TASCAM FW-1884 Control Surface Messaging

Revision 1.6
Date: 3/31/2004

Change Log
Revision 1.6   3/31/04   Added Unicode version of SoftLCD text messages, Device Inquiry messaging (These messages added for Windows driver software 1.20; will be included in the next (post-v1.20) Mac OS X driver.)
Revision 1.5   1/27/04   Extended SoftLCD commands section.
Revision 1.4   11/4/03   Added notes regarding FE-8 and SoftLCD support.
Revision 1.3   6/24/03   Small fixes and clean-up.
Revision 1.2   5/16/03   Clarified host-to-FW1884 fader messages by explicitly including the UPDATE_FADER_POSITION message. (Previously this was dealt with as a note to the FW1884-to-host FADER POSITION message description.)
Revision 1.1   5/5/03   Changed the channel 1 fader message in and out. This used the same MIDI controller as "Sustain Pedal" which is zero'd by the Windows MIDI system when a MIDI port is closed. Note: This channel fader message is no longer compatible with the US-428.
Revision 1.0   3/24/03   Original version

Purpose
Provide simple, effective integration between the FW-1884 and host software applications. Support for channel strip expansion (via the FE-8) and on-screen feedback (via SoftLCD) is also provided.

Introduction
The FW-1884 provides digital audio I/O, MIDI, and control surface functions in a single affordable FireWire-based product. While the audio and MIDI I/O follow established standards which are easily interfaced with host applications, full integration of the control surface aspects of the FW-1884 requires a set of messages to be defined which permits two-way communication of control information between the host application and FW-1884. These messages are transmitted and received over Firewire on the virtual MIDI"FW-1884 Control" port.

The FE-8 is a fader-expansion unit for the FW-1884. It replicates the FW-1884's 8 channel strips, including touch-sensitive 100mm motorized fader, illuminated MUTE, SOLO, and SELECT buttons, and an encoder. Up to 15 FE-8's may be used with an FW-1884. Every FE-8 that is connected to a host computer is controlled by its own virtual MIDI control port. The MIDI messages to and from an FE-8 are identical to the channel strip messages to and from an FW-1884.

SoftLCD is a host computer application that can display information on behalf of the FW-1884. MIDI sysex commands can be sent to the FW-1884 to direct it to display characters in the SoftLCD window. This document describes the Midi message format that an application can use to "write" onto the SoftLCD display.

<u>Functional Groups</u>
The FW-1884's control surface is divided into several major functional groups. From left to right:

  a) Shortcut buttons and LED's
  b) Encoder-assignment buttons and LED's
  c) Channel-strip controls (faders, mutes, solos, encoders, etc)
  d) EQ buttons, continuous EQ and encoders, and associated status LED's
  e) Surface mode selection buttons and LED's
  f) MIDI routing buttons and LED
  g) Assignable function buttons, LED's
  h) Navigation arrow-keys, shuttle button, and data wheel
  i) Bank buttons and LED's
  j) Transport, nudge, marker, and locate buttons and LED's
  k) Miscellaneous buttons and LED's

Note: Some of the buttons and LED's are not visible to the host computer and the associated
     applications running on the host. For example, the status of the "1394", "ADAT", "S/PDIF", and
     "CLOCK" LED's is controlled by firmware running on the FW-1884.

The buttons and LED's which have no visibility or relationship to the host computer are:

  1. PFL button and LED
  2. Surface mode buttons and LED's (COMPUTER, MIDI CTRL, MON MIX)
  3. CLOCK button
  4. CONTROL PANEL button and LED
  5. MIDI ROUTE buttons and LED's
  6. F7-F10 and the automation buttons and LED's when MIDI routing is active
  7. DIG IN and CLOCK LED's (1394, CLOCK, ADAT, SPDIF)
  8. When in MON MIX or MIDI CNTRL modes, the BANK-LEFT and BANK-RIGHT button, and
      associated LED's are controlled strictly by firmware, as are most other buttons and LED's, except
      for those in the bottom-right of the control surface (transport/locate buttons, NUDGE buttons, data
      wheel, SHUTTLE button).
  9. Channel OVR and SIG LED's
  10. Metering LED's

