



Juggler Pixel Processor

Operating Juggler 1 Pixel Processor

User Guide



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Printed: April 2023

This edition is for software version N/A
Document ref.: M611-1

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Introduction

Juggler™ and Compere™ go together. Juggler is the hardware that processes the pixels and Compere, like an event manager, is the control software and user interface that tells one or more Jugglers what to do. Together, any range of digital inputs can be transformed and directed to an any range of outputs, because Juggler modules can be daisy-chained on a data bus to expand inputs, outputs and bandwidth as required. Compere does much more besides in its Visualise role (separate licence), but this guide focuses on Juggler system set up.

For setting Juggler 1 systems up in Compere, see The Compere User Guide:

➤ [Compere 1.0-5 User Guide](#)

Juggler is a highly modular FPGA-based pixel processor, providing the highest hardware performance and efficiency, combined with ultimate connectivity. It is specified according to application, with a very wide choice of input and output options: DisplayPort™ 1.2, HDMI™ 2.0, SDI, and with Video over IP in development. The Juggler 1 system can process a data bandwidth of approximately 14 GB/s. As an example, that equates to a canvas size of 16K × 4K at 60 fps 10-bit 4:4:4.

The configuration of a particular Juggler module will optimise use of the available bandwidth according to requirement, and the Juggler concept is one of tremendous flexibility. Modules can be daisy-chained via a high-speed box-to-box fibre-optic link, to expand I/O type and capacity. Juggler can also display all inputs via an NDI thumbnail matrix on the front panel.

Juggler and Compere

The concepts behind a pixel processor can may be new to you, so here is an overall picture of how the key components of a Juggler system work together.

Why Juggler?

Juggler is not just a standalone rack module. We imagine it as stage performer in an event, where as many Jugglers and other performers as you want can join, take part, or leave, all under the direction of a Compere, or stage manager that holds the event together.

Juggler is a modular hardware base for full high bit-depth pixel-based colour processing, warp and blend. Its main component board is a field-programmable gate array (FPGA), which makes it extremely versatile for performing highly specialised processing tasks. It accepts a scalable number of inputs and delivers a scalable number of outputs, in many protocols. 2D, passive and active stereo 3D are fully supported.

With latency reduced to an absolute minimum, Juggler is ideal for live performance. All sources can be genlocked to frame accuracy, with instant system failover across all connected devices via frame-data monitoring (an API is available for third-party sources).

Compere

Compere (pronounced 'KOM pair') is the software system that manages all Juggler connections in a 'stage set' (we call it the Project Group), defines inputs, outputs and manages displays. A version of Compere runs in every Juggler on a Linux OS that drives the front panel touch display and communicates with the FPGA.

Compere provides the user interface (UI) for a Juggler system. Here you create Project Groups of Jugglers and configure all the inputs and outputs of each Juggler involved. All group activity can then be managed via external control from multiple network points.

Compere does much more, but for configuring your Juggler system with its media inputs and display outputs, you need to become familiar with the Juggler side of Compere.

Connect up your hardware before you venture into Compere. Once that is done, connect into the system from a workstation control PC with Compere running, and every part of the system will be recognised and identified, along with all their available ports, in order to create the relationships between each Juggler, their input sources and output devices.

Projects and Groups

Projects are a bit like stage sets, with scenery and equipment ready for a play or show. When you create or see a Project in Compere, you will see a list of what belongs together for the 'stage set': Jugglers, input devices, display panels, projectors, 3D models and so on, that are assigned as a Project Group.

All the details and settings are held in the Project file, which governs how every member of the Project Group behaves. Whichever instance of the Compere software takes control (the one assigned as server), like a stage manager, coordinates and distributes this set of stage instructions to all instances of Compere, which includes every Juggler in the Group. If any of these members, as clients, wants to make changes at any time, the changes are handed back to the server to redistribute around the Group.

Any client joining the Project Group is handed the common current Project file and performs as directed. In this way any PC running Compere on the network can join the Project Group, become the server or stay as a client and interact with the rest of the Group. This might be to make static changes in the 'stage set' or to move things around dynamically, such as picture-in-picture elements.

If network connection is lost by any Juggler in a Project Group, the local copy of the Project will keep running until it can reconnect and re-sync with the Group, at which point any changes to the Project file will be received from the assigned (or a reassigned) server.

Simultaneous Editing of a Project

Any instance of Compere can edit the Project configuration, save it locally and then redistribute it to all Compere clients. This is a powerful feature of Compere, giving multiple users the potential to accomplish large-scale tasks much faster. A good example of this would be one user using an instance of Compere to warp one side of a projection surface while another, using a separate instance connected to the same project, warps the other side.

The wider network

There can be more than one Project Group, each with an assigned server to coordinate it. They can all be on the same network, and any member can be moved from one Group to another as required. If you need other Groups, they can be created and named, and available members assigned to them instead of the initial default (unnamed) Group.

Features and capability of the Juggler pixel processor

- Modular FPGA-based pixel processor.
- Configurability: multiple Juggler modules can be daisy-chained via high-speed fibre-optic link, to add additional input and output capability within a 16K × 4K 10-bit 4:4:4 canvas, or equivalent bandwidth.

- Video scaling, video matrixing and picture-in-picture capability, genlocking, framerate conversion.
- Failover redundant source management with 7thSense IntelligentSource™ (API available).
- DisplayPort™ 1.2, 12G SDI and HDMI™ 2.0 (optional HDCP™ compliant)
- DisplayPort output SST to MST conversion.
- Supports 12-bit 4:4:4 – internal processing at high precision.
- Colourspace mapping via 3D LUT.
- External control over IP.
- User interface: 7thSense Compere software.
- Warp, blend, and black level output support via MPCDI (2D MPCDI).
- NDI® 5.0 confidence monitoring.

➤ [Physical Specifications](#) ³¹

➤ [Rack Mounting Jugglers](#) ³³

➤ [Care and Maintenance](#) ³⁴

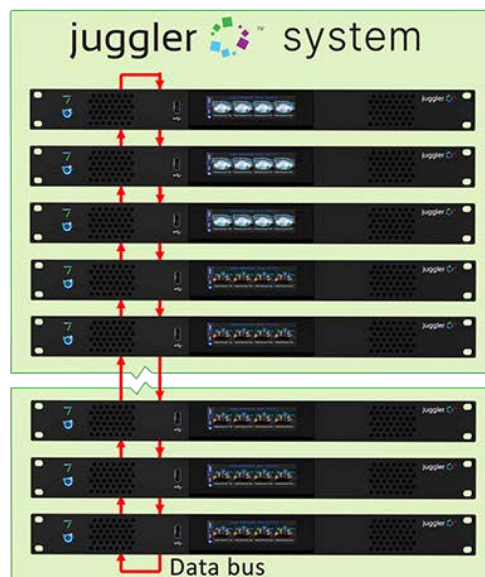
System Architecture

- Every Juggler has four video processing channels.
- Each Juggler unit has a flexible design for provisioning a number of inputs and outputs of various and mixed types.
- Jugglers can be daisy-chained by utilising a high capacity data bus.
- The number and balance of inputs and outputs in a Juggler system is completely scalable.
- Any input – live capture, streamed or prerecorded – can be processed by any Juggler to any output and placed anywhere in the overall output space.
- Redundancy and failover can be built into a Juggler system

As this example shows, the Juggler system maps the whole-site canvas, uniting, processing and placing all sources with all displays, expanding inputs and outputs as required:

Many inputs:

HDMI
DisplayPort 1.2
SDI
Video over IP



Many outputs:

