Itar V2

USER MANUAL

Performance controls, MIDI implementation, and SysEx reference.

SlideMode/MPE/ new Expression Engine/ Expanded Zone types/ Expanded sysex profile for the new IRIE, Itar Interactive Remote Editor.

REVISION	DATE	SOURCE BASIS
1.0	2026-08-31	Active iTar feature firmware selected by the project Debug configuration

Starr Labs Inc.

DOCUMENT CONTROL

Firmware reference: iTar20-IRIE-iTarTuning-Ch15-TriggerMode-USB-OUT-Fix-Release-2026-0903.bin

ITEM	VALUE
Document	iTar V2 Firmware User Manual
Revision	1.0
Publication date	September 10 2026
USB identity	Manufacturer StarrLabs; product iTar-MIDI
BLE identity	iTar-BLE
Board definition	nStrings=6, nFRETS=20

How to read this manual

Front-panel names are shown in capitals. MIDI channel numbers are shown as musicians see them (1–16); hexadecimal protocol values use the 0x prefix. “Encoded channel” means the transmitted nibble 0–15. Source uncertainties are labeled rather than inferred.

SAFETY AND HARDWARE The repository does not establish connector type, battery chemistry, charging limits, power-switch procedure, environmental ratings, or electrical safety limits. Use only the hardware documentation and power accessories supplied for the instrument.

CONTENTS

FAST START Connect by USB MIDI or pair the iTar-BLE MIDI port, select a receiving instrument, press frets to play, and tap TRIGGER to cycle P → S → T → SL. Start with octave value 3 (neutral).

1 PRODUCT OVERVIEW

The iTar firmware turns a pressure-sensitive, illuminated six-string by twenty-fret surface into a MIDI performance controller. It can send musical data over class-compliant USB MIDI and over a 31.25-kbit/s UART path used by the BLE MIDI subsystem and described in source comments as a MIDI-jack path.

Core performance features

- Four selectable play modes: Poly (P), Strum (S), Tapping (T), and Slide (SL).
- Velocity derived from the fret sensor's analog peak, transmitted as 1–127 for Note On.
- Six configurable logical string channels; defaults are MIDI channels 1–6.
- Guitar-note mapping with standard E3–A3–D4–G4–B4–E5 open-string bases.
- iTar grid mapping on MIDI channel 16 for software that treats each fret as a unique pad.
- KeyPressure output assignable to Pitch Bend, Channel Pressure, CC11, CC74, or Pitch Bend + CC74.
- Versioned SysEx for modes, octave, expression, per-string channels, and explicit Store/Recall/Factory Reset.

Signal path

SOURCE	FIRMWARE ACTION	DESTINATION
Fret and KeyPressure sensors	Scan, debounce, scale, route by mode	USB MIDI and UART/BLE when available
TRIGGER / EDIT / octave controls	Change state; send status SysEx	Local engine, LED controller, connected editor
USB MIDI input	Parse iTar SysEx; forward MIDI bytes to LED controller	Configuration engine and LPC1114 LED controller
UART/BLE input	Parse iTar SysEx; forward bytes to LED controller	Configuration engine and LPC1114 LED controller

2 SETUP AND CONNECTIONS

USB MIDI

1. Connect the iTar's USB port to a USB host using the correct cable for the hardware.
2. Select iTar-MIDI in the host's MIDI input list. The firmware declares USB 2.0, MIDI streaming, 100 mA, and both bus-powered and self-powered attributes.
3. The firmware delays USB initialization by approximately 200 ms after internal setup; enumeration then proceeds asynchronously.
4. USB is optional. Scanning and BLE/UART service continue when no USB host is configured.

Bluetooth MIDI

1. Power the instrument with the On/Off switch
2. Press the Bluttooth pairing button on the iTar.
3. Open the host's operating system's Bluetooth MIDI connection interface and select iTar-BLE. Iit will say "Connected" when paired.
4. Pairing does not require the iTar app or a SysEx handshake, but pairing to the iTar app does place the iTar into iTarMode Tuning [see Page 8]. Select the resulting MIDI port in the receiving app or instrument.

First sound

1. Choose a MIDI sound that receives the iTar's channels. The compiled default uses channels 1–6, one logical string per channel.
2. Start in P (Poly) mode. Press a fret; pressure controls Note On velocity.
3. If using SL or KeyPressure Pitch Bend, configure the receiving sound to accept the RPN bend range sent by the iTar (default 20 semitones in Slide).
4. The iTar app has several sound sources available: the embedded Sound Font Player, or any installed plugins or external apps within the same device or in remote devices seen over USB-MIDI/BLE-MIDI.

