

# Tone Packets

*A protocol initiated by Gregory Riker and David Collett*

v1.1 – June 1, 2024

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## Objectives

- Define a compact representation of *note clusters*. Note clusters may represent chords, scales, or any arbitrary collection of notes. A note cluster sent via MIDI SysEx is part of a *tone packet*.
- Create reference implementations to demonstrate use cases.
- Evangelize the implementation of Tone Packets to application developers.

## Background

MIDI is awesome. It's been remarkably resilient during its 40 years of existence.

With the evolution of computer-based music-making, where apps and plugins are surrogates for human input, algorithmic creation of MIDI events to make music has become commonplace.

There exists a class of apps which listen to incoming MIDI and generate related output. For this discussion, we're focusing on those which use chord recognition and preset scales, specifically within the domain of iOS, although the intent is for the protocol to be usable in any MIDI context.

Consider Strummer, an iOS guitar simulation app. Strummer features a chord recognition mode, in which it listens to incoming MIDI, analyzes the chord, then plays an arpeggiated pattern with the recognized chord in guitar voicing. iBassist works similarly, listening to incoming MIDI and generating a bass line in response.

Each of these smart accompaniment apps require receiving MIDI notes ahead of the beat to allow processing time to analyze incoming notes, then be ready to play appropriate notes at the upcoming measure boundary. It's extremely inefficient and sometimes ambiguous to depend on chord recognition for communication between apps.

Consider any iOS app using scales to filter or limit output notes. Every scale-selecting app has a different method for selecting scales. Some use CCs, AUv3 parameters, or UI interactions, or a combination of these approaches.

For apps which are performing chord recognition or applying scales, why not simply share tonal metadata in a compact, standardized form?

Our proposal is to create a *Tone Packet* protocol for connected and cooperating music apps. This Tone Packet protocol will define how to represent and transmit the note metadata.

## Benefits

The primary benefit of the Tone Packet protocol is to provide a fast, efficient and unambiguous method for sharing chord and scale information between music apps in real time. The protocol simplifies internal code requirements for receiving apps by offering a compact and efficient alternative to chord recognition or scale selection.

Tone packets will enable musicians and developers to communicate any combination of up to 24 notes for an unlimited palette of chords, scales, and note clusters.

With a range of music apps supporting the tone packet protocol as senders and receivers, we hope to create new accompaniment possibilities for intelligent music creation.

# Packet Contents

The sending app will transfer 8 bytes of 7-bit data containing a header, metadata and note clusters via SysEx. Packet bytes are 7 bits (bit 7 is unused) to comply with MIDI protocol standards.

## Packet Structure

Tone packets are structured with a header byte, metadata, an identity index, the note cluster and inversion:

Tone Packet Element	Size	Description
Header	1 byte	Length, Notes on/off, Version number
Metadata	2 bytes	Content type, Rootless voicing, Root note, Octave, Slash note
Identity index	1 byte	Index into standardized chord or scale tables naming the note cluster.
Note cluster	4 bytes	Encoded note cluster (24 bits) Inversion, 0-15

### Header: 1 byte

The tone packet header includes a description of the contents, plus the remaining number of bytes:

Bit position	Description	Value	7 6 5 4 3 2 1 0
6	Notes On or Notes Off	1 = Notes On 0 = Notes Off	- x . . . . .
5-4	Tone Packets version	0 = current version ( <i>initial release</i> ) 1-3 reserved for future versions	- . x x . . . .
3-0	Length (also designates the packet type)	0-15 bytes following this byte 0: Notes Off 3: Compact (no cluster) 7: Full (with 4-byte cluster)	- . . . x x x x

*Tone packet header: 1 byte*

### Metadata: 2 bytes

The tone packet metadata provides additional context for the Identity index and note cluster:

	Byte 1	7 6 5 4 3 2 1 0
Cluster content	0 = Unassigned 1 = Chord 2 = Scale 3 = Cluster	- x x . . . . .
Rootless voicing	0 = FALSE (root will be played) 1 = TRUE (root should be omitted)	- . . x . . . .
Root note	0=unassigned, 1=C ... 12=B (13-15 undefined)	- . . . x x x x
	Byte 2	7 6 5 4 3 2 1 0
Octave	3 bits, 0 - 7	- x x x . . . .
Slash chord note	0=unassigned, 1=C ... 12=B (13-15 undefined)	- . . . x x x x

*Tone packet metadata: 2 bytes*

### Identity Index: 1 byte

The *Identity index* describes the contents of the note cluster by referencing the list of chords or scales included as part of this document (see pages 6–9). Declaring an Identity is not a requirement. A value of 0 means an undefined identity.

### Note Cluster and Inversion: 4 bytes

The *Note Cluster* is a 24-bit, binary-encoded representation of a two-octave span of notes. If the octave is significant to the receiver, perhaps for an arpeggiator, the preferred octave can be retrieved from the metadata. The sample note clusters below are formatted to clarify how they are packaged within the tone packet across four 7-bit bytes.

The last 4 bits (24–27) indicate the inversion number (0–15), adequate for chords or scales with up to 16 notes. If a slash chord is indicated, any inversion applies to the chord itself, not to the slash note, which should remain within the octave directly under the lowest note of the chord, whether it is in root position or inversion.

If a scale is indicated, the inversion specifies which note of the scale should be the first to play.

		0 1 2 3 4 5 6	7 8 9 10 11 12 13	14 15 16 17 18 19 20	21 22 23	24 25 26 27 (Inversion #)
<b>Major chord</b>	Chromatic notes 0, 4, 7	1 0 0 0 1 0 0	1 0 0 0 0 0 0	0 0 0 0 0 0 0	0 0 0 0	0 0 0 0
<b>Quartal 5-note</b>	Stacked perfect 4ths	1 0 0 0 0 1 0	0 0 0 1 0 0 0	0 1 0 0 0 0 1	0 0 0 0	0 0 0 0
<b>M9+13x5</b>	M7, add 9, 13; omit 5th	1 0 0 0 1 0 0	0 0 0 0 1 0 0	1 0 0 0 0 0 0	1 0 0 0	0 0 1 0
<b>Note cluster</b>	Any combination of notes	1 1 1 1 0 0 0	0 0 0 0 0 1 1	1 0 0 0 0 0 1	1 0 1 1	1 0 0 1
<b>11-note scale</b>	1 octave	1 0 1 1 1 1 1	1 1 1 1 1 0 0	0 0 0 0 0 0 0	0 0 0 0	0 0 0 0
<b>14-note scale</b>	2 octaves	1 1 1 0 0 1 0	1 1 0 0 1 0 1	0 1 1 0 1 0 1	1 0 1 1	0 1 1 0

