through a 10k ohm resistor.

## 7.3  Hayes Smartmodems

The Hayes Smartmodem is connected between the 5300RI and the telephone system. The modem must be configured using its internal DIP switches to communicate with the 5300RI. Functional settings rather than the actual settings of individual switches are described here, as the location and number of DIP switches may vary from unit to unit. Proper switch position should be determined for each particular unit.

| | |
|---|---|
| Data Terminal Ready | Support RS232-C DTR lead. Do not set this signal to the fixed ON setting. |
| Auto Answer | OFF. Modem will not automatically answer the phone. |
| Data Carrier Detect | Signals the actual status of the carrier. Do not set this signal to the fixed ON position. |
| Command Recognition | Enabled. The 5300RI sends command codes to the modem. |
| Telephone Line Type | Set in accordance with the telephone system type; single or multi-line installations. |
| Result Codes | These settings will not affect the operation of the unit as the 5300RI will change these settings via software commands. |

Once the interface between the 5300RI and the modem is established, the CSD-5300 can request or provide the time as described in the Operation section of this manual. If communication problems between the CSD-5300 and the modem are experienced, test the modem and telephone system by connecting the modem to a computer terminal and making a few calls.

## 7.4  Important Notes for Usage with all Radio Receivers

Since the date is not specified by transmitting stations, the 5300RI will reject date information from the radio receiver and will return a date of 000000 to the CSD-5300. this data will cause the CSD-5300 to retain its current date without change.

The CSD-5300 provides a fixed telephone loopback time to compensate for delays caused in the translation of data from the receiver into CSD-5300 format and thus, DO NOT manually enter a millisecond value for the Phone offset.

Please note that radio receivers are subject to periods of poor signal reception, and can lose lock with the transmitted signal. The 5300RI will query the receiver to determine if the unit is in lock. If the receiver's data is considered to be of poor accuracy, then the 5300RI will reject the data and indicate a failed phone call by flashing the front-panel time display. The CSD-5300 status code will indicate **P** for **failed last phone update**. As such, the CSD-5300 should be set to call the receiver at a time of the day when the quality of the reception is known to be good and the receiver to be in lock. To determine when reception is best, consult the radio receiver manual. Most receivers indicate a lock condition with the transmitted signal by lighting up a front panel LED.

## 7.5  Installation Procedures For The Supported Receivers:

### 7.5.1  Precision Standard Time Inc. Receiver

Before installing, read the manual accompanying the radio receiver and become familiar with its proper installation, usage and adjustment. The receiver must be configured by setting a number of DIP switches in the receiver. The functional settings rather than the actual switch numbers and positions are described here as the location and number of switches may vary from model to model. Proper switch position should be determined for each particular model.

The RS232 port should be configured for 300 baud, 8 data bits, no parity, and 1 stop bit. Set the receiver to return the time in the 24-hour format. The Hour Offset is set according to your local time zone. The propagation delay switches are set according to the location of the receiver with respect to the transmitting stations in Colorado and Hawaii. The Daylight Savings Time (D.S.T.) switch will determine whether or not the receiver decodes the D.S.T. bit transmitted by the source and switches the receiver to daylight savings time. This should be set in accordance with individual requirements. The date information is ignored.

The CSD-5300 may now be set to call for the time as described in the Operation section of this manual. The telephone number entered is of no consequence.

The 5300RI will query the receiver with the QA command. This consists of a 6 byte code, QA0600, that requests the time in accordance with the time zone and the D.S.T. setting of the unit. The 5300RI expects to receive a 13 byte reply in the following format:

QSmmSMHxxxxx<c/r>

where:

| | | |
|---|---|---|
| | Q | is the quality byte, indicating the receiver lock status. |
| | S | is the receiver DIP switch status. |
| | mm | is milliseconds in binary. |
| | S | is seconds in binary. |
| | M | is minutes in binary. |
| | H | is the hour in binary |
| | x | is the date, year, and unused data. |
| | <c/r> | is ASCII carriage return. |

The time returned is assumed to coincide with the trailing edge of the stop bit of the <c/r>.

## 7.5.2   Kinemetrics Radio Receivers

Before installing, read the manual accompanying the radio receiver and become familiar with its proper installation, usage and adjustment. The receiver must be configured by setting a number of DIP switches in the receiver. The functional switches rather than the actual switch number of switches may vary from model to model. Proper switch position should be determined for each particular model.

The RS232 port should be configured for 300 baud, 8 data bits, no parity, and 1 stop bit. Set the receiver to return the time in the 24-hour format. The Hour Offset is set according to your local time zone. The propagation delay switches are set according to the location of the receiver with respect to the transmitting stations. The date information is ignored.

The CSD-5300 configures the receiver through a series of control commands. It places the receiver in the T mode and configures the output data, whereby the receiver returns the time on demand in the following format:

<soh> HHMMSSmmmQ <c/r> <l/f>

where:       h       is ASCII start-of-header code, $01.