HDMI
DisplayPort 1.2
SDI
Video over IP



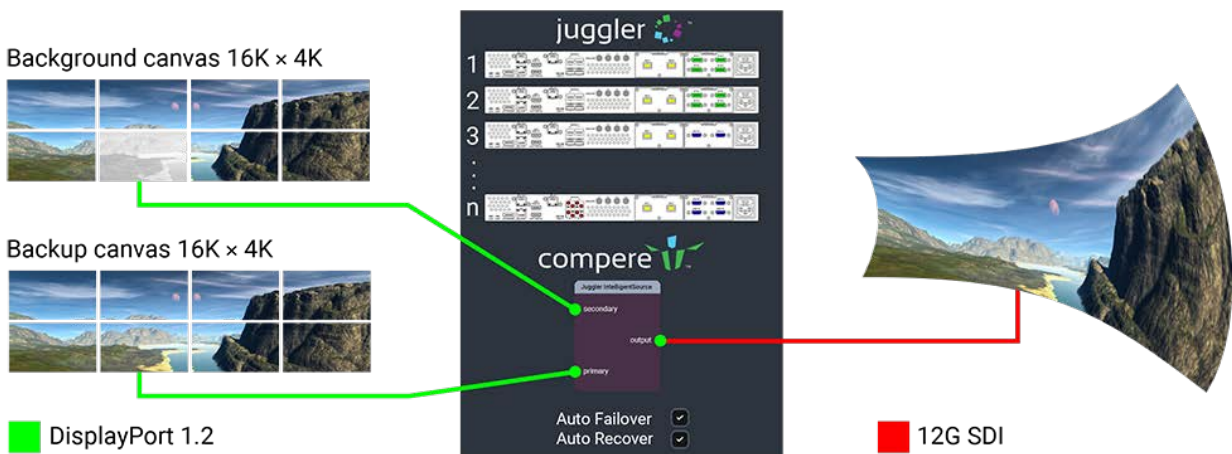
What Juggler Can Do

Here are two examples of Juggler applications that demonstrate its potential roles.

Example 1: IntelligentSource™ failover

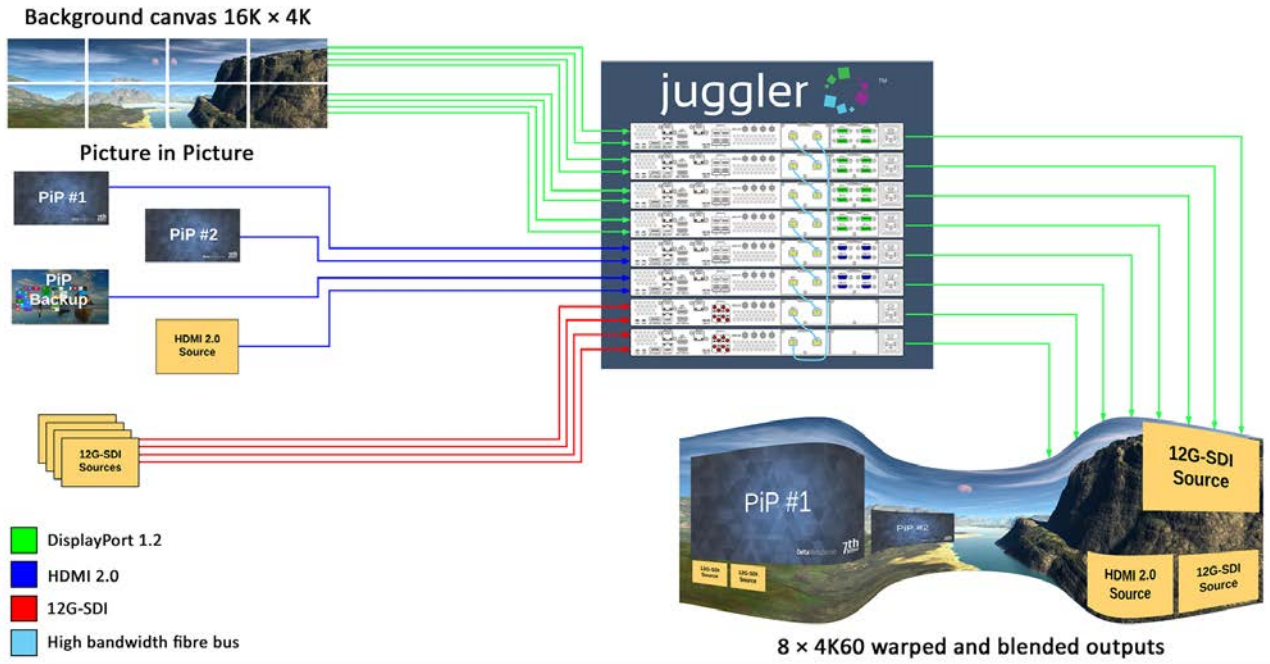
Use cases: Ultra-reliable auto failover, per input, or whole system, seamless source switching

- A large 16K × 4K canvas
- IntelligentSource
- Format conversion
- Warp and blend

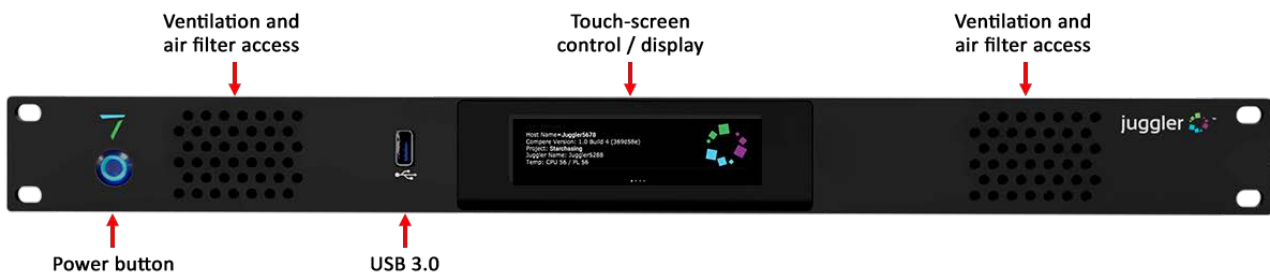


Example 2

- A large 16K × 4K DisplayPort input canvas
- IntelligentSource™ failover
- Picture in picture (PiP)
- Scaling
- Warp and blend



Front Panel: Controls



Power button

Juggler must first be connected to an appropriate power source using the supplied IEC power cord. The front panel power button will show a dim blue ring indicating this connection. Press and release the power button to start the unit. The power button will show a bright blue ring and the display panel will go through a start-up cycle before settling to status information and the Juggler logo.

Reset

Should you need to reset the internal FPGA board only, the power button can be pressed and held for 3 seconds then released when the blue light dims. The blue button light will flash for 2 seconds before returning to normal status.

USB port

For service use only.

Touch-screen display

The touch screen display is a tabbed swipe and scroll screen: see [Front Panel Display](#)⁽¹²⁾.

Front Panel Display

The Juggler front panel touch-sensitive display is driven by a Linux CPU board running a minimised instance of Compere, which also, as a network client, shares the common Project file for the whole networked system.

The display presents a menu system that conveys elements of the Compere graphical interface, allowing direct interaction with, and monitoring of a single Juggler by selecting, and swiping. The default page that comes up on start-up, and to which other pages revert after 30 seconds, is set in the properties of the Juggler internal (Linux) processor.