3 CONTROLS AND GESTURES

CONTROL / GESTURE	ACTION	FEEDBACK
TRIG {The TriggerMode Button] : Short press and release	Cycles TapPoly → Strum → TapMono → SlideMode→ Button acts on the release edge.	Red P, S, T, or SL glyph scrolls across the fretboard. The selected Mode's SysEx is sent via USB/BLE
TRIG Long-press :	Toggles SlideMode/ Portamento	SL Glyph scrolls the fretboard
EDIT: short press and release	Toggles between Guitar Tuning/6-channels and iTar Tuning [Notes 0-126/Channel15] *iTarTuning is used with the iTar App and Ableton Live*	no dedicated local glyph.
EDIT, hold at least 1 second, then release	Toggles KeyPressure on/off.	Two power-LED blinks = on; one = off. Each phase is 300 ms.
Octave UP short press and release	Decrements every runtime zone's encoded octave, minimum 0.	String 6 LEDs show the Octave #
Octave DOWN short press and release	Increments every runtime zone's encoded octave, maximum 5.	String 6 LEDs show the Octave #
Oct+ and Oct- combination Press and release	MIDI Panic! . Sends All Notes Off, ResetControllers	Power LED is driven during panic; MIDI reset sequence is sent.
String1&String6 on Fret 1 + EDIT combo acts on release	Toggles Right-hand/ Left-hand after first releasing sounding notes.	Two blinks = left-handed; one = right-handed.
String1&String6 on Fret 20 + EDIT combo acts on release	Stores Preset and Expression settings to EEPROM	Cyan SAVE for 2 s; 3 blinks success, 5 failure.
String1&String6 on Fret 19 + EDIT combo acts on release	Recalls and validates EEPROM settings.	Restore: Cyan "REST "then "ORE", 1 s each; 3 blinks success, 5 failure.
Fret Keys	Generate velocity-sensitive notes and channel afterpressure if enabled. Also with Portamento if enabled.	Key lighting has several sources available : direct key-velocity, Ableton Live Session View, Clip controll Zone, Lighting scripts, text, Chord/Scale chart color maps., images.

4 OPERATING MODES

DISPLAY	MODE	PLAYING BEHAVIOR	MODE ENTRY / EXIT
P	Full Poly	Every active fret in a configured zone can sound independently. Guitar mapping uses tuning/octave/channel; iTar mapping uses unique grid notes on channel 16.	On entry, sends CC127 value 0 (Poly Mode On / All Notes Off) once per configured channel.
S	Strumming	Frets 1–16 select pitch. Frets 17–20 are the strum zone; pressing a strum-zone fret triggers the highest selected fret on that string with strum velocity. State is maintained per string.	Entry initializes strum state. Exit sends Note On velocity 0 for ringing notes.
T	Tapping	Monophonic per string. The highest held fret sounds; a higher press replaces the old note, and release falls back to the next-highest held fret.	Entry initializes per-string state. Exit sends all active notes off.
SL	Slide	The first held highest fret sends one Note On. Later highest-fret changes retarget Pitch Bend instead of retriggering while the range permits. Pull-offs can retarget lower held frets.	Entry sends RPN 0 bend range (default 20 semitones) per configured channel. Exit stops notes and restores the default 2-semitone bend range.

Slide timing

Portamento value 0 selects the adaptive algorithm. The ramp duration is based on the time since the previous target, 50% by default, with a 12 ms minimum, a 12 ms-per-crossed-semitone floor, and a 250 ms maximum. Values 1–2000 select a fixed ramp duration. The initial Note On is immediate; only the bend trajectory is timed.

CHANNEL INDEPENDENCE Slide is polyphonic across strings only when each active string has its own MIDI channel. If channels are shared, pressing a new string stops the other string states so conflicting Pitch Bend cannot detune multiple notes.

5 PLAYING, TUNING, AND MAPPING

Default Guitar mapping

LOGICAL STRING	OPEN BASE	DEFAULT CHANNEL	FRET 1…20 NOTE RANGE
1	E3 / 40	1	41…60
2	A3 / 45	2	46…65
3	D4 / 50	3	51…70
4	G4 / 55	4	56…75
5	B4 / 59	5	60…79
6	E5 / 64	6	65…84

The global octave is encoded 0–5, with 3 neutral. Each step changes pitch by 12 semitones. The firmware clamps MIDI note values to 127 but does not provide a separate underflow warning.

iTar grid mapping for the iTar App or Ableton Live

In P mode with iTar Tuninng selected, every physical fret becomes a unique note on MIDI channel 16. Logical string n uses note = (n − 1) × 21 + fret. The unplayed open positions are gaps at notes 0, 21, 42, 63, 84, and 105.