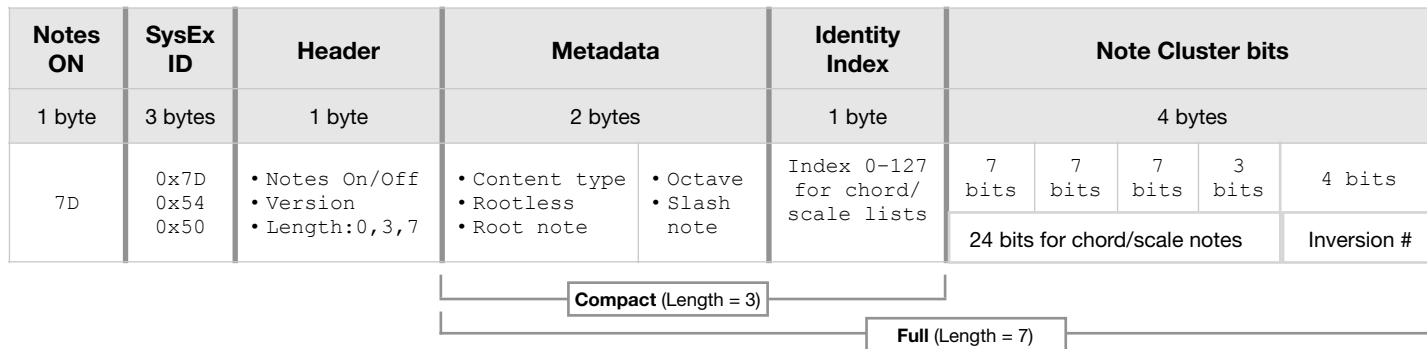
Sample note clusters: 4 bytes

If bit 6 is OFF in the header byte (Notes Off), it represents an All Notes Off packet with a length of 0 (no metadata or note cluster in packet).

Receiving apps would utilize the defined list of chords and scales provided with this document, but are not required to support all chord or scale types in the lists. Upon receiving a packet with an unsupported chord type, the receiver would do its best to respond with a chord that minimally matches the note cluster, or simply ignore the packet.

## Transport Options

We propose a standard SysEx packet of the following form:



# Sample pseudocode for senders and receivers:

## Tone Packet Sender: Sequencer, sending tone packets:

- 1) Identify the chord to be played at the next bar, eg Cm.
- 2) Prepare and transmit a Note On tone packet ahead of the beat:
  - Populate Metadata with root note C, rooted voicing, preferred octave, slash chord note.
  - Populate Identity Index with minor chord (04, 0x04) from the defined list of chords (see p.6)
  - Populate the Note Cluster.
  - Construct the Header.
  - Transmit the packet.
- 3) To release the chord, send a Header byte with bit 6 OFF and length 0 (signifying all Notes off).

*JustChords (v6.8 or later) and Helium (v1.38 or later) function as Tone Packet senders for testing and validation.*

## Tone Packet Receiver: Instrument, receiving tone packets:

- 1) Receive and parse the tone packet
- 2) Process the header and metadata, then start playing the appropriate accompaniment

Header	Metadata		Identity Index	Note Cluster bits			
Byte 1 Header	Byte 2 Metadata 1	Byte 3 Metadata 2	Byte 4 Identity index	Byte 5	Byte 6	Byte 7	Byte 8
- 1 00 0111 0x47	- 01 0 0001 0x21	- 011 0000 0x30	- 0000100 0x04	- 1001000 0x48	- 1000000 0x40	- 0000000 0x00	- 000 0000 0x00
• Note On = 1 • TP version = 0 • Length = 7 (full packet)	• Chord = 01 • Rootless = FALSE • Root = C	• Octave = 3 • chord bass (none)	• Chord /Scale ID index = 4 (minor chord)	• 1-7	• 8-14	• 15-21	• 22-24 • Inversion, 0-15

```

if Byte 2 & 0x20 // Chord packet (= 1)?
  if Byte 1 & 0x40 // Notes On packet (= 1)?
    chordType = chordTable[Byte 4] // Fetch chord type from local chordTable[] lookup
    chordRoot = Byte 2 & 0x0F // Root = C
    play chord at next beat //
  else // Notes Off packet
    stop playing
  endif
endif
endif

```

# Implementation Notes

## Senders

- **Chord and Scale packets** (0x01 and 0x02 of Metadata 1) are *modal*:  
Sending a Cm chord followed by a Dm chord would immediately cancel the Cm chord, then start playing a Dm chord. Chords and scales are active until a new tone packet is sent, or a Notes Off packet is sent.
- **Note Cluster packets** (0x03) are *non-modal*:  
The sender may send a series of tone packets which are to be 'stacked' or played simultaneously by the receiver, until receipt of a Notes Off packet, which cancels all active notes.
- Chord senders should add a dedicated Tone Packet output port to avoid conflict with regular MIDI messages. For sequencer applications, chord packets should be able to be sent ahead of the beat. For most chord-recognizing applications, we have found 1/16 anticipation to be adequate. For maximum future-proofing, it may be wise to add a user selectable option for anticipation values of 1/4, 1/8, 1/16, and Off (no anticipation).
- Scale senders should also use a dedicated Tone Packet output port, with the same anticipation options described above for Chord senders.
- Senders wishing to transmit undefined chords or scales should send them as full packets (with a note cluster) and an Identity Index of 0.

## Receivers

- **Rootless voicing**: This flag signifies whether or not to voice the root note of the chord.
- **Slash chord note**: An additional note to be voiced below the chord, through all inversions. This note should remain less than or equal to 12 semitones below the lowest note of the chord, whether rootless voicing is on or off.
- When used in combination, the following logic applies:
  - If Rootless voicing is ON, and a Slash chord note is specified, the Slash chord note is voiced in place of the Root note.
  - If Rootless voicing is OFF, and a Slash chord note is specified, then both the Root note and the Slash chord note are to be voiced.
- Receivers supporting a subset of the defined list of chords may implement a mapping table between the defined list and their internally supported chords. This enables the receiving app to respond with a simpler chord that complements the specified chord. The same is true for scales.

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# Defined List of Chords and Scales

The scales and chords lists consist of 127 definitions each, which includes the first value 0x00 (Undefined). The tone packet Identity index specifies the location of the chord or scale in these defined lists.

## Chords as Defined in Tone Packet note clusters

- Number of chords: 126
- + denotes added note(s)
- 7, 9, 11, 13 denote a dominant function (e.g. 9+13 = dom7 with added 9th, 13th); mM7 = minor triad with added M7
- "xxxx" in Byte 8 denotes the chord inversion number (0 = root position)
- Any desired chord/cluster not listed below can be formed using the Note Cluster
- See the 3 external documents: [TP Scales – Spreadsheet \(Excel\)](#), [TP Scales – Notes \(PDF\)](#), [TP Scales – Alternate Names \(PDF\)](#)

Index	Name	Notes	---- Chord Binary Representation ----				-- Chord Hex values --			
			Byte 5	Byte 6	Byte 7	Byte 8	B.5	B.6	B.7	B.8
0x00	000	<Undefined>	-0000000	-0000000	-0000000	-000xxxx	0x00	0x00	0x00	0x00

### 2-note Chords:

0x01	001	Power4	0,5	-1000010	-0000000	-0000000	-000xxxx	0x42	0x00	0x00	0x00
0x02	002	Power5	0,7	-1000000	-1000000	-0000000	-000xxxx	0x40	0x40	0x00	0x00

