ARGO INSTALLATION & TECHNICAL MANUAL

Digital Broadcast IP Production Console

calrec.com

CALREC

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Calrec Audio Ltd reserve the right to change specifications without notice. E & O.E.

The established policy of Calrec Audio Ltd. is to seek improvements to the design, specifications and manufacture of all products. It is not always possible to provide notice outside the company of the alterations that take place continually.

Despite considerable effort to produce up to date information, no literature published by the company nor any other material that may be provided should be regarded as an infallible guide to the specifications available nor does it constitute an offer for sale of any particular product.

Argo S, Argo Q, Apollo, Apollo+, Artemis, Artemis+, Summa, Brio, RP1, Type R, VP2, Hydra Audio Networking, Bluefin High Density Signal Processing (HDSP) and ImPulse are trade marks of Calrec Audio Ltd.

All other trade marks are acknowledged.

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IMPORTANT INFORMATION

After Sales Modifications
Please be aware that any modifications other than those made or approved by Calrec Audio Limited or their agents, may invalidate the console's warranty. This includes changes to cabling provided by Calrec and variations to the recommended installation as detailed in Calrec documentation.

Modifications to this equipment by any party other than Calrec Audio Limited may invalidate EMC and safety features designed into this equipment. Calrec Audio Limited can not be liable for any legal proceedings or problems that may arise relating to such modifications.

If in doubt, please contact Calrec Audio Limited for guidance prior to commencing any modification work.

Installation
In many installations the AC power connectors will not be readily accessible, effectively making the equipment permanently connected. The installation should be carried out in accordance with all applicable installation rules and regulations.

Service Personnel
The AC power disconnect devices are the 2 x IEC (IEC60320-1 C13/C14) couplers located at the rear of each unit. WARNING: The apparatus has a dual power system. It is essential that BOTH AC power IEC couplers are disconnected to prevent exposure to hazardous voltage within the unit.

Third Party Equipment
Integrating third party equipment into a Calrec system may compromise the product's ability to comply with the radiated emission limits set in the latest EMC (Electro Magnetic Compatibility) standard.

Calrec Audio Limited can not be responsible for any non-conformities due to use of third party equipment. If in doubt, please contact Calrec Audio Limited for guidance prior to integrating any third party equipment.

ESD (Static) Handling Procedures
In its completed form, this equipment has been designed to have a high level of immunity to static discharges. However, when handling individual boards and modules, many highly static sensitive parts are exposed. In order to protect these devices from damage and to protect your warranty, please observe static handling procedures, for example, use an appropriately grounded anti-static wrist band. Calrec will supply an electrostatic cord and wrist strap with all of its digital products.

All modules and cards should be returned to Calrec Audio Limited in anti-static wrapping. Calrec Audio Limited can supply these items upon request, should you require assistance.

This applies particularly to digital products due to the types of devices and very small geometries used in their fabrication, analogue parts can however still be affected.

FIG 1 - LEAD FREE

Pb-Free Lead Free

RoHS Legislation
In order to comply with European RoHS (Reduction of Hazardous Substances) legislation, Calrec PCB and cable assemblies are produced with lead-free (tin/copper/silver) solder instead of tin/lead solder. See Figure 1.

In the unlikely event of a customer having to carry out any re-soldering on Calrec hardware, it is imperative that lead-free solder is used; contaminating lead-free solder with leaded solder is likely to have an adverse effect on the long-term reliability of the product.

FIG 2 - LEAD FREE LOGO

e1

Circuit boards assembled with lead-free solder can be identified (in accordance with IPC/JEDEC standards) by a small oval logo (see Figure 2) on the top-side of the circuit board near the PCB reference number (8xx-xxx). The same logo is used on the connector hoods of soldered cable assemblies.

If in doubt, please check with a Calrec customer support engineer before carrying out any form of re-soldering.

ISO 9001 and RAB Registered
Calrec Audio Ltd has been issued the ISO9001: 2008 standard by the Governing Board of ISOQAR.

The award, for both UKAS (Figure 3) and RAB (Figure 4) registration, is the most comprehensive of the ISO9000 international standards. Granted in recognition of excellence across design, development, manufacture and after-sales support, the certification follows a rigorous and thorough review of Calrec's internal and external communication and business procedures.

FIG 3 - UKAS REGISTRATION

ISOQAR QUALITY ASSURED ISO 9001
UKAS QUALITY MANAGEMENT 026
Certificate number 3205/02

FIG 4 - RAB REGISTRATION

ISOQAR QUALITY ASSURED ISO 9001
ANAB ACCREDITED
Certificate number 3205/02

HEALTH AND SAFETY

Important Safety Instructions:

- Read these instructions.
- Keep these instructions.
- Heed all warnings.
- Follow all instructions.
- Do not use this apparatus near water.
- Do not block any ventilation openings.
- Install in accordance with the manufacturer's instructions.
- Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.
- Protect the power cord from being walked on or pinched particularly at the plugs, convenience receptacles, and the point where they exit from the apparatus.
- Use only with the cart, stand, tripod, bracket, or table specified by the manufacturer, or sold with the apparatus. When a cart is used, use caution when moving the cart/ apparatus combination to avoid injury from tip-over.
- Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.
- Warning: To reduce the risk of fire or electric shock, do not expose this apparatus to rain or moisture.
- Not intended for outdoor use.
- This equipment must be EARTHED.
- Caution - Shock Hazard
- Disconnect all power sources before starting any servicing operation, equipment must be isolated from the AC power supply. The disconnect devices are the 2 x IEC connectors (IEC 60320-1 C13/C14 couplers).
- An appropriate disconnect device shall be provided as part of the installation. If the plug is to be used as the disconnection device, then the socket outlet shall be easily accessible.
- Do not allow ventilation slots to be blocked.
- Do not leave the equipment powered up with the dust cover fitted.

Cleaning

For cleaning the front panels of the equipment we recommend using a soft anti-static cloth, lightly dampened with water if required.

Explanation of Warning Symbols

Triangular warning symbols contain a black symbol on a yellow background, surrounded by a black border.

The lightning flash with arrow head symbol within an equilateral triangle, as shown on this page, is intended to alert the user to the presence of dangerous voltages and energy levels within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock or injury.

The exclamation mark within an equilateral triangle, as shown on this page, is intended to prompt the user to refer to important operating or maintenance instructions in the documentation supplied with the product.

The altitude warning symbol indicates that the equipment is to be used at an altitude not exceeding 2000m.

The multiple power sources symbol indicates that more than 1 power source is connected and that all power sources should be disconnected before servicing.

Earthing

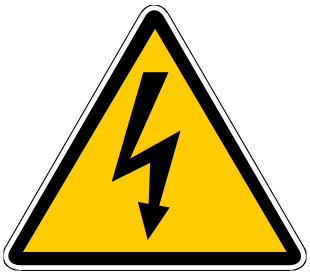
This is a Class I product. An Earth connection MUST be provided in each AC power cord.

For those users who wish to have a separate ground/earth connection use an Earth cable at least 6mm^2 in cross section (10 AWG), this connection is optional and is NOT a requirement to comply with safety standards.

Lithium Battery Replacement

Caution: Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type. Batteries must not be exposed to excessive heat such as sunshine, fire or the like.

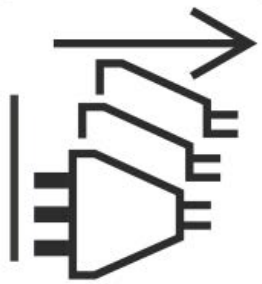
DANGEROUS VOLTAGES



IMPORTANT INSTRUCTIONS

ALTITUDE WARNING SYMBOL

MULTIPLE POWER SOURCES SYMBOL



This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

TECHNICAL SUPPORT

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Fax:	+44 (0) 1422 842159
Website:	www.calrec.com

Should you require any technical assistance with your Calrec product then please contact your regional Calrec distributor. Customers within the UK or Ireland should contact Calrec directly.

For a complete list of worldwide distributors by region, go to www.calrec.com or contact us for more information.

For pre-delivery technical enquiries, UK and Ireland customers should contact the Calrec project manager assigned to their order. Post delivery, the Calrec Customer Support team will take care of your technical enquiries.

Our UK customer support team work closely with our global distributor network to provide the highest level of after sales support. Your distributor should be your first point of contact and will often be able to provide an instant solution, be it technical advice, spares or a site visit by an engineer.

Calrec UK customer support and our global technical team provide free of charge technical support and advice by phone or e-mail to all customers.

Once your console is installed we can provide an engineer on site to carry out system commissioning.

Commissioning ensures the equipment is correctly installed and fully functioning before it goes into use. During commissioning, our engineers can also help and advise with configuration and setup.

Calrec after sales support includes:

- Free of charge comprehensive technical advice and support by phone and e-mail.
- Software and hardware upgrades.
- Repairs.
- Quick supply of replacement or loan hardware in the event of a failure.
- Providing export documentation for the return of faulty parts.
- On site commissioning visits.
- On site service and health check visits.
- Emergency engineer visits.
- On site on-air support, for complete peace of mind - providing operational guidance, and technical engineering support for new installations or high profile events.
- Operational training.
- Maintenance / technical training.
- Supply of replacement components.
- Supply of documentation.

Service contracts

We offer a range service contracts to our UK and Ireland customers, offering 24/7 telephone support, regular health checks and extended warranty amongst other benefits. Please contact our customer support team for more information on service contracts.

Product Warranty

A full list of our conditions & warranties relating to Goods & Services is contained in the Company's standard Terms and Conditions. A copy of this is available on request.

Repairs

If you need to return goods to Calrec, for whatever reason, please contact your regional distributor or Calrec customer support beforehand for guidance, as well as to log the details of the problem and receive a reference number. For customers outside the UK and Ireland, shipping via the distributor saves customers from dealing with exportation paperwork. If there is a need to send direct to Calrec, contact us beforehand to log the incoming repair and for assistance with exportation documents.

Standard of Service

Ensuring the highest standards is a priority, if you have any comments on the level of service, product quality or documentation offered to you by Calrec, please contact the Calrec Customer Support team in the UK who will endeavour to address the issues. Calrec welcomes all customer feedback.

For feedback specific to this document, please contact enquiries@calrec.com.

ARGO
CONTROL SURFACES

CALREC

ARGO S SURFACE

There are currently two variants of Argo Control surfaces.

The surface shown below is known as an Argo S and is the smaller of the two surfaces.

The chassis is designed to support from two to eight 12 fader wide sections which supports up to a 96 fader wide surface.

Each section can be fitted with:-

- IU6576 standard 12 fader panel placed at the bottom of the section.

1 x additional control panel above this which can be fitted with either:-

- CA6575 Wild Assign panel, which provides 48 rotary control cells each with a built in switch, its own mini TFT display and soft button.
- IU6577 Short Fader panel, which provides an additional 12 short throw Faders/Cut buttons/Access buttons/24 x 4 button control cells each with a mini TFT displays and a variety of other mini TFT displays.
- MY6574 Monitor panel, which provides rotary controls for the various loudspeaker outputs with mini TFT displays/20 x 4 button control cells each with a mini TFT display, TB Mic socket and USB port.

Above the control panels is fitted:-

- MU6572 Touch display TFT panel. This is a 1920px X 1080px display with a multi touch TFT screen which is used to show the current ++operational displays and provide On-Screen touch controls.

The top of each section is fitted with:-

- MD6573 Meter TFT panel. This also has a 1920px X 1080px display and is primarily used to show audio data on meters on the panel.

The Argo S console shown below is a 36 fader wide surface with 3 standard fader panels, 2 wild assign panels and a monitor panel.

FIG 1 - 36 FADER ARGO S SURFACE WITH 1 ROW OF ADDITIONAL PANELS

Note: The following blanking panels are available if the customer requires user custom panel or blank panel areas: NN6605 Standard Fader panel blank, NN6606 Short/Wild/Monitor panel blank and NN6607 Touch TFT panel blank. These will fit either the Argo S or Argo Q surfaces.

ARGO Q SURFACE

The surface shown below is known as an Argo Q and is the larger of the two surfaces.

The chassis is designed to support from two to eight 12 fader wide sections which supports up to a 96 fader wide surface.

Each section can be fitted with:-

- IU6576 standard 12 fader panel placed at the bottom of the section.

2 x additional control panels above this which can be fitted with either:-

- CA6575 Wild Assign panel, which provides 48 rotary control cells each with a built in switch, its own mini TFT display and soft button.
- IU6577 Short Fader panel, which provides an additional 12 short throw Faders/Cut buttons/Access buttons/24 x 4 button control cells each with a mini TFT displays and a variety of other mini TFT displays.
- MY6574 Monitor panel, which provides rotary controls for the various loudspeaker outputs with mini TFT displays/20 x 4 button control cells each with a mini TFT display, TB Mic socket and USB port.

Above the control panels is fitted:-

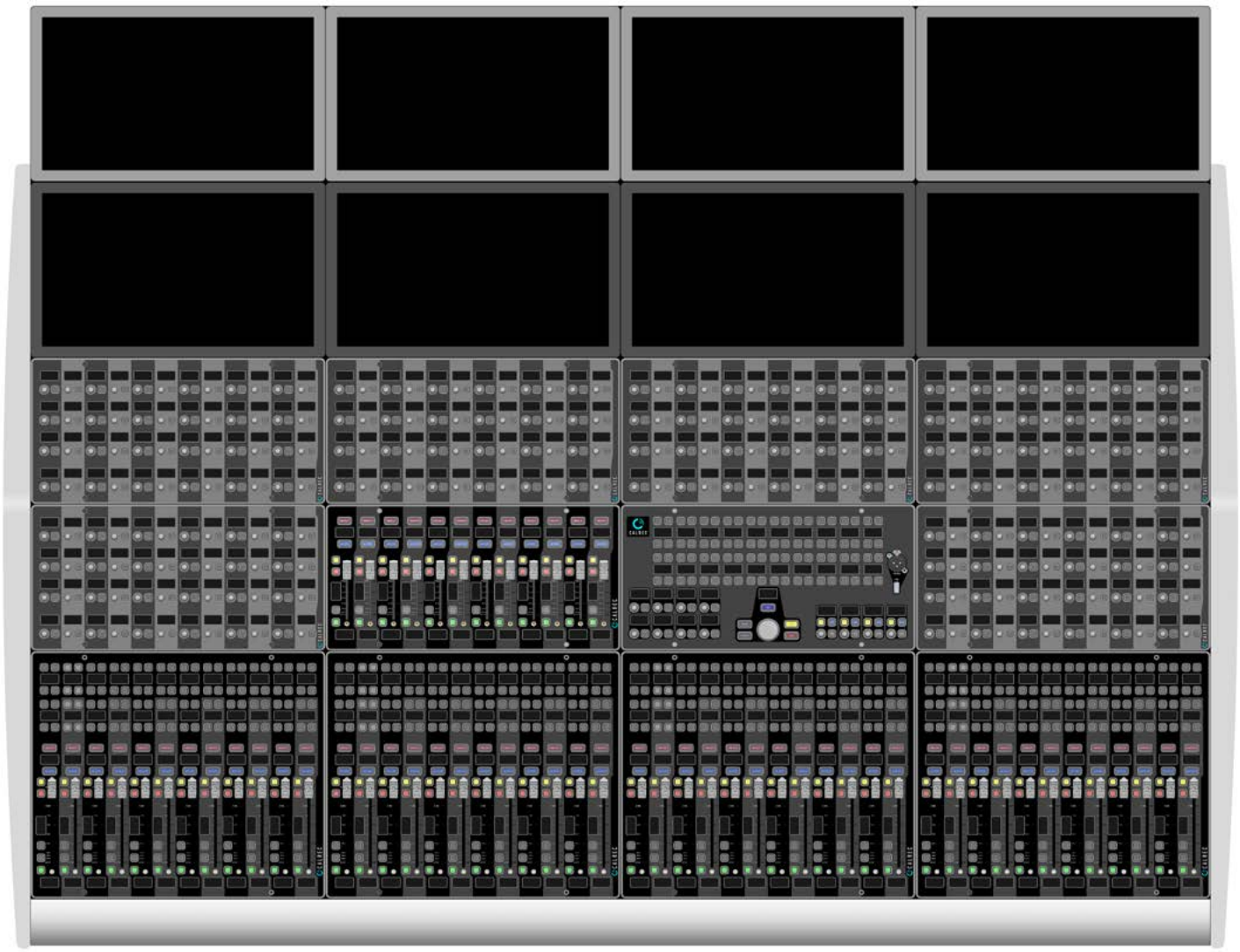
- MU6572 Touch display TFT panel. This is a 1920px X 1080px display with a multi-touch TFT screen which is used to show the current operational displays and provide On-Screen touch controls.

The top of each section is fitted with:-

- MD6573 Meter TFT panel. this also has a 1920px X 1080px display and is primarily used to show audio data on meters on the panel.

The Argo Q console shown below is a 48 fader wide surface with 4 standard fader panels, 6 wild assign panels, a short throw fader panel and a monitor panel.

FIG 1 - 48 FADER ARGO Q SURFACE WITH 2 ROWS OF ADDITIONAL PANELS



SURFACE DIMENSIONS AND ASSEMBLY

The Argo S and Argo Q control surfaces can be customised in terms of width and fader count, and can be provided with a number of stand and trim options.

Desk-top mounting
The control surface can be supplied with no floor stand, or if supplied, the floor stand can be removed to allow for desk-top mounting, as shown in Fig 1 for Argo S & Fig 3 for Argo Q on the next page.

Floor stand options - Feet
The floor stands have been designed to cater for various height options.

The standard 'Studio' floor stand type, as shown in Fig 2 for Argo S & Fig 4 for Argo Q on the next page has adjustable feet for levelling and as shown in Fig 2 the adjustable feet may be placed in two different positions to allow for either a 740mm nominal fader surface height in "**Foot Position 1**" or a 700mm nominal fader surface height in **"Foot Position 2"**.