Communication model
Standard MIDI controller and sysex messages will be used to communicate between the host and FW-1884. In many cases, the commands transmitted by the FW-1884 in "native mode" are identical to those generated by the Tascam US-428 and/or the JL Cooper CS-10 controller. In general, it is desired that overall system "state information" be maintained by the host application, rather than in the FW-1884. As an example, here is how a change in transport state from STOP to PLAY might be communicated:

1. User presses PLAY button on FW-1884.
2. Play-button command is sent via Firewire to host application as MIDI .
3. Application receives Play message from the "FW-1884 Control" Midi input device.
4. Application switches to PLAY mode, just as if user had performed the operation with a mouse-click.
5. Application sends Transport Update message to "FW-1884 Control" Midi output device, which is sent via Firewire to the FW-1884.
6. FW-1884 interprets transport-update command, and responds by activating the PLAY LED.

In this example, the FW-1884 doesn't "know" the state of the transport. It has simply sent a command indicating the button-press, and responded to the transport-update command from the host by lighting the appropriate transport LED.

It is recommended that the following three buttons always be used as type-modifier buttons: SHIFT, CTRL, and REC. When any of these are held down, they can be used to modify the behavior of other button presses.

Transport/Locate command set
The FW-1884 contains a set of standard transport buttons: REW, FFWD, STOP, PLAY, and RECORD. In addition, dedicated status LED's are used to communicate the current transport state to the user. The LED's indicate REW, FFWD, PLAY, and RECORD. (Note that there is no LED to indicate STOP.) Additionally, there are three locate buttons, which can be used to set and locate to markers established on the host application's timeline. SET is intended to be used as a SHIFT key, along with either the < or > button to drop a marker at the application's current time.

FW-1884 to Host Messages (transmitted at button transitions)

1. TRANSPORT_REWIND
    a. Button-down: BF 13 7F
    b. Button-up: BF 13 00
2. TRANSPORT_FFWD
    c. Button-down: BF 14 7F
    d. Button-up: BF 14 00
3. TRANSPORT_STOP
    e. Button-down: BF 15 7F
    f. Button-up: BF 15 00
4. TRANSPORT_PLAY
    g. Button-down: BF 16 7F
    h. Button-up: BF 16 00
5. TRANSPORT_RECORD
    i. Button-down: BF 17 7F
    b. Button-up: BF 17 00

6. LOCATE_LEFT (non CS-10)
    j. Button-down: BF 18 7F
    k. Button-up: BF 18 00
7. LOCATE_RIGHT (non CS-10)
    l. Button-down: BF 19 7F
    m. Button-up: BF 19 00

8. SET_LOCATE (non CS-10)
   n. Button-down: BF 1A 7F
   o. Button-up: BF 1A 00
9. PUNCH_IN (non CS-10)
   p. Button-down: BF 1B 7F
   q. Button-up: BF 1B 00
10. PUNCH_OUT (non CS-10)
   r. Button-down: BF 1C 7F
   s. Button-up: BF 1C 00
11. NUDGE_LEFT (non CS-10)
   t. Button-down: BF 1D 7F
   u. Button-up: BF 1D 00
12. NUDGE_RIGHT (non CS-10)
   v. Button-down: BF 1E 7F
   w. Button-up: BF 1E 00
13. FOOTSWITCH
   x. Switch-down: BF 1F 7F
   y. Switch-up: BF 1F 00

Host to FW-1884 Messages (transmitted when host transport-state changes)

1. UPDATE_TRANSPORT_LED:
   a. State is REWIND: F0 4E <UNIT> 12 01 13 <STATE> F7
   b. State is FFWD: F0 4E <UNIT> 12 01 14 <STATE> F7
   c. State is STOP: F0 4E <UNIT> 12 01 15 <STATE> F7
   d. State is PLAY: F0 4E <UNIT> 12 01 16 <STATE> F7
   e. State is RECORD: F0 4E <UNIT> 12 01 17 <STATE> F7

Where:
   <UNIT> is device ID. Should be transmitted as 0 for now.
   <STATE> == 0 turns LED OFF
   <STATE> == 7F turns LED ON

Per-channel Control command set
The FW-1884 and the FE-8 include a set of 8 channel-strip controls and LED's. Each channel-strip
includes the following controls:

a. Motorized fader with touch-sensor for gain control
b. Mute button and LED
c. Solo button and LED
d. Select button and LED
e. Record-enable LED
f. Pan/aux encoder

Note: The per-channel SIG, OVR LED's are under FW-1884 firmware control, and do not have
    associated host control messages.