### 3-note Chords:

0x03	003	major	0,4,7	-1000100	-1000000	-0000000	-000xxxx	0x44	0x40	0x00	0x00
0x04	004	minor	0,3,7	-1001000	-1000000	-0000000	-000xxxx	0x48	0x40	0x00	0x00
0x05	005	dim	0,3,6	-1001001	-0000000	-0000000	-000xxxx	0x49	0x00	0x00	0x00
0x06	006	aug	0,4,8	-1000100	-0100000	-0000000	-000xxxx	0x44	0x20	0x00	0x00
0x07	007	sus4	0,5,7	-1000010	-1000000	-0000000	-000xxxx	0x42	0x40	0x00	0x00
0x08	008	sus2	0,2,7	-1010000	-1000000	-0000000	-000xxxx	0x50	0x40	0x00	0x00
0x09	009	Power4+8	0,5,12	-1000010	-0000010	-0000000	-000xxxx	0x42	0x02	0x00	0x00
0x0A	010	Power5+8	0,7,12	-1000000	-1000010	-0000000	-000xxxx	0x40	0x42	0x00	0x00
0x0B	011	quartal (3)	0,5,10	-1000010	-0001000	-0000000	-000xxxx	0x42	0x08	0x00	0x00

### 4-note Chords:

0x0C	012	M6	0,4,7,9	-1000100	-1010000	-0000000	-000xxxx	0x44	0x50	0x00	0x00
0x0D	013	m6	0,3,7,9	-1001000	-1010000	-0000000	-000xxxx	0x48	0x50	0x00	0x00
0x0E	014	7	0,4,7,10	-1000100	-1001000	-0000000	-000xxxx	0x44	0x48	0x00	0x00
0x0F	015	7b5	0,4,6,10	-1000101	-0001000	-0000000	-000xxxx	0x45	0x08	0x00	0x00
0x10	016	7#5	0,4,8,10	-1000100	-0101000	-0000000	-000xxxx	0x44	0x28	0x00	0x00
0x11	017	m7	0,3,7,10	-1001000	-1001000	-0000000	-000xxxx	0x48	0x48	0x00	0x00
0x12	018	m7b5, halfdim7	0,3,6,10	-1001001	-0001000	-0000000	-000xxxx	0x49	0x08	0x00	0x00
0x13	019	m7#5	0,3,8,10	-1001000	-0101000	-0000000	-000xxxx	0x48	0x28	0x00	0x00
0x14	020	dim7	0,3,6,9	-1001001	-0010000	-0000000	-000xxxx	0x49	0x10	0x00	0x00
0x15	021	7sus4, m7sus4	0,5,7,10	-1000010	-1001000	-0000000	-000xxxx	0x42	0x48	0x00	0x00
0x16	022	7sus2, m7sus2	0,2,7,10	-1010000	-1001000	-0000000	-000xxxx	0x50	0x48	0x00	0x00
0x17	023	M7	0,4,7,11	-1000100	-1000100	-0000000	-000xxxx	0x44	0x44	0x00	0x00
0x18	024	M7b5	0,4,6,11	-1000101	-0000100	-0000000	-000xxxx	0x45	0x04	0x00	0x00
0x19	025	M7#5	0,4,8,11	-1000100	-0100100	-0000000	-000xxxx	0x44	0x24	0x00	0x00
0x1A	026	M7sus4	0,5,7,11	-1000010	-1000100	-0000000	-000xxxx	0x42	0x44	0x00	0x00
0x1B	027	M7sus2	0,2,7,11	-1010000	-1000100	-0000000	-000xxxx	0x50	0x44	0x00	0x00
0x1C	028	mM7	0,3,7,11	-1001000	-1000100	-0000000	-000xxxx	0x48	0x44	0x00	0x00
0x1D	029	mM7b5, dim+m7	0,3,6,11	-1001001	-0000100	-0000000	-000xxxx	0x49	0x04	0x00	0x00
0x1E	030	mM7#5	0,3,8,11	-1001000	-0100100	-0000000	-000xxxx	0x48	0x24	0x00	0x00
0x1F	031	M+9	0,4,7,14	-1000100	-1000000	-1000000	-000xxxx	0x44	0x40	0x40	0x00
0x20	032	quartal (4)	0,5,10,15	-1000010	-0001000	-0100000	-000xxxx	0x42	0x08	0x20	0x00
0x21	033	quintal (4)	0,7,14,21	-1000000	-1000000	-1000000	-100xxxx	0x40	0x40	0x40	0x40
0x22	034	quartal (3)+9	0,5,10,14	-1000010	-0001000	-1000000	-000xxxx	0x42	0x08	0x40	0x00
0x23	035	quartal (3)+13	0,5,10,21	-1000010	-0001000	-0000000	-100xxxx	0x42	0x08	0x00	0x40
0x24	036	Stacked M2	0,2,5,7	-1010010	-1000000	-0000000	-000xxxx	0x52	0x40	0x00	0x00
0x25	037	sus4+9	0,5,7,14	-1000010	-1000000	-1000000	-000xxxx	0x42	0x40	0x40	0x00
0x26	038	Tristan	0,6,10,15	-1000001	-0001000	-0100000	-000xxxx	0x41	0x08	0x20	0x00

### 5-note Chords:

0x27	039	9	0,4,7,10,14	-1000100	-1001000	-1000000	-000xxxx	0x44	0x48	0x40	0x00
0x28	040	9b5	0,4,6,10,14	-1000101	-0001000	-1000000	-000xxxx	0x45	0x08	0x40	0x00
0x29	041	9#5	0,4,8,10,14	-1000100	-0101000	-1000000	-000xxxx	0x44	0x28	0x40	0x00
0x2A	042	m9	0,3,7,10,14	-1001000	-1001000	-1000000	-000xxxx	0x48	0x48	0x40	0x00
0x2B	043	m9b5, halfdim7+9	0,3,6,10,14	-1001001	-0001000	-1000000	-000xxxx	0x49	0x08	0x40	0x00
0x2C	044	m9#5	0,3,8,10,14	-1001000	-0101000	-1000000	-000xxxx	0x48	0x28	0x40	0x00
0x2D	045	9sus4, m9sus4	0,5,7,10,14	-1000010	-1001000	-1000000	-000xxxx	0x42	0x48	0x40	0x00
0x2E	046	M6+9	0,4,7,9,14	-1000100	-1010000	-1000000	-000xxxx	0x44	0x50	0x40	0x00
0x2F	047	M6sus4+9, m6sus4+9	0,5,7,9,14	-1000010	-1010000	-1000000	-000xxxx	0x42	0x50	0x40	0x00
0x30	048	m6+9	0,3,7,9,14	-1001000	-1010000	-1000000	-000xxxx	0x48	0x50	0x40	0x00
0x31	049	7#9	0,4,7,10,15	-1000100	-1001000	-0100000	-000xxxx	0x44	0x48	0x20	0x00
0x32	050	7b9	0,4,7,10,13	-1000100	-1001001	-0000000	-000xxxx	0x44	0x49	0x00	0x00
0x33	051	7b5b9	0,4,6,10,13	-1000101	-0001001	-0000000	-000xxxx	0x45	0x09	0x00	0x00