LOGICAL STRING	FRET 1	FRET 20
1	1	20
2	22	41
3	43	62
4	64	83
5	85	104
6	106	125

Handedness

When switching Right/Left hand tuning, the physical-to-logical string lookup used for tuning, channels, and iTar grid notes. The Store/Recall chords remain tied to the physical outer strings and therefore do not move. Handedness is runtime-only in this feature build and is not stored by the global Expression record.

Velocity and note-off

Fret velocity is derived from the fret-key's captured analog peak and scaled to 0–127. Use the Curves and Gain settings to adjust the response as needed. Note-releases are transmitted as Note On with velocity 0; a distinct 0x8n Note Off status is not generated by the performance paths. This is done to ease MIDI Running Status when the synth allows it.

6 LED INDICATIONS

INDICATION	COLOR / PATTERN	TIMING	MEANING
Startup sign-on	Cyan ITAR, centered	2.0 s	Firmware completed initialization and started USB attach.
Mode label	Red P, S, T, or SL moving toward the bridge	24 shifts × 100 ms = 2.4 s	New TRIGGER-selected play mode.
Octave 1–5	White count on one fretboard LED string beginning at physical fret 1	900 ms	Encoded octave value; 3 is neutral.
Octave 0	One red marker at physical fret 1	900 ms	Encoded octave value zero.
KeyPressure	Power LED: 2 blinks on; 1 blink off	300 ms off/on phases	Long-EDIT result.
Handedness	Power LED: 2 blinks left; 1 blink right	300 ms off/on phases	Fret-1 outer-string chord result.
Store	Cyan SAVE; power LED 3 or 5 blinks	SAVE 2 s; 300 ms phases	3 success; 5 EEPROM write/read-back failure.
Recall	Cyan REST then ORE; power LED 3 or 5 blinks	1 s each page; 300 ms phases	3 success; 5 invalid/missing record.
USB stage diagnostic	Power LED: 1–4 blinks in a repeating window	Starts after 3 s; 200 ms on / 200 ms off; repeats every 2.4 s	1 no bus reset; 2 reset seen; 3 SETUP traffic; 4 configured.
Fret activity	LED-controller Note command, value 20	On each configured-zone fret event	Exact visible color/persistence is controlled by the separate LPC1114 firmware, not present here.

Internal color indices

The LPC1347 source uses LED-controller palette indices Off 0, Red 1, Green 43, Cyan 64, Blue 86, and White 127. These are palette references, not RGB triplets. The onbooard selectable Color map has 127 color locations, each defined by a 15-bit color representation.

7 MIDI IMPLEMENTATION

Implementation chart

FUNCTION	TRANSMITTED	RECOGNIZED	DETAILS
Basic channel	1–16	1–16 in configuration	Defaults: logical strings 1–6 use channels 1–6; iTar grid uses channel 16.
Note number	0–127	Not used as musical input	Guitar, Live Session, Strum, Tapping, and Slide mappings as described.
Velocity	1–127; Note On 0 for release	Not used as musical input	Pressure-derived Note On velocity.
Aftertouch—poly	No	No	Unsupported.
Aftertouch—channel	Optional	No	KeyPressure assignment 0 sends Channel Pressure/ CC11/ CC74/ PitchBend.
Pitch Bend	Yes, 14-bit	No	Slide trajectories; optional additive KeyPressure. Center 8192.
Program Change	No	No	Preset field patch exists but no active send path; unsupported.
Bank Select MSB/LSB	No	No	CC0/CC32 unsupported.
System real-time	No	Ignored on SysEx input	Bytes 0xF8–0xFF are discarded by the configuration parser.
MIDI Clock / transport	No	No	Unsupported.
Active Sensing	No	No	Unsupported.
System Reset	No	No	MIDI 0xFF is ignored by the SysEx parser.
System Exclusive	Yes	Yes	Starr Labs manufacturer ID 00 01 42; implementation in Section 8.

Control Change and RPN messages

CC / RPN	VALUE	WHEN	CHANNELS
CC11 Expression	Configured continuous value; default held-note value 127; Panic recovery 127	Optional legacy expression; KeyPressure assignment; after Panic	Performance string channel or all 16 during recovery
CC74 Timbre	0–127	KeyPressure assignment 1 or 4	Performance string channel
CC112	127 default	Optional Panic preamble	All 16
CC121 All Controllers Off	0	Panic	All 16
CC123 All Notes Off	0	Panic	All 16
CC127 Poly Mode On	0	Entering P mode; also implies All Notes Off	Each configured channel once
RPN 0 Pitch Bend Sensitivity	MSB = semitones; LSB = 0	Entering Slide / preparing channel; restored on exit	Each prepared Slide channel
CC101 / CC100	0,0 then 127,127	Select and null RPN 0	Each prepared Slide channel
CC6 / CC38	Range semitones / 0	Data Entry for RPN 0	Each prepared Slide channel