FW-1884/FE-8 to Host Commands

1. FADER_POSITION: BF 4x vv 5x ww   x = [F, 1, 2, 3, 4, 5, 6, 7],   (channel, except
                                        for the first channel which is mapped to "F")
                                        vv = [0..7F] (7 MSB's)
                                        ww = [00,10,20,30,40,50,60,or 70]
                                        (3 LSB's of fader ADC shift left)
2. FADER_TOUCH:
    f. Fader touched   BF 7x 7F   x=[0..8], 0..7 for track faders, 8 for master fader
    g. Fader released   BF 7x 00
3. MUTE_SWITCH:
    a. Button-down: BF 0x 7F
    b. Button-up: BF 0x 00   x=[0..7]
4. SOLO_SWITCH
    a. Button-down: BF 0x 7F   x=[8.. F]
    b. Button-up: BF 0x 00
5. SELECT_SWITCH:
    h. Button-down: BF 2x 7F
    i. Button-up: BF 2x 00   x=[0..7]
6. PAN_ENCODER   BF 6x vv   x=[8..F], vv = 2's complement using 7 data bits
7. REC_SWITCH:
    j. Button-down: BF 29 7F
    k. Button-up: BF 29 00

Host to FW-1884/FE-8 Messages
Note: In these messages, <STRIP #> is a number in the range [0..7], corresponding to the channel-strip #, and <STATE> is either 0x00 (LED OFF) or 0x7F (LED ON) . Transmit <UNIT> as 0 for now.

1. UPDATE_MUTE_LED: F0 4E <UNIT> 12 02 <STRIP #> <STATE> F7
2. UPDATE_SEL_LED: F0 4E <UNIT> 12 03 <STRIP #> <STATE> F7
3. UPDATE_REC_LED: F0 4E <UNIT> 12 04 <STRIP #> <STATE> F7

// Note: following message forces FW-1884 to send current fader position messages to host
// via the FW-1884 Control Port

4. DUMP_FADER_POS: F0 4E <UNIT> 12 10 F7
5. UPDATE_SOLO_LED   F0 4E <UNIT> 12 13 <STRIP #> <STATE> F7
6. CLEAR_ALL_LEDS   F0 4E <UNIT> 12 16 F7
7. ZERO_CHANNEL_FADERS   F0 4E <UNIT> 12 17 F7

8. UPDATE_FADER_POSITION: BF 4x vv 5x ww   x = [F, 1, 2, 3, 4, 5, 6, 7],   (channel, except for the first channel which is mapped to "F")
vv = [0..7F] (7 MSB's)
ww = [00,10,20,30,40,50,60,or 70]
(3 LSB's of fader ADC shift left)
NOTE: To move the fader from the host computer, the above messages are transmitted by the host application. They will be interpreted in the driver, which will send the appropriate 10-bit values to the FW-1884 and move the fader. To minimize fader noise, the MS and LS parts of the fader position should be sent in quick succession.

Bank-Switching Command Set

The FW-1884 has two buttons that allow the user to select the bank of application channels that is addressed by the eight channel-strips. For example, an application with 32 virtual tracks would define 4 banks of eight channel strips each. The Bank-L and Bank-R buttons let the user quickly shift the control surface to address any bank of eight channels. There are two LED's adjacent to the Bank-L and Bank-R buttons, which indicate that pressing the button will cause the application software to switch to the next lower or higher bank, respectively. It is OFF when there are no further virtual fader banks available in that direction.

