Models:

FT11N-4 Secure RS-232 Isolator Diode
FF11N-4 Secure RS-232 Filter, Configurable with Regular Expressions
CP11N-4 Secure RS-232 Filter, Compatible with HSL Secure Copy-Paste Tool
FXJ11N-4 Secure RS-232 Filter, Configurable with JSON Schema

HLT36827 Rev. 1.1

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INTRODUCTION

HSL's Secure RS-232 Isolators enforce unidirectional data flow of information between two devices communicating over serial connections. An Isolator receives RS-232 data from any connected device (referred to hereafter as the Sending Device) and sends it forward to its destination device (referred to as the Receiving Device), while ensuring there is no return signal from the Receiving Device to the Sending Device. Some models can also be programmed to filter data sent through them, blocking data from a specified Black List but allowing data on a White List to pass through. This allows for data transfer across multiple domains, while protecting against malicious data infiltration and attacks.

This manual shows how to install, configure and use HSL's Secure RS-232 Isolators, including securely transferring data between devices.

Secure RS-232 Isolators

HSL offers multiple models of Isolators that enforce unidirectional flow of data between Sending and Receiving Devices, with different models dedicated to specific purposes.

- **FT11N-4:** Enforces unidirectional flow of data between devices.
- **FF11N-4:** Filters transmitted data according to a Black List and White List which are configured in the device.
- **CP11N-4:** Allows for Copy/Paste between the two computers, while filtering the copied data via the Secure Copy-Paste Tool.
- **FXJ11N-4:** Filters transmitted data according to a JSON schema configured in the device.

Black Lists and White Lists

HSL's FF11N-4, CP11N-4, and FXJ11N-4 Secure RS-232 Isolators make use of Black Lists and White Lists to filter what data can and cannot be transferred between Devices.

Any command sent from the Sending Device is first checked against the Black List. If the Black List blocks the command, it is not sent further. If the command is allowed, it is then checked against the White List. From there, if the command is on the White List, it will reach the Receiving Device; if it is not on the White List, it is not sent further.

RS-232 Isolators Specifications

Part Number	FT11N-4/FF11N-4/CP11N-4/FXJ11N-4
Performance	
Bandwidth	230,400 kb/s
Physical	
Dimensions	145x105x28mm / 5.8x4.2x1.1in
Weight	0.3kg / 0.64lb
Environmental	
Operating Temperature	32° to 104° F (0° to 40° C)
Storage Temperature	-4° to 140° F (-20° to 60° C)
Humidity	20 to 80% non condensing; Storage – 10 to 90% non condensing
Software	
Supported OS	Windows, Linux, Mac

Before Installation

Unpack the Product

Before opening the product's sealed packaging, inspect the seal's condition to ensure that the product was not accessed or tampered with during delivery. If the packaging seal looks suspicious, contact the HSL support team and do not use the product.

- After removing the seal, inspect the packaging content to verify that the required components are included. See the packaging content list.
- After the RS-232 Isolator is removed from its packaging materials, carefully inspect the tamper-evident label to assure that product is properly sealed. If the label is damaged or missing, contact HSL support and do not use the product.

Tamper-Evident Labels

- The Isolator uses a holographic tamper-evident label to provide visual indications in case of enclosure intrusion attempts. These labels indicate white dots or the text "VOID", once removed. When opening the product's packaging, inspect the tamper-evident label.
- If, for any reason, one or more tamper-evident labels are missing, appear disrupted, or look different than the example shown here, please call HSL Technical Support and avoid using that product.

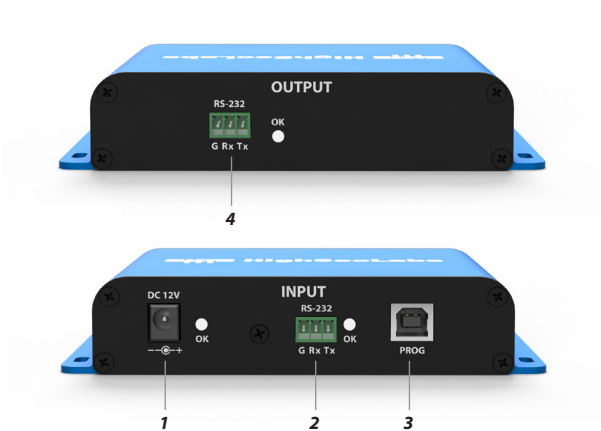
***Figure 1**: HSL Holographic Tamper-Evident Label*