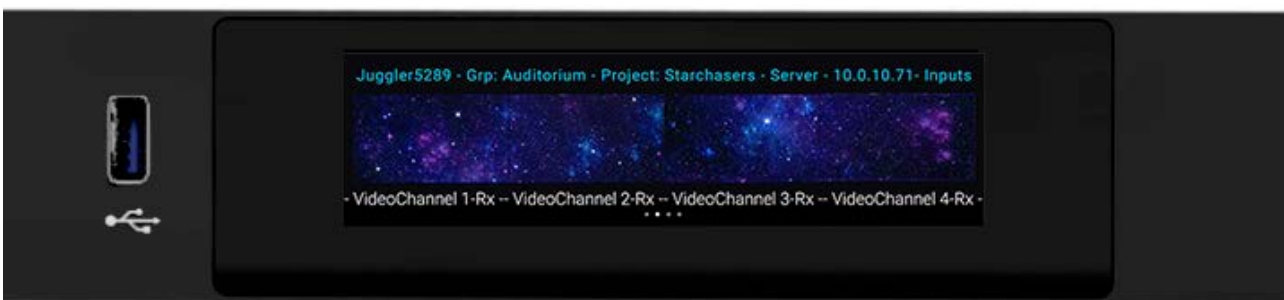
Page 1: Server info



This shows the Juggler name, IP addresses, network mode, project group, project name and connection status, and subnet. Processor temperatures are also shown.

Page 2: Video Channels Rx, Page 3: Video Channels Tx

This tab provides a direct NDI display of media being processed by the unit, as a row of video channels 1 to 4. Page 2 is the Rx media, page 3 is Tx media.



Page 4: Set Juggler IP

Swipe to page 4 for editing the static IP address:

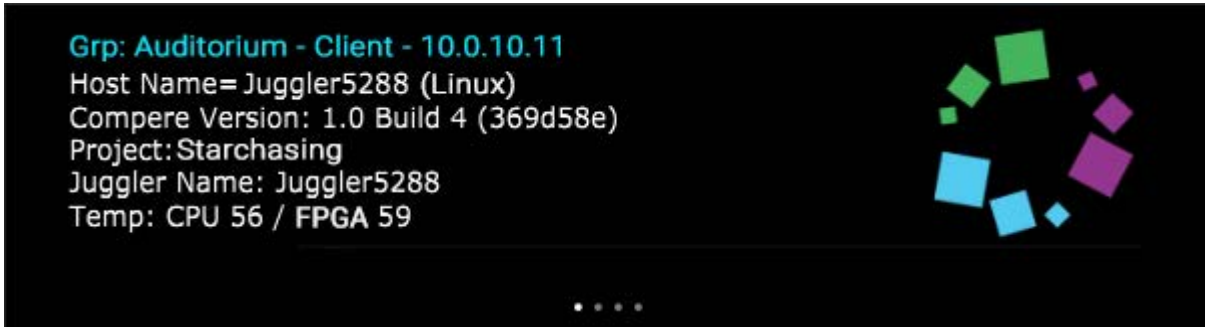


➤ See [Set Juggler Static IP and Subnet](#) ¹⁴

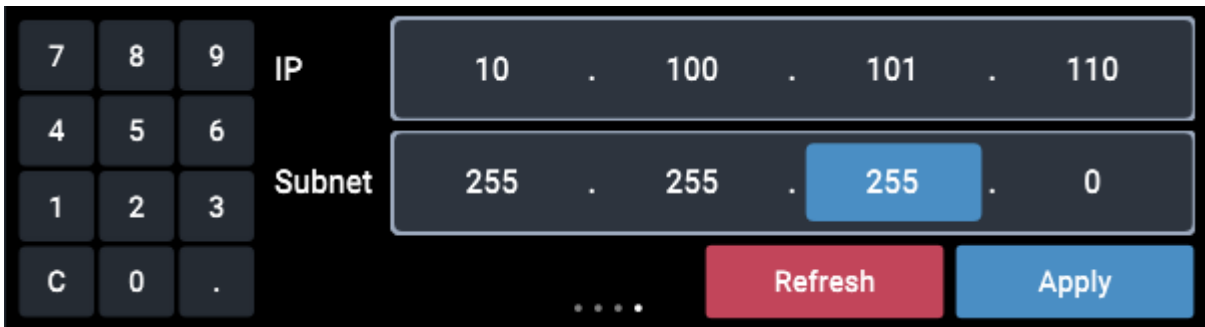
Set Juggler Static IP and Subnet

This can be done from the Juggler front panel touch screen.

- Touch to select 'Info' tab if it is not already showing.



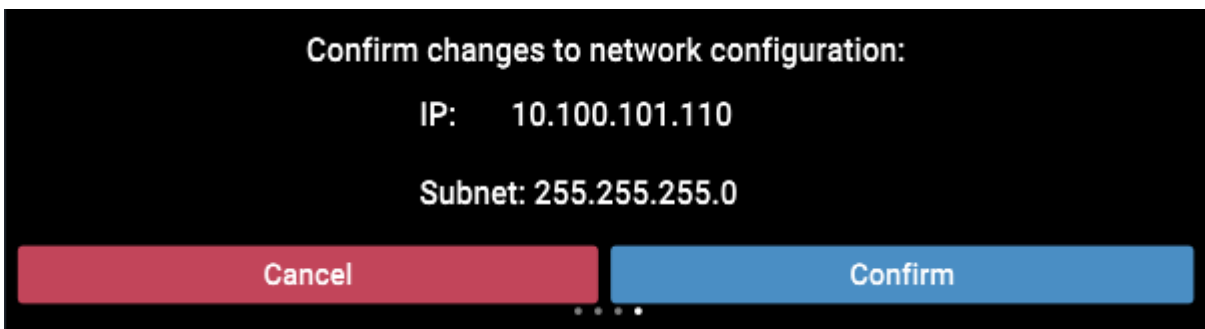
- Swipe from right to left to move to the IP Editor page:



- Touch to select an octet (address element) to change; it will show highlighted blue.
- Use the number pad on the left to enter a value up to 255.

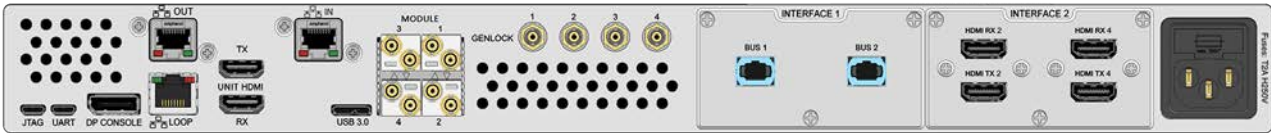
On the number pad:

- . (separator) moves to the next octet
- C (clear) sets the selected octet value to 0
- Touch 'Reset' to undo all changes, or
- Touch 'Apply' and then Confirm the changes:



Rear Panel Connections

The back panel of each Juggler is factory configurable to order. The required number and type of inputs and outputs for a system of Jugglers is expandable by adding Juggler modules as required.

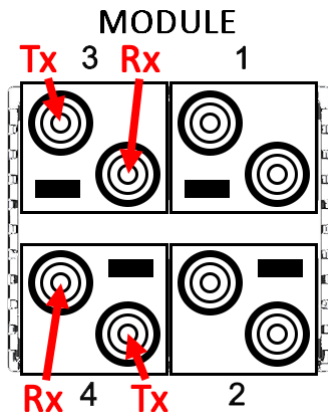


Working from left to right, these connections are available:

JTAG	Service use only.
UART (serial over USB)	Service use only. Default TCP (alt UDP) connection for Juggler Console to address the FPGA (field-programmable gate array) processor.
DP CONSOLE	Not used.
OUT and LOOP	Non-user Ethernet ports relating to front panel control, always connected to each other. (LEDs on OUT are inactive.)
UNIT HDMI Tx and Rx	Used in Juggler modules configured for HDMI, expandable with the I/O Interface panels.
IN (RJ45)	Network port (LEDs on this port are inactive).
USB 3.0	Not used.
MODULE × 4, numbered 1-4 (options)	4 × SFP modules, <i>either</i> 12G bidirectional coax (12G-SDI HD-BNC) <i>or</i> optical fibre (LC) for SDI or to form a 4-lane ('half') bus between Juggler modules see Connect a Juggler Data Bus ⁽²⁵⁾
GENLOCK / GPIO – 4 × HD-BNC, numbered 1-4	4 × HD-BNC independent configurable I/O for synchronising; genlock, 3D sync etc. GPIO and Genlock Juggler Systems ⁽²⁰⁾
I/O INTERFACE 1 and INTERFACE 2(options)	Choice of 2 × I/O channels of DP 1.2 or HDMI 2.0, or 2 × MPO optical fibre to form an 8-lane ('full') bus between Juggler modules with greater bandwidth than afforded via SFP transceivers see Connect a Juggler Data Bus ⁽²⁵⁾ .