Panic sequence

1. If enabled, send configured Panic CC/value on channels 1–16 (default CC112/127).
2. If in SL mode, stop Slide notes and restore prepared channels' bend ranges.
3. For channels 1–16, send Pitch Bend center, CC123/0, and CC121/0.
4. Send CC11/127 on channels 1–16 because All Controllers Off commonly resets expression to zero.
5. Set the internal mode to Panic. The next TRIGGER press returns through the normal mode list starting from P

Expression settings

FIELD	RANGE / DEFAULT
Version	05
Flags	bit0 legacy expression; bit1 Panic CC; bit2 KeyPressure enabled; bit3 editor owns enable
Legacy expression CC	0–127 / 11
Legacy held-note value	0–127 / 127
Portamento ms, 14-bit	0 adaptive; 1–2000 fixed / 0
Pitch Bend range semitones	1–127 / 20
Bend points per semitone	1–16 / 5
Gesture time used	1–100% / 50
Minimum glide ms	0–2000 / 12
Minimum ms per semitone	0–2000 / 12

FIELD	RANGE / DEFAULT
Maximum adaptive glide ms	minimum…2000 / 250
Panic CC	0–127 / 112
Panic value	0–127 / 127
Bend range restored on exit	1–127 / 2 semitones
KeyPressure assignment	0 Channel Pressure; 1 CC74; 2 Pitch Bend; 3 CC11; 4 Pitch Bend + CC74; default 2
Pressure curve	1 linear; 2 quadratic / 2
Soft threshold, 14-bit	0–2046 / 600
Hard threshold, 14-bit	soft+1…2047 / 2047
KeyPressure Pitch Bend depth cents, 14-bit	0–2400 / 100

Versions 1–4 remain accepted only at their exact defined lengths: v1 6 bytes, v2 18 bytes, and v3/v4 24 bytes. Missing newer fields preserve their current values. A successful set returns canonical version 5.

Legacy full preset

FIELD	ENCODING
presetId	4 native bytes
left-handed	1 native bool
velocity mode	1 byte
KeyPressure enabled	1 native bool
Strum enabled	1 native bool
sensitivity gain	1 byte
zone count	1 byte, maximum 5
each Zone	start/end fret, low/high string, patch, octave, LED flags, six tuning bytes, six channel bytes
checksum	Additive sum of active preset bytes, masked to 7 bits; placed in header for transmission/storage

9 STORE, RECALL, AND RESET

What global Store includes

- Expression version 5 settings, including KeyPressure enable and assignment.
- Exact play mode P/S/T/SL.
- Global octave encoded 0–5.

Factory defaults

P mode, octave 3 neutral, legacy fixed expression off, Panic CC enabled at CC112/value 127, KeyPressure off but preselected for Pitch Bend, 20-semitone Slide range, 2-semitone restore range, adaptive timing, quadratic pressure curve, thresholds 600/2047, and 100-cent KeyPressure depth.

10 TROUBLESHOOTING

SYMPTOM	CHECK	SOURCE-BASED ACTION
No USB MIDI device	Power LED USB diagnostic after 3 s	1 blink: host reset not seen; 2: reset only; 3: SETUP traffic; 4: configured. Try a known data cable/port and reconnect after boot.
BLE pairs but no notes	Host selected iTar-BLE as MIDI input; receiving channels	Use P mode and listen on channels 1–6. BLE pairing itself does not require an app handshake.
One string bends other strings	Channel assignment	Give each active Slide string an independent MIDI channel
Slide interval is wrong	Receiver bend range	Allow the iTar RPN 0 sequence or manually set the receiver to the firmware's configured range (default 20 semitones).
KeyPressure does nothing	Enable state and assignment	Hold EDIT at least 1 s and release; two blinks means on. Confirm synth supports the selected Pitch Bend/Channel Pressure/CC destination.
Pitch remains raised	KeyPressure pressure and Panic	Release pressure. If needed, hold both octave controls for Panic; it sends center bend and controller resets on all channels.
Unexpected notes after short EDIT	Mapping mode	Short EDIT toggles Guitar/iTar mapping. In iTar mapping P mode uses channel 16 and grid note numbers.
Store/Recall fails	Five power-LED blinks	Repeat while musically idle. Recall failure means no valid magic/version/length/value/CRC record; live settings remain unchanged.
Settings do not return after power cycle	Build policy	In the selected Debug build this is expected. Use explicit Recall. Shipping auto-restore requires owner-confirmed build selection.
Mode label or note LED looks wrong	Separate LED controller	The LPC1347 sends commands to an LPC1114 whose source is not in this project. Verify matching LED-controller firmware.