FW-1884 to Host Commands

1. BANK_LEFT:
      a. Button-down: BF 10 7F
      b. Button-up: BF 10 00
2. BANK_RIGHT:
      a. Button-down: BF 11 7F
      b. Button-up: BF 11 00

Host to FW-1884 Messages:
1. UPDATE_BANK_LEFT_LED: F0 4E <UNIT> 12 07 <STATE> F7
2. UPDATE_BANK_RIGHT_LED: F0 4E <UNIT> 12 08 <STATE> F7
3. UPDATE_BANK_2_LED: F0 4E <UNIT> 12 14 <STATE> F7
4. UPDATE_BANK_3_LED: F0 4E <UNIT> 12 15 <STATE> F7

where <STATE> is either 0x00 (LED OFF) or 0x7F (LED ON)
<UNIT> is device ID. Should be transmitted as 0 for now.

EQ Knobs and Band Selection Command Set

Three continuous-turn rotary encoders allow the user to set the Gain, Frequency, and Bandwidth of a band of parametric EQ. The controller numbers used are the same as the JL Cooper CS-10, however instead of an absolute 0..7F value, the increment/decrement of the encoder is transmitted. The application must understand when the logical limit of the EQ control has been reached, and provide on-screen feedback to let the user know that he is at the minimum or maximum setting for the control. This prevents "wrapping" and discontinuous changes in the values of the parameters being sent. A pan encoder knob is also defined; its operation is similar to the EQ encoders.

FW-1884 To Host Commands:
1. SELECT_EQ_HI
   a. Button-down: BF 2C 7F
   b. Button-up: BF 2C 00
2. SELECT_EQ_HIMID
   c. Button-down: BF 2D 7F
   d. Button-up: BF 2D 00
3. SELECT_EQ_LOMID
   e. Button-down: BF 2E 7F
   f. Button-up: BF 2E 00
4. SELECT_EQ_LO
   g. Button-down: BF 2F 7F
   h. Button-up: BF 2F 00
5. EQ_GAIN_CHANGE:
   i. BF 48 vv,   vv = 2's complement using 7 data bits

6. EQ_FREQ_CHANGE
   j. BF 49 vv,   vv = 2's complement using 7 data bits

7. EQ_BW_CHANGE
   k. BF 4A vv,   vv = 2's complement using 7 data bits

8. MASTER_FADER
   l. BF 4B vv 5B ww,   vv = [0..7F] (7 MSB's)
                               ww = [00,10,20,30,40,50,60,or 70]
                               (3 LSB's of fader ADC shift left)

Host to FW-1884 Messages:
1. UPDATE_EQ_HI_LED: F0 4E <UNIT> 12 09 <STATE> F7
2. UPDATE_EQ_HIMID_LED: F0 4E <UNIT> 12 0A <STATE> F7
3. UPDATE_EQ_LOMID_LED: F0 4E <UNIT> 12 0B <STATE> F7
4. UPDATE_EQ_LO_LED: F0 4E <UNIT> 12 0C <STATE> F7

where <STATE> is either 0x00 (LED OFF) or 0x7F (LED ON)
<UNIT> is device ID. Should be transmitted as 0 for now.

Function and Automation buttons, LED's, and continuous data wheel

Above the datawheel are eight buttons. The top four are function buttons F7-F10. These are mappable to any DAW function. Below them are four buttons that are normally for automation, but can also be mapped. Below these are arrow buttons and an illuminated shuttle button next to the datawheel.

FW-1884 to Host Commands:

1. F7
   - a. Button-down: BF 35 7F
   - b. Button-up: BF 35 00
2. F8
   - a. Button-down: BF 36 7F
   - b. Button-up: BF 36 00
3. F9
   - a. Button-down: BF 37 7F
   - b. Button-up: BF 37 00
4. F10
   - a. Button-down: BF 38 7F
   - b. Button-up: BF 38 00
5. READ
   - a. Button-down: BF 39 7F
   - b. Button-up: BF 39 00
6. WRT
   - a. Button-down: BF 3A 7F
   - b. Button-up: BF 3A 00
7. TCH
   - a. Button-down: BF 3B 7F
   - b. Button-up: BF 3B 00
8. LATCH
   - a. Button-down: BF 3C 7F
   - b. Button-up: BF 3C 00
9. SHUTTLE_SWITCH
   - a. Button-down: BF 7B 7F
   - b. Button-up: BF 7B 00
10. ARROW_UP
    - c. Button-down: BF 7C 7F
    - d. Button-up: BF 7C 00
11. ARROW_DOWN
    - e. Button-down: BF 7D 7F
    - f. Button-up: BF 7D 00
12. ARROW_LEFT
    - g. Button-down: BF 7E 7F
    - h. Button-up: BF 7E 00

