



LXI HiSLIP Extended Function

Revision 1.3

May 26, 2022

LXI HISLIP EXTENDED FUNCTION	1
REVISION HISTORY	5
20 LXI HISLIP EXTENDED FUNCTION	6
20.1 INTRODUCTION.....	6
20.2 PURPOSE AND SCOPE.....	6
20.2.1 Purpose	6
20.2.2 Scope	6
20.3 APPLICABLE STANDARDS AND DOCUMENTS	7
20.3.1 Trade Association Standards”	7
20.4 RELATIONSHIP TO OTHER LXI STANDARDS.....	7
20.4.1 RULE – Comply with LXI Device Specification	7
20.4.2 RULE – Devices that implement IPv6 shall conform to LXI IPv6 Extended Function connections on IPv6	7
20.4.3 Deprecated RULE -- Obey LXI Connection Locking if implemented	7
20.4.4 RULE – Do not change HiSLIP on LCI	7
20.5 LXI DEVICE CONFORMANCE REQUIREMENTS.....	8
20.5.1 RULE – Conformance Requirements	8
20.6 LXI HISLIP PROTOCOL REQUIREMENTS.....	8
20.6.1 RULE – Implement the IVI 6.1 HiSLIP Protocol.....	8
20.6.2 RULE – Accept IPv4 HiSLIP Connections	8
20.6.3 RULE – Accept IPv6 HiSLIP Connections	8
20.6.4 Deprecated RULE -- Apply HiSLIP Locks to other LAN Interfaces	8
20.7 LXI HISLIP DNS-SD SERVICE REQUIREMENTS	9
20.7.1 RULE – Advertise the HiSLIP DNS-SD Service	9
20.7.2 RULE – Use the LXI Single Service Instance Name	9
20.7.3 RULE – Use Service Type Name ‘_hislip._tcp’	9
20.7.4 RULE – Include Required TXT Record Keys	9
20.7.5 Deprecated RULE – Advertise HiSLIP DNS-SD Service after ‘_lxi._tcp’	10
20.7.6 RULE – Advertise HiSLIP DNS-SD Service with HiSLIP Port	10
20.8 LXI HISLIP WEB INTERFACE REQUIREMENTS.....	11
20.8.1 RULE – Include ‘LXI HiSLIP’ in Welcome Web Page “LXI Extended Functions”	11
20.8.2 RULE – Include HiSLIP Address String in Welcome Web Page “LXI Device Address String”	11
20.8.3 RULE – Include HiSLIP port on the LXI LAN Configuration Web Page	11
20.8.4 RULE – Preserve HiSLIP port across power cycles	12
20.9 LXI HISLIP XML IDENTIFICATION DOCUMENT REQUIREMENTS	12
20.9.1 RULE – Include the HiSLIP Address String in LXI Identification XML	12
20.9.2 RULE – Include the LXI HiSLIP Function in the <LxiExtendedFunctions> element	12

Notices

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 may 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>

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:

Executive Director
LXI Consortium
www.lxistandard.org
ExecDir@lxistandard.org

LXI is a registered trademark of the LXI Consortium

Revision history

<i>Revision</i>	<i>Description</i>
Version 1.3 May 26, 2022	Added LXI HiSLIP mDNS Service Discovery Requirements Requires IVI HiSLIP 2.0 instead of 1.1 20.6.3 changed from a recommendation to a rule
Version 1.01 Nov 8, 2016	Release Specification
Version 1.0 Feb 23, 2011	Initial Version

20 LXI HiSLIP Extended Function

20.1 Introduction

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

20.2 Purpose and Scope

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

20.2.1 Purpose

The LXI HiSLIP Extended Function 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)
- HiSLIP can work on IPv6 and IPv4 networks

20.2.2 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

20.3 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.

20.3.1 Trade Association Standards^{1,2,3}

IVI-6.1, “High-Speed LAN Instrument Protocol (HiSLIP) v2.0 April 23, 2020

20.4 Relationship to other LXI Standards

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

20.4.1 RULE – Comply with LXI Device Specification

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

20.4.2 RULE – Devices that implement IPv6 shall conform to LXI IPv6 Extended Function connections on IPv6

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

20.4.3 Deprecated RULE -- Obey LXI Connection Locking if implemented

Deprecated in Version 1.01

20.4.4 RULE – Do not change HiSLIP on LCI

The devices HiSLIP configuration shall not be impacted by LCI.

The state of the connection and HiSLIP locks should not be changed by LCI unless necessary as part of network reconfiguration.

Observation

If active HiSLIP connections are closed, all HiSLIP locks are released.

¹ IVI specifications are available from the IVI Foundation at <http://www.ivifoundation.org>

² LXI Standards are available from the LXI Consortium at <http://www.lxistandard.org>

³ VXI-11 specifications are available from the VXI Bus Consortium at <http://www.vxibus.org/>

20.5 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.

20.5.1 RULE – Conformance Requirements

The LXI HiSLIP function is an optional function for devices conforming to the LXI Device specification, as defined in section 1.4.4.2 of “LXI Device Specification v1.6”.