FIG 1 - NO FLOOR STAND FITTED, END ELEVATION ARGO S

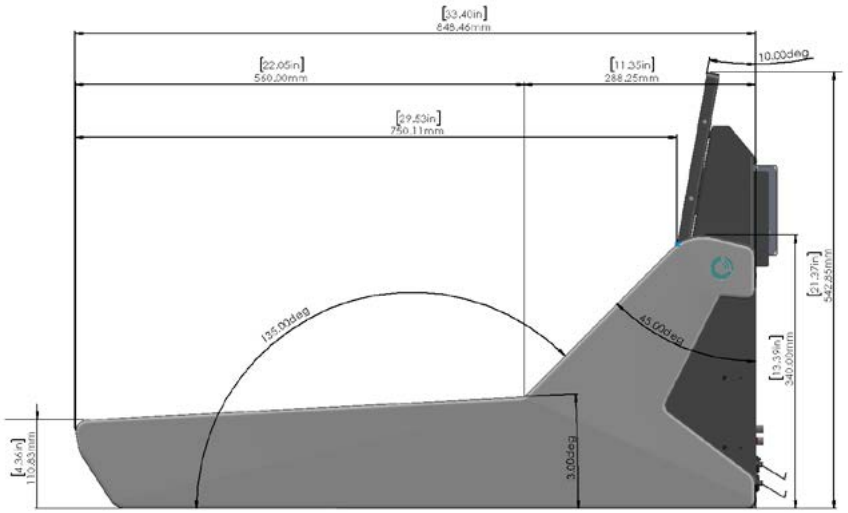


FIG 2 - FLOOR STAND FITTED ADJUSTABLE FEET, END ELEVATION ARGO S

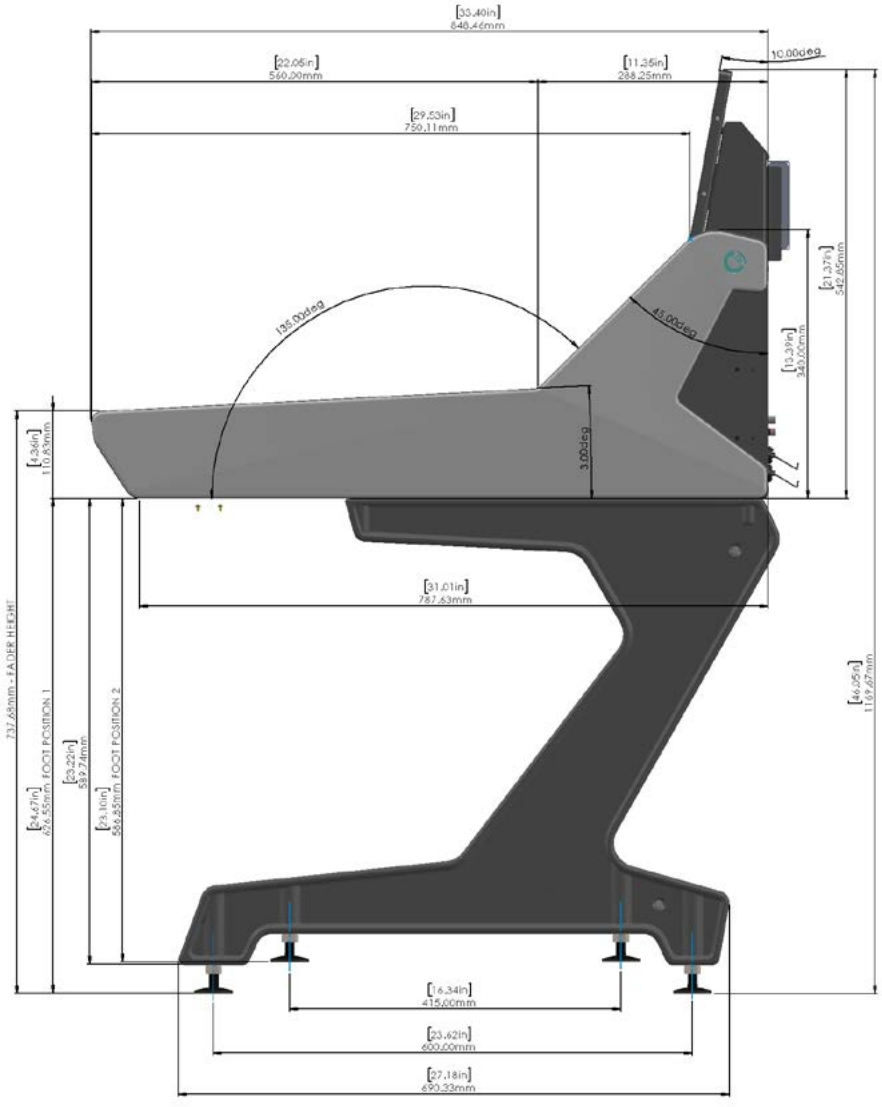


FIG 3 - NO FLOOR STAND FITTED, END ELEVATION ARGO Q

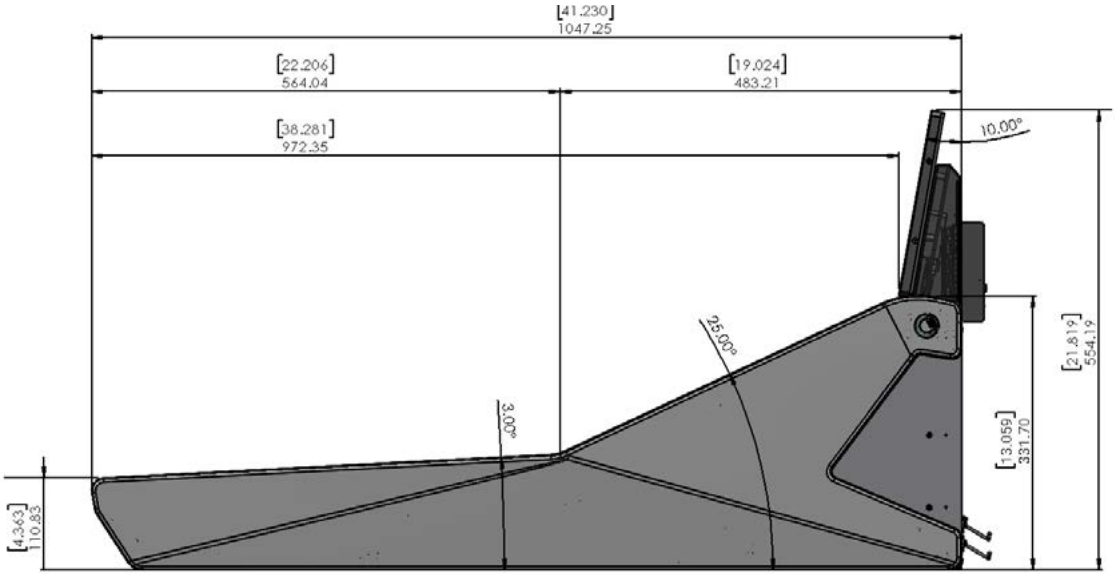
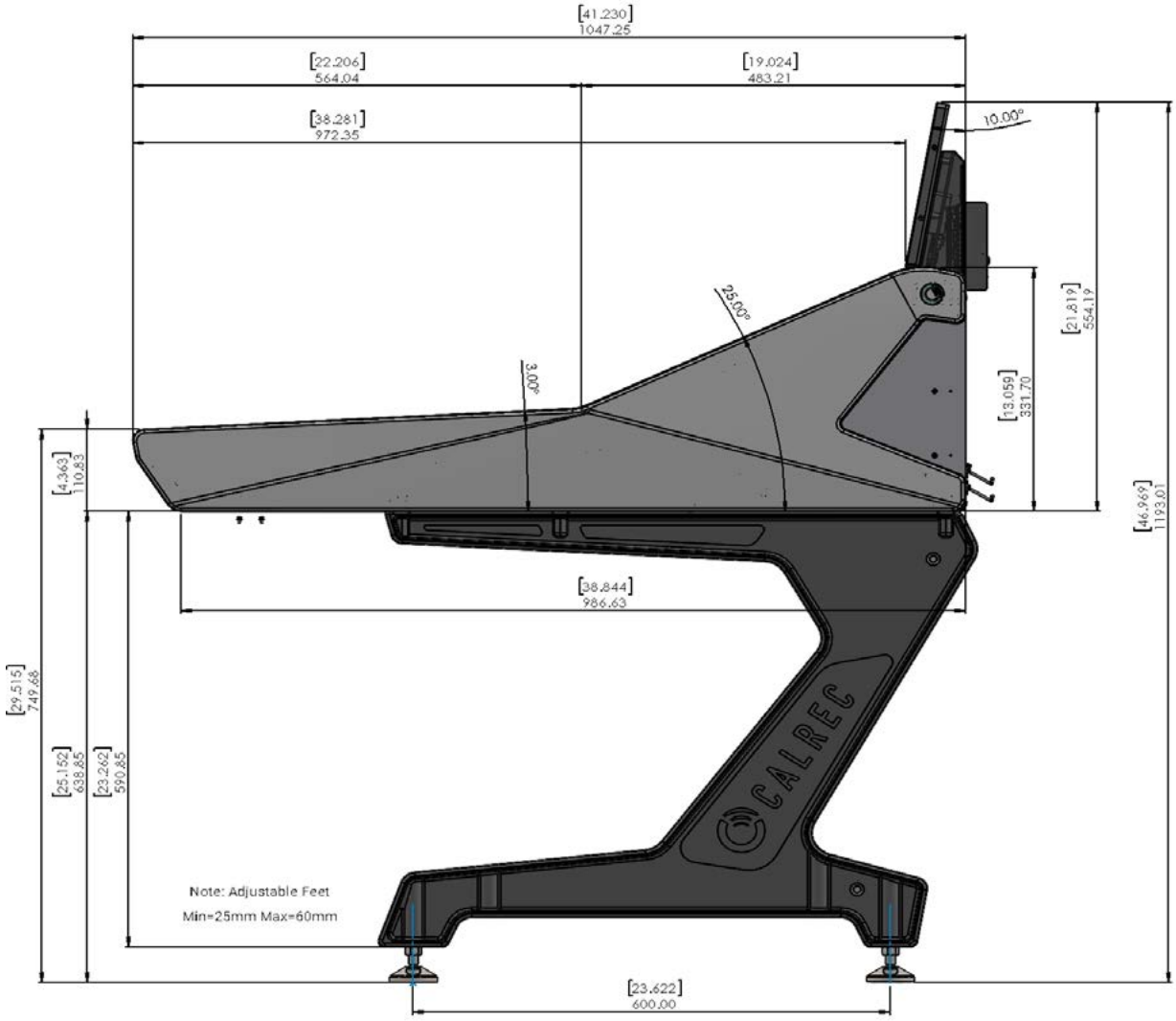


FIG 4 - FLOOR STAND FITTED ADJUSTABLE FEET, END ELEVATION ARGO Q

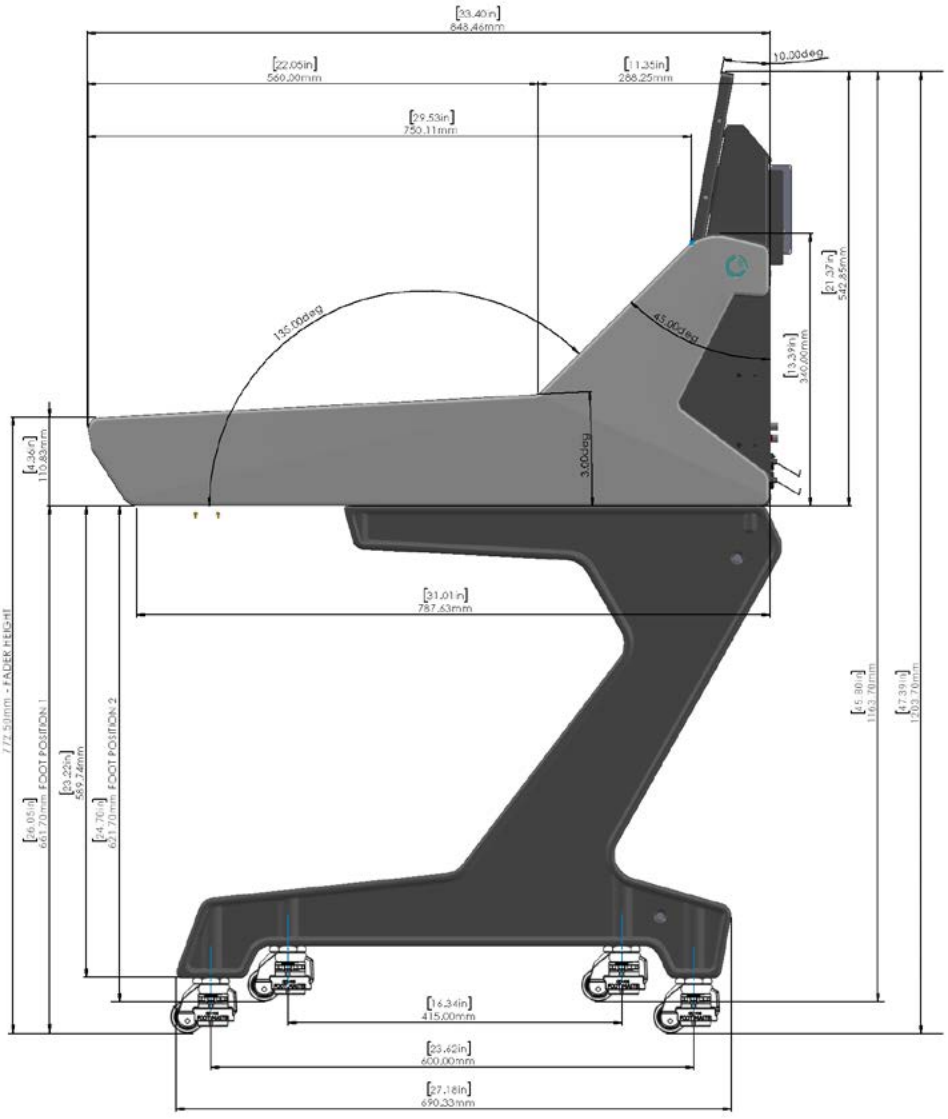


Floor stand options - Castors
The floor stands have been designed to cater for various height options.

The 'Mobile' floor stand type, as shown in Fig 5 for Argo S & Fig 7 for Argo Q on the next page has castors fitted which allow the consoles to be moved to different locations as required. The castors may be placed in two different positions to allow for either a 772mm nominal fader surface height in "**Foot Position 1**" or a 732mm nominal fader surface height in **"Foot Position 2"**.

Note: the castor stands are taller than their studio equivalents, sitting the control surface 32mm [1.26'] higher.

FIG 5 - FLOOR STAND FITTED CASTORS, END ELEVATION ARGO S



Floor stand options - Bolt-Down
To provide the option of securing the control surface to the floor by its stand, as required when fitted in mobile or outside broadcast units, the OB style stand shown replaces the adjustable feet with bolt down feet as shown in Fig 6 below right. The 'OB' version allows for the stand to be bolted to the floor, typically for use in mobile or outside broadcast units.

Note: the 4 bolt down feet are designed to be secured to the floor with 2 x 7mm set screws or bolts per foot on a 38mm pitch.