SFP Modules

Note the orientation of SDI modules in particular. These are marked with indented arrows, but note that modules are inserted back to back (lower row inverted):



The same orientation is true for fibre-optic modules, but these are keyed. If using the 4-lane 'half'-bus option to daisy-chain Jugglers, see [Connect a Juggler Data Bus](#)⁽²⁵⁾: 'Half bus'.

Important! Only SFP modules approved by 7thSense should be fitted to the Juggler unit, fitting non-approved SFP modules may cause damage to the Juggler or prevent the unit operating.

Loop cable (every Juggler)

This is a necessary connection, to be kept as short as possible. A 12 cm, black Ethernet cable is provided for this with every Juggler. It must not be disconnected.



Input and Output Options

In a multi-Juggler system with a data bus, any input of any Juggler can be sent to the bus and taken off the bus as an input to any other Juggler. These internal interconnections are done in Compere, the software user interface. For example, this means that an HDMI input can be sent out elsewhere from the system via SDI.

There are three types of internal connection in a Juggler or a Juggler system:

1. Some Juggler inputs may match its outputs directly, for example providing layers from a media server to a whole-canvas background, requiring no processing on the way. These can save bandwidth by using the 'Bypass' feature.
2. Other Juggler inputs may occupy an entire video channel, in which case they go directly from input port to output port.
3. For placing and scaling any Juggler input on the system Canvas, Canvas Windows are matched onto the input ports, which in turn are passed to Canvas Outputs on output ports.

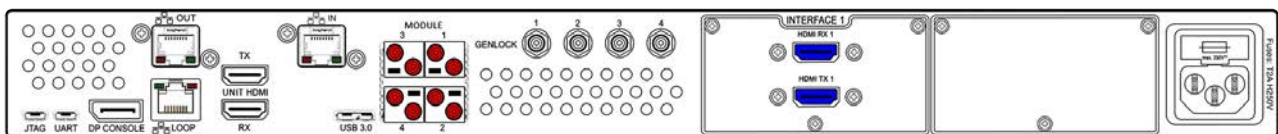
➤ For an explanation of terms and parts of the system Canvas, see the [Compere 1.0-5 User Guide](#).

Connection configurations in Juggler modules

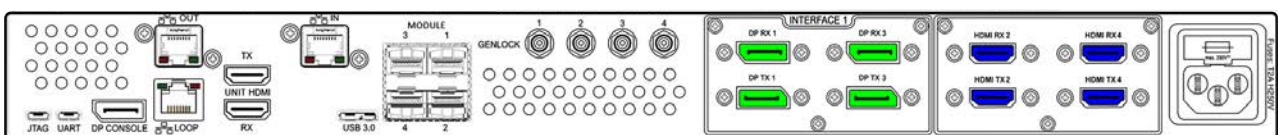
Juggler supports connectivity via HDMI™ 2.0, DisplayPort™ 1.2 and 12G SDI. Some typical configurations of I/O options are shown here.

Media inputs and outputs

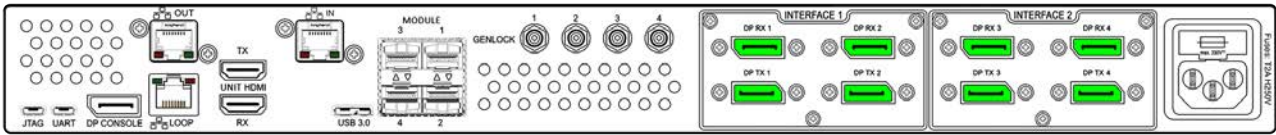
HDMI-configured Juggler with a total of $3 \times \text{Tx} + 3 \times \text{Rx}$ HDMI (shown blue) and $2 \times \text{Tx} + 2 \times \text{Rx}$ SDI (shown red):



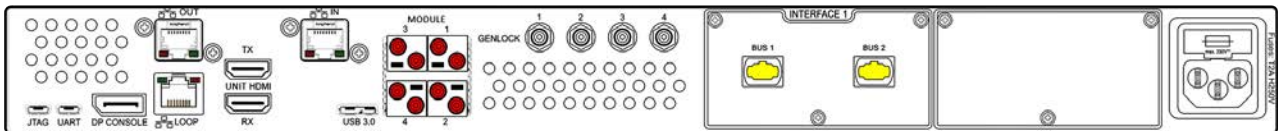
HDMI and DisplayPort configured Juggler with $2 \times \text{Tx} + 2 \times \text{Rx}$ HDMI (shown blue) and $2 \times \text{Tx} + 2 \times \text{Rx}$ DisplayPort (shown green):



DisplayPort Juggler with 4 × Tx + 4 × Rx DisplayPort (Unit HDMI not enabled):

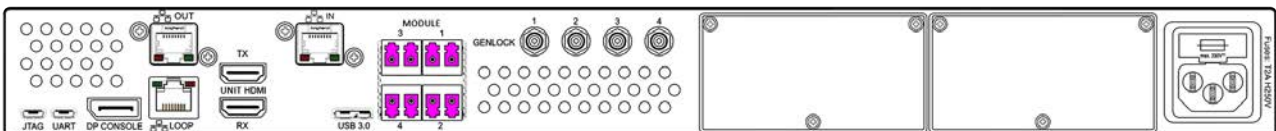
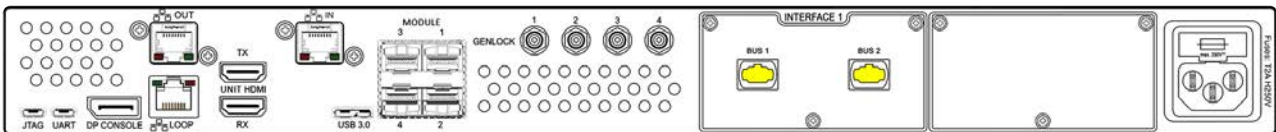


SDI-enabled Jugglers are equipped with up to four SFP modules (shown red):



Data bus

Each Juggler has four processing channels. By bussing Jugglers together, additional processing channels can be added to the Juggler system. To **bus** Juggler modules together, use optical fibre cables. Full 8-lane bandwidth MPO I/O ports (shown yellow) may be used, or 4-lane SFP modules (shown magenta). See also [Connect a Juggler Data Bus](#) ⁽²⁵⁾:



These are configured typically alongside 2 × DP or 2 × HDMI in the second interface.

Bus capacity

The bus configuration determines the capacity in terms of resolution and equivalent bandwidth. To increase bandwidth, lanes 4 and 8 can share their capacity with lanes 1-3 and 5-7. Effectively this becomes a 6-Lane ‘High Bandwidth’ bus, with lanes 4 and 8 unavailable to separate video channels.

Bits per Pixel determines capacity of your bus for your media requirement.

Bus Mode Bits Per Pixel	Max Resolution at 60fps, or equivalent bandwidth	4-Lane Bus (HD-BNC SFP modules)	8-Lane Bus (MPO Interface)
30	UHD (3840 × 2160)	4 buses (2 + 2)	8 buses (4 + 4)
24	4800 × 2160	4 buses (2 + 2)	8 buses (4 + 4)
30 High-Bandwidth Mode	4800 × 2160	n/a	6 buses (3 + 3)

GPIO HD-BNC Ports

Each Juggler back panel has four HD-BNC connectors. These can be independently designated as inputs, or outputs that can be assigned to the Juggler's video channels, in the Juggler properties of Compere.



