

Appendix E

External Control of CP650

The CP650 can be controlled by devices connected to the RS-232 **serial data** connector, or to the **remotes** connector located on the rear of the CP650.

This appendix is for use by customers who are highly qualified to modify hardware and write software. Dolby Laboratories cannot be held liable for incidental, special, direct, indirect, or consequential damages; or loss of use, revenue, or profit by users attempting to interface the CP650 with other systems.

E.1 Control Via RS-232 Serial Data Port

CP650 control via the serial data connector (the primary interface designed and supported by Dolby) is available in CP650 system software version 1.2.1.1 and later.

The CP650 provides a SERIAL DATA port that supports standard 9-pin serial connections to PC serial ports and other RS-232 devices. Although this port is primarily used while running the Dolby CP650 Setup software from a PC, the software interface described below allows the serial data port to be used with a simple ASCII character interface to set and get information regarding the current CP650 processor status.

The raw serial interface parser accepts ASCII commands as described below. Each command consists of a simple keyword, <key>, followed by an “=” sign and the <value> for that key. A command is terminated by an end-of-line character combination (“\r\n”). This is the typical “end of line” combination sent by PC terminal programs.

Current CP650 settings may be queried by substituting a question mark “?” for the “<value>” field. The complete set of known settings may be queried by using the special “all=?” command. See the examples below.

Commands

| Key | Range of Values | Notes |
|---------------------------|---|--|
| format_button | 0 .. 7 indicating which button on the CP650 front panel should be applied: Data Button Applied 0 Format 01 1 Format 04 2 Format 05 3 Format 10 4 Format 11 5 User Format 1 6 User Format 2 7 Nonsync Format Any Preset Fader Level associated with the indicated button is also applied, and the LED for the selected button is illuminated. | |
| fader_level | 0 .. 100 corresponding to fader values 0.0 ... 10.0 | Querying fader_level while the fader_setting is "auditorium" returns the level as determined by the auditorium fader. |
| fader_setting | "local" "auditorium" If "auditorium" is selected, the main shaft fader is disabled as are any attached Remotes (Cat. No. 779, Cat. No. 771). | <see above> If changed via this serial interface, this setting is lost at the next CP650 restart. |
| mute | 0 .. 2 indicating the desired mute setting: Data Mute Operation 0 Unmute 1 Mute 2 Toggle Any applicable "Fade In/Out Time" is applied just as if the front panel MUTE button were used. | |
| user_formats | | This key can only be queried, not modified. Querying this key returns on one line a comma-separated list indicating the user formats: <user 1>, <user 2>, <nonsync> |
| projector | 1 .. 2 | This key can only be queried, not modified. |
| preset_fader_level | | This key can only be queried, not modified. Querying this key returns on one line a comma-separated list indicating the current value for all format buttons separated by commas. The buttons are listed in the following order: 01, 04, 05, 10, 11, U1, U2, NS Each level can be 0 .. 100 or -1. A setting of -1 indicates no preset fader level for that button. |

Query

Querying an Individual Parameter

“<key>=?” returns a “<key>=<value>” output line for that key.

Querying All Available Parameters

“all=?” results in a series of output lines representing every known key in the serial control system.

Query Errors

If a query cannot be parsed or does not match a known parameter, “error” will be output. External controllers must wait for the response to a query before proceeding.

Notes

1. The ASCII interface system operates at a baud rate of 9600 bps (8 data bits, 1 stop bit, No Parity, No Flow Control) and cannot be invoked while the SERIAL DATA port is in use by the CP650 Setup or Reader Alignment programs.
2. The interface operates in RAW serial mode. Characters are not echoed back to the controller, and control characters are ignored.
3. Command parsing is not case sensitive.
4. Whitespace (<space>, <tab>, etc.) is ignored on input lines.
5. No error correction (CRC), sync bytes, or protocol is applied to this interface. Customers must be aware of any stability or dropout issues with their own hardware.
6. If a command is parsed successfully but the value is out of range (or the same as the current setting), no error is issued and the command has no effect.

Examples

| Operation | Character String to Send | Output from the CP650 |
|---|--------------------------|--|
| To set the CP650 fader level to 6.5 | fader = 65\r\n | |
| To ensure the CP650 is not muted | mute = 0\r\n | |
| To apply the Format 10 button | format_button = 3\r\n | |
| To query the status after the above three commands are sent | query all\r\n | fader = 65\r\n mute = 0\r\n format_button = 3\r\n user_formats = 13, 64, 60\r\n projector = 1\r\n preset_fader_level = -1, -1, -1, 65, 68, -1, -1, 75\r\n |

E.2 Control Via Remotes Connector

CP650 control using single-wire communications via the **remotes** connector is available in CP650 System software version 1.1.5 and later. To do so, it is recommended that a Cat. No. 779 Remote Control or Cat. No. 771 Remote Fader be used.

Dolby Laboratories occasionally receives requests to interface the CP650 to other types of computers, for the purposes of remote control. While this was never intended to be a feature of the remote port, it may be possible to command the CP650 to change the fader level, select any one of the eight front-panel formats, and to toggle the mute status.