FIG 6 - BOLT DOWN OPTION FOR OB

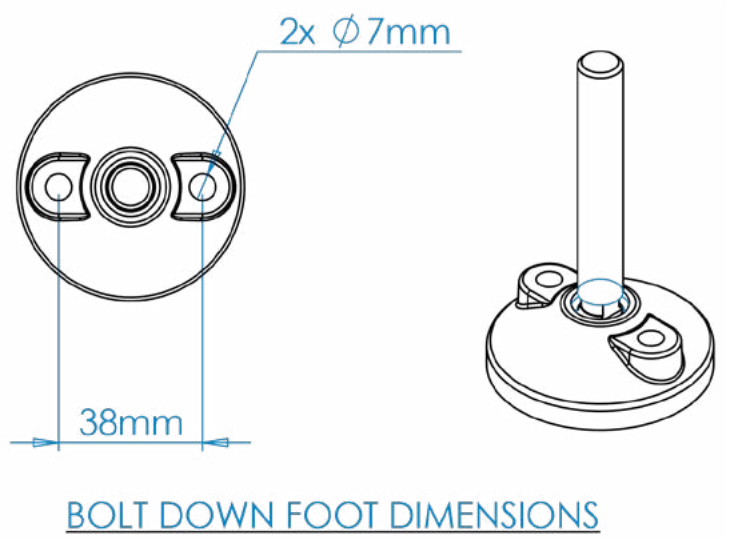
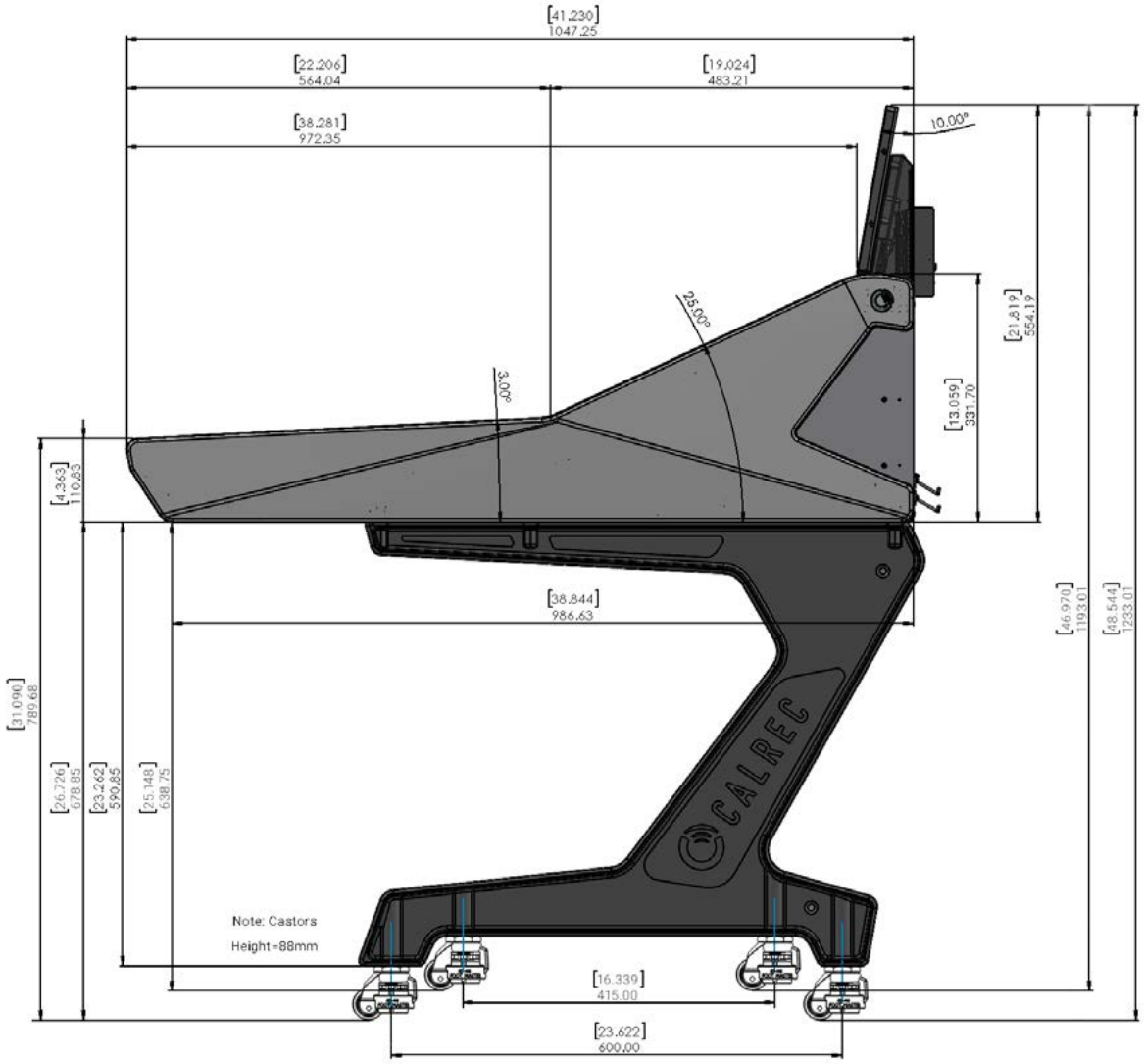


FIG 7 - FLOOR STAND FITTED CASTORS, END ELEVATION ARGO Q



Floor Stand Removal
If the control surface is supplied with a floor stand, it can be removed if required to reduce the size & weight when desktop mounting is preferred.

The floor stand is attached to the control surface by eight x M6 bolts from inside the console chassis as highlighted in **CYAN** in Fig 8 above right.

In order to remove the stand, access is required to the inside of the chassis which involves removing the left and right set of Standard Fader and the Wild assign panels above them to access the front set of bolts and removing the rear cover plates of the 2 end sections to access the rear set of bolts.

With the fixing bolts removed, the console surface can be lifted of the stand by a minimum of 2 people and care needs to be taken whilst the surface is not fixed to the stand.

Note: it is NOT recommended to do work under the control surface unless it is securely fixed in place.

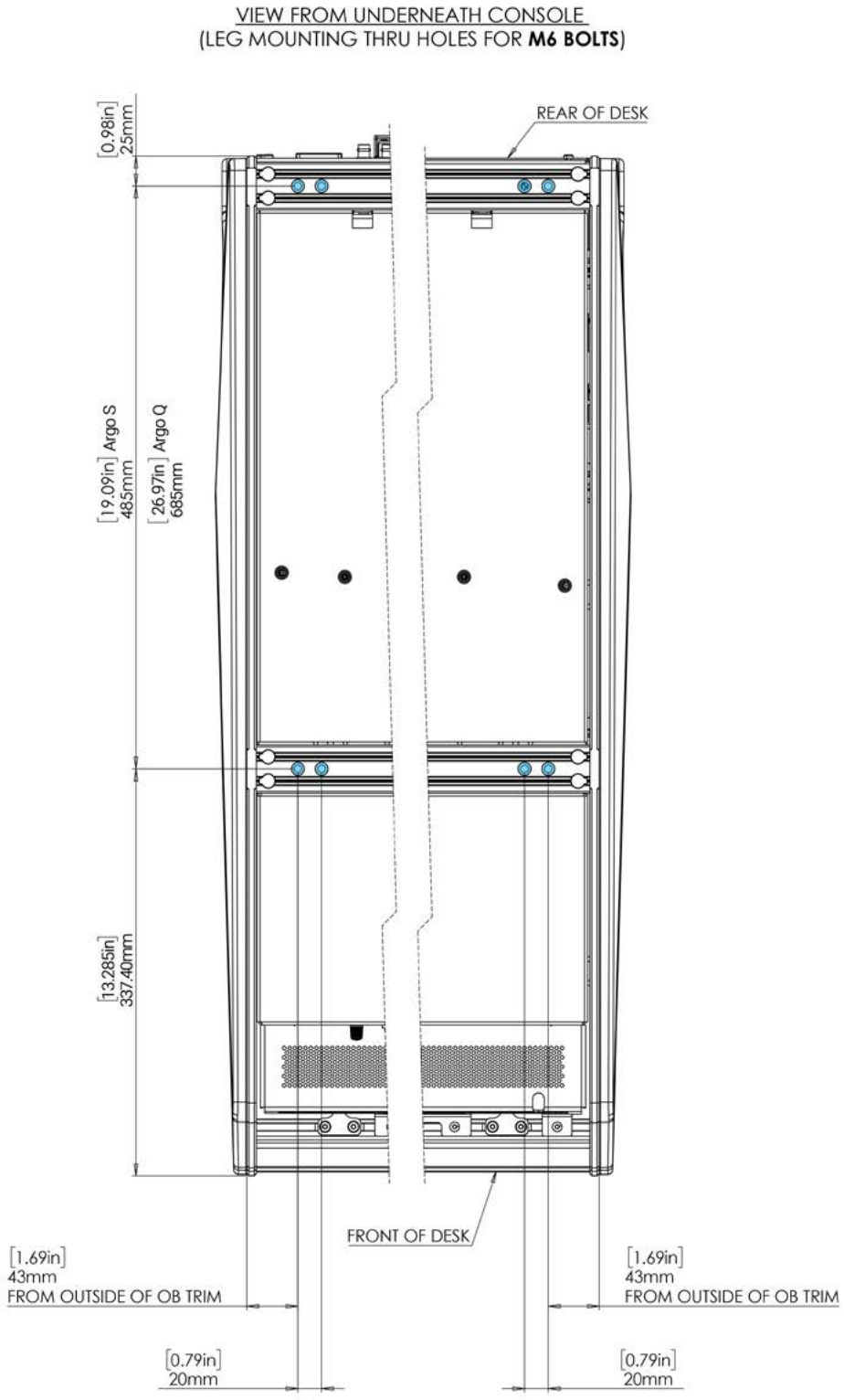
Floor Stand Refitting
When re-attaching the stand after placing the surface carefully on top of the stand by a minimum of 2 people, take care to align the fixing holes to avoid cross-threading the bolts.

The surface MUST be correctly fastened to the stand to prevent possible equipment damage or personal injury.

Note: the Argo S and Q floor stands are constructed as a rigid framework consisting of 2 legs with an upper and a lower cross member which are securely bolted through the legs using M8 countersunk bolts as highlighted in **CYAN** in Fig 9 on the next page.

There should be no need to take the floor stand apart but if it is, then it MUST be put back together securely before fitting a surface on to it.

FIG 8 - STAND MOUNTING POINTS FOR ARGO S & ARGO Q



Surface sizes
Argo S & Argo Q surface sizes, are stated in the number of standard faders they can contain. A number of sections are fitted together to provide a control surface of a suitable width to contain the number of faders required, or to fit the physical space available.

Often consoles' are ordered to be larger than is required at the time to allow for a future increase in the quantity of faders.

Consoles come in a variety of widths and are defined by the number of 12 fader wide control panels that they can contain across their width.

Up to 8 x 12 fader wide sections can be fitted into a chassis.

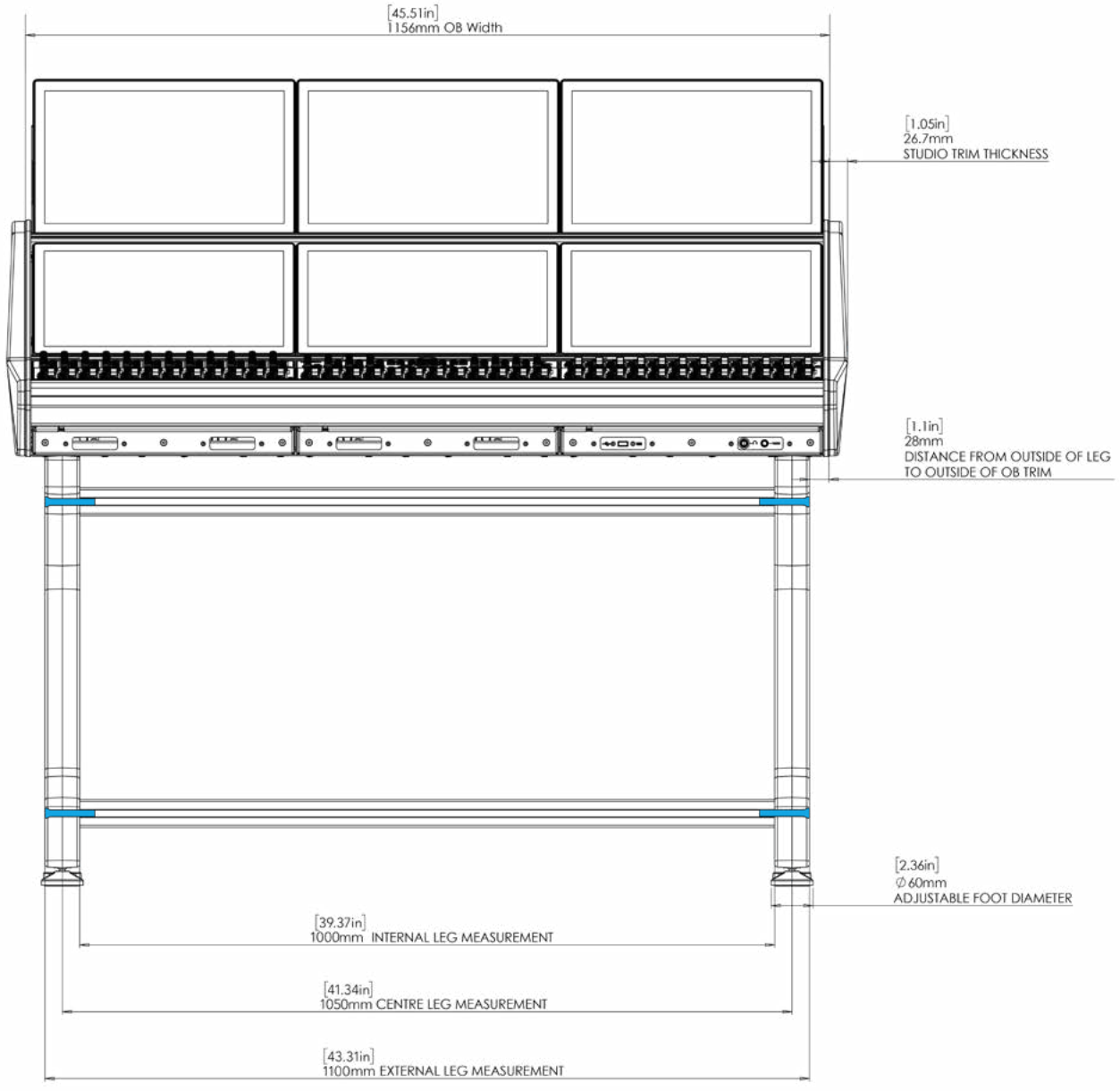
A standard Argo S or Argo Q layout, consists of a number of standard fader panels across the bottom, 1 row(Argo S) or 2 rows (Argo Q) of the various Wild Assign panels/Short fader panels or Monitor panels across the middle, a row of TFT touch panels above these and a row of TFT Meter display panels across the top.

The IU6576 standard fader panel is 378.5mm [14.90'] wide and is fitted with twelve faders across its width, see **"Argo S Surface" on page 10** & **"Argo Q Surface" on page 11** for example layouts.

Leg Measurements
Fig 9 & Fig 10 shows the Internal and External Legs and the Surface measurements for the distances between the support legs for the total width of each console size from 2 to 8 sections wide.

The example shown below in Fig 9 is a 3 section Argo S console on its stand.

FIG 9 - LEG MEASUREMENTS - FRONT ELEVATION FOR ARGO S & ARGO Q



Surface widths

Fig 10 shows the total surface widths and surface measurements for the width of each console size from 1 to 8 sections wide with either thin trim at 16mm width (8mm x 2) or standard trim which adds an extra 54mm width (27mm x 2) i.e. a total trim width of 70mm to be added on.

A gap is allowed between panels for ease of fitting, as an example a three section thin trim console width is made up from:- 8mm left trim + 1mm gap + 378.8mm fader panel + 1mm gap + 378.8mm fader panel +1mm gap + 378.8mm fader panel +1mm gap +8mm right trim=1156.4mm total width.

For a standard trim console width this would be an extra 53.4mm=1209.8mm.

FIG 10- SURFACE WIDTH MEASUREMENTS USING STANDARD 12 FADER SECTIONS

Fader Count Max	Number of 380mm sections	Total Width * Standard trim 54+16=70mm	Total width ** Thin trim (16mm)	Internal Leg Measurement	External Leg Measurement
12	1	450mm [17.72"]	396mm [15.59"]	No Stand	No Stand
24	2	830mm [32.68"]	776mm [30.55"]	620mm [24.41"]	720mm [29.13"]
36	3	1210mm [47.64"]	1156mm [45.51"]	1000mm [39.37"]	1100mm [43.31"]
48	4	1590mm [62.60"]	1536mm [60.47"]	1380mm [54.33"]	1480mm [58.27"]
60	5	1970mm [77.56"]	1916mm [75.43"]	1760mm [69.29"]	1860mm [73.23"]
72	6	2350mm [92.52"]	2296mm [90.39"]	2140mm [84.25"]	2240mm [88.19"]
84	7	2730mm [107.48"]	2676mm [105.35"]	2520mm [99.21"]	2620mm [103.15"]
96	8	3110mm [122.44"]	3056mm [120.32"]	2900mm [114.17"]	3000mm [118.11"]

Typical surface measurements

* Measurements for typical Surface widths and Internal/External Leg measurements are rounded to the nearest mm and shown in Fig 10 above. This allows a simpler calculation as follows:- 380mm per section, 16mm thin trim 8mm+8mm pair, 54mm studio trim 27mm+27mm pair, Legs are 50mm wide & are set in 28mm from the thin trim outer edge so external leg measurements are 56mm less than the **Total width thin trim column values and internal leg measurements are 100mm less than external leg measurements.

Access to surface connections

The primary and secondary data connections from the Argo S or the Argo Q control surface to the Impulse processing core are usually made via the two Ethernet surface switches on the rear of the console see **"Surface To Core Connections" on page 34.**

Two fibres or Cat5e cables depending on the installation, need to be routed through the Cisco Surface Switches to the primary and secondary Impulse Control module, for redundancy. The rear interface panel also provides power connections on two IEC's. see Fig 11 and also **"Fig 3 - UN6539 Section Processor Located In Rear of a console section" on page 20.**

Local audio and connections can also be provided for interfacing audio equipment speakers, microphones, headphones etc to a variety of Argo AoIP devices.

The format of the rear interface panels will vary depending on the optional hardware fitted within the surface as shown in the Connector Information section of this document.

FIG 11 - REAR INTERFACE PANELS FOR DATA AND AUDIO CONNECTIONS

Argo Rear section 1 view showing Section Processor, 10 port Ethernet Switch and 2x IEC AC Mains inlets

Argo Rear section 2 view showing Section Processor, and Combo I/O AoIP Audio Interface

Argo Rear section 3 view showing Section Processor and 10 port Ethernet Switch

Access to internal surface components

Removing the various control surface panels gives open access to the internal components:-

For the AC power connections there is a pair of redundant IEC mains connectors on the rear of a section as shown above which supplies power for up to 4 sections, powering the dual redundant DC PSU arrangement see **"Surface Power - AC In" on page 22.**

For the DC power connections between the PSU's and the section processor, the DC power connections to the various control panels and TFT touch/meter displays see **"Surface Power - DC Out" on page 23.**

For the data connections between the section processor and their control panels and TFT touch and meter displays see **"Surface Control & Display Connections" on page 24**

SURFACE COMPONENTS

There are a range of components within the surface. This section explains how these components are connected, receive power and communicate with each another.

UN6539 Section Processor
The Section Processor as shown on fig 1 (front) and Fig 2 (rear) on the next page, connects to all the surface section elements fitted in the specified console. The section processor unit is designed to be housed in a ventilated enclosure under the upper surface at the rear of the console as shown in Fig 3 on the next page and has the following features:-

Gigabit Ethernet Ports:
- Rear facing (external), see Fig 2.
- 2 x GBE stacked ports on RJ45 for connectivity to Core Processing unit (e.g. Impulse core)
- Will connect to Ethernet switches housed in the rear of the console or at remote location.
- Redundancy is provided by two Ethernet ports
- Identical function and performance is provided on both ports
- Section Processor may connect to the Impulse Cores via either port
- LEDs for connectivity and activity status are supported for each GBE port.

