

LXI HiSLIP Extended Function

Revision 1.02

8 November 2016



**Notice of Rights** All rights reserved. This document is the property of the LXI Consortium.  It may be reproduced, unaltered, in whole or in part, provided the LXI copyright notice is retained on every document page.

**Notice of Liability** The information contained in this document is subject to change without notice. “Preliminary” releases are for specification development and proof-of-concept testing and may not reflect the final “Released” specification.

The LXI Consortium, Inc. makes no warranty of any kind with regard to this material, including but not limited to, the implied warranties of merchantability and fitness for a particular purpose. The LXI Consortium, Inc. shall not be liable for errors or omissions contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

**LXI Standards** Documents are developed within the LXI Consortium and LXI Technical Working Groups sponsored by the LXI Consortium Board of Directors. The LXI Consortium develops its standards through a consensus development process modeled after the American National Standards Institute, which brings together volunteers representing varied viewpoints and interests to achieve the final product. Volunteers are not necessarily members of the Consortium and serve without compensation. While the LXI Consortium administers the process and establishes rules to promote fairness in the consensus development process, the LXI Consortium does not exhaustively evaluate, test, or verify the accuracy of any of the information contained in its standards.

Use of an LXI Consortium Standard is wholly voluntary. The LXI Consortium and its members disclaim liability for any personal injury, property or other damage, of any nature whatsoever, whether special, indirect, consequential, or compensatory, directly or indirectly resulting from the publication, use of, or reliance upon this, or any other LXI Consortium Standard document.

The LXI Consortium does not warrant or represent the accuracy or content of the material contained herein, and expressly disclaims any express or implied warranty, including any implied warranty of merchantability or fitness for a specific purpose, or that the use of the material contained herein is free from patent infringement. LXI Consortium Standards documents are supplied “as is”. The existence of an LXI Consortium Standard does not imply that there are no other ways to produce, test, measure, purchase, market, or provide other goods and services related to the scope of the LXI Consortium Standard. Furthermore, the viewpoint expressed at the time a standard is approved and issued is subject to change brought about through developments in the state of the art and comments received from users of the standard. Every LXI Consortium Standard is subjected to review at least every five years for revision or reaffirmation. When a document is more than five years old and has not been reaffirmed, it is reasonable to conclude that its contents, although still of some value, do not wholly reflect the present state of the art. Users are cautioned to check to determine that they have the latest edition of any LXI Consortium Standard.

In publishing and making this document available, the LXI Consortium is not suggesting or rendering professional or other services for, or on behalf of, any person or entity. Nor is the LXI Consortium undertaking to perform any duty owed by any other person or entity to another. Any person utilizing this, and any other LXI Consortium Standards document, should rely upon the advice of a competent professional in determining the exercise of reasonable care in any given circumstances.

This specification is the property of the LXI Consortium, a Delaware 501c3 corporation, for the use of its members.

**Interpretations** Occasionally questions may arise regarding the meaning of portions of standards as they relate to specific applications. When the need for interpretations is brought to the attention of LXI Consortium, the Consortium will initiate action to prepare appropriate responses. Since LXI Consortium Standards represent a consensus of concerned interests, it is important to ensure that any interpretation has also received the concurrence of a balance of interests. For this reason, LXI Consortium and the members of its working groups are not able to provide an instant response to interpretation requests except in those cases where the matter has previously received formal consideration. Requests for interpretations of this standard must be sent to interpretations@lxistandard.org using the form “*Request for Interpretation of an LXI Standard Document*”. This document plus a list of interpretations to this standard are found on the LXI Consortium’s Web site: [http://www.lxistandard.org](http://www.lxistandard.org/)

LXI is a registered trademark of the LXI Consortium

**Legal Issues, Trademarks, Patents, and Licensing Policies.** These items are addressed specifically in the document “LXI *Consortium Trademark, Patent, and Licensing Policies*” found on the LXI Consortium’s Web site: <http://www.lxistandard.org> .

**Conformance** The LXI Consortium draws attention to the document “*LXI Consortium Policy for Certifying Conformance to LXI Consortium Standards*” found on the LXI Consortium’s Web site: <http://www.lxistandard.org> .That document specifies the procedures that must be followed to claim conformance with this standard.