INSTALLATION

Package Contents

FT11N-4	Secure FT11N-4 RS-232 Isolator Diode	1
	RS-232 Mating Terminal Plugs	2
	Wall-Mounted 12V Power Supply	1
FF11N-4	Secure FF11N-4 Configurable RS-232 Filter	1
	RS-232 Mating Terminal Plugs	2
	Wall-Mounted 12V Power Supply	1
CP11N-4	Secure CP11N-4 Configurable RS-232 Filter	1
	USB to RS-232 Cables with 3-pin Connectors	2
	RS-232 Mating Terminal Plugs	2
	Wall-Mounted 12V Power Supply	1
FXJ11N-4	Secure FJX11N-4 JSON Configurable RS-232 Filter	1
	RS-232 Mating Terminal Plugs	2
	Wall-Mounted 12V Power Supply	1

Product Overview



1	DC 12V Power Supply Jack	**3**	USB-B Port
2	RS-232 Input Port	**4**	RS-232 Output Port

***Figure 2**: RS-232 Isolator Connectors Diagram*

RS-232 Isolator Setup

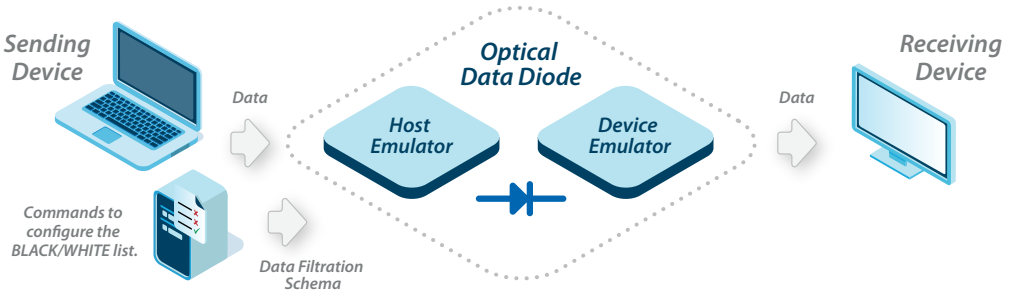


***Figure 3**: RS-232 Isolator Setup Diagram*

INSTALLATION

Setup

Required Hardware

- **RS-232 Mated Cables:** Cables with 3-pin RS-232 terminal plugs to connect the Sending and Receiving Devices to the Isolator's Input and Output Connector Ports. The CP11N-4 includes 2 USB to RS-232 cables in the package; the FT11N-4 and FF11N-4 include 2 RS-232 mating terminal plugs to attach cable leads.
- **USB B Cable:** A USB Type A to USB Type B cable to connect the Programming Device to the Isolator's USB B port when configuring the Isolator. Sold separately.
- **DC 12V Power Source:** A wall-mounted power source that connects to the Isolator's DC 12V port. Included in the package.

Required Software

- **CDM21228 Driver:** A USB to RS-232 serial port driver that allows Windows computers to interface with RS-232 products.
- **HSL Copy-Paste Tool:** HSL's application for the CP11N-4 that allows devices to send and receive up to 10,000 characters of textual data. The latest version of the Secure Copy-Paste Tool is required on both the Sending and Receiving Devices, and can be found here: https://highseclabs.com/solutions/copypaste/
- **HSL_HSLMF Config Tool:** The application to configure the rules for what data can and cannot pass through an FF11N-4 or CP11N-4 Isolator. It can also be used to configure the baud rate and keepalive intervals on an FT11N-4 Isolator. This can be found here: https://highseclabs.com/dow_type/drivers-tools/
- **PuTTY or similar Terminal Program:** An application that will allow the Sending Device to enter commands directly to the FT11N-4 or FXJ11-4 Isolators.

INSTALLATION

Download and Install the Supporting Software

- Download and install the CDM21228 serial port driver on both the Sending and Receiving Devices, to allow them to interface with the Isolator via the USB to RS-232 cables.
- If using the CP11N-4, download and install the HSL Secure Copy-Paste Tool on both the Sending and Receiving Devices, to allow them to transfer textual data.
- If using either the FF11N-4 or CP11N-4, download and install the HSL_HSLMF Configuration Tool to configure the Black List/White List rules.
- If using either the FT11N-4 or FXJ11N-4, download and install PuTTY or a similar terminal program to the Programming Device.