Video Input/Output Interfaces:
- Rear facing (external), see Fig 2.
- Provides two transport and protocol agnostic video I/O interfaces.
- 2 x SFP+ compatible cages are provided; horizontally side by side.
- MSA compliant and SFP+ modules are supported.
- An MSA compliant port supports Transceiver, Single Transmitter or Single Receiver SFP with SDI host interface.
- These ports support 10 Gigabit SFP+ modules for native video over IP encapsulation / de-encapsulation.
- Video Conversion & Scaling of third party video input at minimum 1080p.
- Video output is available at 1080p.
- Access to control and status MSA pinouts provided to give module flexibility in support of all MSA SFP/SFP+ devices.
- LEDs for status indication via FW/SW.

Display Modules:
- Front facing (internal), see Fig 1.
- The Section Processor provides two Display Port interfaces to display rendered graphics and composited video on both the Meter and Touchscreen Display Modules for:-
- Console GUI.
- Rendered Bar Graphs.
- Input Video.
- 2 x DP Display Port 1.4 interfaces.
- Cable length 2m; possibly more at the data rates used by this system; below maximum of DP standard.
- The Section Processor has 2 x full-size DP latching connectors.
- System uses standard low-cost fully screened DP cable between Section Processor and each Display Module.
- HPD sense and AUX channels are supported as key requirements of the standard.
- Display backlight level and enable control provided as baseband signalling over unused DP pairs.
- Non-compliant mode to be engaged only if EDID matches TFT for Display Module.
- Open-drain signalling to prevent damage to 3rd party equipment if non-compliant mode is inadvertently enabled.
- Display Port Dual-Mode (DP++)/Dual-Mode Display Port is **not** supported.
- A USB 2.0 connector which is dedicated to the touch digitiser in the Touchscreen Display Module is provided.

Controller Surface Modules:
- Front facing (internal), see Fig 1.
- 3 x USB 3.0 Type A connectors which connect to the Surface Controller fitted in the Control Surface Modules.
- Proprietary use of USB 3.0 interface is implemented for use with the Control Surface Modules only
- 2 x LVDS outputs on each USB 3.0 port for Mini-TFT data to Control Surface Modules are provided.
- LVDS transports clock & video data over SuperSpeed pairs on the USB 3.0 port.
- The USB 2.0 legacy pair in the USB 3.0 connector transports surface control events between panels and host processor.
- Surface reset via Control Surface Module, implemented as base band signal on USB 3.0 cable

User USB Inputs:
- Front facing (internal), see Fig 1.
- 2 x USB 2.0 to front-facing USB Type-A Panel connectors are provided for:-
- Keyboard, mouse or file transfer when connected to USB 2.0 port Type-B connector on Monitor panel.

USB Misc Inputs:
- Rear facing (external), see Fig 2.
- 2 x USB 2.0 connectors to rear-facing USB Type-A connectors are provided for general-purpose USB functions
- Used for Recovery boot, development communications & service access.

Surface USB Switch Output:
- Rear facing (external), see Fig 2.
- Amalgamated Touchscreen and User USB connectivity may also be routed to rear panel USB 2.0 Type B Touch Output port for direct control of an external third-party system.
- This is Intended to be used with video input to provide in-surface control of 3rd party equipment.

Configuration IP Set/HW ID/Switches:
- Rear facing (external), see Fig 2.
- A 10 way binary switch is available with MSB on the left & each switch ON when in the "UP" position. It is used to set an IP address or select features as required.

DC Power distribution:
- Front facing (internal), see Fig 1.
- The Section Processor has a pair of redundant +12V inlets from power supply.
- The Section Processor provides six separate +12V DC power over six 4-way cables to supply:
- Control Surface Modules (x3).
- Display Modules (x2).
- I/O Board or Ethernet switch (x1)
- Provision for independent SW control of power ports is made.
- Power sequencing to spread inrush loading is implemented.

Reset Switch:
- Rear facing (external), see Fig 2.
- The Section Processor provides a momentary action Reset switch for manual reset on the rear panel next to the 2x GB Ethernet ports stack.

FIG 1 - UN6539 SECTION PROCESSOR FRONT VIEW AS SEEN FROM FRONT OF CONSOLE

FIG 2 - UN6539 SECTION PROCESSOR REAR VIEW AS SEEN FROM BACK OF CONSOLE

FIG 3 - UN6539 SECTION PROCESSOR LOCATED IN REAR OF A CONSOLE SECTION

Component Placement
Fig 3. above shows an Argo console section seen from the rear, the components are placed as follows:

2 x ZN6578 Surface PSU modules side by side at the bottom (behind vent panel),
2 x IEC Mains AC Inlets in first section between the ZN6578 PSU modules.
1 x 491-329 Cisco GB Ethernet switch in the middle.
1 x UN6539 Section Processor at the top.
Vent panel above section processor.

Note: the Cisco GBE switch is powered from the Power for I/O connector.

CONFIGURING SECTION PROCESSORS

When an Argo Surface section processor has been initially programmed with its software and firmware, it is given default primary and secondary IP addresses.

In order to put sections together to build a surface the IP addresses and the Config switches on the rear of each console section is changed to unique values for each processor.

Fig 1 above right shows the section processor Config switches and Primary/ Secondary surface links which can be accessed from the rear of the console.

Although the section processors and Config switches will have been set by the production team at the factory, it is useful to know how these are configured.

A computer is connected via the Ethernet port into each section processor in turn and the IP primary / secondary addresses changed from their factory defaults of **172.16.255.197/24** & **172.16.255.198/24** for the first section processor, to **192.168.24.101/24** & **192.168.25.101/24** and for the second section processor to **192.168.24.102/24** & **192.168.25.102/24** etc for the number of section processors.

Fig 2 middle right shows the Configure application being used to configure the virtual adapter for the Argo Surface on the primary Impulse core, which has been set to be in the same subnet as the Section processors in the Surface.

In addition to configuring the section processors IP addresses, the Config switches on each section processor are set to different values, which are used by the surface layout arrangement in the Configure application.

In this example the first section processor is set to 0x1, i.e. (0000000001) and a fader panel added for faders 1-12, the second section processor is set to 0x2 i.e. (0000000010) and a fader panel added for faders 13-24, etc for the required number of section processors to be populated.

FIG 1 - UN6539 SECTION PROCESSOR CONFIGURATION SWITCH & LINKS

FIG 2 - CONFIGURE APP- SETTING THE SURFACE A PRIMARY IP ADDRESS

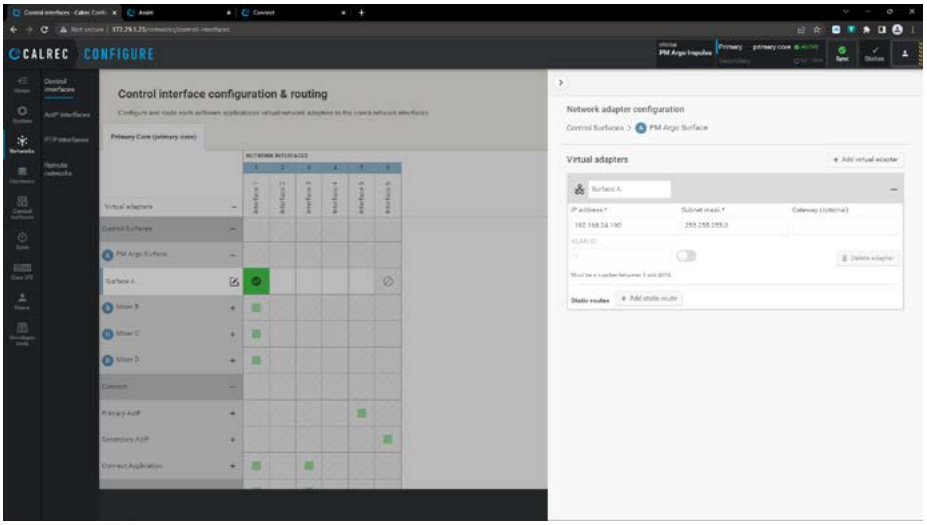


FIG 3 - CONFIGURE APP - EDITING THE SURFACE LAYOUT FOR EACH SECTION

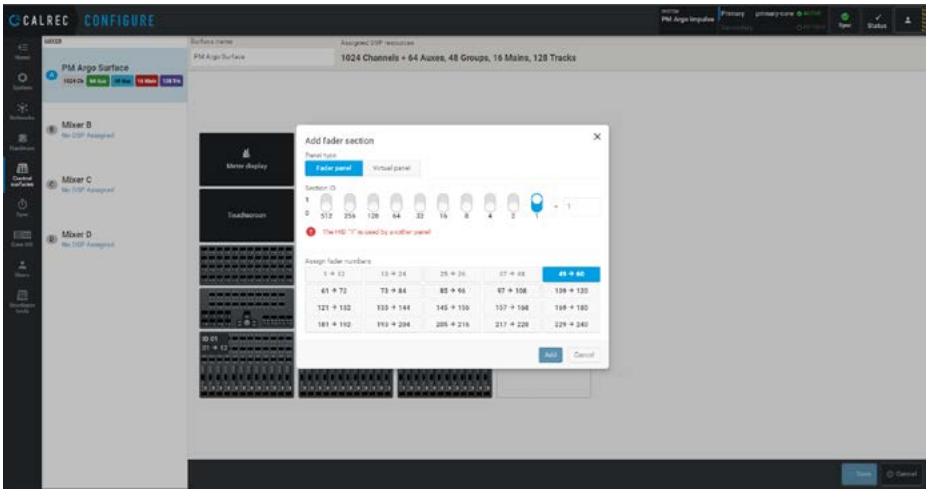


Fig 3 below right shows the console surface layout page in the Configuration Application which uses the Section Processor configuration switches to identify each section column and add the various Fader/Wild/Monitor/Short Fader/Touch TFT and Meter TFT panels associated with it.

Note: in Argo the individual panels themselves do not have unique IP addresses, the panels are accessed via their section processors using its IP Address to process control data and generate TFT and LED displays.

SURFACE POWER – AC IN

Argo S & Argo Q control surfaces have 2 x IEC AC 100–240V AC mains inputs, powering up to 4 sections. Including redundancy PSU's.

The AC power inlets which are placed in the first section and positioned between the two ZN6578 Surface Power Supply Unit modules within the same section as shown in Fig 3 on the previous page.

The AC inlets are wired to connector plugs which are plugged into the Mains sockets of the 2 PSU's within each section which provide AC/DC power redundancy.

Each Power supply has an AC input socket and an AC output socket which allows the AC power to be distributed by "daisy chaining" the PSU's with plug and socket power cables.

Fig 1 below shows 3 sections each of which contains dual power supplies for AC system redundancy with the AC inputs, fed from each of the two mains sources.

The power system is designed to cascade up to 4 x 12 fader sections in a single chassis. This typically would provide up to 48 standard faders.

Note: the frame is designed to support up to 8 sections any consoles with more than 4 sections requires an extra Mains Input section as shown in Fig 3 on the previous page.

Other than the ZN6578 power supplies all the hardware in the control surface is DC powered via the UN6539 Section processor's DC outputs which are distributed on 4 way connectors.

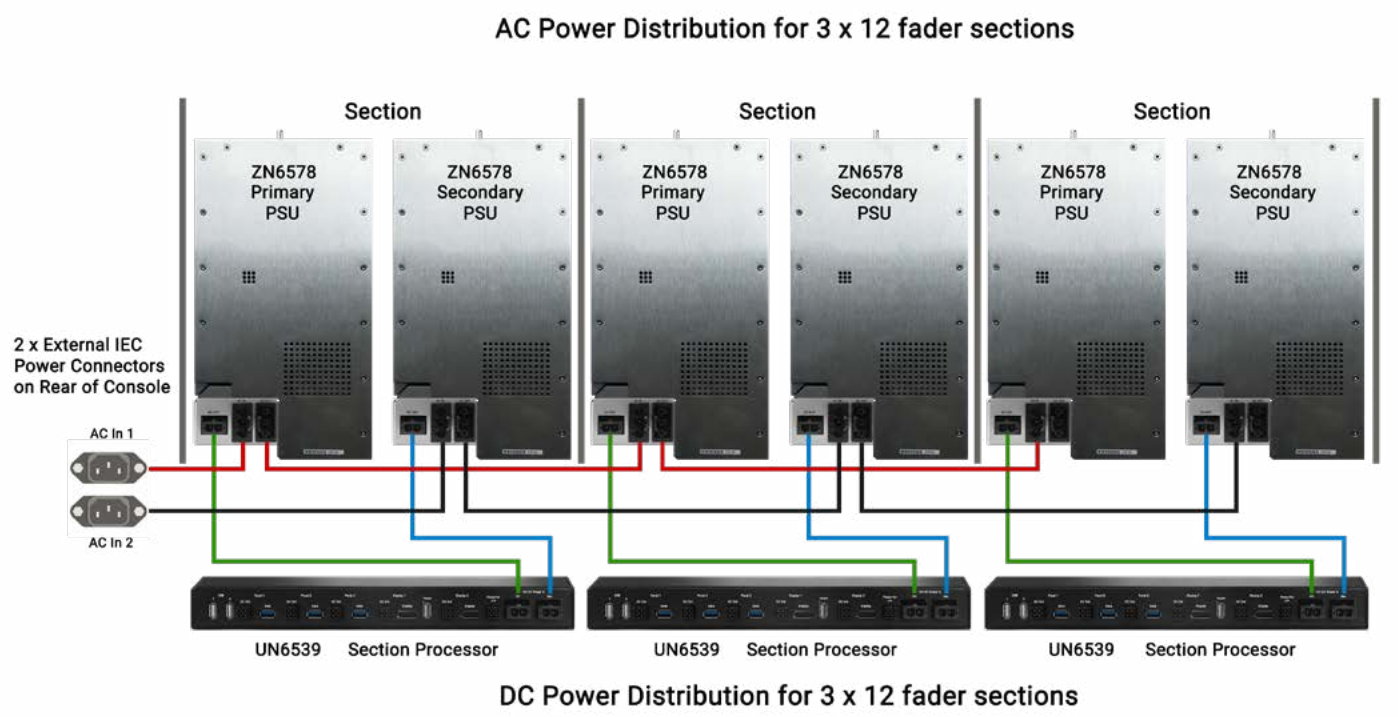
The lower area of Fig 1 shows that the 12V DC outputs from each of the PSU's are connected to the DC Power inputs of the UN6539 section processor which has 2 x DC inputs one fed from each PSU in the section for DC system redundancy.

To ensure all equipment is powered and redundancy is applied where available, both IEC inputs to the control surface need to be fed with 100–240V AC.

If only one of the first two inputs is fed, System Status error messages will be generated indicating they are not receiving power on both inputs.

It is recommended that these two mains inputs are fed from two separate AC supplies where possible to provide redundancy against external power failure.

FIG 1 - SURFACE AC POWER CONNECTIONS & PSU DC OUTPUTS



SURFACE POWER – DC OUT

The UN6539 takes in 12V DC power via the 2 x 2 Pin Molex connectors shown on right of the image in Fig 1 shown right RJ45 connectors. These are fed from the DC Outputs of the ZN6578 Surface PSU modules.

The 2 x 12V DC power input connectors on each section processor are labelled Pri (green) and Sec (blue).

Only one input needs to be connected for the unit to operate however for full redundancy both DC input connectors should be connected.

There are 6 x 4 pin 12v DC output connectors on the unit, these are labelled DC Out and are associated with each of the 3 Panels (orange), 2 TFT Displays (orange) and an I/O power (magenta) connector used to power either an Ethernet switch or one of the AoIP audio interface units fitted in the back of the console. These 6 connectors are highlighted on the image in Fig 1 above.

Fig 2 below right shows the DC power distribution for the panels and displays, a 2 section part of an Argo Q Console which contains an extra row of panels. From bottom to top the panels and displays are fed with 12v DC power from the 4 pin connectors , left to right across the UN6539 section processor.

Panel 1's DC Out powers the IU6576 Standard Fader panel.

Panel 2's DC Out powers either the CA6575 Wild Assign panel, IU6577 Short Fader panel or the MY6574 Monitor panel.

Panel 3's DC Out is only used for Argo Q with the extra row of panels with the same panel options as per Panel 2.