**Comments for Revision** Comments for revision of LXI Consortium Standards are welcome from any interested party, regardless of membership affiliation with LXI Consortium. Suggestions for changes in documents should be in the form of a proposed change of text, together with appropriate supporting comments. Comments on standards should be addressed to:

Bob Helsel
Executive Director
LXI Consortium
PO Box 1016
Niwot, CO 80544-1016

303-652-2571 Office – LXI
303-579-2636 Mobile
303-652-1444 Fax
ExecDir@lxistandard.org
LXI.WGs@gmail.com

**LXI is a registered trademark of the LXI Consortium**

**Revision history**

|  |  |
| --- | --- |
| ***Revision*** | ***Description*** |
| Nov 8, 2016 | Release Specification |
| Sept 12, 2016 | Added Recommendation to add Address parameter to announcement of service information during mDNS discovery. Removed Appendix A to example documentation |
| October 18, 2011 | Several editorial edits associated with feedback from the 1.00 vote. Updated references to IVI 6.1 HiSLIP protocol version 1.1. Removed references to locking, which LXI is no longer pursuing. |
| June 3, 2011 | Added rules 20.7.6 (Advertise HiSLIP DNS-SD with HiSLIP port) and 20.8.4 (Preserve HiSLIP port across power cycles) |
| May 16, 2011 | Added standard draft patent rights language to cover sheet. |
| March 8, 2011 | Change 20.8.3 to a rule (Hislip Address string on web page). Fix formatting of 20.9.2. Revise 20.4.4 to specify HiSLIP behavior for LCI. |
| February 23, 2011 | Remove resolved issue regarding use of alternate ports for HiSLIP, use ‘LXI Device Specification 2011’, add observations that rules referencing future LXI specs (LXI IPv6, LXI Connection Locking) are only recommendations until those specs are adopted. Clarify standardizing on IVI 6.1 HiSLIP protocol version 1.0. |
| January 26, 2011 | Minor formatting fixes, use ‘LXI Device Specification 2010’, 4880 port use issue |
| January 11, 2011 | Accepted all changes, removed now-resolved issues list. |
| December 14, 2010 | Add locking rules, additional LXI standards relationships, and clean up text |
| December 13, 2010 | Add section relating this to other extended functions. Clarify address strings in the LXI XML info document. |
| December 3, 2010 | Include changes recommended by the Extended Function working group: remove Appendix B, move Appendix C (test procedures) to a separate document. |
| November 5, 2010 | Add Test Appendix |
| October 26, 2010 | Address issues from the initial LXI Consortium presentation |
| October 5, 2010 | Adapt to use Extension Template |
| October 4, 2010 | Initial draft |

[LXI HiSLIP Extended Function 1](#_Toc454221930)

[Revision history 4](#_Toc454221931)

[20 LXI HiSLIP Extended Function 6](#_Toc454221932)

[20.1 Introduction 6](#_Toc454221933)

[20.2 Purpose and Scope 6](#_Toc454221934)

[20.2.1 Purpose 6](#_Toc454221935)

[20.2.2 Scope 7](#_Toc454221936)

[20.3 Applicable Standards and Documents 7](#_Toc454221937)

[20.3.1 Trade Association Standards,, 7](#_Toc454221938)

[20.4 Relationship to other LXI Standards 7](#_Toc454221939)

[20.4.1 RULE – Comply with LXI Device Specification 7](#_Toc454221940)

[20.4.2 RULE – Obey LXI IPv6 if supporting IPv6 for HiSLIP 7](#_Toc454221941)

[20.4.3 [This Rule Deleted in version 1.01] 8](#_Toc454221942)

[20.4.4 RULE – Reset to Default HiSLIP Port and Close Connections on LCI 8](#_Toc454221943)

[20.5 LXI Device Conformance Requirements 8](#_Toc454221944)

[20.5.1 RULE – Conformance Requirements 8](#_Toc454221945)

[20.6 LXI HiSLIP Protocol Requirements 8](#_Toc454221946)

[20.6.1 RULE – Implement the IVI 6.1 HiSLIP Protocol 8](#_Toc454221947)

[20.6.2 RULE – Accept IPv4 HiSLIP Connections 8](#_Toc454221948)

[20.6.3 RECOMMENDATION – Accept IPv6 HiSLIP Connections 8](#_Toc454221949)

[20.6.4 [This Recommendation Deleted in version 1.01] 8](#_Toc454221950)