Connect the Power Supply

- Connect the 12V power supply to a power outlet.
- Connect the 12V power supply to the Isolator via the DC 12V port.

Connect the Devices

- Connect the Sending Device to the Isolator via the 3-pin port labeled INPUT, and the Receiving Device to the Isolator via the 3-pin port labeled OUTPUT.
  - If using the CP11N-4, this can be done using the included USB to RS-232 cables. Otherwise, this can be done using cables terminating in the included RS-232 Mating Terminal Plugs.
- Confirm that the front- and rear-panel LEDs blink green to indicate a working connection.
- To configure the Isolator, connect the Programming Device to the Isolator using a USB A to USB B cable, via the USB-B port labeled PROG.

CONFIGURATION

Configure Settings Using the HSL-HSLMF Configuration Tool

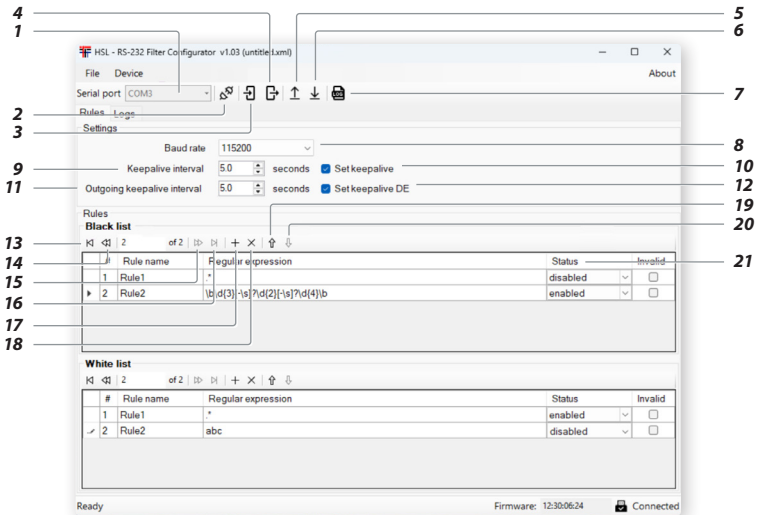


***Figure 4**: HSLMF Config Tool Dashboard*

1 Select Serial Port
2 Connect/Disconnect
3 Import File
4 Export to File
5 Load from Device
6 Save to Device
7 Get Logs
8 Baud Rate
9 Keepalive Interval
10 Set Keepalive
11 Outgoing Keepalive
12 Set Keepalive DE
13 Move First
14 Move Previous
15 Move Next
16 Move Last
17 Add New
18 Delete
19 Move Rule Up
20 Move Rule Down
21 Enabled/Disabled

Connect the Configuration Tool to the Isolator

- Connect the USB A-B cable from the Sending Device to the Isolator via the port labeled PROG.

Note: While the USB A-B cable is connected to the Isolator, the connection between the Sending and Receiving Devices is interrupted.

- If using the CP11N-4, ensure that the Secure Copy-Paste Tool is not running on either device while configuring.
- Launch the HSL_HSLMF Config Tool.
- Select the correct COM port using the "Serial Port" drop-down menu.
- Select the "Connect" icon.
- To adjust the speed at which the Isolator communicates with the Devices, select the "Baud rate" drop-down menu.
  - By default, the baud rate is 115200 bits per second.
- To adjust the rate at which the Sending Device sends a Keepalive message, select the "Keepalive interval" menu and adjust in increments of 0.1 seconds, then select the "Set keepalive" checkbox.
  - By default, the Keepalive interval is 5.0 seconds.
- To adjust the rate at which the Receiving Device sends a Keepalive message, select the "Outgoing keepalive interval" menu and adjust in increments of 0.1 seconds, then select the "Set keepalive DE" checkbox.
  - By default, the Outgoing keepalive interval is 5.0 seconds.

Note: The baud rate, Keepalive interval, and Outgoing keepalive interval are the only settings that can be adjusted on the FT11N-4 using the Config Tool.