Recovery sequence

1. Return the receiving synth to a known patch and listen on channels 1–6.
2. Select P mode and octave 3.
3. Perform Panic with both octave controls.
4. Short-press EDIT if the controller is accidentally in iTar grid mapping.
5. If a known valid global record exists, perform manual Recall; otherwise use remote Factory Reset.

Clipper$_{tm}$ Command charts and appendices Starr Labs (c) 2012-2026

LED Fingerboard Command Specification

24-fret instruments use MIDI Channels 15 and part of 16 for addressing the 144 LEDs on the fretboard.

20-fret instruments like the iTar have 126 LEDs and are addressed full on MIDI channel 15

Special MIDI-Note Functions on Channel 16 :

[Notice that the minimum velocity value available for your use is the number 1. Velocity = 0 is reserved for the Note-Off function.]

Command	#	Comments
CLEAR FRAME	127	Ignore velocity, clears to 0 unless clear to background mode set
INIT ZONES	126	ignore velocity
REFRESH	125	ignore velocity
ENABLE ZONE	124	velocity = ZONE 1 - 31, bit6 1 = enable 1 = disable (Displays Zone lighting. Bring to foreground)
LEFTRIGHT	123	velocity 2 = LEFT, 1 = RIGHT, mirror about the Y-axis
SHIFT RIGHT	122	velocity offset 0:no effect, =>1:Shift Right one position Bit6=0: Rotate (Wrap) image, Bit6=1: Do not wrap image. Rotate Right: vel<64; Shift Right: vel =>64D
SHIFT LEFT	121	velocity offset 0:no effect, =>1:Shift Left one position Bit6=0: Rotate (Wrap) image, Bit6=1: Do not wrap image. Rotate Left: vel<64; ShiftLeft: vel =>64D
SCROLL UP	120	velocity offset: 0:no effect, =>1:Shift Up one position Bit6=0: Rotate (Wrap) image, Bit6=1: Do not wrap image. Rotate Up: vel<64; Shift Up: vel =>64D
SCROLL DN	119	velocity offset: 0:no effect, =>1:Shift Down one position Bit6=0: Rotate (Wrap) image, Bit6=1: Do not wrap image. Rotate Down: vel<64; Shift Down: vel =>64D
BLINK ON(upper 16)	118	velocity + 128 = led#
BLINK ON(lower 128)	117	velocity = led#
BLINK OFF(upper 16)	116	velocity + 128 = led#

BLINK OFF(lower 128)	115	velocity = led#
BRIGHT(upper 16)	114	velocity + 128 = led#
BRIGHT(lower 128)	113	velocity = led#
DIM(upper 16)	112	velocity + 128 = led#
DIM(lower 128)	111	velocity = led#
RedBox Scroll Up	110	Velocity: Ignore - not used by ledfb firmware, output to Ableton
RedBox Scroll Down	109	Velocity: Ignore - not used by ledfb firmware, output to Ableton
RedBox Scroll Right	108	Velocity: Ignore - not used by ledfb firmware, output to Ableton
RedBox Scroll Left	107	Velocity: Ignore - not used by ledfb firmware, output to Ableton
• Unused -	106	• unused -
REVERSE LEDS	105	Velocity: 0-64 = Normal, 65-127 = Reverse
TABLE TOP GUITAR	104	Mirror about X-axis. Velocity 7F=Tabletop: body is low LED number Velocity 00=Guitar: head is low LED number
Set Char (lower 128)	103	velocity = text character in lower 128 of ASCII table
Set Char (upper 128)	102	velocity + 128 = text character in upper 128 of ASCII
SET CHAR DIRECTION	101	velocity sets the direction Chars scroll from, 0 from head, >0 from body
SELECT SCRIPT [Available scripts are listed in a table below.]	100	Velocity selects a Script, 0 aborts. A Script is an embedded macro that can display images, text, and/or lighting effects. The opening splash screen is a Script. Any script is aborted by asserting Select-Script with a value=0.
ENABLE BACKGROUND	99	Enable Background: velocity 1 = clear to black, velocity 2 = Enable background. When an LED is turned on, then turned off according to some dynamic function, the off-state may be either an image saved to the background or simply black.
SET COLOR MAP	98	velocity is color map number; Max = 4. *See Pg.18, Maps*
SELECT IMAGE	97	velocity is the number of the image to display. Image# 0-31 are RAM, images 32-128 are ROM based images
SET STRING 6	96	Set all LEDs on a string to the same color. Velocity = color index
SET STRING 5	95	Velocity = color index
SET STRING 4	94	Velocity = color index
SET STRING 3	93	Velocity = color index
SET STRING 2	92	Velocity = color index