[20.7 LXI HiSLIP DNS-SD Service Requirements 9](#_Toc454221951)

[20.7.1 RULE – Advertise the HiSLIP DNS-SD Service 9](#_Toc454221952)

[20.7.2 RULE – Use the LXI Single Service Instance Name 9](#_Toc454221953)

[20.7.3 RULE – Use Service Type Name ‘\_hislip.\_tcp’ 9](#_Toc454221954)

[20.7.4 RULE – Include Required TXT Record Keys 9](#_Toc454221955)

[20.7.5 RULE – Advertise HiSLIP DNS-SD Service after ‘\_lxi.\_tcp’ 10](#_Toc454221956)

[20.7.6 RULE – Advertise HiSLIP DNS-SD Service with HiSLIP Port 10](#_Toc454221957)

[20.8 LXI HiSLIP Web Interface 11](#_Toc454221958)

[20.8.1 RULE – Include ‘LXI HiSLIP’ in Welcome Web Page “LXI Extended Functions” 11](#_Toc454221959)

[20.8.2 RULE – Include HiSLIP Address String in Welcome Web Page “LXI Device Address String”…………………. 11](#_Toc454221960)

[20.8.3 RULE – Include HiSLIP port on the LXI LAN Configuration Web Page 11](#_Toc454221961)

[20.8.4 RULE – Preserve HiSLIP port across power cycles 12](#_Toc454221962)

[20.9 LXI HiSLIP XML Identification Document 12](#_Toc454221963)

[20.9.1 RULE – Include the HiSLIP Address String in LXI Identification XML 12](#_Toc454221964)

[20.9.2 RULE – Include the LXI HiSLIP Function in the <LxiExtendedFunctions> element 12](#_Toc454221965)

# LXI HiSLIP Extended Function

## Introduction

The LXI HiSLIP Extended Function adds support for the IVI 6.1 HiSLIP protocol for fast instrument communication.

## Purpose and Scope

This document is an extension of the LXI Device Specification 2011. Numbering for Section, **RULES,** and **RECOMMENDATIONS** is consistent with the hierarchy of the LXI Device Specification 2011.

### Purpose

The LXI HiSLIP Extension defines use of the IVI HiSLIP protocol (IVI 6.1) for fast instrument communication.

HiSLIP has the following features:

* Sockets-like IO speed (approaching LAN saturation for large binary blocks)
* VXI-11-like Instrument-like behavior
	+ Reliable ‘EOM’ (end of message) signaling, regardless of data content
	+ Asynchronous SRQ (service request) signaling
	+ Read instrument Status byte
	+ Asynchronous Device Clear support
	+ Group trigger
	+ Remote/local mode switching
	+ Better lock support:
		- VISA-compatible shared and exclusive locks with nesting.
		- Locks honored across PC’s: Locks held in instrument.
		- Locking programs can coexist with lock-unaware programs
		- Short term locks only delay other program’s instrument operations
	+ Interrupted error detection/correction (MEPE message exchange control protocol subset for LAN)
* IPv6: Usable on IPv6 or IPv4 networks

### Scope

This document defines a set of RULES and RECOMMENDATIONS for constructing a LXI Device conformant with the LXI HiSLIP Extension. Whenever possible these specifications use existing standards.

The standard specifies:

1. LXI HiSLIP protocol requirements,
2. LXI HiSLIP DNS-SD service announcement requirements,
3. LXI HiSLIP Web page requirements,
4. LXI HiSLIP device information XML requirements,
5. LXI HiSLIP device IPv4 and IPv6 requirements

## Applicable Standards and Documents

The following referenced documents are indispensable for the application of this document (i.e., they must be understood and used). For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments or corrigenda) applies.

### Trade Association Standards[[1]](#footnote-1),[[2]](#footnote-2),[[3]](#footnote-3)

IVI-6.1, “High-Speed LAN Instrument Protocol (HiSLIP)”, Dated February 24, 2011, Revision 1.1

IVI VISA 5.0 specifications:

VPP-4.3: The VISA Library

## Relationship to other LXI Standards

The LXI HiSLIP extended function relates to other LXI standards as specified below.

### RULE – Comply with LXI Device Specification

Devices implementing the LXI HiSLIP extended function shall comply with the LXI Device Specification.