The remote port interface consists of three wires. One provides 15 volts at low current to power the remote units. The other two lines of the remote port are ground (0 volts) and data. The ground line should be connected to the reference ground voltage of the serial port on the computer. This is usually found on pin 7 of a DB-25 serial connector, or pin 5 of a DB-9 connector.

The single data line presents the single biggest challenge of interfacing another computer to the CP650. All industry-standard RS-232 ports have two data lines; one to transmit, and one to receive. The CP650 data line works by placing the single data line in a “high impedance” state while listening for transmitted data, and driving voltages onto this line when it needs to send information. In other words, the single data line is a “receiving” line for all devices, except when they need to send data, at which point it is a “transmitting” line.

Thus, when the CP650 needs to communicate, or a remote accessory needs to communicate with the CP650, it “takes control” of the single data line just long enough to send its message. It then must place the line back in a high impedance state, and listen for a response.

Interfacing an external computer's serial port to the single data line can be tricky. The actual requirement, as stated above, is for the serial port to “tri-state” its transmitter when it is not sending.

If a one cannot engineer this type of circuit for the computer's serial port, an alternate method can be tried, but it may damage the serial port. Pass the serial port's transmit line through a series-connected resistor, and tie that line to both the serial port receive line and the CP650's data line. If one is lucky, the serial port's transmitter (which does not tri-state) can be overridden by the CP650's transmitter, and yet still function as a transmitter when necessary (when the CP650 is in “listen” or high-impedance mode).

To do this, start with a high resistance (say, 100 k Ω), and reduce it until the computer's serial port is able to both send and receive data. The exact value required depends on the types of chips used in the serial port.

The DDCMP Protocol

Digital Data Communications Message Protocol (DDCMP) was developed by Digital Equipment Corporation as a serial link layer protocol.

All messages between the CP650 and the remote accessories take place within the context of the DDCMP protocol. An important reference document can be found via the internet at the following URL:

<http://gatekeeper.dec.com/pub/DEC/DECnet/PhaseIV/ddcmp.txt>.

The network is a half-duplex multipoint network. The operating mode of the remote accessories is that of a half-duplex tributary station, with the control station being the CP650.

The CP650 supports remote accessory device addresses 1 through 9.

The CP650 has intentionally added one non-standard modification to the DDCMP protocol. If the CP650 sends out the hex value "FF" twenty times in a row, all remote accessories should recycle themselves to their power-on state. This includes resetting themselves to the ISTRT state, and attempting to re-establish the link.

Disclaimer: An attempt has been made to implement the DDCMP protocol as defined in the document referenced above. If there is a difference between the reference document and the CP650 implementation, the CP650 method is defined to be correct, and will not be modified. Dolby Laboratories reserves the right to make changes to the remote port communication scheme or interface at any time, without notice.

DDCMP Timers

A real timer must exist in both the ISTRT and ASTRT states, of approximately one second, for sending STRT and STACK messages respectively.

Establishing the DDCMP Link

On power-up, the remote accessories should be in the ISTRT state. As specified in the DDCMP document, the link to the CP650 is established by each remote accessory sending one (or more) STRT messages until the remote accessory receives the STACK message (indicating that the link has been established).

The delay between repeated STRT messages should be determined by each accessory's address (slightly different for each address) to prevent repeated transmission collisions.

Remote Accessories-to-CP650 Message

A periodic ACK from the CP650 will pass the select flag to each remote accessory (in turn). If no change in the state of the CP650 is required by the selected remote accessory, the remote simply returns the select flag via an ACK message.

If the remote has been given the select flag, and it intends to change the state of the CP650, it will send the one-byte data message.

Note: All remotes must parse all messages. This requires looking at the length and cannot be ignored.

To command the CP650 to toggle the mute setting, the data message must have a value of zero. If the CP650 was unmuted before receiving this command, it will be in the muted mode afterwards, and if muted before, it will be unmuted after.

The CP650 front panel buttons can be thought of as being numbered 1 through 8 (format 01, 04, 05, 10, 11, U1, U2, and NS, respectively). To command the CP650 to assert a format change, the data byte should be a number between 1 to 8.

To change the fader level, the data byte should be a value between 10 and 110. This corresponds to a fader setting between 0.0 and 10. (Subtract 10 from the value of the data byte and then divide by 10 to obtain the resulting fader value.)

CP650-to-Remote Accessories Message

The message from the CP650 to any remote accessory will always contain two bytes of data. The CP650 will periodically transmit this message to all registered remote accessories to insure that they have the proper data. This data message will also be sent immediately whenever there is a relevant change in the state of the CP650.

The least significant seven bits of the first byte in the data packet (received from the CP650) contains the current fader level, between 0 and 100. Divide by ten to obtain the correct fader level.

The most significant bit of the first byte in the data packet tells the remote accessory whether or not to blank its fader display (0 = display on, 1 = display off).

The least significant three bits of the second byte in the data packet contain the current format of the CP650. The value will be between 1 and 8, corresponding to the front-panel buttons as described above.

The next most significant bit tells if the CP650 is muted (0 = not muted, 1 = muted).

The next most significant bit tells which projector is in use (0 = projector 1, 1 = projector 2).

The next most significant bit tells if the current CP650 format is valid or not (0 = normal, 1 = invalid format).

The next most significant bit tells if the auditorium fader is active (0 = not active, 1 = active).

The most significant bit of the second data byte is not used.