Index	Name	Notes	---- Chord Binary Representation ----				-- Chord Hex values --				
			Byte 5	Byte 6	Byte 7	Byte 8	B.5	B.6	B.7	B.8	
0x34	052	7#5b9	0,4,8,10,13	-1000100	-0101001	-0000000	-000xxxxx	0x44	0x29	0x00	0x00
0x35	053	7b5#9	0,4,6,10,15	-1000101	-0001000	-0100000	-000xxxxx	0x45	0x08	0x20	0x00
0x36	054	7#5#9	0,4,8,10,15	-1000100	-0101000	-0100000	-000xxxxx	0x44	0x28	0x20	0x00
0x37	055	7sus4b9, m7sus4b9	0,5,7,10,13	-1000010	-1001001	-0000000	-000xxxxx	0x42	0x49	0x00	0x00
0x38	056	7sus4#9, m7sus4b9	0,5,7,10,15	-1000010	-1001000	-0100000	-000xxxxx	0x42	0x48	0x20	0x00
0x39	057	M9	0,4,7,11,14	-1000100	-1000100	-1000000	-000xxxxx	0x44	0x44	0x40	0x00
0x3A	058	M9b5	0,4,6,11,14	-1000101	-0000100	-1000000	-000xxxxx	0x45	0x04	0x40	0x00
0x3B	059	M9#5	0,4,8,11,14	-1000100	-0100100	-1000000	-000xxxxx	0x44	0x24	0x40	0x00
0x3C	060	M9sus4, mM9sus4	0,5,7,11,14	-1000010	-1000100	-1000000	-000xxxxx	0x42	0x44	0x40	0x00
0x3D	061	mM9	0,3,7,11,14	-1001000	-1000100	-1000000	-000xxxxx	0x48	0x44	0x40	0x00
0x3E	062	mM9b5	0,3,6,11,14	-1001001	-0000100	-1000000	-000xxxxx	0x49	0x04	0x40	0x00
0x3F	063	mM9#5	0,3,8,11,14	-1001000	-0100100	-1000000	-000xxxxx	0x48	0x24	0x40	0x00
0x40	064	dim7+9	0,3,6,9,14	-1001001	-0010000	-1000000	-000xxxxx	0x49	0x10	0x40	0x00
0x41	065	dim7b9	0,3,6,9,13	-1001001	-0010001	-0000000	-000xxxxx	0x49	0x11	0x00	0x00
0x42	066	7sus2+11, m7sus2	0,2,7,10,17	-1010000	-1001000	-0001000	-000xxxxx	0x50	0x48	0x08	0x00
0x43	067	7sus2+#11	0,2,7,10,18	-1010000	-1001000	-0000100	-000xxxxx	0x50	0x48	0x04	0x00
0x44	068	7+#11	0,4,7,10,18	-1000100	-1001000	-0000100	-000xxxxx	0x44	0x48	0x04	0x00
0x45	069	7#5+#11	0,4,8,10,18	-1000100	-0101000	-0000100	-000xxxxx	0x44	0x28	0x04	0x00
0x46	070	m7+11	0,3,7,10,17	-1001000	-1001000	-0001000	-000xxxxx	0x48	0x48	0x08	0x00
0x47	071	m7b5+11	0,3,6,10,17	-1001001	-0001000	-0001000	-000xxxxx	0x49	0x08	0x08	0x00
0x48	072	m7#5+11	0,3,8,10,17	-1001000	-0101000	-0001000	-000xxxxx	0x48	0x28	0x08	0x00
0x49	073	M7+#11	0,4,7,11,18	-1000100	-1000100	-0000100	-000xxxxx	0x44	0x44	0x04	0x00
0x4A	074	M7#5+#11	0,4,8,11,18	-1000100	-0100100	-0000100	-000xxxxx	0x44	0x24	0x04	0x00
0x4B	075	7+13	0,4,7,10,21	-1000100	-1001000	-0000000	-100xxxxx	0x44	0x48	0x00	0x40
0x4C	076	7+b13	0,4,7,10,20	-1000100	-1001000	-0000001	-000xxxxx	0x44	0x48	0x01	0x00
0x4D	077	7b5+13	0,4,6,10,21	-1000101	-0001000	-0000000	-100xxxxx	0x45	0x08	0x00	0x40
0x4E	078	7b5+b13	0,4,6,10,20	-1000101	-0001000	-0000001	-000xxxxx	0x45	0x08	0x01	0x00
0x4F	079	7sus4+13, m7sus4+13	0,5,7,10,21	-1000010	-1001000	-0000000	-100xxxxx	0x42	0x48	0x00	0x40
0x50	080	7sus2+13, m7sus2+13	0,2,7,10,21	-1010000	-1001000	-0000000	-100xxxxx	0x50	0x48	0x00	0x40
0x51	081	m7+13	0,3,7,10,21	-1001000	-1001000	-0000000	-100xxxxx	0x48	0x48	0x00	0x40
0x52	082	m7b5+13	0,3,6,10,21	-1001001	-0001000	-0000000	-100xxxxx	0x49	0x08	0x00	0x40
0x53	083	M7+13	0,4,7,11,21	-1000100	-1000100	-0000000	-100xxxxx	0x44	0x44	0x00	0x40
0x54	084	M7b5+13	0,4,6,11,21	-1000101	-0000100	-0000000	-100xxxxx	0x45	0x04	0x00	0x40
0x55	085	M7sus4+13	0,5,7,11,21	-1000010	-1000100	-0000000	-100xxxxx	0x42	0x44	0x00	0x40
0x56	086	M7sus2+13	0,2,7,11,21	-1010000	-1000100	-0000000	-100xxxxx	0x50	0x44	0x00	0x40
0x57	087	quartal(5)	0,5,10,15,20	-1000010	-0001000	-0100001	-000xxxxx	0x42	0x08	0x21	0x00
0x58	088	quartal(3)+9+13	0,5,10,14,21	-1000010	-0001000	-1000000	-100xxxxx	0x42	0x08	0x40	0x40
0x59	089	Electra, M6+b9	0,7,9,13,16	-1000000	-1010001	-0010000	-000xxxxx	0x40	0x51	0x10	0x00
0x5A	090	Gamma (Bartok), mM7+#11	0,3,6,8,11	-1001001	-0100100	-0000000	-000xxxxx	0x49	0x24	0x00	0x00