All Juggler ports are configured independently in Compere, including GPIO. See [Compere User Guide: GPIO Properties](#).

These GPIO ports can also be used to support genlocking. For example, on one Juggler in a system, GPIO:1 can be used to collect the VSync of a media input, pass it out to GPIO:2, collect on GPIO:1 of the next, out from GPIO:2 and so on to daisy-chain down the line.

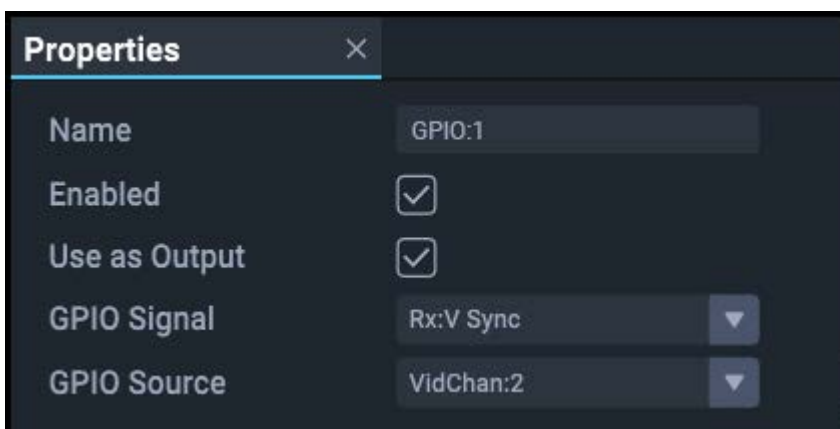
GPIO Genlock Example

Example: Use an input VSync

In the Juggler system, the first in line is designated as providing the source for genlock.

In Compere

This first Juggler's GPIO:1 is set to be an **output**, using a video channel media input as its **source**, and the **signal** it is sending as the V Sync is receiving from this source (expressed as Rx:V Sync) (see terms above).



➤ See [Compere 1.0-5 User Guide: GPIO Properties](#).

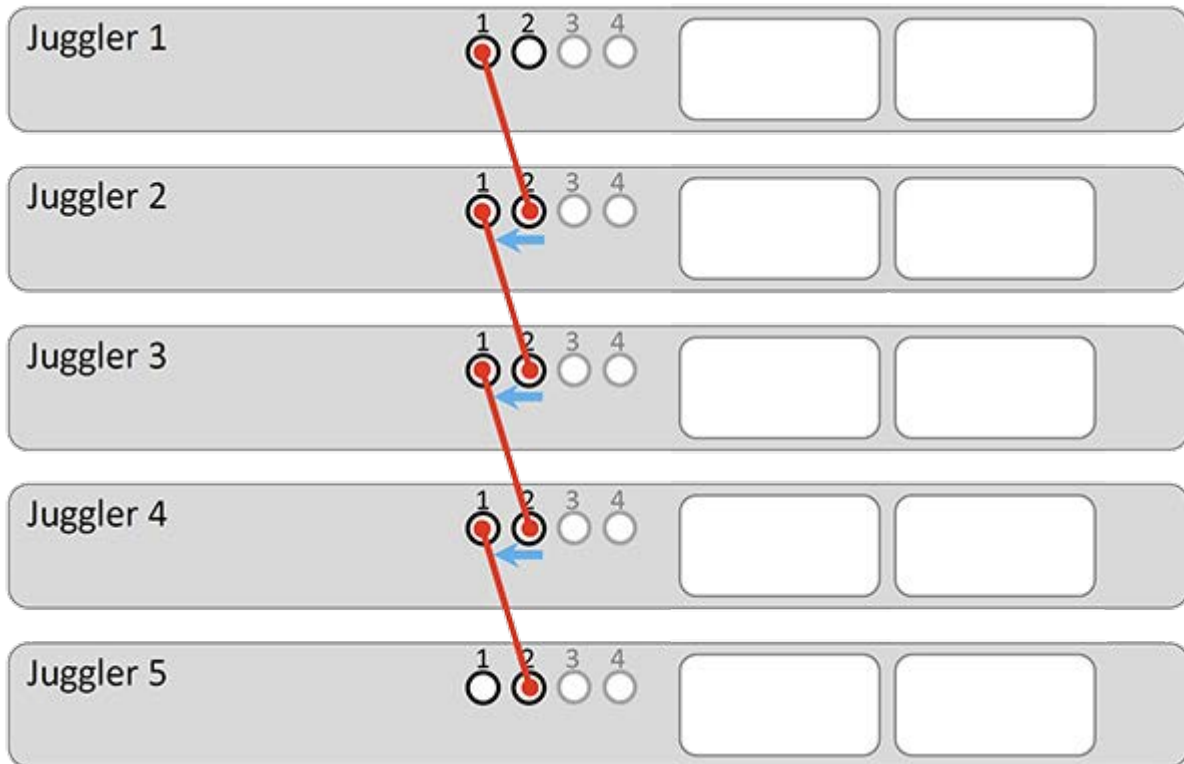
The next Juggler in line has its **GPIO:2** set to be in **input**, in other words, simply receiving from the attached cable.

Its **GPIO:1** is set to be an output, using its GPIO:2 as its source (the signal need not be specified).

This is repeated down the line, the last of course not needing to be assigned a sending GPIO.

Connections

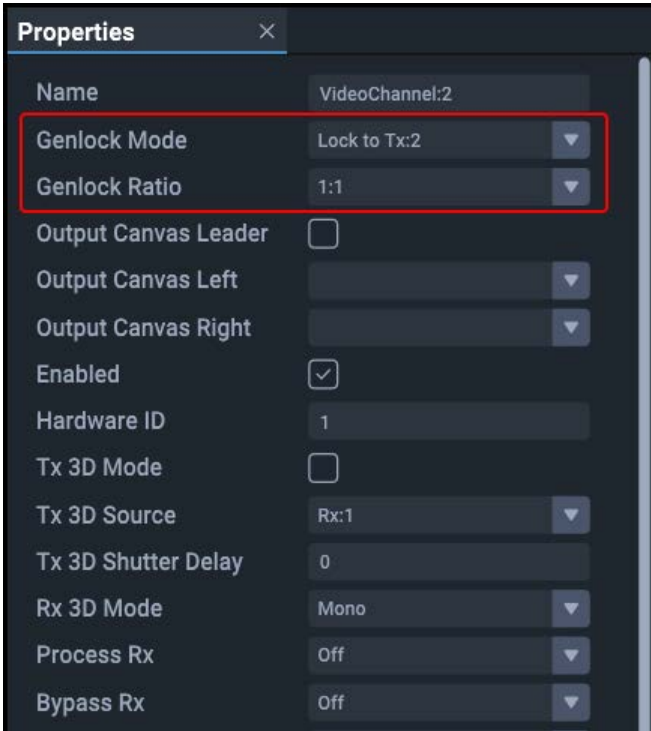
Five Jugglers would therefore be cabled as follows:



Genlock Mode

Now that every unit has a genlock signal, each that has a signal received on its GPIO:2 can use that for the output **genlock mode** in Compere.

The *first* Juggler has no signal on GPIO:2, so uses the same signal received on Video Channel 2 (Compere, *JugglerName* > Video Channel 2 > Properties):



Workflow: Physical Connections

Configure the Physical Connections

1. Unbox Jugglers and perform an all-round physical check for any signs of transit damage.
2. Rack the Jugglers so that the units are fully supported at the back and bolted securely at the front.
3. Connect power, press the front panel power button, and confirm that each unit comes to life.
4. The front panel will go through an initialising routine and settle to show an IP address for the unit and the Juggler logo.
5. Reassign [IP addresses](#)¹⁴ for each Juggler as required.
6. Switch off all units.
7. Connect any [data bus](#)²⁵ or buses between Jugglers that will combine to form a system.
8. Connect all input devices available at this stage, and required output devices.
9. Switch on or boot all the components of your system. You may find it best to establish your own preferred order, for example projectors first, working back through devices that take most time to boot up.