SET STRING 1	91	Velocity = color index
Display Tuning Map	90	Velocity = zone number*
Send To Background	89	Send the foreground image to the background. Velocity is ignored.
Set Tuning	88	Pre-defined Tuning Maps are stored in ROM. The full list is provided below. Velocity = Tuning map number. Guitar, Piano, etc. 1=ClearTuning, which clears the background. The full list is described on Page 11.
SCROLL-IMAGE	87	A selected image is scrolled over the short dimension of the fingerboard. Velocity = step timing for the Scroll delay. Velocity = color map index# of the foreground color.
SET FOREGROUND COLOR SET BACKGROUND COLOR	86	Velocity = color map index# of the background color.
	85	
Rotate RedBox 90°	84	Velocity: Ignore - not used by ledfb firmware, this talks to Ableton Live and Rotates the Ableton RedBox
SYNC	83	Reset the Blink timer and other internal step-timers.

MIDI-Note Messages on Channel 16 continued:

OFFSET FOREGOUND COLOR INDEX	82	Velocity is added to all color selections for indexed-color pixels, i.e., foreground colors. If the resulting color-index exceeds the length of the color map, the value wraps around to the beginning of the table.
SET FRETMARKS OVERLAY COLOR	81	Velocity = color for the Fretmarks
ENABLE FRETMARKS OVERLAY	80	Velocity = 1 disables the Fretmarks. Velocity = 2 enables the Fretmarks

MIDI-CC Messages on Channel 16 (Channel 15- Unused):

Latch LEDs	64	Off < 65, On > 64; Once set, all LEDs will remain lit until the command is reset.

MIDI-CC Messages used by the LED fingerboard. Only on channel 16

BRIGHTNESS	7	Scale global brightness from Master Volume, Channel 16
SCALE RED	20	Adjust the brightness for all Red LEDs on the
SCALE GREEN	21	Adjust the brightness for all Green LEDs on the
SCALE BLUE	22	Adjust the brightness for all Blue LEDs on the
SCALE SATURATION	23	0-127; Scales the intensity of all colors. Applies to images, tuning maps, and foreground colors.
VU String 1 *	24	Fires all of the LEDs on String #1 in sequence (Data value= length of the lit-string. All LEDs are lit from Fret1 to the scaled data-level) CC-data values of 0-127 scale from no lights to all 24 columns lit. All LEDs will light from Fret1 up to the scaled data-value. Each Fret (column) corresponds to a data increment of a little more than 5.
VU String 2	25	Fires all of the LEDs on String #2 (in sequence, value= length) lights sequential number of frets according to MIDI data 0-127
VU String 3	26	Fires all of the LEDs on String #3 (in sequence, value= length) lights sequential number of frets according to 0-127
VU String 4	27	Fires all of the LEDs on String #4 (in sequence, value= length) lights sequential number of frets according to 0-127
VU String 5	28	Fires all of the LEDs on String #5 (in sequence, value= length) lights sequential number of frets according to 0-127
VU String 6	29	Fires all of the LEDs on String #6 (in sequence, value= length) lights sequential number of frets according to 0-127
VU All Strings	30	Fires all of the LEDs on all Strings (in sequence, value= length) lights sequential number of frets according to 0-127
VU Fret 1 **	31	Lights LEDs sequentially up fret 1 like a VU meter. CC-data values of 0-127 scale from no lights to all 6 rows lit in 12 increments. From bottom to top: Rows 1-4= green, Row5=yellow, Row6=Red. Each key lights at half-brightness for the lower half of its own range. Any given data value will light all keys from the bottom to the scaled level. Each lighting increment corresponds to a data increment of about 10 and a half. For example, a datum110 (decimal) lights Row6 (Red) at half-brightness, Row5 (Yellow) full-brightness, and Rows4-1 (Green) full-brightness.
VU Fret 2	32	Lights LEDs sequentially up fret 2 like a VU meter. Value of 0-127 scales from no lights to all lit, fading in brightness and color.
VU Fret 3	33	Lights LEDs sequentially up fret 3 like a VU meter. Value of 0-127 scales from no lights to all lit, fading in brightness and color.