### 6-note Chords:

0x5B	091	9+#11	0,4,7,10,14,18	-1000100	-1001000	-1000100	-000xxxxx	0x44	0x48	0x44	0x00
0x5C	092	11	0,4,7,10,14,17	-1000100	-1001000	-1001000	-000xxxxx	0x44	0x48	0x48	0x00
0x5D	093	7+b9#11	0,4,7,10,13,18	-1000100	-1001001	-0000100	-000xxxxx	0x44	0x49	0x04	0x00
0x5E	094	m11	0,3,7,10,14,17	-1001000	-1001000	-1001000	-000xxxxx	0x48	0x48	0x48	0x00
0x5F	095	m11b5, halfdim7+9+11	0,3,6,10,14,17	-1001001	-0001000	-1001000	-000xxxxx	0x49	0x08	0x48	0x00
0x60	096	m11#5	0,3,8,10,14,17	-1001000	-0101000	-1001000	-000xxxxx	0x48	0x28	0x48	0x00
0x61	097	dim7+9+11	0,3,6,9,14,17	-1001001	-0010000	-1001000	-000xxxxx	0x49	0x10	0x48	0x00
0x62	098	dim7b9+11	0,3,6,9,13,17	-1001001	-0010001	-0001000	-000xxxxx	0x49	0x11	0x08	0x00
0x63	099	halfdim7b9+11	0,3,6,10,13,17	-1001001	-0001001	-0001000	-000xxxxx	0x49	0x09	0x08	0x00
0x64	100	9+13	0,4,7,10,14,21	-1000100	-1001000	-1000000	-100xxxxx	0x44	0x48	0x40	0x40
0x65	101	9b5+13	0,4,6,10,14,21	-1000101	-0001000	-1000000	-100xxxxx	0x45	0x08	0x40	0x40
0x66	102	9sus4+13, m9sus4+13	0,5,7,10,14,21	-1000010	-1001000	-1000000	-100xxxxx	0x42	0x48	0x40	0x40
0x67	103	m9+13	0,3,7,10,14,21	-1001000	-1001000	-1000000	-100xxxxx	0x48	0x48	0x40	0x40
0x68	104	m9b5+13, halfdim7+9+13	0,3,6,10,14,21	-1001001	-0001000	-1000000	-100xxxxx	0x49	0x08	0x40	0x40
0x69	105	M7sus4+9+13	0,5,7,11,14,21	-1000010	-1000100	-1000000	-100xxxxx	0x42	0x44	0x40	0x40
0x6A	106	M7sus4+9+b13	0,5,7,11,14,20	-1000010	-1000100	-1000001	-000xxxxx	0x42	0x44	0x41	0x00
0x6B	107	M11	0,4,7,11,14,17	-1000100	-1000100	-1001000	-000xxxxx	0x44	0x44	0x48	0x00
0x6C	108	M9+#11	0,4,7,11,14,18	-1000100	-1000100	-1000100	-000xxxxx	0x44	0x44	0x44	0x00
0x6D	109	mM9+11	0,3,7,11,14,17	-1001000	-1000100	-1001000	-000xxxxx	0x48	0x44	0x48	0x00
0x6E	110	mM9+#11	0,3,7,11,14,18	-1001000	-1000100	-1000100	-000xxxxx	0x48	0x44	0x44	0x00
0x6F	111	Wholetone closed, 9#11	0,4,8,10,14,18	-1000100	-0101000	-1000100	-000xxxxx	0x44	0x28	0x44	0x00
0x70	112	Wholetone open	0,4,8,14,18,22	-1000100	-0100000	-1000100	-010xxxxx	0x44	0x20	0x44	0x20
0x71	113	Mystic	0,6,10,14,16,21	-1000001	-0001000	-1010000	-100xxxxx	0x41	0x08	0x50	0x40
0x72	114	Petrushka closed	0,3,5,6,9,11	-1001011	-0010100	-0000000	-000xxxxx	0x4B	0x14	0x00	0x00
0x73	115	Petrushka open1	0,5,9,15,18,23	-1000010	-0010000	-0100100	-001xxxxx	0x42	0x10	0x24	0x10
0x74	116	Petrushka open2, 7b9#11	0,4,7,10,13,18	-1000100	-1001001	-0000100	-000xxxxx	0x44	0x49	0x04	0x00

### 7-note Chords:

0x75	117	13	0,4,7,10,14,17,21	-1000100	-1001000	-1001000	-100xxxxx	0x44	0x48	0x48	0x40
0x76	118	13#11	0,4,7,10,14,18,21	-1000100	-1001000	-1000100	-100xxxxx	0x44	0x48	0x44	0x40
0x77	119	13b9	0,4,7,10,13,17,21	-1000100	-1001001	-0000100	-100xxxxx	0x44	0x49	0x08	0x40
0x78	120	13b9#11	0,4,7,10,13,18,21	-1000100	-1001001	-0000100	-100xxxxx	0x44	0x49	0x04	0x40
0x79	121	M13	0,4,7,11,14,17,21	-1000100	-1000100	-1001000	-100xxxxx	0x44	0x44	0x48	0x40
0x7A	122	M13#11	0,4,7,11,14,18,21	-1000100	-1000100	-1000100	-100xxxxx	0x44	0x44	0x44	0x40
0x7B	123	m13	0,3,7,10,14,17,21	-1001000	-1001000	-1001000	-100xxxxx	0x48	0x48	0x48	0x40
0x7C	124	Mm9+11+13	0,3,7,11,14,17,21	-1001000	-1000100	-1001000	-100xxxxx	0x48	0x44	0x48	0x40
0x7D	125	Mm9+11+#13	0,3,7,11,14,18,21	-1001000	-1000100	-1000100	-100xxxxx	0x48	0x44	0x44	0x40

### 8-note Chords:

0x7E	126	Alpha, dim+M7,9,11,b13	0,3,6,9,11,14,17,20	-1001001	-0010100	-1001001	-000xxxxx	0x49	0x14	0x49	0x00
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## Scales as Defined in Tone Packet note clusters

- Number of scales: 126
- H=half-step; W=whole-step; harm harmonic; Dbl=double; penta=pentatonic; sym=symmetric; dom=dominant; nat=natural
- Messiaen xyz: x = # of the Mode of Limited Transposition; y = modal # (°); z = # possible transpositions for the MLT scale
- Many scales have multiple names; common alternate name(s) are given; there are no bit pattern duplicates
- Starting with 4-notes, the scales are arranged in order of interval sizes from left to right
- "xxxx" in Byte 8 can be used to specify the scale transposition (which note of the scale to start on); default = 0
- See the 3 external documents: [TP Scales – Spreadsheet \(Excel\)](#), [TP Scales – Notes \(PDF\)](#), [TP Scales – Alternate Names \(PDF\)](#)

Index	Name	Notes	---- Scale Binary Representation ----				-- Scale Hex values --			
			Byte 5	Byte 6	Byte 7	Byte 8	B.5	B.6	B.7	B.8
0x00	0	<Undefined>	-0000000	-0000000	-0000000	-000xxxx	0x00	0x00	0x00	0x00

### Basic modes and minor:

0x01	1	Ionian, Major, Diatonic	0,2,4,5,7,9,11	-1010110	-1010100	-0000000	-000xxxx	0x56	0x54	0x00	0x00
0x02	2	Dorian	0,2,3,5,7,9,10	-1011010	-1011000	-0000000	-000xxxx	0x5A	0x58	0x00	0x00
0x03	3	Phrygian	0,1,3,5,7,8,10	-1101010	-1101000	-0000000	-000xxxx	0x6A	0x68	0x00	0x00
0x04	4	Lydian	0,2,4,6,7,9,11	-1010101	-1010100	-0000000	-000xxxx	0x55	0x54	0x00	0x00
0x05	5	Mixolydian	0,2,4,5,7,9,10	-1010110	-1011000	-0000000	-000xxxx	0x56	0x58	0x00	0x00
0x06	6	Aeolian, Nat m	0,2,3,5,7,8,10	-1011010	-1011000	-0000000	-000xxxx	0x5A	0x68	0x00	0x00
0x07	7	Locrian	0,1,3,5,6,8,10	-1101011	-0101000	-0000000	-000xxxx	0x6B	0x28	0x00	0x00
0x08	8	Harmonic Minor	0,2,3,5,7,8,11	-1011010	-1100100	-0000000	-000xxxx	0x5A	0x64	0x00	0x00
0x09	9	Melodic Minor	0,2,3,5,7,9,11	-1011010	-1010100	-0000000	-000xxxx	0x5A	0x54	0x00	0x00