Black List/White List Rules

The FF11N-4, CP11N-4, and FXJ11N-4 feature programmable Black Lists and White Lists, which can be configured using the HSL_HSLMF configuration tool.

Note: By default, the FF11N-4, CP11N-4, and FXJ11N-4 do not allow any information to pass; information must be added to a White List in order for it to pass.

Add/Edit a Rule

- In the respective subsection labeled "Black List" or "White List," select the "Add New" icon to create a new rule.
  - The Black List and White List indexes are limited to 5 rules each.
- Add or edit the name of the rule in the cell labeled "Rule name."
- Add or edit the parameters of the rule in the cell labeled "Regular expression."
  - A rule can contain only a single line of text.
  - A rule can contain a maximum of 64 characters.
  - See the Appendix for supported regular expression characters.
- Move a rule up or down in the list by selecting the "Move rule up" or "Move rule down" icons.

Enable/Disable a Rule

- Select the rule to enable or disable.
- Use the "Status" drop-down menu to select "enabled" or "disabled."

Remove a Rule

- Select the rule to remove and select the "Delete" button.

Load/Save Rules Settings

- To load the Black List/White List rules as they are currently saved on the Isolator, select the "Load from Device" icon.
- To save the current rules settings to an XML file on the Sending Device, select the "Export to file" icon.
- To load an XML file of rules settings from the Sending Device into the configuration tool, select the "Import file" icon.
- To save the configuration tool's current rules settings onto the Isolator, select the "Save to Device" icon.

Example Rules

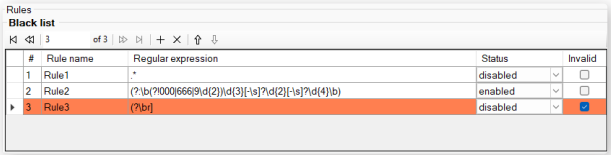


***Figure 5**: HSL_HSLMF Config Tool Example Rules*

In the following examples, three rules have been added to the Black List:

- **Rule 1:** The regular expression for Rule 1 signifies any possible number of any possible characters, meaning that Rule 1 blocks all textual data from passing through. However, since this rule is set to the status "disabled," it does not block any textual data.
- **Rule 2:** The regular expression for Rule 2 signifies any combination of 9 numbers, including the optional addition of spaces or hyphens in between (such as in a Social Security Number). Since this rule is set to the status "enabled," no combination of 9 numbers can pass through.
- **Rule 3:** The regular expression for Rule 3 is not valid. Therefore, it is noted as "invalid", and the status is locked to "disabled" until the expression is changed to a valid one.

Configure the FT11N-4 and FXJ11N-4 with a Terminal Program

The hardware settings for the FT11N-4 and Black List / White List rules for the FXJ11N-4 Isolators are configured using a terminal program such as PuTTY.

Connect the Terminal Program to the Isolator

- Ensure the Isolator is connected to the Sending Device via the 3-pin connector port labeled INPUT.
- Connect the USB A-B cable from the Sending Device to the Isolator via the port labeled PROG.

Note: While the USB A-B cable is connected to the Isolator, the connection between the Sending and Receiving Devices is interrupted.

- Open the terminal program on the Sending Device.
- Select the COM Port connected to the Isolator.
  - This can be found by opening the Device Manager on the Sending Device and confirming which COM port has been added.
- Once the terminal program is connected, it should display the keepalive message "~00@alive ffffffff"

Note: if it displays the keepalive message "~01@alive," the Isolator is connected to the Output RS-232 port. Disconnect the Isolator and connect it to the Input port.

- The Isolator is ready to configure.

Configure Hardware Settings for the FT11N-4

The FT11N-4 Isolator's hardware settings can be configured with the following commands:

- #HSLSET BAUDRATE=X: sets the baud rate, the speed at which the Isolator communicates with the devices. (X) equals the desired speed in bits per second. By default, the baud rate is set to 115200 bps.
- #HSLSET KEEPALIVE=X: adjusts the frequency at which the Sending Device sends a keepalive signal. (X) can be set from 5-50, where 50 sets a frequency of 7 seconds. To set the interval to 5 seconds, for example, set (X) to 35.
- #HSLSET DE_KEEPALIVE=X: adjusts the frequency at which the Receiving Device sends a keepalive signal. (X) can be set from 5-50, where 50 sets a frequency of 7 seconds. To set the interval to 5 seconds, for example, set (X) to 35.
- #HSLRST: performs a soft reset on the Isolator.
- #HSLRFD: restores the Isolator to its factory default settings.