To configure the internal system connections in Compere, see the Compere 1.0-5 User Guide:

➤ [Configure Juggler Connections in Compere](#)

There you will find how to establish Project Groups, assemble display outputs, and configure Juggler 1 I/O connectors.

Connect a Juggler Optical Data Bus

Jugglers in a system should be racked adjacent to each other, since optical connections must be short and loop freely. If you are using multiple Jugglers on a data bus, make these connections first, before inputs and outputs; they can become quite congested with many units. There are two bus configurations, 4 and 8 lane, with each lane having a capacity of up to the equivalent of UHD 60 fps 10-bit 4:4:4.

Please note that as a critical component, optical cables used should be supplied or approved by 7thSense. Cables do not need to be short but the minimum bend radius of a free-hanging cable should be not less than 10 times the cable outside diameter.

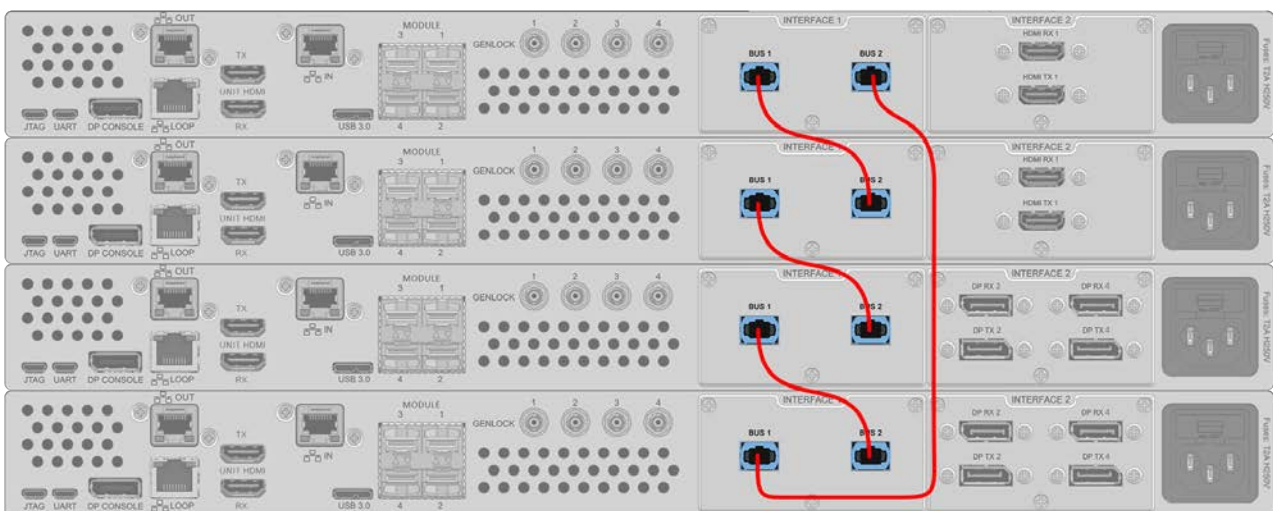
This page covers the physical cabling of a single bus. For an explanation of how this works, and the use of the data bus in the Compere software, see the relevant sections in the Compere 1.0-5 User Guide:

- [Bus Connections in a Juggler System](#) (bus individual inputs)
- [Bridging Two 8-Lane Buses](#) (e.g. to provide redundancy)
- [Output Canvas Bus](#) (bus the whole canvas)

How your Juggler system is used will depend on your overall requirements, and can include combinations of bus types.

8-Lane ‘Full’ Bus

With the MPO (Multi-Fibre Push-on) optical fibre option, twice the bandwidth is available. Each fibre-optic cable carries 8 lanes, 4 in each direction:



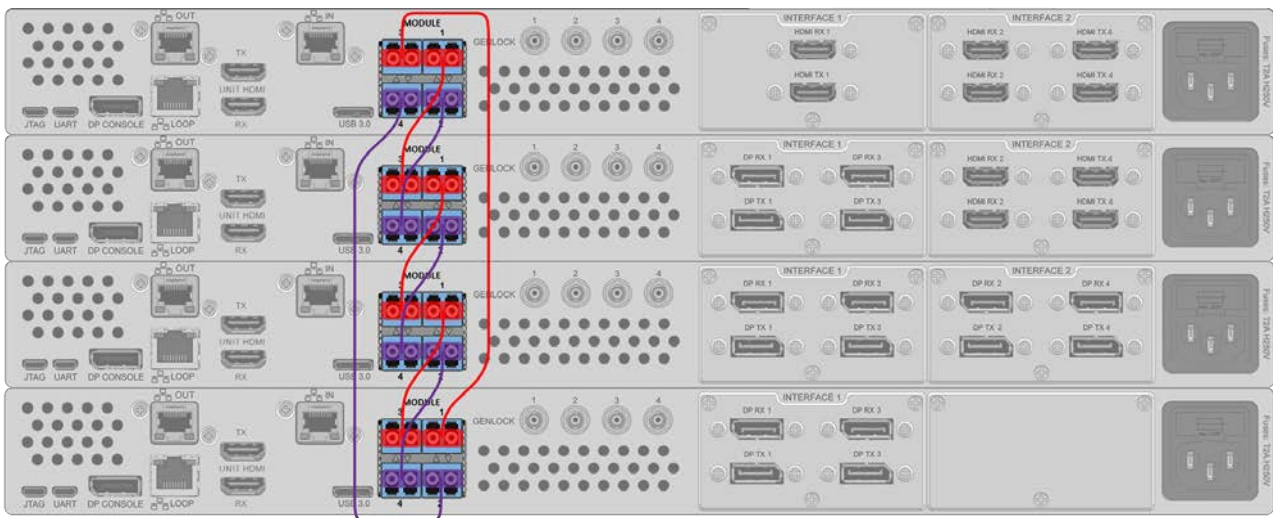
Units are daisy-chained unit to unit, 1 to 2 and loop back from the last unit to the first in the same way.

Cables

Use MTP/MPO 12-fibre 50/125 patch cables, type B, Female to Female.

4-Lane 'Half' Bus

Using the 'half-bus' optical transceivers, Juggler modules can be bused together using on-board SFP modules. Each fibre optic cable carries 1 lane in each direction.



Units are daisy-chained progressively unit to unit, 1 to 3, 2 to 4 and loop back from the last unit to the first in the same way.

We recommend the use of paired crossover patch cables, which will have colour or tag identifiers. It can be helpful to choose an identifier to work with (yellow, a number etc.) and keep these on the outside as you work down one side and up the other.

Care with Optical Connectors



Optical connectors are a Class 1 laser product.

Never look directly into the end of fibre cables until you are positive that there is no light source at the other end.

Cleaning Optical Connectors

The most common problem with fibre optical connectors is contamination – residues or dust. Plastic easily generates static, which attracts fine particles, too small to see with the naked eye, and any contamination will affect performance or cause failure. **Avoid troubleshooting by inspecting first.**

Inspect before you connect

Hand-held fibre inspection microscopes may seem expensive, but prevention is cheaper than troubleshooting, and it is essential to ensure optical connector end-faces are clean *before you connect*. Problems arise when components are left unconnected and uncapped, so keep caps on until the point of connection. Residues can even be present in an out-of-the-bag cable, or from the moulded cap itself, and can transfer to a bulkhead connector.

Inspect, clean, reinspect

We recommend that the polished ends of fibre leads should be cleaned with a push-click pen cleaner. Dry cleaning is always recommended; alcohol-based agents should *not* be used. Specialist cleaning kits are available that ensure contaminants are not just moved about, or reintroduced by a second use of a tool.