VU Fret 4	34	Lights LEDs sequentially up fret 4 like a VU meter. Value of 0-127 scales from no lights to all lit, fading in brightness and color.
VU Fret 5	35	Lights LEDs sequentially up fret 5 like a VU meter. Value of 0-127 scales from no lights to all lit, fading in brightness and color.
VU Fret 6	36	Lights LEDs sequentially up fret 6 like a VU meter. Value of 0-127 scales from no lights to all lit, fading in brightness and color.
VU Fret 7	37	Lights LEDs sequentially up fret 7 like a VU meter. Value of 0-127 scales from no lights to all lit, fading in brightness and color.
VU Fret 8	38	Lights LEDs sequentially up fret 8 like a VU meter. Value of 0-127 scales from no lights to all lit, fading in brightness and color.
VU Fret 9	39	Lights LEDs sequentially up fret 9 like a VU meter. Value of 0-127 scales from no lights to all lit, fading in brightness and color.
VU Fret 10	40	Lights LEDs sequentially up fret 10 like a VU meter. Value of 0-127 scales from no lights to all lit, fading in brightness and color.
VU Fret 11	41	Lights LEDs sequentially up fret 11 like a VU meter. Value of 0-127 scales from no lights to all lit, fading in brightness and color.
VU Fret 12	42	Lights LEDs sequentially up fret 12 like a VU meter. Value of 0-127 scales from no lights to all lit, fading in brightness and color.
VU Fret 13	43	Lights LEDs sequentially up fret 13 like a VU meter. Value of 0-127 scales from no lights to all lit, fading in brightness and color.
VU Fret 14	44	Lights LEDs sequentially up fret 14 like a VU meter. Value of 0-127 scales from no lights to all lit, fading in brightness and color.
VU Fret 15	45	Lights LEDs sequentially up fret 15 like a VU meter. Value of 0-127 scales from no lights to all lit, fading in brightness and color.
VU Fret 16	46	Lights LEDs sequentially up fret 16 like a VU meter. Value of 0-127 scales from no lights to all lit, fading in brightness and color.
VU Fret 17	47	Lights LEDs sequentially up fret 17 like a VU meter. Value of 0-127 scales from no lights to all lit, fading in brightness and color.
VU Fret 18	48	Lights LEDs sequentially up fret 18 like a VU meter. Value of 0-127 scales from no lights to all lit, fading in brightness and color.
VU Fret 19	49	Lights LEDs sequentially up fret 19 like a VU meter. Value of 0-127 scales from no lights to all lit, fading in brightness and color.
VU Fret 20	50	Lights LEDs sequentially up fret 20 like a VU meter. Value of 0-127 scales from no lights to all lit, fading in brightness and color.
VU Fret 21	51	Lights LEDs sequentially up fret 21 like a VU meter. Value of 0-127 scales from no lights to all lit, fading in brightness and color.
VU Fret 22	52	Lights LEDs sequentially up fret 22 like a VU meter. Value of 0-127 scales from no lights to all lit, fading in brightness and color.
VU Fret 23	53	Lights LEDs sequentially up fret 23 like a VU meter. Value of 0-127 scales from

		no lights to all lit, fading in brightness and color.
VU Fret 24	54	Lights LEDs sequentially up fret 24 like a VU meter. Value of 0-127 scales from no lights to all lit, fading in brightness and color.
LATCH MODE	64	(MIDI Sustain) When Latch Mode is On, incoming Note-Off messages will be ignored rather than turning off their intended LEDs. Velocity < 65 = Off, velocity > 64 = On.
FADE TIME	72	CC-data sets the duration the LEDs remain illuminated after being lit from a Note-On event. Similar to a synthesizser's ADSR Release time.
SET-SCRIPT-CLOCK-COARSE	75	Sets the coarse timing delay for clocked script-looping functions like the Swirl effect in 10 millisecond increments. Delay = velocity x .01 seconds.
SET-SCRIPT-CLOCK-FINE	76	Sets the fine timing for clocked script-looping functions like the Swirl effect in 0.1 millisecond increments. Delay = velocity x .0001 seconds. The coarse and fine values are additive.
STORE-RAM-IMAGE		The dynamic LED data frame buffer is copied to a RAM image location. Velocity = Image number (v = 0-9)
	77	The duration of the lights from pressed keys; similar to a synth "release time".

Clipper Setup Charts

Embedded lighting Scripts:

[Set-script command: Note 100]

0: Null script
1: Abort Script. Aborts any active script.
2: Grand Demo. Combines several scripts and the Starr Labs sign-on screen.
3: Product_ID. Current Clipper OS version#.
4: Null
5: Spiral Effect. Single shot event.
6: Spiral Script. Loops the spiral effect.
7: Swirl Effect. Single shot event.
8: Swirl Script. Loops the swirl effect.
9: Boustrofedon. Serpentine effect.
10: Boustrofedon Script. Loops the single shot event.
11: Show current color map.
12: Scroll RAM Images.
13: Scroll ROM images.
14: Cylon script

Embedded Color Maps:

[One of these Color Maps is loaded into the default 127-location Color Map table. When you apply a MIDI note to light up a location on the fingerboard, the velocity selects a color from the default table.]