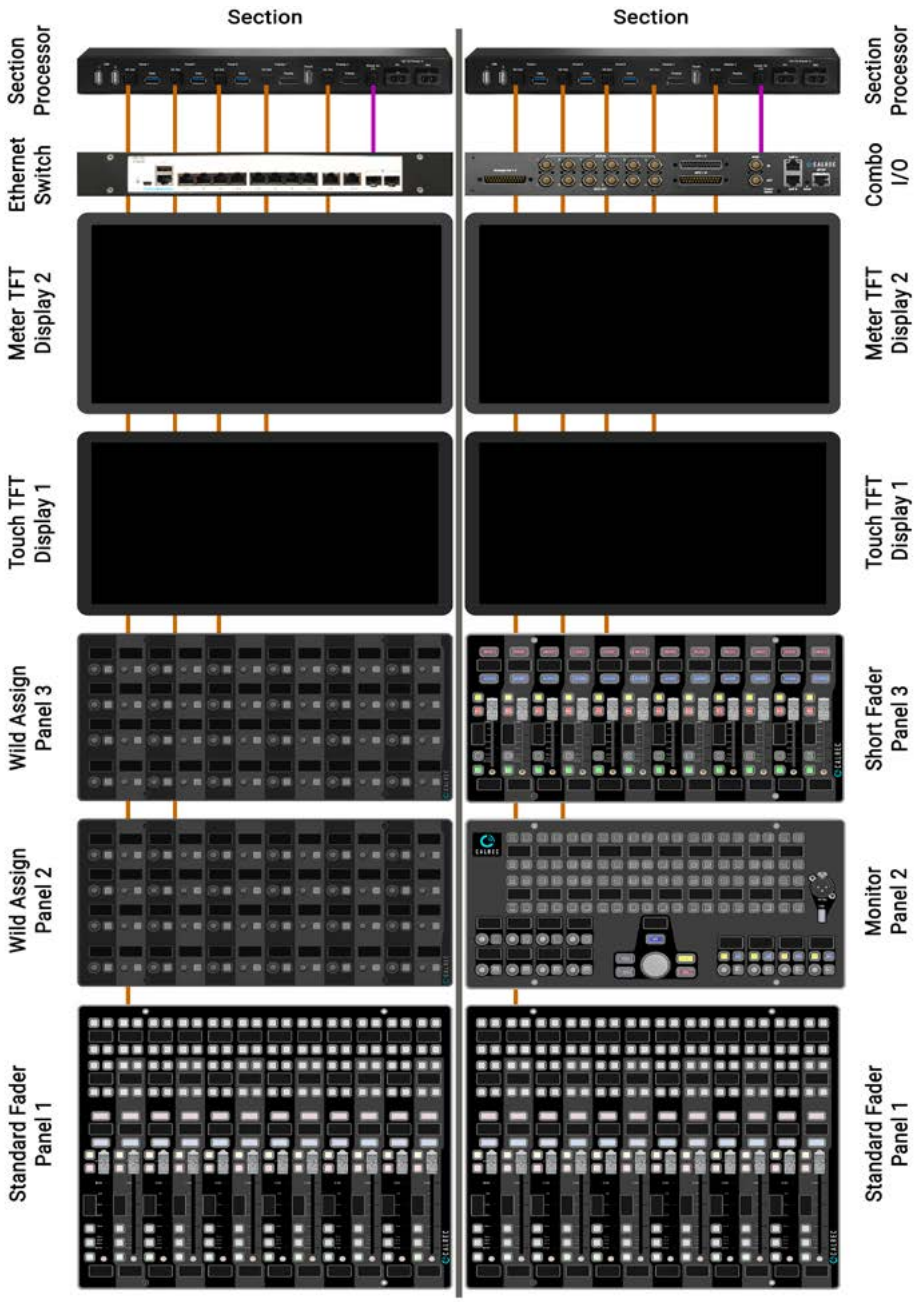
Note: an Argo S does not use this connector.

Display 1's DC Out is used for the MU6572 Touch display TFT panel.

Display 2's DC Out is used for the MD6573 Meter TFT panel.

FIG 1 - DC CONNECTIONS ON UN6539 SECTION PROCESSOR

FIG 2 - DC OUT POWER DISTRIBUTION FOR TWO SECTIONS



Power for I/O DC Out is used to power a 491-329 Cisco Ethernet switch, fitted into the back of a console section. Alternatively this can be used to power one of the AoIP interface modules also designed to fit into the back of a console section such as the JB6549 Combo I/O device. If no switch or Audio interface is required then a blanking panel NN6675 may be fitted in its place.

SURFACE CONTROL & DISPLAY CONNECTIONS

The UN6539 uses a combination of USB 3.0 ports for the Surface Control Panels, Display Ports for the TFT Displays, USB 2.0 ports for Touch control on the TFT's and User USB ports such as the one on the MY6549 Monitor Panel, which also has a RJ45 Studio Hub socket on it to connect the Talkback Microphone to the JB6549 Combo I/O unit.

There are 3 x USB 3.0 Type A (blue) connectors which connect to the Surface Controller PCB's fitted in each of the Control Surface Panels via USB 3.0 Type B connectors, 2 x DP Display Port 1.4 (yellow) interfaces which connect to the Meter TFT and the Touch Display TFT which also has a USB 2.0 Type B connector connected to it on the rear from the "Touch" USB 2.0 type A (white) connector on the Section Processor. The Monitor panel provides a user USB 2.0 connection for memory sticks or keyboard/mouse combinations which can be connected to one of the USB 2.0 type A (white) ports numbered 1 & 2 on the left side of the section processor.

These 6 connectors are highlighted on the image in Fig 1 above right.

Fig 2 below right shows the Control and Display connections for the panels and displays, a 2 section part of an Argo Q Console which contains an extra row of panels. From bottom to top the panels and displays are controlled from the connectors, left to right across the UN6539 section processor.

Panel 1's USB 3.0 port provides controls and displays on the IU6576 Standard Fader panel.

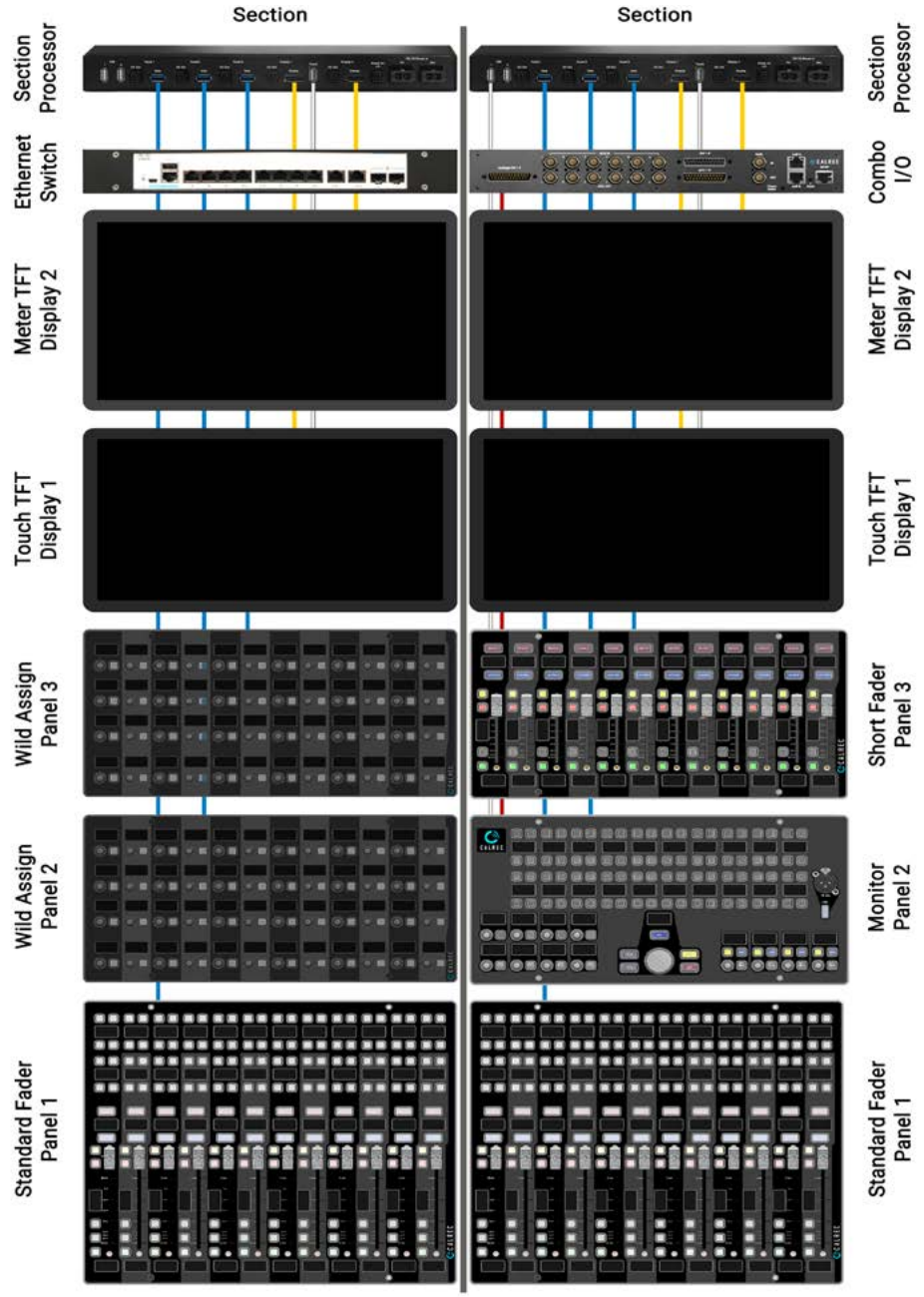
Panel 2's USB 3.0 port provides controls and displays for either the CA6575 Wild Assign panel, IU6577 Short Fader panel or the MY6574 Monitor panel.

Panel 3's USB 3.0 port is only used for Argo Q with the extra row of panels.

Note: an Argo S does not use this connection.

FIG 1 - DATA CONNECTIONS ON UN6539 SECTION PROCESSOR

FIG 2 - USB3, DP & USB2 PANEL CONNECTIONS FOR TWO SECTIONS



Display 1's DP connector is used for the MU6572 Touch display TFT panel, together with it's USB 2.0 touch port

Display 2's DP connector is used for the MD6573 Meter TFT panel.

The MY6574 Monitor panel has a User USB 2.0 type B port connected to USB 1 or 2 on the section processor and also a Studio Hub RJ45 (red) connector for the Talkback Microphone which is connected to the rear of the JB6549 Combo I/O unit.

ARGO
IMPULSE PROCESSING CORE

CALREC

CORE DIMENSIONS AND MOUNTING

Argo uses the Impulse processing core which is a 5U 19' rack mount enclosure designed for installation in standard 19' equipment bays.

Airflow

The core is cooled by fan assisted convection. Air is drawn in from the front into each of the modules except for the PSU's that use a large heat sink.

The DSP module has two 80mm fans mounted on its front panel, the Control Processor Module and each of the four Router modules have two 40mm fans one mounted in the front panel and one in the bottom of the module blowing upwards.

This fan arrangement pulls air through the module frame which then exits through vents across the top and rear of the core.

All fans are speed monitored and System Status error message are generated for any failures. To ensure air can flow through the card frame freely, the air vents at the rear of the core should be left clear and unobstructed. No clearance is required above or below the core for cooling.

Support

The weight at the rear of the core should be adequately supported to prevent stress on the front racking angles. This is particularly important when the units are mounted in mobile installations. Calrec will not accept liability for damage caused by insufficient support.

Connections

All connections, including power are made to the front of the core which is recessed from the racking angles to allow cable clearance within the bay.

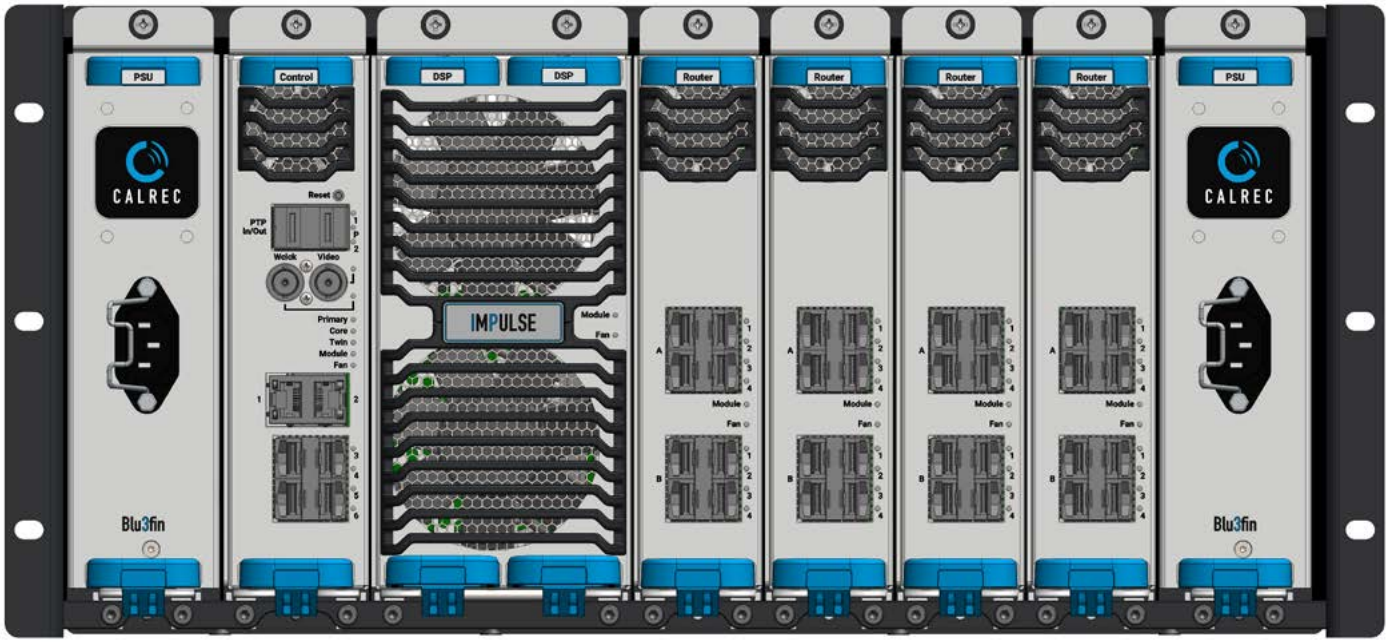
FIG 1 - ED6534 - 3D VIEW

FIG 2 - CORE DIMENSIONS-WEIGHT-HEAT DISSIPATION

ED6534 Core	
Height	5U (223mm)
Depth	500mm
Width	19'
Weight	25kg (max)
Heat Dissipation	368W (max)

MODULE TYPES & LAYOUT

FIG 1 - ED5634 FRONT VIEW - FULLY POPULATED 5U IMPULSE CORE



Slot 1 | Slot 2 | Slot 3 | Slot 4 | Slot 5 | Slot 6 | Slot 7 | Slot 8

External Interconnects
The external interconnects to the Impulse Core are as follows.

• **Mains Power** – The Impulse Core has two Mains PSU modules that plug into and supply DC power to the backplane and all the other core modules. One AC Mains IEC inlet is present on the face of each PSU module below. The Mains input is converted within the module to 12V and 5V DC power rails that are distributed via the backplane. A single PSU module is sufficient to power a fully populated system. The second power supply module is provisioned for redundancy. The PSU modules are plugged in at either end of the Impulse core unit, as shown below in slots 1 & 8.

• **AoIP Ethernet Connections** – Router modules provide up to 8 SFP Ethernet ports for connections to network infrastructure for audio transport. Each router module can be set to operate with 4 x ST-2022-7 pairs for 1Gbps interfaces or 1 pair for 10Gbps interfaces. It is intended that each pair of interfaces connects to two separate networks such that if any critical link in one network fails or an Ethernet packet is dropped, then packets will be received over the redundant network link, which allows uninterrupted or "hit-less" operation under fault conditions.

Up to four Router modules can be plugged into an Impulse Core allowing 4 pairs x 10Gbps redundant AoIP links or 16 pairs x 1Gbps redundant AoIP links or a combination thereof in total. The router modules are fitted between the Impulse DSP module and the right hand PSU module as shown below in slots 4-7.

• **PTP Ethernet Connections** – The Control Processor module provides two dedicated connections for PTP sync. At least one of these needs to be connected to the media network regardless of whether the core is acting as a PTP master or slave. In AoIP systems, the primary means of synchronisation is through Precision Time Protocol (PTP) synchronisation to a master clock source over the audio Ethernet network. A pair of 1Gbps SFP interfaces are provided on the module for redundant connection to two AoIP networks, either of which can be the source for PTP synchronisation.

• **Legacy Sync Connections** – In addition to the pair of Ethernet ports for PTP synchronisation, the control processor sync subsystem provides a pair of BNC inputs for synchronisation to legacy Video and Wordclock sources. When an Impulse core is configured to act as a PTP master, it can free run or it can be made synchronous with one of these legacy sync inputs.

• **Control Processor Ethernet Connections** – The Control Processor modules also provide two RJ45 and four SFP interfaces. This provides Ethernet connectivity to control and management networks. These interfaces can assume different configurations for connectivity to different networks or for dedicated purposes. They provide connectivity to surfaces and also provide redundancy links to other Impulse cores. They may be configured to support third party control and monitoring protocols and will serve Assist, Connect and other Calrec control Web UIs over COTS network infrastructures. The Control Processor module is plugged into the Impulse core between the Impulse DSP module and the left hand PSU module as shown above in slot 2.

System Module Overview
The major system modules of the Impulse Core are as follows:

Control Processor Module
This carries the main host CPU, a powerful Intel processor for coordinating all of the functions of the Impulse system. It provides all processing for the core and console local and network control systems as well as control of the DSP and router modules in the core. The control processor provides fast storage and network interfaces for rapid state changes and low latency control. The control processor module also provides the Impulse Core Sync Subsystem, which uses a dedicated network interface for PTP synchronisation (or BNCs for legacy inputs) to generate a timebase for synchronising audio transfer on the backplane. The control processor module contains 2 small fans:- one on the front and one on the base. The PTP, legacy and ethernet connections are all described in the system interconnects section.

Above the PTP connections in the core control processor module is a recessed reset button on the front panel (see right), which allows a two-level core system reset. A short press and release of the reset button using a pointed object such as a paperclip will trigger the first level, "Short" reset, this acts as a reset of the control processor module only. If the button is held in the depressed position for at least 4 seconds, the second level, "Long" reset is triggered, which provides a system level reset signal is asserted as well. This signal is routed to the backplane connector striped across the core backplane to provide a system level reset. This signal generally resets all Management Controllers and Power Sequencers in the core, thus causing a system-wide power re-sequence and system reset and initialization.

FIG 2 - UN6426 IMPULSE CONTROL PROCESSOR MODULE - FRONT VIEW

The control processor module also controls two fans, the first is mounted on the front of the module and the other is mounted in the base of the module. The 'Fan' LED shows the 'Fan' status, if the Fan LED lights solid green this indicates that the Fans are OK, but if it lights red this indicates a Fan failure. This status LED along with the other status LEDs are shown in the image on the left. The LED status function table on the next page describes the usage and behaviour of these LEDs. Note: this or any other failure within the core is also reported in the UI.