After cleaning, reinspect. You may still have contamination. Do not connect until you know a connection is clean on both sides.

Connecting to a Network and Devices

Juggler systems must be connected on a single network each with a [static IP address](#)⁽¹⁴⁾. All devices running Compere will be visible in any Compere UI, along with their host names, where their network binding NICs can be assigned along with their roles and any descriptive comments. Network configuration is done in Compere.

➤ See [Network Configuration](#) in the Compere 1.0-5 User Guide.

Process

Having established any [data bus between Jugglers](#)⁽²⁵⁾, connect your source inputs (from Juggler physical input ports) and display outputs (to Juggler physical output ports). First identify the Rx and Tx ports – and in particular the numbering on the rear panel – so you understand how these are represented in Compere’s representations. All live ports are automatically identified in Compere, and it is there that you will make the internal and process connections.

You can regard outputs and inputs across the system as independent. Unlike many devices, the Juggler in and out (Tx and Rx) are not linked one-to-one. You will decide in the Compere control software precisely how input streams are processed, where they end up via which outputs and into what visual space.

Switch everything on. Jugglers take a short while to self-configure, and then you will see the Juggler logo show, along with the unit IP address. The order in which you switch system components on should not matter. Compere will recognise every member of the shared network, and all their connection types.

Juggler Software and Firmware

Compere is already installed for the internal operation of each Juggler on Linux. It handles all system communications including the front panel display. To configure your system over the Juggler network, install Compere on a local PC on the same network.

Versions

Juggler projects require compatible versions of the Compere software on all units in a project. If incompatible versions are detected in a Project Group, these will show in the Network Discovery Panel.

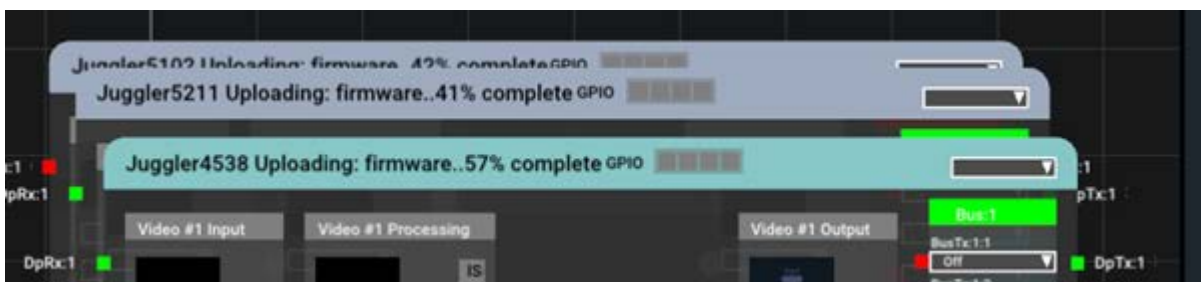
The current version of Compere shows in several places: on a Juggler front panel display, in the Compere UI title bar, and in *Help > Show About*. To see the version of a remote Juggler on the same network, select it in a Compere Project Panel and find 'Compere version' in the Properties panel.

Upgrading Compere on Jugglers

You may need to install or update a (Linux) version of Compere on a Juggler or many Jugglers in a Project Group. This can be done remotely from a control PC to distribute the installer. In Compere on the control PC, select the required Jugglers in the Nodes panel. Right-click on one and select *Admin > Upgrade Compere* (or Ctrl+Alt+C). Browse to the Linux installer on the control PC and click on 'Open'. This will distribute the file to all the Juggler internal controllers. Progress can be seen in the Compere Task Tracker icon or in the tracker panel (select main menu *Panels > Task Tracker*). Once all tasks have completed 100%, the selected Jugglers can be rebooted remotely in the Nodes Panel from the same right-click menu (*Power > Reboot*) and will be upgraded.

Juggler Firmware

Juggler is a highly configurable item, yours will carry firmware with some specific original configurations to match your requirements. Firmware updates may be available from time to time to improve performance, not in Compere but in the FPGA processor. The update process is very similar to upgrading Compere, but the file you will have been provided with will be called BOOT.bin. Progress of firmware uploading can also be seen in each Juggler:



Wait for all tasks to be complete 100% before rebooting.

Juggler maintenance

Several operations are available from a control PC running Compere, by selecting a Juggler or Jugglers in the [Nodes](#) Panel of Compere and using the right-click context menu for the Juggler (i.e. not in a channel). The same three options are available on right-click of a Juggler in the Project panel.

Uploads

Upload EDID (Shift+E)

Upload an EDID file to become available to this Juggler.

Upload Script (Ctrl+Shift+E)

Example: IntelligentSource (Python) script.

Import MPCDI (Shift+I)

(Any Juggler) upload an MPCDI file to the Project.

Admin

Show Juggler Console (Shift+C)

Admin access to the Juggler TCP/UDP (service/support) console.

Update Firmware (Shift+F)

Juggler firmware determines the configuration and functionality of each unit. Improved versions may be required, or older versions brought into line with newer units.

Juggler Console Mode [Disabled, Enabled, Enabled (errors only)]

Normally disabled by default. Reduces performance when enabled. Admin / developer use only via the UART port.

Upgrade Compere (Ctrl+Alt+C)

Distribute and install a Linux version of Compere to selected Jugglers.

Power

Reset

Temporarily remove a Juggler from the Project, reboot and and reset it to clean state.

Reboot

Restart the Juggler.

Shutdown

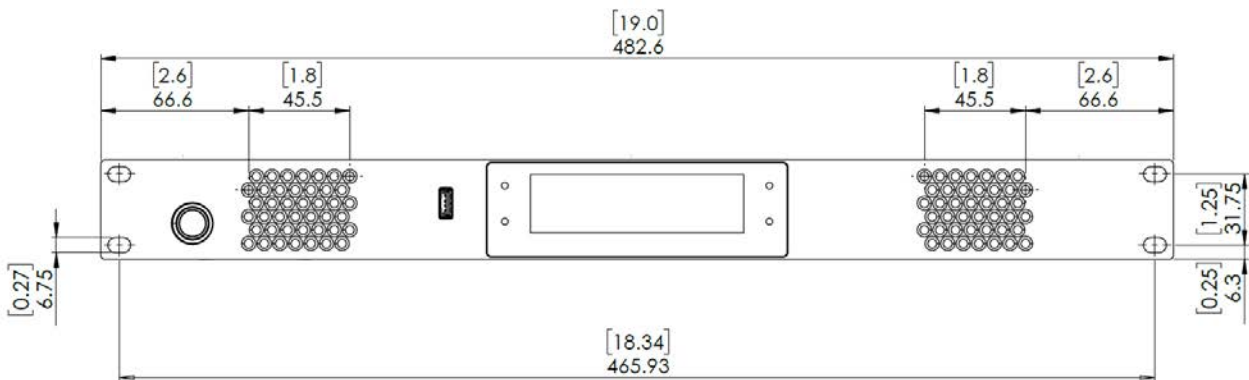
Turn the Juggler unit off. (Cannot be subsequently turned on remotely.)