CONFIGURATION

Configure Rules for the FXJ11N-4 with JSON Schema

The White List and Black List rules for the FXJ11N-4 Isolator must be uploaded as a JSON schema via a serial terminal program.

To define a schema, enter the #HSLCFG command with the following SCHEMA parameter, without enclosing double quotes:

#HSLCFG SCHEMA= { “anyOf”: [{ “type”: “object” }, { “type”: “array” }] }

For a full list of the rules for creating a JSON Schema for the FXJ11N-4 Isolator, see the Appendix.

Launch HSL Secure Copy-Paste for the CP11N-4

The CP11N-4 Isolator works with HSL's Secure Copy-Paste Tool to transfer data between isolated devices. To operate the Secure Copy-Paste Tool, perform the following steps:

- Ensure both the Sending and Receiving Device have the most recent version of the Secure Copy-Paste Tool, and that the USB A-to-B cable is disconnected from the Isolator.
  - The most recent version of the Secure Copy-Paste Tool can be downloaded here: https://highseclabs.com/solutions/copypaste/
- Launch the Secure Copy-Paste Tool on both devices.
  - By default, this will launch minimized and will have to be opened from the toolbar.
  - The Secure Copy-Paste Tool will auto-probe to find the correct RS-232 connection.
- Once the display shows "Ready to copy" on the Sending Device and "Ready to Paste" on the Receiving Device, the Isolator is ready to begin transferring textual data.

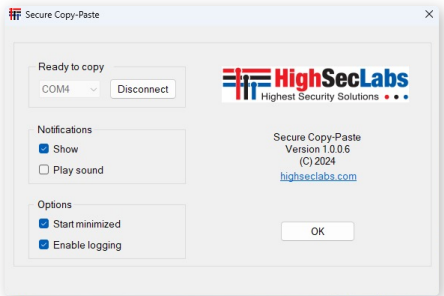


***Figure 6**: HSL Secure Copy-Paste Tool Dashboard*

Copy and Paste Data Between Devices

To copy data from the Sending Device and paste it on the Receiving Device:

- Ensure that both devices have the Secure Copy-Paste Tool running.
- On the Sending Device, select the text to copy.
- Right click and select "Copy," or press **Ctrl | c**
  - The tool can copy a maximum of 10,000 characters at a time.
  - Copied data is stored in the Isolator's internal memory and checked against the Black List and White List before it can be pasted on the Receiving Device.
- After attempting to Copy data, the Copy-Paste Tool on the Sending Device will display a notification with one of the following messages:
  - On the Sending Device:
    - Copy Successful: the user has successfully copied the text.
    - Textual Information Too Large: the copy operation failed because the text exceeded the size limit.
    - Can't Copy: Rule #0: The text did not pass because no White List rules have been loaded on the Isolator.
    - Can't Copy: Rule #(1-5): The text did not pass one of the Black List/White List rules loaded on the Isolator.
    - Communication Lost: Communication has been lost between the Sending Device and the Isolator.
  - On the Receiving Device:
    - Data Received: the text has been received and is ready to be pasted.
    - Communication Lost: Communication has been lost between the Receiving Device and the Isolator.
  - Once the textual information has been successfully copied, on the Receiving Device, right click and select "Paste," or press **Ctrl | v**

TROUBLESHOOTING

Copy-Paste Issues

When using the Secure Copy-Paste Tool, ensure the following:

- Both devices are running the same version of the Secure Copy-Paste Tool.
  - The latest version can be downloaded here: https://highseclabs.com/solutions/copypaste/https://highseclabs.com/solutions/copypaste/
- The CDM21228 serial port driver is installed on both devices.
- The front- and back-panel LEDs by the Input and Output ports are green to signal a working connection.
- The USB A to B cable has been disconnected from the Isolator.
- The display in the Secure Copy-Paste Tool shows "Ready to Copy" on the Sending Device, and "Ready to Paste" on the Receiving Device.
  - This may require resetting the Isolator.