### 4-note Scales:

0x0A	10	Phrygian pentatonic	0,1,3,7	-1101000	-1000000	-0000000	-000xxxx	0x68	0x40	0x00	0x00
0x0B	11	Aeolian/Dorian penta	0,2,3,7	-1011000	-1000000	-0000000	-000xxxx	0x58	0x40	0x00	0x00
0x0C	12	Ionian/Mixo pentatonic	0,4,5,7	-1000110	-1000000	-0000000	-000xxxx	0x46	0x40	0x00	0x00
0x0D	13	Lydian pentatonic	0,4,6,7	-1000101	-1000000	-0000000	-000xxxx	0x45	0x40	0x00	0x00

### 5-note Scales:

0x0E	14	Balinese, Pelog	0,1,3,7,8	-1101000	-1100000	-0000000	-000xxxx	0x68	0x60	0x00	0x00
0x0F	15	Prometheus (Liszt)	0,1,4,5,8	-1100110	-0100000	-0000000	-000xxxx	0x66	0x20	0x00	0x00
0x10	16	Iwato	0,1,5,6,10	-1100011	-0001000	-0000000	-000xxxx	0x63	0x08	0x00	0x00
0x11	17	In, Sakura, Kumoi Joshi	0,1,5,7,8	-1100010	-1100000	-0000000	-000xxxx	0x62	0x60	0x00	0x00
0x12	18	Insen, Han Iwato	0,1,5,7,10	-1100010	-1001000	-0000000	-000xxxx	0x62	0x48	0x00	0x00
0x13	19	Hirajoshi, Kumoi	0,2,3,7,8	-1011000	-1100000	-0000000	-000xxxx	0x58	0x60	0x00	0x00
0x14	20	Prometheus 5 (Scriabin)	0,2,4,6,9	-1010101	-0010000	-0000000	-000xxxx	0x55	0x10	0x00	0x00
0x15	21	Pentatonic major, Ryo	0,2,4,7,9	-1010100	-1010000	-0000000	-000xxxx	0x54	0x50	0x00	0x00
0x16	22	Pentatonic dominant	0,2,4,7,10	-1010100	-1001000	-0000000	-000xxxx	0x54	0x48	0x00	0x00
0x17	23	Yo, Ritsu, Scottish	0,2,5,7,9	-1010010	-1010000	-0000000	-000xxxx	0x52	0x50	0x00	0x00
0x18	24	Egyptian, Yosenpo	0,2,5,7,10	-1010010	-1001000	-0000000	-000xxxx	0x52	0x48	0x00	0x00
0x19	25	Prometheus inverted	0,3,4,7,8	-1001100	-1100000	-0000000	-000xxxx	0x4C	0x60	0x00	0x00
0x1A	26	Locrian pentatonic	0,3,5,6,10	-1001011	-0001000	-0000000	-000xxxx	0x4B	0x08	0x00	0x00
0x1B	27	Pentatonic minor, Minyo	0,3,5,7,10	-1001010	-1001000	-0000000	-000xxxx	0x4A	0x48	0x00	0x00
0x1C	28	Blues minor 2, Man Gong	0,3,5,8,10	-1001010	-0101000	-0000000	-000xxxx	0x4A	0x28	0x00	0x00
0x1D	29	Mixolydian pentatonic	0,4,5,7,10	-1000110	-1001000	-0000000	-000xxxx	0x46	0x48	0x00	0x00
0x1E	30	Ionian penta, Ryukuan	0,4,5,7,11	-1000110	-1000100	-0000000	-000xxxx	0x46	0x44	0x00	0x00
0x1F	31	Lydian penta (Chinese)	0,4,6,7,11	-1000101	-1000100	-0000000	-000xxxx	0x45	0x44	0x00	0x00

### 6-note Scales:

0x20	32	Mixolydian chromatic	0,1,2,5,6,7	-1110011	-1000000	-0000000	-000xxxx	0x73	0x40	0x00	0x00
0x21	33	Dorian chromatic	0,1,2,5,7,8	-1110010	-1100000	-0000000	-000xxxx	0x72	0x60	0x00	0x00
0x22	34	Balinese	0,1,3,7,8,10	-1101000	-1101000	-0000000	-000xxxx	0x68	0x68	0x00	0x00
0x23	35	Persian 6-note	0,1,4,5,6,8	-1100111	-0100000	-0000000	-000xxxx	0x67	0x20	0x00	0x00
0x24	36	Lydian chromatic	0,1,4,5,6,9	-1100111	-0010000	-0000000	-000xxxx	0x67	0x10	0x00	0x00
0x25	37	Hexatonic Gypsy	0,1,4,5,7,9	-1100110	-1010000	-0000000	-000xxxx	0x66	0x50	0x00	0x00
0x26	38	Heptatonic (Debussy)	0,2,3,4,5,6	-1011111	-0000000	-0000000	-000xxxx	0x5F	0x00	0x00	0x00
0x27	39	Blues major hexatonic	0,2,3,4,7,9	-1011100	-1010000	-0000000	-000xxxx	0x5C	0x50	0x00	0x00
0x28	40	Hungarian ml	0,2,3,6,7,8	-1011001	-1100000	-0000000	-000xxxx	0x59	0x60	0x00	0x00
0x29	41	Hirajoshi	0,2,3,7,8,10	-1011000	-1101000	-0000000	-000xxxx	0x58	0x68	0x00	0x00
0x2A	42	Kumoi	0,2,3,7,9,10	-1011000	-1011000	-0000000	-000xxxx	0x58	0x58	0x00	0x00
0x2B	43	Prometheus 6, Mystic	0,2,4,6,9,10	-1010101	-0011000	-0000000	-000xxxx	0x55	0x18	0x00	0x00
0x2C	44	Phrygian chromatic	0,3,4,5,8,10	-1001110	-0101000	-0000000	-000xxxx	0x4E	0x28	0x00	0x00
0x2D	45	Augmented, Sym aug	0,3,4,7,8,11	-1001100	-1100100	-0000000	-000xxxx	0x4C	0x64	0x00	0x00
0x2E	46	Blues minor 1	0,3,5,6,7,10	-1001011	-1001000	-0000000	-000xxxx	0x4B	0x48	0x00	0x00