Observation

The first version of the LXI specification defining the LXI Device Specification is ‘LXI Device Specification 2011’ dated March 1, 2011. That document contains a definition of terms regarding rule and recommendation language that applies to this document.

### RULE – Obey LXI IPv6 if supporting IPv6 for HiSLIP

If devices support IPv6 HiSLIP connections, they shall also conform to the LXI IPv6 Extended Function.

Observation

This rule only applies to devices tested for conformance after the LXI IPv6 Extended Function is adopted. However, vendors should conform to the draft LXI IPv6 Extended Function if they support IPv6 HiSLIP in the interim.

### [This Rule Deleted in version 1.01]

### RULE – Reset to Default HiSLIP Port and Close Connections on LCI

HiSLIP devices shall respond to LCI (LAN Configuration Initialize) by resetting to the default HiSLIP port (4880) and closing all active HiSLIP connections.

Observation

As a result of closing active HiSLIP connections, all HiSLIP locks are released.

## LXI Device Conformance Requirements

The document “***LXI Consortium Policy for Certifying Conformance to LXI Consortium Standards***” gives specific requirements on conformance certification. Refer to Section 2 and Section 3 of that document for further information related to conformance of this extended function.

### RULE – Conformance Requirements

The LXI HiSLIP function is an optional function for devices conforming to the LXI Core Device specification, as defined in section 1.4.4.2 of “LXI Device Specification 2011”.

All LXI Devices implementing the LXI HiSLIP function as permitted by 1.4.4.1 of the “LXI Device Specification 2011” shall implement and conform to the requirements of all sections in this document in addition to any relevant requirements of ‘LXI Device Specification 2011’.

## LXI HiSLIP Protocol Requirements

### RULE – Implement the IVI 6.1 HiSLIP Protocol

Devices implementing the LXI HiSLIP Function shall implement the HiSLIP protocol version 1.1, as defined in “IVI 6.1: High-speed LAN Instrument Protocol (HiSLIP) February 24, 2011”.

### RULE – Accept IPv4 HiSLIP Connections

LXI HiSLIP Devices shall accept HiSLIP connections over the IPv4 network.

### RECOMMENDATION – Accept IPv6 HiSLIP Connections

LXI HiSLIP Devices should accept HiSLIP connections over the IPv6 network.

### [This Recommendation Deleted in version 1.01]

## LXI HiSLIP DNS-SD Service Requirements

### RULE – Advertise the HiSLIP DNS-SD Service

Devices implementing the LXI HiSLIP Function shall advertise that they accept HiSLIP connections via the HiSLIP DNS-SD service announcement.

### RULE – Use the LXI Single Service Instance Name

LXI devices shall use the same service name for all LXI DNS-SD services, including HiSLIP.

### RULE – Use Service Type Name ‘\_hislip.\_tcp’

HiSLIP DNS-SD service announcements shall use the mDNS service type name ‘\_hislip.\_tcp’.

### RULE – Include Required TXT Record Keys

HiSLIP DNS-SD service announcements shall have the following TXT record keys:

* txtvers=<version of TXT record>
	+ Recommended, but may be omitted if the version is ‘1’. If omitted defaults to: “txtvers=1”
	+ If included, must be the first TXT record key
* Manufacturer=<first element of response to IEEE 488.2 \*IDN?>
* Model=<second first element of response to IEEE 488.2 \*IDN?>
* SerialNumber=<third element of response to IEEE 488.2 \*IDN?>
* FirmwareVersion=<fourth element of response to IEEE 488.2 \*IDN ?>

Example:

* txtvers=1
* Manufacturer=Example Test Inc.
* Model=LXI-1
* SerialNumber=65193
* FirmwareVersion=1.0

#### RECOMMENDATION – Add VISA Address as TXT Record Key with HiSLIP DNS-SD service announcement

Provide a TXT Record Key during announcement of HiSLIP service that replaces having to read the device’s xml file to determine port information during discovery. Add the following after FirmwareVersion TXT Record Key, as shown under Rule 20.7.4.

TXT Record Key: VisaAddress=<VISA Address>

Example: TCPIP::myHiSLIPInst.local::hislip0::INSTR

VISA Address can be derived from the generated xml file associated with this device. Use the IP address or hostname and do not include the domain name, as shown in the Example above.

### RULE – Advertise HiSLIP DNS-SD Service after ‘\_lxi.\_tcp’

The HiSLIP DNS-SD service advertisement shall follow advertisement of the LXI DNS-SD service.