Configuration Issues

When configuring the Isolator, ensure that:

- The USB A to B cable has been connected from the Sending Device to the Isolator.
- The front-and-back-LEDs by the Input and Output ports are green to signal a working connection.
- The correct COM port is selected in the terminal program.
- If the Isolator is connected to PCs, ensure the CDM21228 serial port driver is installed on both devices.

Contact HSL Support

If difficulties persist, contact the High Sec Labs Support Team at:

https://highseclabs.com/submit-support-case

APPENDIX

Supported Regular Expression Characters

When using Regular Expressions to configure rules for the HSL FF11N-4 or CP11N-4 Isolator, these characters are supported by the product:

Note: To create a White List or Black List that passes/blocks all possible combinations of all characters, the Regular Expression is .*

Symbol	Phrase	Description	Example [OK]	Example [Bad]
*	Ab*c	Char [b] matches 0 times or more	Ac, accAc, acc, abc, 1ac	Af, ca, AC
+	12+3	Char [2] matches 1 time or more	123, 1223, 312223	213, 312, 13
( )	1A(3)	Char [A] is repeated 3 times	41AAAC, 31AAAAC	41AAC, 1A5
{min,}	1A{3,}C	Char [A] is repeated 3 times or more	1AAAC, 31AAAAAC	1AAC
{,max}	1A{,5}C	Char [A] is repeated 5 times or less	1AAAAAC, 31AAC	1AAAAAAAAAAAC
{min,max}	2U{3,5}F	Char [U] is repeated between 3 and 5 times	2UUUF, 42UUUUF	2UU, 2UUUUUUU
.	2Y.6	Char [.] can be replaced with any other char	2YA6, 32Y96,YY 6	2Y6, 6YA2
?	4?26	Char [4] is optional	426, 261,10726	1062, 42, 6, 261
[ ]	A[345]B	Pattern contains either 3,4,or 5	A3B, A4B	AB, AUB, A34B
[-]	4[a-e]6	Pattern contains char between [a] and [e]	4a6, 44e6, 24c61	2a6, 4z6
^	^abc	Pattern starts with abc	Abc, abcef, abc36	6abc, ac20
$	123$	Pattern ends with 123	6123, ab123, 5123	5132, 12a4, ab12
|	Y1|3Z	Phrase contains Y1 OR 3Z	Y1, 3Z	16Y1, 6Y11, 43Z
\d	Y\d1	Replace \d with a single digit/number [0-9]	Y11, CYY21, 8Y81	4Y, aYY
\D	7y\D1	Replace \D with a single non-digit char [a,b,@]	7ya1, 7y#12	7y11, 7yaaa1
\s	p\s11	Replace \s with spaces or blanks	p 11, 1p 11a	p112, p1 1
\S	12\S12	Replace \S with non-space or blank char	12k12, 412@121	12 12
\w	a\w21	Replace \w with a single letter or number	aa21, 1a721	a?21, 4a3321
\W	r\W32	Replace \W with a symbol or space	r%32, 56r 324	r2!32, 2ra 325
a.*b	Mah.*a	Match any string with "Mah" followed by "a"	Maha, Mah2a, Mah a	Mahb, Mah
\b	d\b	Match between char matched by \w and a char not matched by \w, without consuming any characters	d8888d	

APPENDIX

JSON Schema Rules for the FXJ11N-4

The FXJ11N-4 supports only JSON Schema Draft-04. All schemas must obey the following restrictions and limitations:

- All keywords must be explicitly present:
  - Every field must have a type (“type”).
    - If an object has properties, then “properties” keyword is required.
    - If an array has items, then “items” keyword is required.
- References (“$ref”) are not supported, validation will fail.
- Definitions (“definitions”) are not supported, validation will fail.
- Schema dependencies (“dependencies” : {“a”:{}) are not supported, validation will fail.
  - Note that property dependencies (“dependencies” : {“a”:[]) are supported.
- Format (“format”) is not supported, validation will succeed.
- Schema is limited to 6000 characters, not counting whitespace.
- Input is also limited to 6000 characters, not counting whitespace.
- Input should be formatted as a single line, ending in “cr” (carriage return).
- Output will be printed without whitespace.

To define a schema, use #HSLCFG command with SCHEMA parameter without enclosing double quotes, e.g.:

#HSLCFG SCHEMA= { “anyOf”: [{ “type”: “object” }, { “type”: “array” }] }

Highseclabs.com

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