Juggler Physical Specifications

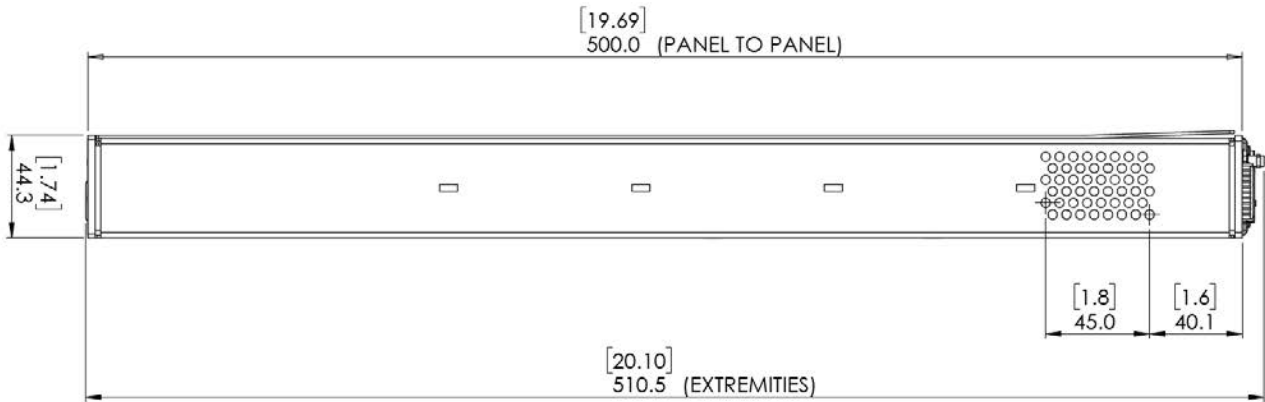
Environmental Characteristics	Operating	Non-operating
Temperature	+15 to +30 °C	-10 to +50 °C
Humidity (non-condensing)	10 to 90%	5 to 95%
Altitude	≤2000 m	≤10000 m

Specification	Rating/Description	Notes
Rackmount Dimensions (H × W × D)	(1U) 44.3 × 424 × 500 mm	Width including mounting ears: 482.6 mm
Rackmount weight (approx.)	7.2 kg (approx)	
Power Supply	100-240 VAC 50-60 Hz	Autoranging, IEC C14 inlet
Power	100 W	
Current (max.)	1.5/0.9 A	
Cooling	Forced air	Inlets at front, exhaust at rear
BTU Rate	341	

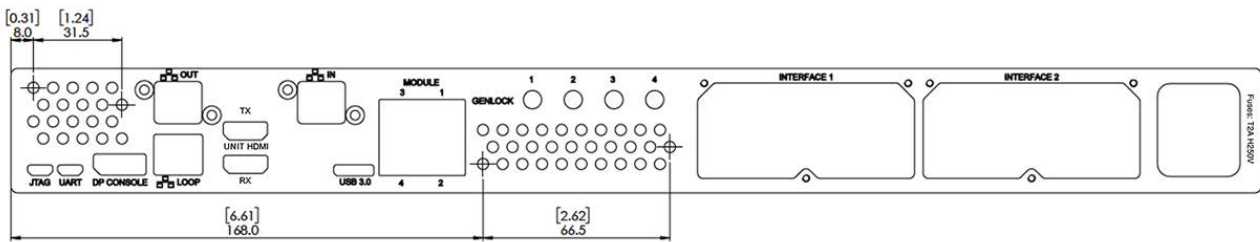
Front panel dimensions, mm [in]



Side panel exhaust vents, mm [in]



Rear panel exhaust vents, mm [in]



Rack Mounting Jugglers

Juggler units must be installed in a rack with load-bearing support along the sides, under the rear, or on a shelf. The rear and side exhaust vents must be kept clear. The front panel should be secured using an M6 rack mount bolt in each of the top and bottom mounting holes on each side of the unit's front panel. These ears alone will not support the weight of the unit.

Mount Jugglers with a minimum one-third rack-unit spacing:



➤ See [Juggler Physical Specifications](#)³¹ for dimensions.

Airflow and cooling

Airflow intake is through the filtered vents in the front panel, and exhaust is out through the rear panel and the rear right-hand side. These vents must all have a clearance of at least 50 mm.

Juggler Care and Maintenance

Environment

Juggler is intended for use in a commercial (not domestic) environment and should be operated in a clean, dust free area (e.g. a server room). It is intended for operation in benign environments (not subject to corrosive or explosive atmospheres, moisture or flammable gases). Units are not protected against ingress of liquid (IPx0) or designed to be subject to excessive mechanical shock or vibration.



Only used at altitude not exceeding 2000 m



Only used in not-tropical climate regions

Thermal

Do not block any of the unit's air vents and ensure the ambient temperature around the Juggler is compatible with the environmental characteristics stated in the [Physical Specifications](#)³¹.

Particularly when mounted in a rack cabinet with front or rear doors the ambient temperature around the unit may be higher than the ambient room temperature.

Electrical

Before connecting power to the unit, ensure the electricity supply is compatible with the electrical ratings shown in this document and on the unit's product label. The unit shall not be connected to an IT (unearthed neutral) power distribution system and the mains socket-outlet used shall connect to the building installation ground.

Juggler is connected to and disconnected from the mains supply with the IEC 60320 power connector on the rear of the unit.

The Juggler is protected by twin (live and neutral) fuses in the IEC mains connector block. These are the only user-serviceable part of the Juggler. If either malfunctions, they must both be replaced by a qualified person, and only by **F2A H250V, 5 × 20 mm ceramic cartridge fuses**. Disconnect the Juggler from the mains supply before releasing the clip with a suitable tool to withdraw the fuse drawer, and replace both fuses. Push the drawer back in securely before reconnecting.

Cleaning

External casing and the front panel should be carefully wiped with a soft cloth and antistatic solution.

Air filter

A user-serviceable air filter is located behind each of two vents on the unit's front panel. It is important to remove and clean or replace the filters periodically to avoid overheating.

Spare filter pads for Juggler units can be provided by 7thSense. Juggler should not be run without filters, since accumulations of dust inside the chassis can also cause overheating.

Replacing filters

Withdraw the Juggler from the rack far enough to access the retaining screws above the front panel. There are two per filter allowing a small carrier to be lifted vertically out. The Juggler lid does not need to be unscrewed or raised.



Internal maintenance

Other than the mains fuses, Juggler contains no user-serviceable parts.

Warning: Do not operate the Juggler with any covers removed as the air flow through the unit will be compromised and may lead to overheating. The lid of the Juggler forms an integral part of the cooling circuit. Operation of the unit with the lid removed can cause overheating.

Any alterations to the product's specification, e.g. additional/alternative components, may invalidate the warranty or impact the unit's performance. Additionally, such changes or modifications could cause equipment no longer to comply with the relevant EMC regulations, and void the user's authority to operate the equipment. If in doubt, please contact your supplier.

Internal batteries

The Juggler has a service-only replaceable CMOS battery on the Intel Atom CPU.

End of service life

Dispose of the equipment and any components in accordance with all local and national safety and environmental requirements.

Warranty, Support and Service

Standard warranty is 24 months, return-to-distributor. Please contact 7thSense Design if you require an extended warranty.

Please ask for instructions and request authorisation before returning a Juggler unit to your distributor.

Juggler Internal Maintenance

Internal maintenance must only be undertaken by suitable qualified service personnel.



Warning: Do not operate Juggler units with any covers removed as the air flow through the unit may be compromised leading to overheating.

Any alterations to the product's specification, e.g. additional/alternative components, may invalidate the warranty or impact the unit's performance. Additionally, such changes or modifications could cause equipment no longer to comply with the relevant EMC regulations, and void the user's authority to operate the equipment. If in doubt, please contact your supplier.

Electrostatic discharge (ESD)

When handling electronic assemblies, take precautions to avoid electrostatic discharge (ESD) causing damage. Precautions should include the wearing of an ESD protective wrist strap and using antistatic bags for electronic assemblies when not installed in any equipment.

➤ Visit our Support Portal for [support and service](#)

Regulatory Compliance

FCC

Juggler Pixel Processor complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Note: The equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with this user guide, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their own expense.

UK and European Union

Juggler Pixel Processors are a Class A product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures.

End of Service Life



Dispose of the equipment and any components in accordance with all local and national safety and environmental requirements.

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December 2021	1	Compere 1.0 build 5	Previously published as part of M512, Juggler and Compere User Guide	Andie Davidson

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