LED Status Table Reference Numbers

<-1 PTP port 1 active status
<-2 PTP sync status
<-3 PTP port 2 active status

<-4 Video Sync Status

<-5 Wordclock Sync Status

<-6 Acting as Primary Core
<-7 Core Status
<-8 Twinned Status
<-9 Module OK
<-10 Fan Ok

Standard RJ45 LEDs Not Controlled
RJ45-1 Active and Connected
RJ45-2 Active and Connected

<-11 SFP port 3 (left) activity

<-12 SFP port 4 (right) activity

<-13 SFP port 5 (left) activity

<-14 SFP port 6 (right) activity

The above numbers are referenced in the LED status table on the next page.

AoIP Router Module

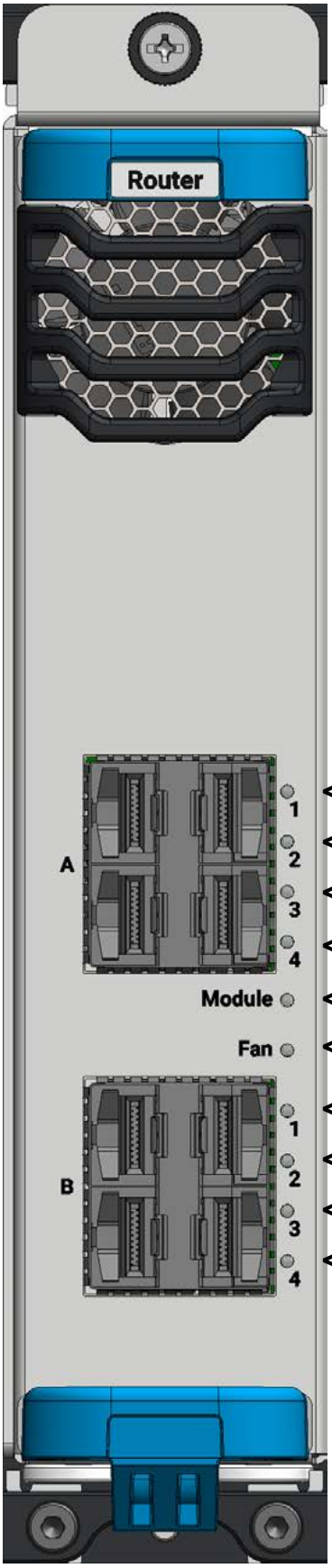
This module can provide up to eight 1Gbps ethernet connections (four redundant pairs) or two 10Gbps ethernet connections (one redundant pair) via SFP modules for networked audio transport with other AoIP endpoints. The router buffers and synchronises the audio data between these ethernet interfaces and the backplane interface for transport to the DSP or another router module.

The router module also controls two fans the first is mounted on the front of the module and the other is mounted in the base of the module. Two LED indicators appear on the front of the module , one to show the 'Module OK' status. If the module LED lights solid green this indicates that the module is OK, but if it lights solid red this indicates that the Module is not OK. The other LED shows the 'Fan' status, if the Fan LED lights solid green this indicates that the Fans are OK, but if it lights red this indicates a Fan failure.

Impulse AoIP capacity - 1Gbps mode:

- Each router card is capable of 2048x2048 audio channels.
- Each router card provides 4 pairs of 2022-7 packet merging media NICs.
- Each NIC can send and receive up to 64 streams in each direction.
- Each stream can be configured to have up to 80 channels (depending on MTU, based on packet time, codec and audio sample rate).
- In 1G mode, the limitation is on the bandwidth of the 4 x 1G NICs.
- General good practise with AoIP says media streams should not exceed around 60% of the link bandwidth.
  - This generally equates to 256 channels per 1G, assuming a baseline config of 32 x 8 channel streams @ 125us packet time/L24 codec/48k audio sample rate.
  - Using higher channel count streams you can get more channels, e.g. 6 x 80 channel streams + 1 x 32 channel streams = 512 channels in 625Mbps per NIC
  - The rough 60% bandwidth utilisation figure can be pushed higher if you have a well-managed and deterministic network.

FIG 3 - RY6427 IMPULSE ROUTER MODULE - FRONT VIEW



Impulse AoIP capacity -10Gbps mode:

(Available in a later version)

- Each router card is capable of 4096x4096 audio channels.
- Only one media NIC pair per router card is active.
- Each 10G NIC support up to 512 streams in each direction.
- Again each stream can be up to 80 channels.
- In this mode of operation you can fully utilise the router with IP streams, e.g. 512 streams of 8 channels = 4096 = 7,270Mbps.

Router LED Status Indicators

<-1 SFP port A1 (left) activity

<-2 SFP port A2 (right) activity

<-3 SFP port A3 (left) activity

<-4 SFP port A4 (right) activity

<-5 Module OK

<-6 Fan Ok

<-7 SFP port B1 (left) activity

<-8 SFP port B2 (right) activity

<-9 SFP port B3 (left) activity

<-10 SFP port B4 (right) activity

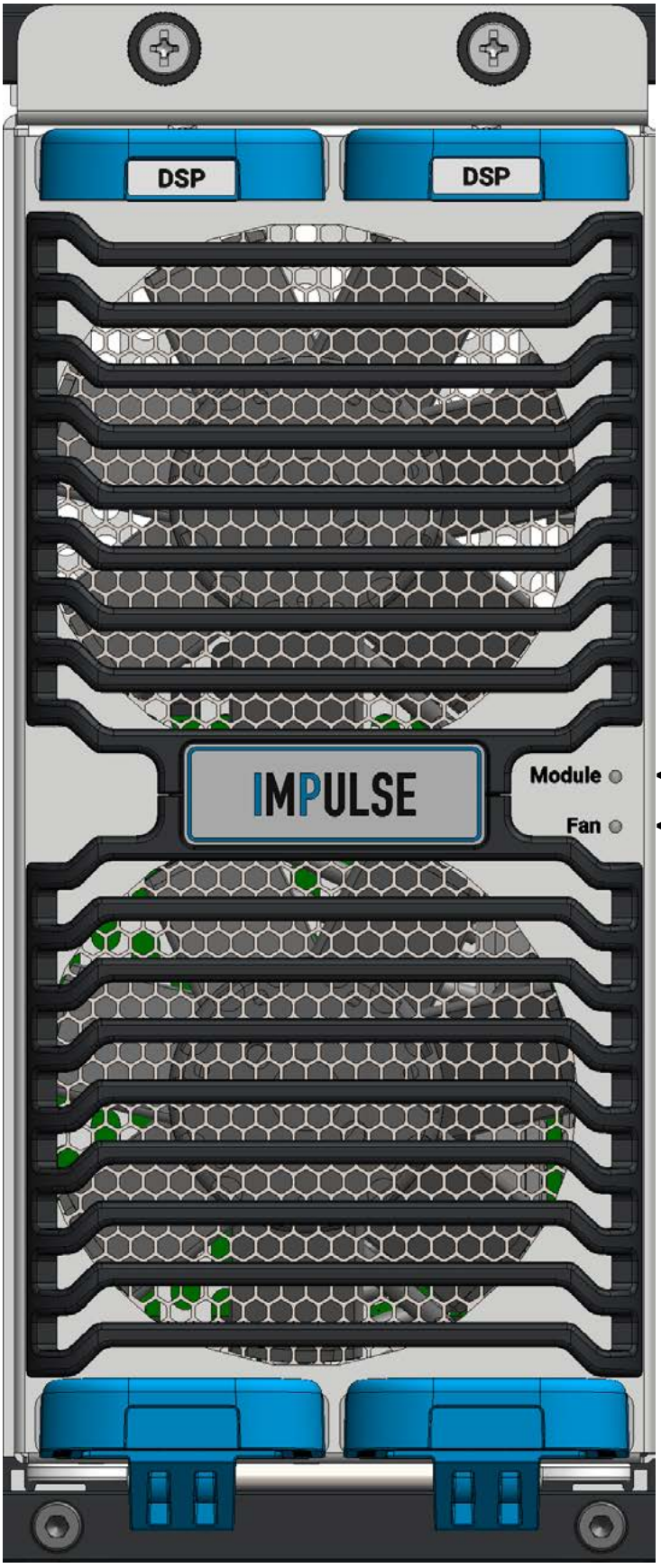
DSP Carrier Module
This module carries up to four DSP mezzanine modules, which provide scalable DSP processing capacity. The carrier also provides high bandwidth interconnect between the mezzanine modules as well as lower level management and power distribution.

The module also controls the 2 large fans mounted on the front of the module. Two LED indicators appear on the front of the module , one to show the 'Module OK' status. If the module LED lights solid green this indicates that the module is OK, but if it lights solid red this indicates that the module is not OK.

The other LED shows the 'Fan' status, if the Fan LED lights solid green this indicates that the Fans are OK, but if it lights red this indicates a Fan failure.

• Mezzanine DSP – The mezzanine DSP module provides a hugely scalable DSP processing resource.

FIG 4 - UD6415 IMPULSE DSP MODULE - FRONT VIEW



DSP LED Status Indicators
<-1 Module OK
<-2 Fan Ok

PSU Module

The PSU module carries a 600W mains power converter and a small PSU module for producing a management sub-rail, control and status interfacing and backplane connectivity.

It is powered via an IEC Mains connector on the front of the module and operates and the Calrec Logo above it illuminates to show that the module has detected no faults and is providing the correct DC power rails required for operation.

Note the ZN6430 does not contain fans it uses the modules heatsink.

• Backplane – The Backplane module (not shown) provides interconnectivity between the above listed modules. In particular, it provides high current power distribution, management and fan power distribution from up to two PSU modules. It provides low level, USB, 1Gbps ethernet and PCIe control connectivity and also high bandwidth audio transport connectivity between the DSP Carrier or router modules.

FIG 5 - ZN6430 IMPULSE PSU MODULE - FRONT VIEW

PSU LED Status Indicator

<-1 Module OK (Logo Illuminates)

ARGO
CONNECTION INFORMATION

CALREC

SURFACE TO CORE CONNECTIONS

Surface Ethernet Switches
The surface Ethernet switches are the interfaces between the control surface via the section processors and the Impulse processing cores. To provide redundancy, two surface Ethernet switches are fitted, primary and secondary.

The system will always attempt to boot and run on the primary, however if there is a problem with the primary or its connections, the secondary will automatically take over.

Like the section processors, the primary and secondary surface Ethernet switches are housed in a ventilated enclosure under the upper surface at the rear of the console in any two of the console sections.

In Fig 1 below they are shown in section 1 and section 3, when viewed from the rear, the primary surface Ethernet switch is usually placed in the left hand section.

The communication with all the control panels and displays is via each section processor. Each section processor is connected to the primary and secondary surface Ethernet switches using the primary and secondary GB Ethernet ports on each section processor.

The primary surface Ethernet switch typically has 10 ports and each of the sections connect to a port. In the example below ports 1-3 are connected leaving ports 4-8 available for connections to sections 4-8 depending on the size of the surface.

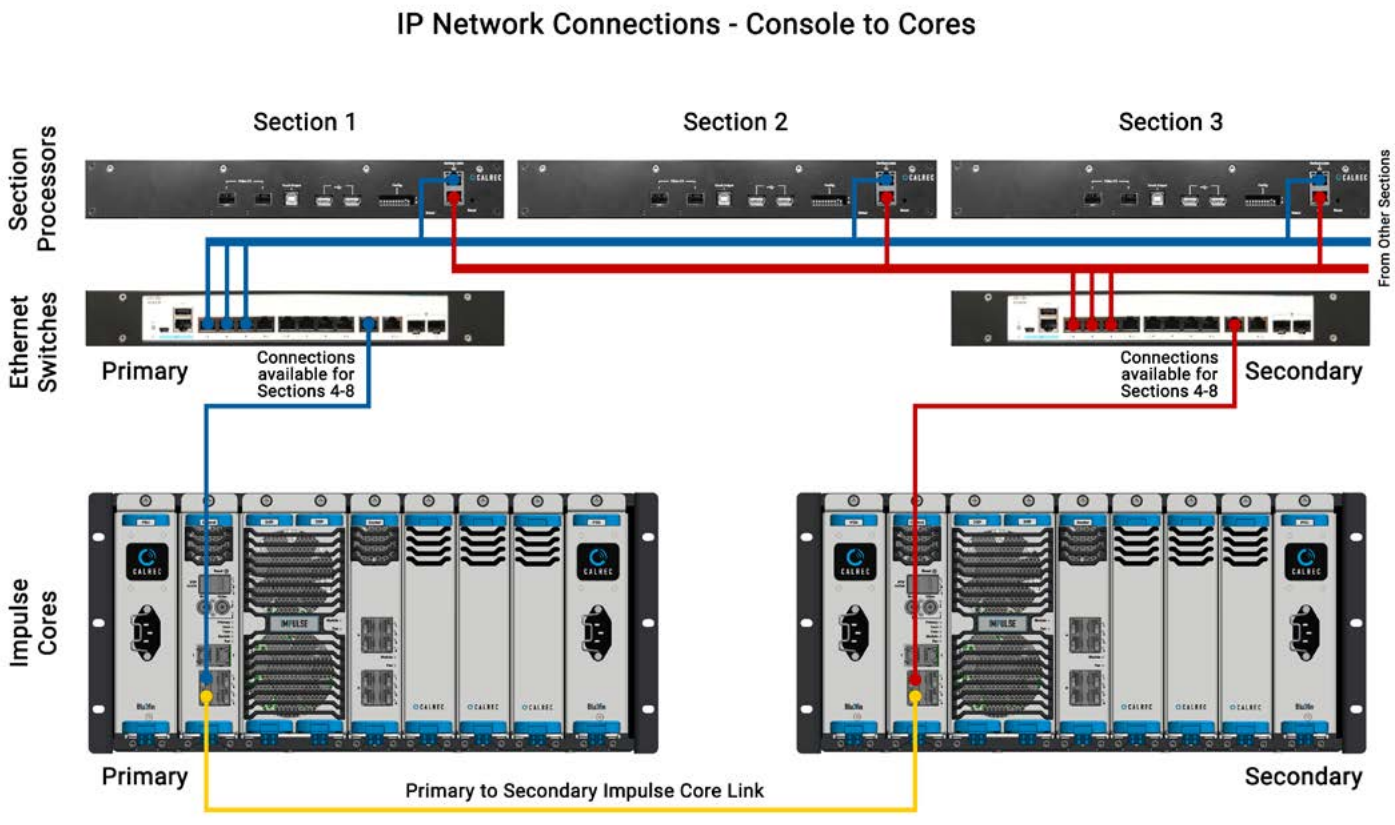
Port 9 is used as the IP link from the primary surface Ethernet switch to the primary Impulse core on SFP Port 3 of the control processor module.
See the blue connections in Fig 1.

This is repeated using the section processor's secondary ports to the secondary surface Ethernet switch and on to the secondary Impulse Core on SFP Port 3 of the control processor module.
See the red connections in Fig 1.

Note: the 2 Impulse cores are directly connected between both control processor modules on SFP port 5's, for IP network redundancy.
See the yellow connection in Fig 1.

Note: if there is a requirement to add other console sections to this surface in the form of a Sidecar where say a separate console on wheels is brought into the studio, then the connections from the Ethernet switches in the sidecar or if no switches the connections directly from the section processors can be added to the Primary and Secondary Ethernet switches rather than routing the cables back to the Impulse cores separately. The sidecar may not even be in the same room as due to the nature of the IP Network the physical location of the surfaces are not a factor.

FIG 1 - SURFACE SECTION CONNECTIONS TO IMPULSE CORES VIA BUILT IN ETHERNET SWITCHES



Control Port Connectivity

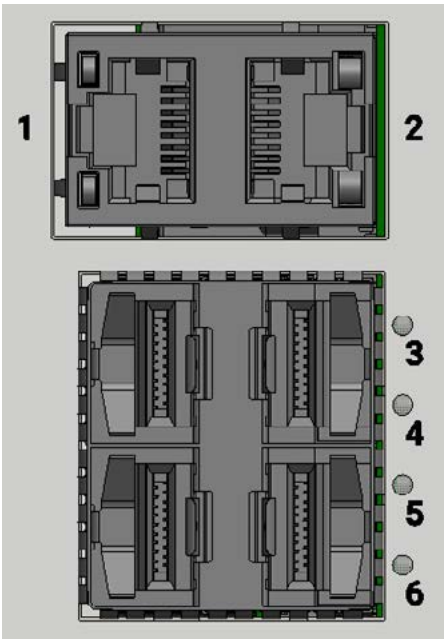
- "Misc control data" includes:- CSCP/SW-P-08/EMBER - 3rd party control such as Mosart.
- Misc control data can also include client PC Access to Calrec UI such as Configure, Connect and Assist apps.
- All misc control data can be aggregated (and/or extended) by connecting to IP switches, or it can instead be spread across the available connections on the Impulse controller modules if diversity is required.
- The connect server connections are made to the IP network for stream control. Note: these can also be aggregated over the same ports on the Impulse core (but would need routing to the media networks).
- The link between the primary and backup impulse cores can also be aggregated (and consolidated over the same misc control connections) if required.
- The Routing of data through the six connections on the front of the control processor module of the impulse core provides very flexible interfacing.

* Note: the configuration of ports on the control processors is managed using the Configure application.

See the **Impulse Configure Application Guide (926-290).pdf** for details.