HH     is the hour, 2 bytes, in BCD.

MM     is minutes, 2 bytes, in BCD.

mmm  is milliseconds, 3 bytes, in BCD.

Q       is the 'quality' byte, indicating lock status.

<c/r>  is ASCII carriage return.

<l/f>   is ASCII line feed.

The time returned is expected to coincide with the leading edge of the start bit of the <soh> character.

The following quality characters are accepted by the 5300RI to indicate that the time is accurate: blank ($20), comma ($2C), and asterisk ($2A). Any other quality bytes, indicating a loss of signal for 90 minutes or more, will cause the data to be deemed unreliable.

## 7.5.3    European Electronic Systems - ESS Model M201

Before installing, read the manual accompanying your radio receiver and become familiar with its proper installation, usage, and adjustment. The receiver must be configured by setting a number of DIP switches in the receiver. As the location and number of DIP switches may vary from model to model, the functional settings rather than the actual switch numbers and positions are described here. You must determine the proper switch positions for your particular receiver.

Configure the receiver's RS232 port for 300 baud, 8 data bits, no parity bits, and 1 stop bit. Set the receiver to return the time in the 24-hour format. The Hour Offset is set according to your local time zone. The propagation delay switches are set according to your geographic location with respect to the transmitting stations. The date information is ignored.

The CSD-5300 may now be set to call and request the time as described in the manual. The phone number entered is of no consequence.

The 5300RI requests the time information from the EES receiver by activating the EES' DSR (RS232 pin 6) and CTS (RS232 pin 5) inputs. The receiver then responds by transmitting the following data via its RS232 port:

mSMHWDNYLBF                          (on older units)

mSMHWDNYLBHF                         (on newer units)

| | | |
|---|---|---|
| where: | m | is the milliseconds, 1 byte in BCD; hundreds/tens |
| | S | is the seconds, 1 byte in BCD; tens/ones |
| | M | is the minutes, 1 byte in BCD; tens/ones |
| | H | is the hours, 1 byte in BCD; tens/ones |
| | W | is day of week, 1 byte in BCD; 0/ones |
| | D | s day of month, 1 byte in BCD; 0/ones |
| | N | is the month, 1 byte in BCD; 0/ones |
| | Y | is the year, 1 byte in BCD; tens/ones |
| | L | is the leap year byte; $00 = not a leap year $01 = leap year |
| | B | is the BST byte; $00 = not BST $01 = BST |
| | H | is the health byte; it is $3F if the receiver is aligned to the radio service. |
| | F | is the frame byte $FF, which indicates the last byte in the sequence. |

The time returned is expected to coincide with the time the CTS and DSR inputs to the receiver go active. The software compensates for the time required to transmit the data to the CSD-5300. Note that the EES radio receiver can provide the time only to the nearest 10 milliseconds. The 5300RI can operate successfully with both data formats of the EES radio receiver described above.

## 7.5.4   Radio Code Clocks Radio Receivers -RCC8000

Before installing, read the manual accompanying the radio receiver and become familiar with its proper installation, usage and adjustment. The RCC receiver must be ordered from factory with a Type 2 Serial Interface. The receiver must also be configured by setting a number of DIP switches in the receiver.

The RS232 port of the receiver should be configured for 300 baud, 7 data bits, no parity, and 2 stop bits.

When updating the time from the radio receiver, the 5300RI requests the time from the RCC8000 by sending a Time-Request byte 'T'. The time data is returned from the receiver in the following format:

HH:MM:SS.mmm DD/MM/YY DDD W S<c/r><l/f>

| where: | HH | is the hour, 2 bytes. |
|---|---|---|
| | MM | is the minutes, 2 bytes. |
| | SS | is the seconds, 2 bytes. |
| | mmm | is the milliseconds, 3 bytes, in BCD. |
| | DD/MM/YY | is the date, 8 bytes. |
| | DDD | is the day of the year, 3 bytes. |
| | W | is the day of the week. |
| | S | is the status byte. |
| | <c/r> | is the carriage return. |
| | <l/f> | is the line feed. |

All characters are in ASCII, and the blank spaces are sent as shown ($20 in ASCII), for a total of 31 bytes.

The actual time is expected to coincide with the leading edge of the start bit of the Time-Request byte. The 5300RI adds a time offset equal to the length of the Request byte and the 31 byte data string to maintain the accuracy of the time information. The CSD-5300 will accept the time data as correct only when the Valid Time bit of the Status Byte is high and the Reject Code bit of the Status Byte is low. This ensures that the CSD-5300 will not accept invalid time data from the receiver.

# 7.6   Circuit Description

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for details.

# Chapter 8

## 5300CD Clock Driver Module

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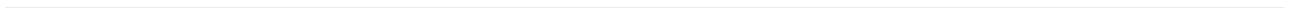
# Chapter 9

## 5300CD-24 Clock Driver Module

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# Chapter 10

## 5300PS Power Supply

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