Observation

LXI requires that the http and lxi mDNS services are advertised first so that later LXI mDNS services can use the same conflict-resolved hostname and service name.

### RULE – Advertise HiSLIP DNS-SD Service with HiSLIP Port

The HiSLIP DNS-SD service advertisement shall use the currently-configured HiSLIP port.

Observation

The default HiSLIP port is 4880, but users can change this via the LXI LAN configuration web page.

## LXI HiSLIP Web Interface

### RULE – Include ‘LXI HiSLIP’ in Welcome Web Page “LXI Extended Functions”

Devices implementing the LXI HiSLIP function shall include ‘LXI HiSLIP’ in the ‘LXI Extended Functions’ display item of the welcome web page.

### RULE – Include HiSLIP Address String in Welcome Web Page “LXI Device Address String”

The Welcome Web Page “LXI Device Address String” display item shall contain the HiSLIP address string necessary to request a HiSLIP connection that conforms with the VISA 5.0 HiSLIP address string format as specified in section 4.3.1 of “VPP-4.3: The VISA Library”.

Observation

The “LXI Device Address String” display item contains other address strings. Each address string should be on separate lines to facilitate copy and paste by users.

The VISA HiSLIP address string takes the form:

TCPIP[board]::host address[::HiSLIP device name[,HiSLIP port]][::INSTR]

Where:

 **Board** is the network interface number (default 0).

 **Host address** is the hostname or IP address of the LXI device.

 **HiSLIP device name** begins with ‘hislip’. Typically, ‘hislip0’ is used.

 **HiSLIP port** is the port number to use for connections, defaulting to 4880.

Examples:

TCPIP::1.2.3.4::hislip0::INSTR

Addresses the device at IPv4 address 1.2.3.4 using the default interface board and HiSLIP port.

TCPIP::[fe80::1]::hislip0::INSTR

Addresses the device at IPv6 link local address fe80::1 using the default interface board and HiSLIP port.

TCPIP::myHiSLIPInst.local::hislip0::INSTR

Addresses the device at a local mDNS hostname using the default interface board and HiSLIP port.

### RULE – Include HiSLIP port on the LXI LAN Configuration Web Page

The HiSLIP port shall be displayed on the LAN Configuration Web Page.

Observation

While most users will want to use the HiSLIP 4880 default port, occasionally it may be necessary to use a different port. One such reason is moving HiSLIP connections to a port that passes through firewalls via a DMZ.

### RULE – Preserve HiSLIP port across power cycles

The HiSLIP port setting shall be preserved across power cycles.

## LXI HiSLIP XML Identification Document

### RULE – Include the HiSLIP Address String in LXI Identification XML

LXI devices implementing HiSLIP shall include an ‘InstrumentAddressString’ XML element with the HiSLIP address string.

Examples:

<InstrumentAddressString>TCPIP::1.2.3.4::hislip0::INSTR</InstrumentAddressString>

<InstrumentAddressString>TCPIP::1.2.3.4::hislipAnalyzer::INSTR</InstrumentAddressString>

Observation

The address string is for the instrument being defined by the current LXI XML Identification document. If other instruments can be addressed in the instrument, their address strings should appear in their own LXI XML identification document, with the parent or root LXI XML identification document containing a Connected Devices entry pointing to that child document.

### RULE – Include the LXI HiSLIP Function in the <LxiExtendedFunctions> element

LXI devices implementing HiSLIP shall include a <Function> element in the <LxiExtendedFunctions> XML element with the FunctionName attribute of “LXI HiSLIP” and a Version attribute containing the version number of this document. If the port number used for HiSLIP is other than the standard HiSLIP port (4880), the <Function> element shall include a <Port> element with the value of the custom port number.

Examples:

<Function FunctionName=”LXI HiSLIP” Version=”1.0”/>

<Function FunctionName=”LXI HiSLIP” Version=”1.0”>

 <Port>12345</Port>

</Function>

1. IVI specifications are available from the IVI Foundation at <http://www.ivifoundation.org> [↑](#footnote-ref-1)
2. LXI Standards are available from the LXI Consortium at <http://www.lxistandard.org> [↑](#footnote-ref-2)
3. VXI-11 specifications are available from the VXI Bus Consortium at <http://www.vxibus.org/> [↑](#footnote-ref-3)