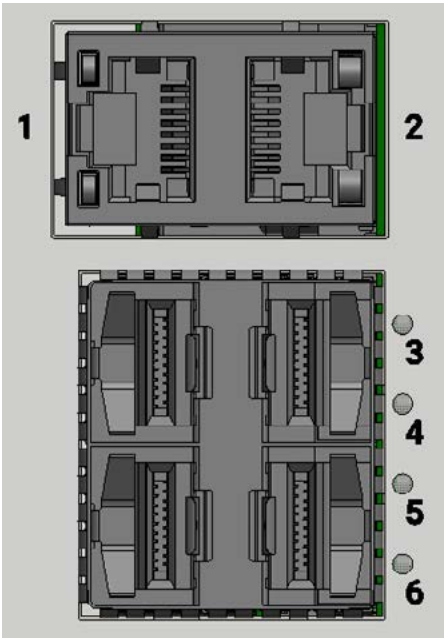
FIG 2 - OTHER IMPULSE CORE CONNECTIVITY

Primary Impulse Core Control Processor module (default example)



Port 1	**RJ45**	**Misc Control Data**
Port2	**RJ45**	**Connect Server**
Port 3	**SFP**	**Surface #1 Primary Link**
Port 4	**SFP**	**Surface #2 Primary Link**
Port 5	**SFP**	**To Secondary Impulse Core**
Port 6	**SFP**	**Available for Other Connections**

Secondary Impulse Core Control Processor module (default example)



Port 1	**RJ45**	**Misc Control Data**
Port2	**RJ45**	**Connect Server**
Port 3	**SFP**	**Surface #1 Secondary Link**
Port 4	**SFP**	**Surface #2 Secondary Link**
Port 5	**SFP**	**To Primary Impulse Core**
Port 6	**SFP**	**Available for Other Connections**

AUDIO I/O CONNECTIONS

All audio inputs and outputs to/from the console signal processing engine are AoIP/AES67 based.

Audio Formats

AoIP I/O devices come in a variety of formats and connector types including MADI & SDI embedders/de-embedders as well as standard AES digital and analogue Mic & Line formats with a variety of connector types. Please refer to the '**AoIP I/O manual (926-293)**' for full details on compatible AoIP I/O.

Power

All AoIP I/O devices are fitted with dual power supplies & IEC mains input connectors operating from 100-240VAC. Both power inputs should preferably be fed from two separate AC sources to provide full redundancy. IEC 'Y' cords are supplied to allow both inputs to be fed from a single cable source in the event that this is all that is available, ensuring both PSU's can always be fed.

ID configuration

Each I/O box in a system needs to be given a unique identity, this is determined by setting IP addresses and Sub-Mask values for Primary and Secondary connections and by setting a DIP switch accessible from the rear of a fixed format box, or on the side of the controller card within a modular I/O box to 0.

AoIP devices have their system IP addresses factory pre-configured and recorded prior to despatch.

Note: For use with Impulse or Type R cores, the DIP switch address need to be set to binary 0 which means all the switches are set to the OFF position.

When ordering additional I/O, please discuss with your sales person or Calrec project engineer to select suitable AoIP devices for the system it is to be used with.

If fitting a replacement I/O box, settings its DIP switches to Off and setting it's IP addresses and Sub-Mask to be the same as the unit it is replacing allows it to function as a drop in replacement with existing user memories and requiring no further configuration (as long as the box types are the same).

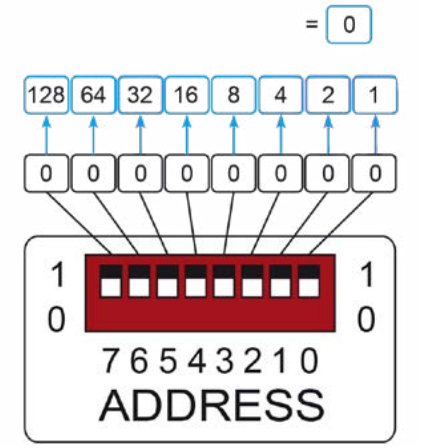
I/O boxes should be disconnected from the network before changing their DIP switches and reset or power cycled once the DIP switch is set to ensure the new 0 value is active before reconnecting to the network.

Do not change I/O box IP addresses or add extra I/O to the system unless you are confident it will not cause a conflict on the network.

Fixed format I/O box IDs

The 8 way DIP switch is set as an 8 bit binary representation with the left hand switch used for the most significant bit, and the right hand switch for the least significant bit.

STANDARD SWITCH FOR AOIP SETTING



- The above diagram shows how each switch relates to a decimal value. The setting shown in the example provides a decimal value of 0.

A switch in the down/off position represents a binary 0 or set in the up/on position represents a binary 1.

Each switch/binary bit equates to a decimal value, starting at 1 for the least significant bit. The remaining switches are double the value of their less significant neighbour, making the 8th switch (the most significant bit) equate to a decimal value of 128.

All fixed format I/O box ID switches are orientated the same way, though some boxes, use a different style switch with more pronounced labelling. Ignore any labels on the switch itself and always refer to the Calrec labelling on the surrounding panel which will show the most significant bit switch on the left and the binary 1 position as up.

Address 2

Some I/O boxes are fitted with 2 banks of DIP switches Address 1 and Address 2, please note that Address 2 should also all be set to the off position.

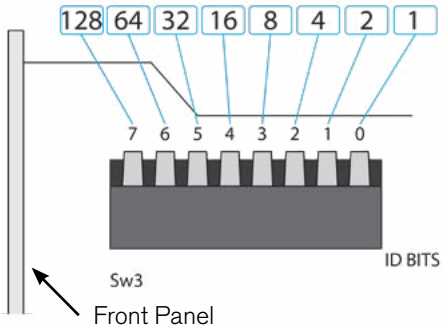
Modular I/O box ID setting

The ID for modular I/O boxes is set by a DIP switch on the controller card and is only accessible by removing the card.

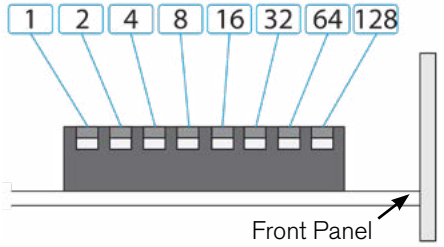
ID switches on modular I/O controller cards are orientated differently. Ignore any labelling on the switch itself and refer to the Calrec labelling printed on the circuit board around the switch to clarify its' orientation. When viewing the card from the side, the most significant bit is on the left and the least significant bit on the right. Pulling a switch towards you sets it as a binary 1, away from you as a binary 0.

The following illustrations show the ID switch on the modular I/O controller card from the side and top views.

MODULAR I/O CONTROLLER - SIDE



MODULAR I/O - VIEWED FROM TOP



Modular I/O card slots

Please note that changing the card type fitted in a modular I/O box slot requires a change to the network configuration.

If the order that cards are fitted in a modular frame matters, please discuss this with your Calrec project engineer prior to delivery. If for any reason the card order needs to be changed post delivery, please contact our Customer Support team or your local distributor for guidance.

Cards of the same type can be interchanged with no configuration change being required.

Additional cards can be fitted in previously empty slots without further configuration.

Argo AoIP Modules connections

The Argo AoIP I/O modules are not fitted with controller switches instead the modules' addresses are determined using the **Connect** application. The connection requirements are however the same as other AoIP devices and the various Argo AoIP modules all have AoIP A & AoIP B connections and are connected on the media network to the Impulse routers via AoIP switches.

The AoIP A RJ45 port connects to an RJ45 port on the Primary Router via an AoIP switch and the AoIP B RJ45 port connects to an RJ45 port on the secondary router typically via another AoIP switch as shown below.

Impulse Router connections

I/O boxes require a connection to a front panel port on to an Impulse router module.

Each I/O box has two AoIP ports to provide redundancy. AoIP 1 should connect to a 'A' router ports & AoIP 2 should connect to the 'B' router ports. Like the AoIP ports on the router modules, connections on AoIP I/O devices are SFPs and therefore the connection type required (copper / single mode fibre / multimode fibre) needs to be specified at the time of order.

Note, any fixed RJ45's ports(if any, i.e. not SFP ports) on the rear of fixed format AoIP/Hydra2 I/O devices are not functional, if copper connections are required, copper SFPs should be specified.

Please refer to the '**AoIP I/O manual (926-293).pdf**' for more comprehensive details on AoIP options and connectivity.

Router Redundancy

Calrec AoIP products support network redundancy, meaning that each device has a pair of A and B AoIP network connections.

It is not essential to have both connected, however it is recommended in order to provide resilience for network traffic. Both A and B connections can be passed over the same physical switching hardware, but to provide the best redundancy, it is recommended that A and B connections are passed over physically separate networks.

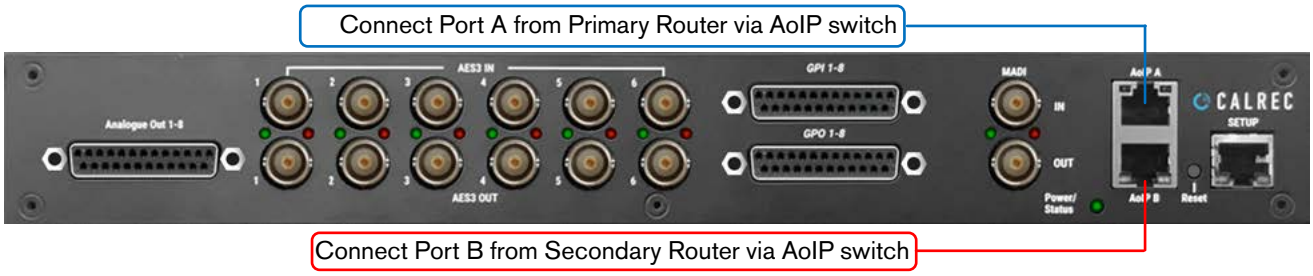
With AoIP redundancy based on ST2022-7, there is no real “primary” and “secondary” - devices are free to receive audio from either A or B networks seamlessly on a packet by packet basis.

Impulse Core redundancy has a complete failover system, only one core of a redundant pair is truly active at a given time. The image at the bottom of the next page shows a single impulse core.

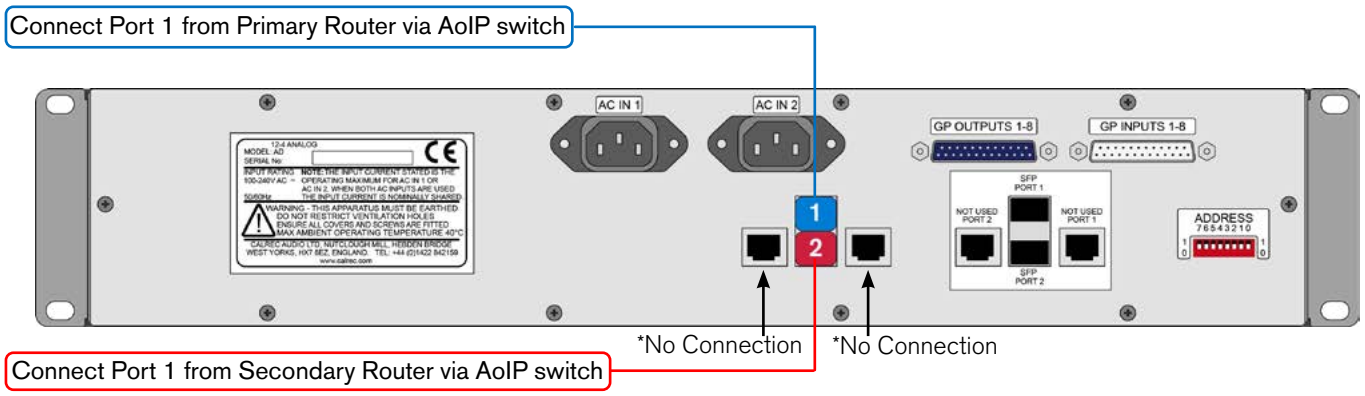
For complete redundancy, both primary and secondary cores should each connect to both A and B audio networks.

For further information about Redundancy connectivity using Primary and Secondary Impulse Cores please refer to the '**Impulse Installation Manual (926-288)**'.

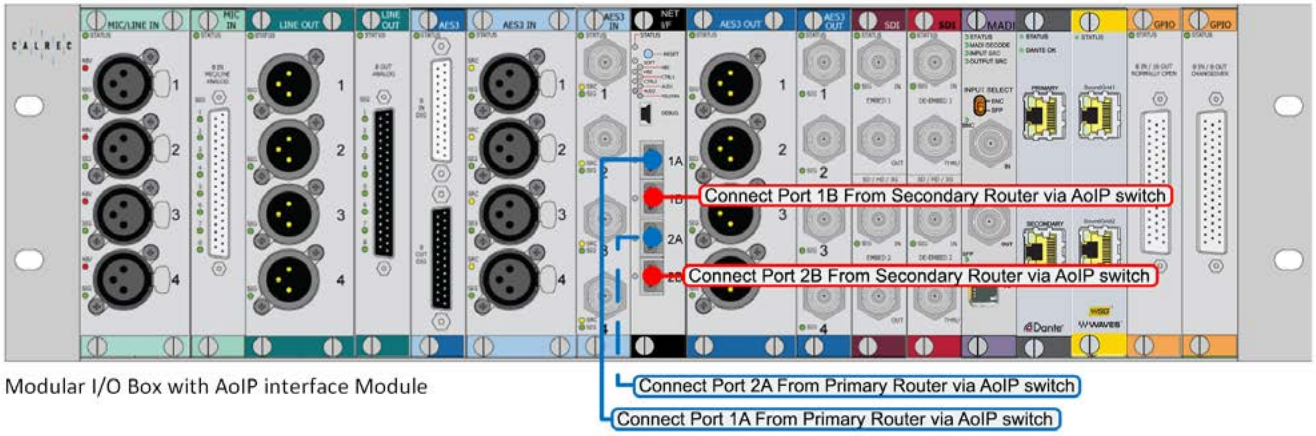
ARGO AOIP DEVICE I/O, REAR FITTED INTERFACE



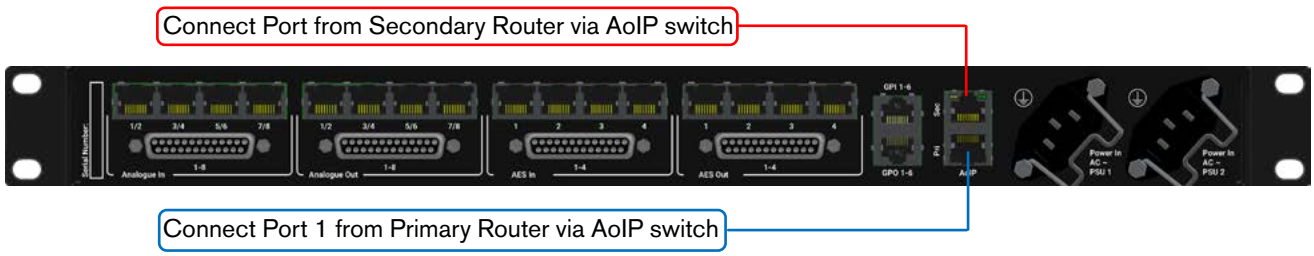
FIXED FORMAT AOIP I/O, REAR INTERFACE EXAMPLE



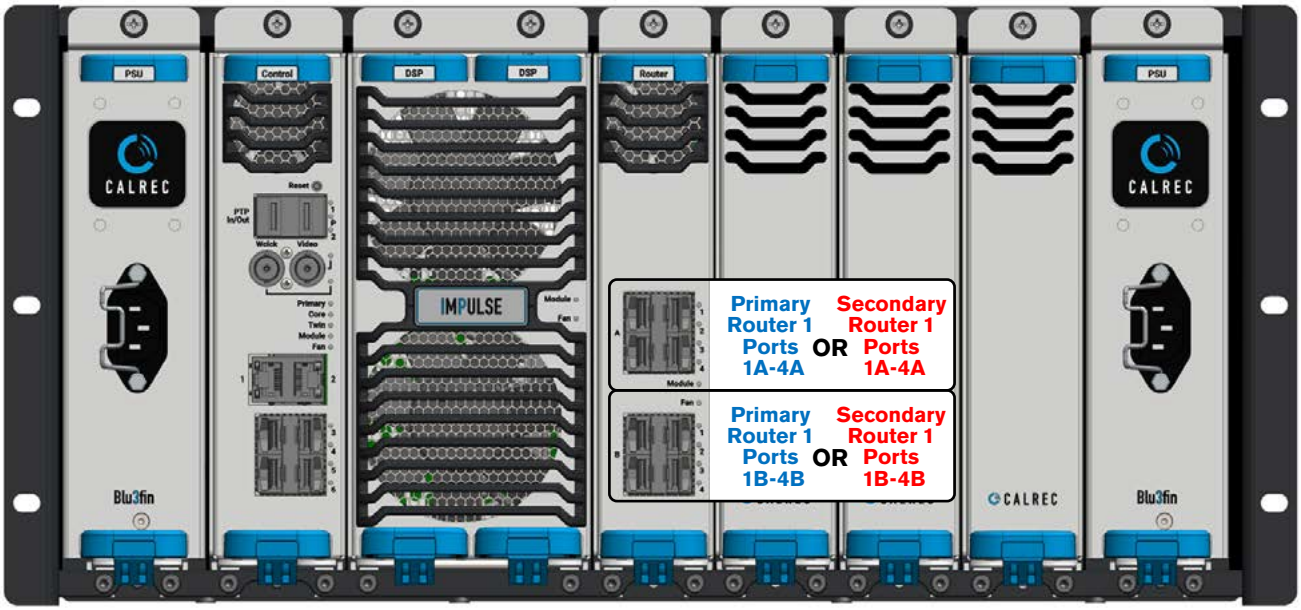
MODULAR AOIP DEVICE I/O, CONTROLLER CARD FRONT INTERFACE



TYPE R AOIP DEVICE I/O, REAR INTERFACE EXAMPLE



IMPULSE CORE- ROUTER A/B I/O PORTS (PRIMARY CORE CONNECTIONS BLUE/SECONDARY CORE CONNECTIONS RED



ARGO AUDIO I/O MODULE OPTIONS

Argo systems have a number of Audio I/O Module options that can be fitted in the rear of each console (1 per section).

The JB6549 & JD6569 Combo I/O modules shown in Fig 1 & Fig 2 provide the following I/O options:-

Analogue I/O same on both variants

- 8 - Analogue Line Outputs on the front of the Module on D-25 Female connector using standard Tascam pinout.
- 4 - Analogue Line Outputs on the rear of the Module on 2 x Stereo RJ45 connectors using Studio Hub pinout.
- 1 - Analogue Talkback Mic Input on the rear of the Module on a RJ45 connector using StudioHub+ pinout.