All LXI Devices implementing the LXI HiSLIP function as permitted by 1.4.4.1 of the “LXI Device Specification v1.6” shall implement and conform to the requirements of all sections in this document in addition to any relevant requirements of ‘LXI Device Specification v1.6’.

20.6 LXI HiSLIP Protocol Requirements

20.6.1 RULE – Implement the IVI 6.1 HiSLIP Protocol

Devices implementing the LXI HiSLIP Function shall implement the HiSLIP protocol version 2.0, as defined in “IVI 6.1: High-speed LAN Instrument Protocol (HiSLIP) v2.0 April 23, 2020 or successors”.

Observation

IVI HiSLIP 2.0 includes the following optional features:

- Secure connections using TLS.
- Client/Server authentication

As these 2 features are optional, they are also optional when implementing the LXI HiSLIP 2.0 specification.

Secure connections and client/server authentication are required if the LXI device implements the Security and API extended functions

20.6.2 RULE – Accept IPv4 HiSLIP Connections

Devices shall accept HiSLIP connections over the IPv4 network if the IPv4 network is enabled.

20.6.3 RULE – Accept IPv6 HiSLIP Connections

Devices that conform to the LXI IPv6 Extended function shall accept HiSLIP connections over the IPv6 network if the IPv6 network is enabled. Note Rule 20.4.2.

20.6.4 **Deprecated** RULE -- Apply HiSLIP Locks to other LAN Interfaces

Deprecated in version 1.01

20.7 LXI HiSLIP DNS-SD Service Requirements

20.7.1 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 (NOTE: default in this section refers to the value used if the field is absent).

Service Type	TXT Record Keys	Description
HiSLIP (_hislip._tcp)	<p>txtvers=<version of TXT record>; default "txtvers=1"; current version is 1</p> <p>Manufacturer=<first element of response to IEEE 488.2 *IDN?></p> <p>Model=<second element of response to IEEE 488.2 *IDN?></p> <p>SerialNumber=<third element of response to IEEE 488.2 *IDN?></p> <p>FirmwareVersion=<fourth element of response to IEEE 488.2 *IDN?></p> <p>Address=<VISA Address></p> <p>Devices may support numerous HiSLIP subaddresses (the string 'hislip0' in the example below). Devices should only provide an example HiSLIP VISA address. Clients can determine additional subaddresses using the Identification XML.</p> <p>Example: TCP/IP::myHostName.local::hislip0::INSTR</p>	HiSLIP Server

20.7.2 RULE – Use the LXI Single Service Instance Name

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

20.7.3 RULE – Use Service Type Name ‘_hislip._tcp’

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

20.7.4 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

20.7.4.1 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

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.

20.7.5 Deprecated RULE – Advertise HiSLIP DNS-SD Service after '_lxi._tcp'

Deprecated in Version 1.6. In LXI Specification 1.6 the rule to abide by an order in which text records are sent has been removed. This rule has been deprecated because of that change.

20.7.6 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 or the LXI API Extended Function, if implemented.

20.8 LXI HiSLIP Web Interface Requirements

20.8.1 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.

20.8.2 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 HiSLIP address strings suitable to request a HiSLIP connection that conforms with the VISA HiSLIP address string format.

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::[credential information@]host address[:,HiSLIP subaddress[,HiSLIP port]][:INSTR]
```

Where:

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

HiSLIP subaddress 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
```

Addresses the device at IPv4 address 1.2.3.4 using the default interface board and HiSLIP port. The connection is made to the instance HiSLIP server with the subaddress *hislip0*.

```
TCPIP::[fe80::1]::hislip_signalAnalyzer
```

Addresses the device at IPv6 link local address fe80::1 using the default interface board and HiSLIP port. The connection is made to the instance with the subaddress *hislip_signalAnalyzer*.

```
TCPIP::CredentialReference@myHiSLIPInst.local::hislip0
```

Addresses the device at a local mDNS hostname using the default interface board and HiSLIP subaddress hislip0 using the credentials configured with the identifier *CredentialReference*.

For the complete definition of the VISA HiSLIP address string, see IVI VPP-4.3: The VISA Library.

20.8.3 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 or for security reasons.

20.8.4 RULE – Preserve HiSLIP port across power cycles

The HiSLIP port setting shall be preserved across power cycles.

20.9 LXI HiSLIP XML Identification Document Requirements

20.9.1 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 </InstrumentAddressString>
```

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

Observation

The address string is for the instrument being described 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.

20.9.2 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.

HiSLIP subaddresses are described using a <Subaddress> string element where the string contains the subaddress. If no <Subaddress> element is present, then the subaddress shall be hislip0. Devices shall include a list of the valid HiSLIP subaddresses unless they only implement the default subaddress of hislip0.

Examples:

```
<Function FunctionName="LXI HiSLIP" Version="2.0"/>
```

```
<Function FunctionName="LXI HiSLIP" Version="1.0">
```

<Port>12345</Port>

<Subaddress>hislip0</Subaddress>

<Subaddress>SignalAnalyzer</Subaddress>

</Function>