0: Null Map, blank
1: Ableton Live color map. 60 colors. Duplicated to (mostly) fill the 127 location map.
2: Spectral color map. Full color in the traditional rainbow sequence.
3: Tertiary color map. The basic 12 colors resulting from the simple combinations of the R,G, and B LEDs.
4: Velocity color map. A four-color map to clearly distinguish MIDI velocity levels.

TUNING MAPS: [maps of 7/7/17]

- Clear: No background lighting.
- Fret Marks: shows guitar fret marks at the standard fret locations.
- Spectral fourths: 7 colors are assigned to the natural-notes, the white keys of the piano. The piano's black keys are defaulted to OFF. Straight Fourths tuning.
- Spectral fourths/Minus-6 : 7 colors are assigned to the natural-notes, the white keys of the piano. The piano's black keys are defaulted to OFF. Straight Fourths tuning. Expands the range of the 12-string Clipper.
- WhiteBlack Fourths: Two colors as on the Piano. Straight Fourths tuning starting at a low F natural.
- WhiteBlack Fourths/Minus-6: Two colors as on the Piano. Straight Fourths tuning starting at a low B natural.

Using the MIDI command Note 88/velocityN, select the desired Tuning Map and then use the SetToBackground command. DisplayTuningMap Note- 90 (only needed one time)

Here is an example to set up a 12-sttring Clipper with a Spectral Tuning (rainbow colors for the natural notes.).

```
Refer to the manual to see the command chart where these commands reside.

Low 6 strings:

Set the Tuning map to Spectral 4ths/ -6 (Low B):
Go to an unused Sensor-Pad.
Set the Pad to Notes-Basic or -All.
In Event #1 set it to Channel 14, Note 88 and for the velocity, instead of
"PAD" set it to 4.
In the Output screen, set it to MIDI: R
Press the Pad.
If it doesn't take at first try setting the pad to Note 90 and press the Pad..
Repeat if necessary.

For the high 6 strings:

Do the exact same thing as for the Lower 6 strings, but for two changes:
1)change the MIDI channel to 16.
2)change the TuningMap selection to Note88-Velocity 3.
```

Your Clipper may have an alternative Map table like this due to different firmware revisions:

- Fret Marks: shows guitar fret marks at the standard fret locations.
- Tertiary guitar: 12 colors, 1 per chromatic scale note-name. Guitar tuning.
- WhiteBlack (2 color): The fingerboard is tuned to standard Guitar tuning and the keys are coded according to the Black and White leys of the piano
- Tertiary fourths: 12 color, 1 per chromatic scale note-name. Straight Fourths tuning.
- WhiteBlack Fourths: Two colors as on the Piano. Straight Fourths tuning starting at a low Open E natural.

11 SPECIFICATIONS

ITEM	SOURCE-VERIFIED VALUE
Controller MCU	NXP LPC1347, Cortex-M3; 64 KiB flash / 8 KiB local RAM target definition
Playing surface	6 strings × 20 compiled frets
Controls	TRIGGER, EDIT, two octave-control mux inputs, fret sensors, per-string KeyPressure sensors
Play modes	P Full Poly; S Strumming; T Tapping; SL Slide
USB	USB 2.0 class-compliant MIDI streaming; VID 0x1FC9; PID 0x1003; endpoint size 16; cable 0
USB name	Manufacturer StarrLabs; product iTar-MIDI; ports iTar Out / iTar In
Serial MIDI path	UART 31,250 bit/s; used by BLE subsystem and source-described MIDI-jack path
BLE MIDI name	iTar-BLE in handoff documentation
Default channels	Logical strings 1–6 → MIDI channels 1–6; iTar grid → channel 16
Default tuning	E3, A3, D4, G4, B4, E5 (MIDI 40,45,50,55,59,64)
Octave	Encoded 0–5; 3 neutral; ±12 semitones per step
Velocity	Fret pressure-derived Note On velocity; Note On velocity 0 release
Pitch Bend	14-bit; Slide default sensitivity ±20 semitones; restores ±2 semitones
Global EEPROM	Address 0x0080; 35-byte v2 record; CRC-8 poly 0x07
Legacy preset EEPROM	Address 0x0004; native Preset structure
LED record	Address 0x0100; initialization disabled in active config path
Power / dimensions / weight / operating environment	Not specified by the inspected repository

APPENDIX B PUBLICATION CONFIRMATIONS

CONFIRMATION NEEDED	WHY IT MATTERS
Confirm whether legacy full-preset writes remain supported in production.	Ingress validation is incomplete and the payload mirrors compiler-native structure layout. This is needed. Please test.