Index	Name	Notes	---- Scale Binary Representation ----				-- Scale Hex values --				
			Byte 5	Byte 6	Byte 7	Byte 8	B.5	B.6	B.7	B.8	
<b>7-note Scales:</b>											
0x2F	47	Tcherepnin octatonic3	0,1,2,3,6,7,8	-1111001	-1100000	-0000000	-000xxxx	0x79	0x60	0x00	0x00
0x30	48	Elephant	0,1,2,4,5,8,10	-1110110	-0101000	-0000000	-000xxxx	0x76	0x28	0x00	0x00
0x31	49	Tcherepnin octatonic2	0,1,2,5,6,7,8	-1110011	-1100000	-0000000	-000xxxx	0x73	0x60	0x00	0x00
0x32	50	Altered, super Locrian	0,1,3,4,6,8,10	-1101101	-0101000	-0000000	-000xxxx	0x6D	0x28	0x00	0x00
0x33	51	Ultraphythgian	0,1,3,4,7,8,9	-1101100	-1110000	-0000000	-000xxxx	0x6C	0x70	0x00	0x00
0x34	52	Phrygian b4	0,1,3,4,7,8,10	-1101100	-1101000	-0000000	-000xxxx	0x6C	0x68	0x00	0x00
0x35	53	Locrian harmonic	0,1,3,5,6,8,11	-1101011	-0100100	-0000000	-000xxxx	0x6B	0x24	0x00	0x00
0x36	54	Locrian nat 6, Oriental 1	0,1,3,5,6,9,10	-1101011	-0011000	-0000000	-000xxxx	0x6B	0x18	0x00	0x00
0x37	55	Neapolitan minor	0,1,3,5,7,8,11	-1101010	-1100100	-0000000	-000xxxx	0x6A	0x64	0x00	0x00
0x38	56	Dorian b2	0,1,3,5,7,9,10	-1101010	-1011000	-0000000	-000xxxx	0x6A	0x58	0x00	0x00
0x39	57	Neapolitan "major", Phryg M	0,1,3,5,7,9,11	-1101010	-1010100	-0000000	-000xxxx	0x6A	0x54	0x00	0x00
0x3A	58	Persian 4, Todi Theta (Thaat)	0,1,3,6,7,8,11	-1101001	-1100100	-0000000	-000xxxx	0x69	0x64	0x00	0x00
0x3B	59	Tcherepnin octatonic1	0,1,4,5,6,7,10	-1100111	-1001000	-0000000	-000xxxx	0x67	0x48	0x00	0x00
0x3C	60	Locrian nat 3	0,1,4,5,6,8,10	-1100111	-1010100	-0000000	-000xxxx	0x67	0x28	0x00	0x00
0x3D	61	Gypsy-Persian, Pers 1	0,1,4,5,6,8,11	-1100111	-0100100	-0000000	-000xxxx	0x67	0x24	0x00	0x00
0x3E	62	Oriental 1	0,1,4,5,6,9,10	-1100111	-0011000	-0000000	-000xxxx	0x67	0x18	0x00	0x00
0x3F	63	Persian 7	0,1,4,5,6,9,11	-1100111	-0010100	-0000000	-000xxxx	0x67	0x14	0x00	0x00
0x40	64	Spanish Gypsy, Phryg M/dom	0,1,4,5,7,8,10	-1100110	-1101000	-0000000	-000xxxx	0x66	0x68	0x00	0x00
0x41	65	Gypsy M, Persian 3, Dbl harm	0,1,4,5,7,8,11	-1100110	-1100100	-0000000	-000xxxx	0x66	0x64	0x00	0x00
0x42	66	Mixolydian b2	0,1,4,5,7,9,10	-1100110	-1101000	-0000000	-000xxxx	0x66	0x58	0x00	0x00
0x43	67	Enigmatic down	0,1,4,5,8,10,11	-1100110	-0101100	-0000000	-000xxxx	0x66	0x2C	0x00	0x00
0x44	68	Romanian major	0,1,4,6,7,9,10	-1100101	-1011000	-0000000	-000xxxx	0x65	0x58	0x00	0x00
0x45	69	Enigmatic up	0,1,4,6,8,10,11	-1100101	-0101100	-0000000	-000xxxx	0x65	0x2C	0x00	0x00
0x46	70	Algerian	0,2,3,5,6,7,8	-1011011	-1100000	-0000000	-000xxxx	0x5B	0x60	0x00	0x00
0x47	71	Locrian nat 2	0,2,3,5,6,8,10	-1011011	-0101000	-0000000	-000xxxx	0x5B	0x28	0x00	0x00
0x48	72	Dorian b5	0,2,3,5,6,9,10	-1011011	-0011000	-0000000	-000xxxx	0x5B	0x18	0x00	0x00
0x49	73	Gypsy/Hung m, Algerian	0,2,3,6,7,8,11	-1011001	-1100100	-0000000	-000xxxx	0x59	0x64	0x00	0x00
0x4A	74	Romanian, Ukranian, Dorian #4	0,2,3,6,7,9,10	-1011001	-1011000	-0000000	-000xxxx	0x59	0x58	0x00	0x00
0x4B	75	Hungarian m2, Lydian b3	0,2,3,6,7,9,11	-1011001	-1010100	-0000000	-000xxxx	0x59	0x54	0x00	0x00
0x4C	76	Locrian major, Arabian	0,2,4,5,6,8,10	-1010111	-0101000	-0000000	-000xxxx	0x57	0x28	0x00	0x00
0x4D	77	Mixo b6, Hindu	0,2,4,5,7,8,10	-1010110	-1101000	-0000000	-000xxxx	0x56	0x68	0x00	0x00
0x4E	78	Harmonic M (Ethiopia)	0,2,4,5,7,8,11	-1010110	-1100100	-0000000	-000xxxx	0x56	0x64	0x00	0x00
0x4F	79	Mixolydian #5	0,2,4,5,8,9,10	-1010110	-0111000	-0000000	-000xxxx	0x56	0x38	0x00	0x00
0x50	80	Ionian #5	0,2,4,5,8,9,11	-1010110	-0110100	-0000000	-000xxxx	0x56	0x34	0x00	0x00
0x51	81	Lydian m, Lydian b6 dom	0,2,4,6,7,8,10	-1010101	-1101000	-0000000	-000xxxx	0x55	0x68	0x00	0x00
0x52	82	Lydian b6	0,2,4,6,7,8,11	-1010101	-1100100	-0000000	-000xxxx	0x55	0x64	0x00	0x00
0x53	83	Lydian b7, Mixo #4	0,2,4,6,7,9,10	-1010101	-1011000	-0000000	-000xxxx	0x55	0x58	0x00	0x00
0x54	84	Lydian #6	0,2,4,6,7,10,11	-1010101	-1001100	-0000000	-000xxxx	0x55	0x4C	0x00	0x00
0x55	85	Lydian #5	0,2,4,6,8,9,11	-1010101	-0110100	-0000000	-000xxxx	0x55	0x34	0x00	0x00
0x56	86	Lydian #5#6, Leading WT	0,2,4,6,8,10,11	-1010101	-0101100	-0000000	-000xxxx	0x55	0x2C	0x00	0x00
0x57	87	Persian 5, Lydian #3#6	0,2,5,6,7,10,11	-1010011	-1001100	-0000000	-000xxxx	0x53	0x4C	0x00	0x00
0x58	88	Nohkan	0,2,5,6,8,9,11	-1010011	-0110100	-0000000	-000xxxx	0x53	0x34	0x00	0x00
0x59	89	Tcherepnin octatonic4	0,3,4,5,6,9,10	-1001111	-0011000	-0000000	-000xxxx	0x4F	0x18	0x00	0x00
0x5A	90	Ionian #2	0,3,4,5,7,9,11	-1001110	-1010100	-0000000	-000xxxx	0x4E	0x54	0x00	0x00
0x5B	91	Persian 2, Ionian #2#6	0,3,4,5,7,10,11	-1001110	-1001100	-0000000	-000xxxx	0x4E	0x4C	0x00	0x00
0x5C	92	Hungarian M1	0,3,4,6,7,9,10	-1001101	-1011000	-0000000	-000xxxx	0x4D	0x58	0x00	0x00
0x5D	93	Persian 6, Mixo #2#5	0,3,4,5,8,9,10	-1001110	-0111000	-0000000	-000xxxx	0x4E	0x38	0x00	0x00
0x5E	94	Lydian #2, Ionian #2#4	0,3,4,6,7,9,11	-1001101	-1010100	-0000000	-000xxxx	0x4D	0x54	0x00	0x00
0x5F	95	Lydian #2#6	0,3,4,6,7,10,11	-1001101	-1001100	-0000000	-000xxxx	0x4D	0x4C	0x00	0x00
0x60	96	Lydian #2#5	0,3,4,6,8,9,11	-1001101	-0110100	-0000000	-000xxxx	0x4D	0x34	0x00	0x00