13. ARROW_RIGHT

      i.   Button-down: BF 7F 7F

      j.   Button-up: BF 7F 00

14. DATA_WHEEL (identical to JL Cooper CS-10)

    a. BF 60 vv,   vv = 2's complement using 7 data bits

Host to FW-1884 Messages:

1. UPDATE_FN_LED: F0 4E <UNIT> 12 0E <FN #> <STATE> F7

2. UPDATE_AUTO_LED: F0 4E <UNIT> 12 0E <AUTO #> <STATE> F7

3. UPDATE_SHUTTLE_LED: F0 4E <UNIT> 12 0E 7C <STATE> F7

where

        <FN #> is in the range [0...3] corresponding to LED's [F7…F10]
        <AUTO #> is in the range [4...7] corresponding to LED's READ, WRT, TCH, and LATCH
        <UNIT> Transmit as 0 for now.
         <STATE> is either 0x00 (LED OFF) or 0x7F (LED ON)

Editing/Shortcut buttons

These buttons in the lower left are shortcuts for editing and other functions. They all have default labels.
While any can be remapped to other functions, it is highly recommended that EDIT_SHIFT and
EDIT_CTRL be used as modifier keys.

FW-1884 to Host Commands:

1. EDIT_SAVE_F1

    a. Button-down: BE 01 7F

    b. Button-up: BE 01 00

2. EDIT_REVERT_F2

    a. Button-down: BE 02 7F

    b. Button-up: BE 02 00

3. EDIT_ALL_SAFE_F3

    a. Button-down: BE 03 7F

    b. Button-up: BE 03 00

4. EDIT_CLR_SOLO_F4

    a. Button-down: BE 04 7F

    b. Button-up: BE 04 00

5. EDIT_MARKER_F5

    a. Button-down: BE 05 7F

    b. Button-up: BE 05 00

6. EDIT_LOOP_F6

    a. Button-down: BE 06 7F

    b. Button-up: BE 06 00

7. EDIT_CUT

    a. Button-down: BE 07 7F

    b. Button-up: BE 07 00

8. EDIT_DEL

    a. Button-down: BE 08 7F

    b. Button-up: BE 08 00

9. EDIT_COPY

    a. Button-down: BE 09 7F

    b. Button-up: BE 09 00

10. EDIT_PASTE

    a. Button-down: BE 0A 7F

    b. Button-up: BE 0A 00

11. EDIT_ALT_CMD

    a. Button-down: BE 0B 7F

    b. Button-up: BE 0B 00

12. EDIT_UNDO

    a. Button-down: BE 0C 7F

    b. Button-up: BE 0C 00

13. EDIT_SHIFT

    a. Button-down: BE 0D 7F

    b. Button-up: BE 0D 00

14. EDIT_CTRL

    a. Button-down: BE 0E 7F

    b. Button-up: BE 0E 00

Host to FW-1884 Messages:

1. UPDATE_EDIT_LED: F0 4E <UNIT> 12 10 <EDIT BUTTON #> <STATE> F7

where:

    <EDIT BUTTON #> is in the range [01...0E] corresponding to edit buttons with the identical
    button codes
    <UNIT> Transmit as 0 for now.
    <STATE> is either 0x00 (LED OFF) or 0x7F (LED ON)

<u>Encoder Assignment Keys</u>

FW-1884 to Host Commands:

1. ASSIGN_FLIP

    a. Button-down: BE 10 7F

    b. Button-up: BE 10 00

2. ASSIGN_PAN

    a. Button-down: BE 11 7F

    b. Button-up: BE 11 00

3. ASSIGN_AUX1

    a. Button-down: BE 12 7F

    b. Button-up: BE 12 00

4. ASSIGN_AUX2

    a. Button-down: BE 13 7F

    b. Button-up: BE 13 00

5. ASSIGN_AUX3

    a. Button-down: BE 14 7F

    b. Button-up: BE 14 00

6. ASSIGN_AUX4

    a. Button-down: BE 15 7F

    b. Button-up: BE 15 00

7. ASSIGN_AUX5

    a. Button-down: BE 16 7F

    b. Button-up: BE 16 00

8. ASSIGN_AUX6

    a. Button-down: BE 17 7F

    b. Button-up: BE 17 00

9. ASSIGN_AUX7

    a. Button-down: BE 18 7F

    b. Button-up: BE 18 00

10. ASSIGN_AUX8

    a. Button-down: BE 19 7F

    b. Button-up: BE 19 00

Host to FW-1884 Messages:

1. UPDATE_ENCODER_ASSIGN_LED: F0 4E <UNIT> 12 11 <ASSIGN BUTTON #> <STATE> F7

where:

<ASSIGN BUTTON #> is in the range [10...19] corresponding to encoder-assignment buttons
with the identical button codes
<UNIT> Transmit as 0 for now.
 <STATE> is either 0x00 (LED OFF) or 0x7F (LED ON)

SoftLCD Commands

SoftLCD is a host computer application that can display information in a window on the host computer on
behalf of the FW-1884. The SoftLCD window displays two lines of 55 characters. If the SoftLCD
application is running, then sysex MIDI messages can be sent to the FW-1884 MIDI control port that will
make characters display in the SoftLCD window. The SoftLCD sysex command provides a string of ASCII
characters and a starting position for that string in the SoftLCD window. The sysex command is:

SoftLCD Text
F0 4E <UNIT> 12 05 <OFFSET> <C1> <C2> … F7

where:

<UNIT>   transmit as 00 for now
<OFFSET>   position of character C1 in the SoftLCD window
                        [00..36] for the top line, [38..6E] for the bottom line
                        Note: an OFFSET of 7F is a special value, used below.
<C1>, <C2> …   ASCII character data to be displayed

When one or more FE-8 expansion units are used with an FW-1884, the current version of SoftLCD will
only display the text information from one of the devices. A sysex message can be send to tell SoftLCD
which set of messages to display (e.g. from the FW-1884, or from FE-8 #1, or from FE-8 #2, etc.). The
SoftLCD application is responsible for caching the text to be displayed from each of the control devices.

The following command can be sent to tell SoftLCD to display text from the associated control device. For
example, pressing a SEL button on an FE-8 that does not have a selected channel strip might select that
channel strip and send this message.

Display SoftLCD Text From This Device
F0 4E <UNIT> 12 05 7F F7

Future versions of SoftLCD may support multiple windows, one per control device. Such an extended application will ignore the "display me" messages, and just route all commands to their associated display window. In this way, the same control plug-in can be compatible with single- or multiple-window SoftLCD applications.

SoftLCD Unicode Text   (Windows driver version 1.20 and later, Mac OS X post-v1.20 driver)
        F0 4E <UNIT> 12 18 <OFFSET>
        <C1H MSN> <C1H LSN> <C1L MSN> <C1L LSN>
        <C2H MSN> <C2H LSN> <C2L MSN> <C2L LSN>
         …
        F7

where:
        <UNIT>   transmit as 00 for now
        <OFFSET>   position of character C1 in the SoftLCD window
                                [00..36] for the top line, [38..6E] for the bottom line
        <C1H MSN>   Unicode High byte Most significant nibble
         <C1H LSN>   Unicode High byte, Least significant nibble
        <C1L MSN>   Unicode Low byte Most significant nibble
         <C1L LSN>   Unicode Low byte, Least significant nibble

Device Inquiry Command   (Windows driver version 1.20 and later, Mac OS X post-v1.20 driver)

The FW-1884 supports the MIDI Non-Real Time System Exclusive General Information "Device Inquiry" message, and sends the associated response.

The inquiry message is
        F0 7E 00 06 01 F7

The FW-1884's response is
        F0 7E 00 06 02 4E 00 00 12 00 30 31 30 30 F7

where:
        4E   TASCAM Sysex ID
        00 00   Family ID == 0
        12 00   Device Type = 0x12 (FW1884)
        30 31 30 30   Software revision == 01.00 (example)