### 8-note Scales:

0x61	97	Spanish 8-note, Espla's	0,1,3,4,5,6,8,10	-1101111	-0101000	-0000000	-000xxxx	0x6F	0x28	0x00	0x00
0x62	98	Phrygian Spanish	0,1,3,4,5,7,8,10	-1101110	-1101000	-0000000	-000xxxx	0x6E	0x68	0x00	0x00
0x63	99	Scala enigmatic (Verdi)	0,1,4,5,6,8,10,11	-1100111	-0101100	-0000000	-000xxxx	0x67	0x2C	0x00	0x00
0x64	100	Bebop mel minor	0,2,3,5,7,8,9,11	-1011010	-1110100	-0000000	-000xxxx	0x5A	0x74	0x00	0x00
0x65	101	Bebop harm minor	0,2,3,5,7,8,10,11	-1011010	-1101100	-0000000	-000xxxx	0x5A	0x6C	0x00	0x00
0x66	102	Ishitotsucho, Ichikosucho	0,2,4,5,6,7,9,11	-1010111	-1010100	-0000000	-000xxxx	0x57	0x54	0x00	0x00
0x67	103	Bebop major	0,2,4,5,7,8,9,11	-1010110	-1110100	-0000000	-000xxxx	0x56	0x74	0x00	0x00
0x68	104	Bebop dominant	0,2,4,5,7,9,10,11	-1010110	-1011100	-0000000	-000xxxx	0x56	0x5C	0x00	0x00

Index	Name	Notes	---- Scale Binary Representation ----				-- Scale Hex values --				
			Byte 5	Byte 6	Byte 7	Byte 8	B.5	B.6	B.7	B.8	
<b>Messiaen Modes of Limited Transposition:</b>											
<b>8-note Messiaen</b>											
0x69	105	Messiaen 112, Whole tone	0,2,4,6,8,10	-1010101	-0101000	-0000000	-000xxxx	0x55	0x28	0x00	0x00
0x6A	106	Messiaen 213, HW, dim blues	0,1,3,4,6,7,9,10	-1101101	-1011000	-0000000	-000xxxx	0x6D	0x58	0x00	0x00
0x6B	107	Messiaen 223, WH, dim	0,2,3,5,6,8,9,11	-1011011	-0110100	-0000000	-000xxxx	0x5B	0x34	0x00	0x00
<b>9-note Messiaen</b>											
0x6C	108	Messiaen 314	0,2,3,4,6,7,8,10,11	-1011101	-1101100	-0000000	-000xxxx	0x5D	0x6C	0x00	0x00
0x6D	109	Messiaen 324	0,1,2,4,5,6,8,9,10	-1110111	-0111000	-0000000	-000xxxx	0x77	0x38	0x00	0x00
0x6E	110	Messiaen 334	0,1,3,4,5,7,8,9,11	-1101110	-1110100	-0000000	-000xxxx	0x6E	0x74	0x00	0x00
0x6F	111	Messiaen 416	0,1,2,5,6,7,8,11	-1110011	-1100100	-0000000	-000xxxx	0x73	0x64	0x00	0x00
0x70	112	Messiaen 426	0,1,4,5,6,7,10,11	-1100111	-1001100	-0000000	-000xxxx	0x67	0x4C	0x00	0x00
0x71	113	Messiaen 436	0,3,4,5,6,9,10,11	-1001111	-0011100	-0000000	-000xxxx	0x4F	0x1C	0x00	0x00
0x72	114	Messiaen 446	0,1,2,3,6,7,8,9	-1111001	-1110000	-0000000	-000xxxx	0x79	0x70	0x00	0x00
0x73	115	Messiaen 516	0,1,5,6,7,11	-1100011	-1000100	-0000000	-000xxxx	0x63	0x44	0x00	0x00
0x74	116	Messiaen 526	0,4,5,6,10,11	-1000111	-0001100	-0000000	-000xxxx	0x47	0x0C	0x00	0x00
0x75	117	Messiaen 536	0,1,2,6,7,8	-1110001	-1100000	-0000000	-000xxxx	0x71	0x60	0x00	0x00
0x76	118	Messiaen 616	0,2,4,5,6,8,10,11	-1010111	-0101100	-0000000	-000xxxx	0x57	0x2C	0x00	0x00
0x77	119	Messiaen 626	0,2,3,4,6,8,9,10	-1011101	-0111000	-0000000	-000xxxx	0x5D	0x38	0x00	0x00
0x78	120	Messiaen 636	0,1,2,4,6,7,8,10	-1110101	-1101000	-0000000	-000xxxx	0x75	0x68	0x00	0x00
0x79	121	Messiaen 646	0,1,3,5,6,7,9,11	-1101011	-1010100	-0000000	-000xxxx	0x6B	0x54	0x00	0x00
<b>10-note Messiaen</b>											
0x7A	122	Messiaen 716	0,1,2,3,5,6,7,8,9,11	-1111011	-1110100	-0000000	-000xxxx	0x7B	0x74	0x00	0x00
0x7B	123	Messiaen 726	0,1,2,4,5,6,7,8,10,11	-1110111	-1101100	-0000000	-000xxxx	0x77	0x6C	0x00	0x00
0x7C	124	Messiaen 736	0,1,3,4,5,6,7,9,10,11	-1101111	-1011100	-0000000	-000xxxx	0x6F	0x5C	0x00	0x00
0x7D	125	Messiaen 746	0,2,3,4,5,6,8,9,10,11	-1011111	-0111100	-0000000	-000xxxx	0x5F	0x3C	0x00	0x00
0x7E	126	Messiaen 756	0,1,2,3,4,6,7,8,9,10	-1111101	-1111000	-0000000	-000xxxx	0x7D	0x78	0x00	0x00