MADI I/O same on both variants

- 1 - 64 channel MADI Output with SRC port on the front of the module on a BNC connector.
- 1 - 64 channel MADI Input with SRC port on the front of the module on a BNC connector.

The DA6544 Line Out 12 I/O module shown in Fig 3 provides the following I/O options:-

Analogue I/O

- 12 - Analogue Line Outputs on the front of the Module on XLR-Male connectors.
- 4 - Analogue Line Outputs on the rear of the Module on 2 x Stereo RJ45 connectors using Studio Hub pinout.
- 1 - Analogue Talkback Mic Input on the rear of the Module on a RJ45 connector using StudioHub+ pinout.

The AD6548 Mic/Line In 8 Input module shown in Fig 4 provides the following I/O options:-

Analogue Input only

- 8 - Analogue Mic/Line Inputs on the front of the Module on XLR-Female connectors.
- No StudioHub+ RJ45 connectors fitted on this module type.

All the Audio I/O modules are fitted with primary (AoIP A) and secondary (AoIP B) RJ45 port connections and a 3rd RJ45 port connection used for setting up the IP addresses of the Audio I/O module. The modules have a hardware Reset button and a Power/Status indicator to show the operational status of the module.

FIG 1 - ARGO AOIP DEVICE - JB6549 COMBO I/O MODULE FRONT & BACK

AES I/O On JB6549 as shown above

- 6 - Digital AES3 Stereo Output ports on the front of the module on Unbalanced BNC connectors.
- 6 - Digital AES3 Stereo Input ports with SRC on the front of the module on Unbalanced BNC connectors.

AES I/O On JD6569 as shown below

- 6 - Digital AES3 Stereo Output ports on the front of the module on a D-25 Female connector using standard Tascam pinout.
- 6 - Digital AES3 Stereo Input ports with SRC on the front of the module on a D-25 Female connector using standard Tascam pinout.

FIG 2 - ARGO AOIP DEVICE - JD6569 COMBO I/O MODULE FRONT & BACK

FIG 3 - ARGO AOIP DEVICE - DA6544 LINE OUT 12 I/O MODULE FRONT & BACK

FIG 4 - ARGO AOIP DEVICE - AD6548 MIC/LINE IN 8 INPUT MODULE FRONT & BACK

GPIO CONNECTIONS

GPIO in Argo systems is an option. GPIO connections provide logic inputs and outputs that can be assigned to various functions on the control surface; allowing console functions to trigger external devices such as fader starts for playback devices and for external devices to trigger console functions, for example auto-fades controlled by a video switcher.

If GPIO is required, please discuss this with your sales person or Calrec project engineer. Optional GPIO cards can be fitted in modular AoIP I/O frames, or any fixed format box with a height of 2U or greater. Multiple boxes can be fitted with GPIO cards to make up the required quantity. The physical location of AoIP I/O boxes within the installation should be considered when choosing which to fit with GPIO cards.

A fixed format I/O box fitted with a GPIO card has two D25 connectors on the rear, female for inputs, male for outputs. GPIO cards for modular frames have a single D50 connector on the front for both inputs and outputs. Two versions of modular card are available, one with 8 changeover relay outputs and one with 16 normally open relay closures.

The JB6549 Combo I/O box is an AoIP module that can be fitted into the rear of an Argo section. This has two D25 connectors on it for GPIO, one carries 8 GPI opto I/P circuits whilst the other carries 8 GPO opto O/P circuits.

Both connectors are female on the JB6549 as can be seen on **"Argo AoIP Device I/O, Rear fitted interface" on page 37.**

There are also 3 Type R I/O boxes that have GPIO built in with 6 GPIs & 6 GPOs:-

- AD6501 Type R Combo I/O box
- AD6502 Type R Analogue I/O box
- JD6503 Type R AES I/O box.

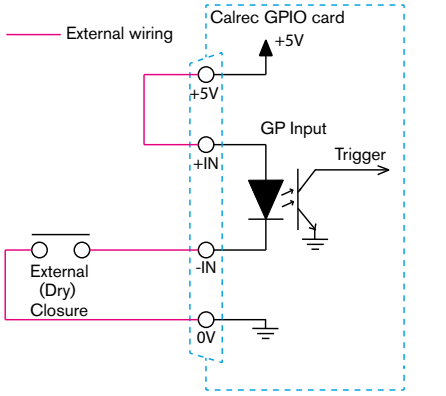
GP inputs

Each GPIO card type has opto-isolated inputs allowing for remote triggering of console functions. Applying DC or AC voltage across the positive and negative pins of an input will trigger it.

A common way to trigger a GP input is by providing a dry closure from a relay with no voltage on it. If using a dry closure, it should not simply be wired across the +/- terminals of the opto input - one half of the closure should be connected to a ground on the GPIO card, the other half of the closure to an opto input, and the other input should be linked in the connector hood to a GPIO card +5V pin.

This prevents potential problems in connecting power between different manufacturers' hardware and is shown in the example below.

GP INPUT WIRING EXAMPLE



GP outputs

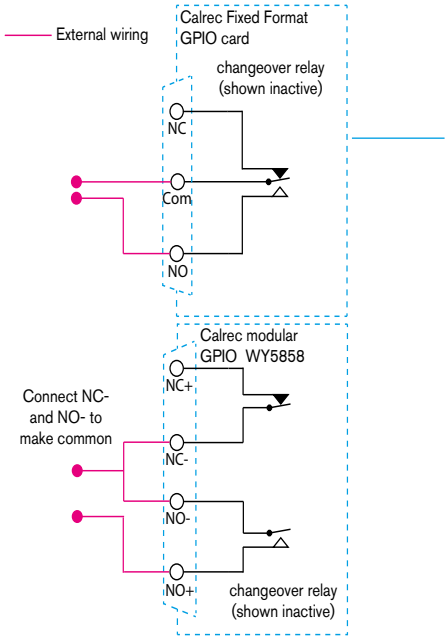
The fixed format I/O box GPIO card, and the WY5858 modular GPIO card have 8 changeover relays each with access to the normally open, normally closed and either common relay pins or normally open/closed negative pins to provide flexibility in use. If required, these contacts can be used to switch audio.

If being used to trigger external equipment expecting a ground, the relay common should be connected to a ground from the external equipment and either the normally open or normally closed contact used as the trigger line.

If a dry closure is required by the external equipment, this can be achieved by wiring one leg to either the normally open or normally closed contact and the other leg to the common or normally open/closed negative contact.

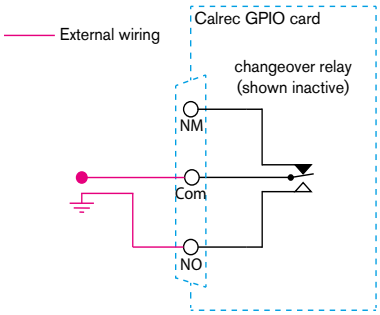
Normally open (NO) contacts short to the common or negative pin when the relay is activated by the selected function. Normally closed (NC) contacts are shorted to common or negative when the function is NOT active.

CHANGEOVER OUTPUT EXAMPLE #1



- Changeover relay shown wired to provide a dry closure when activated. For WY5859 treat NO- as common.

CHANGEOVER OUTPUT EXAMPLE #2



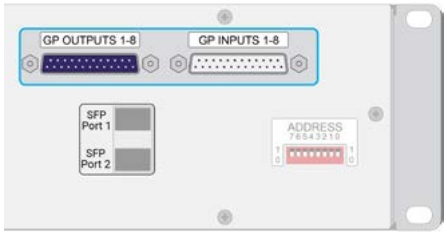
- Changeover relay shown wired to provide a ground when activated. The ground can come from a 0V pin in the GPIO card connector itself as long as the receiving equipment has the same ground reference. For WY5858 and WY5859 common setup see above.

Dry closure only outputs

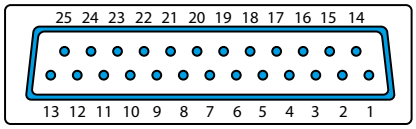
The WY5859 version of modular I/O card provides the same 8 inputs along with 16 dry closure only relay connections that short when activated (NO+ & NO-).

Pin-outs for all GPIO card types are shown the on following pages:

FIXED FORMAT GPIO CONNECTIONS - 8 IN, 8 OUT



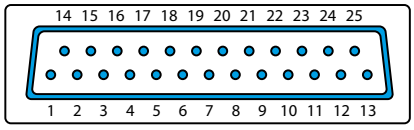
25 Pin Female D-Type - Wiring side of connecting cable



Function		Pin
Relay 1	Common	1
	Normally Open	14
	Normally Made	2
Relay 2	Common	15
	Normally Open	3
	Normally Made	16
Relay 3	Common	4
	Normally Open	17
	Normally Made	5
Relay 4	Common	18
	Normally Open	6
	Normally Made	19
Relay 5	Common	7
	Normally Open	20
	Normally Made	8
Relay 6	Common	21
	Normally Open	9
	Normally Made	22
Relay 7	Common	10
	Normally Open	23
	Normally Made	11
Relay 8	Common	24
	Normally Open	12
	Normally Made	25
Ground		13

- Calrec connector is male, requiring female terminated cable

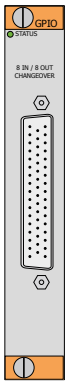
25 Pin Male D-Type - Wiring side of connecting cable

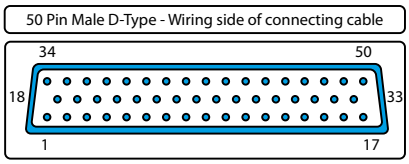


Function		Pin
Opto 1	+	1
	-	14
Opto 2	+	15
	-	3
Opto 3	+	4
	-	17
Opto 4	+	18
	-	6
Opto 5	+	7
	-	20
Opto 6	+	21
	-	9
Opto 7	+	10
	-	23
Opto 8	+	24
	-	12
+5V		2
		5
		8
		11
Ground		16
		19
		22
		25
		13

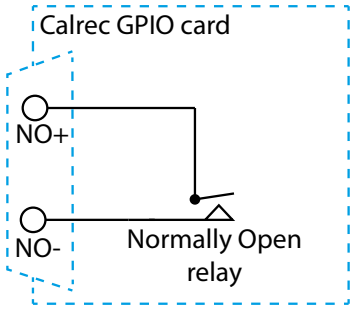
- Calrec connector is female, requiring male terminated cable

WY5858 - MODULAR GPIO 8 IN + 8 OUT

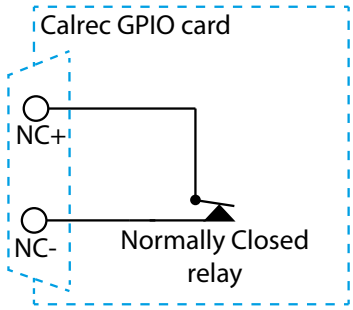




Function		Pin
GPI 1	+	1
	-	34
GPI 2	+	18
	-	2
GPI 3	+	35
	-	19
GPI 4	+	3
	-	36
GPI 5	+	20
	-	4
GPI 6	+	37
	-	21
GPI 7	+	5
	-	38
GPI 8	+	22
	-	6
Supply	+5V	17
Supply	0V	50
GPO 1	NO+	39
	NO-	23
	NC+	7
	NC-	40
GPO 2	NO+	24
	NO-	8
	NC+	41
	NC-	25
GPO 3	NO+	9
	NO-	42
	NC+	26
	NC-	10
GPO 4	NO+	43
	NO-	27
	NC+	11
	NC-	44
GPO 5	NO+	28
	NO-	12
	NC+	45
	NC-	29
GPO 6	NO+	13
	NO-	46
	NC+	30
	NC-	14
GPO 7	NO+	47
	NO-	31
	NC+	15
	NC-	48
GPO 8	NO+	32
	NO-	16
	NC+	49
	NC-	33

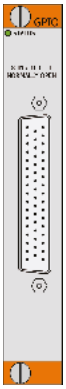


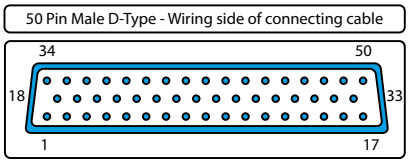
- Closes when activated



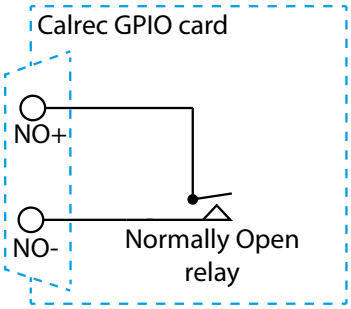
- Opens when activated

WY5859 - MODULAR GPIO, 8 IN + 16 CLOSURE OUTPUT





Function		Pin
GPI 1	+	1
	-	34
GPI 2	+	18
	-	2
GPI 3	+	35
	-	19
GPI 4	+	3
	-	36
GPI 5	+	20
	-	4
GPI 6	+	37
	-	21
GPI 7	+	5
	-	38
GPI 8	+	22
	-	6
Supply	+5V	17
Supply	0V	50
GPO 1	NO+	39
	NO-	23
GPO 2	NO+	7
	NO-	40
GPO 3	NO+	24
	NO-	8
GPO 4	NO+	41
	NO-	25
GPO 5	NO+	9
	NO-	42
GPO 6	NO+	26
	NO-	10
GPO 7	NO+	43
	NO-	27
GPO 8	NO+	11
	NO-	44
GPO 9	NO+	28
	NO-	12
GPO 10	NO+	45
	NO-	29
GPO 11	NO+	13
	NO-	46
GPO 12	NO+	30
	NO-	14
GPO 13	NO+	47
	NO-	31
GPO 14	NO+	15
	NO-	48
GPO 15	NO+	32
	NO-	16
GPO 16	NO+	49
	NO-	33



- Closes when activated

AD6501, AD6502 AND JD6503 TYPE R GPIO CONNECTIONS 6 IN + 6 OUT

GPI RJ45 type Connector
This connector is used for 6 x GP Inputs. Note the two Commons split as 2 connections for GPI 1-3 on Pin 1 and GPI 4-6 on Pin 8.

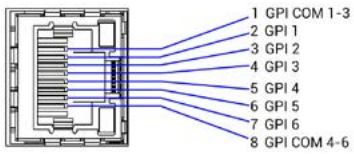
This connector appears on the Type R UR6500 Core Box x 2, AD6501 Combo I/O Box, AD6502 Analogue I/O Box and the JD6503 AES I/O Box.

General Purpose Input Connections

Pin	Function
1	GPI COM 1-3
2	GPI 1
3	GPI 2
4	GPI 3
5	GPI 4
6	GPI 5
7	GPI 6
8	GPI COM 4-6

8-pin RJ45 GP input pin-out for GPI 1-6 or 7-12

GP Input Connections



8-pin RJ45 GP input pin-out for GPI 1-6 or 7-12

GPO RJ45 type Connector
This connector is used for 6 x GP Outputs. Note the Common for all the GPO on Pin 1 and a 5V O/P is made available on Pin 8.

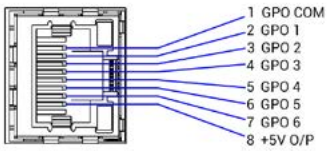
This connector appears on the Type R UR6500 Core Box x 2, AD6501 Combo I/O Box, AD6502 Analogue I/O Box and the JD6503 AES I/O Box.

General Purpose Output Connections

Pin	Function
1	GPO COM
2	GPO 1
3	GPO 2
4	GPO 3
5	GPO 4
6	GPO 5
7	GPO 6
8	+5V O/P

8-pin RJ45 GP output pin-out for GPO 1-6 or 7-12

GP Output Connections



8-pin RJ45 GP output pin-out for GPO 1-6 or 7-12

JB6549 ARGO COMBO BOX - GPIO CONNECTIONS 8 IN + 8 OUT

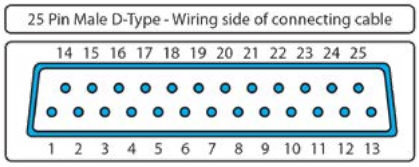
GPI 25 way D-type Connector
This connector is used for 8 x GP Inputs.

Note: All the pins except for the signal pins on 3,4,5,6,7,8,9 & 10 are grounded on the female connector

GPO 25 way D-type Connector
This connector is used for 8 x GP Outputs.

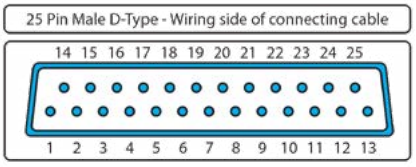
Note: Pins 2,5,8 & 11 are connected to +5v on the female connector and pins 16,19,22,25 & 13 are grounded on the female connector

25 pin Female D-Type panel connector for GPI 1-8



Function		Pin
Opto I/P 1	GPI 1	3
	Ground	16
Opto I/P 2	GPI 2	4
	Ground	17
Opto I/P 3	GPI 3	5
	Ground	18
Opto I/P 4	GPI 4	6
	Ground	19
Opto I/P 5	GPI 5	7
	Ground	20
Opto I/P 6	GPI 6	8
	Ground	21
Opto I/P 7	GPI 7	9
	Ground	22
Opto I/P 8	GPI 8	10
	Ground	23
Ground		1
		2
		11
		12
		14
		15
		24
		25
		13

25 pin Female D-Type panel connector for GPO 1-8



Function		Pin
Opto O/P 1	GPO 1 +	1
	GPO 1 -	14
Opto O/P 2	GPO 2 +	15
	GPO 2 -	3
Opto O/P 3	GPO 3 +	4
	GPO 3 -	17
Opto O/P 4	GPO 4 +	18
	GPO 4 -	6
Opto O/P 5	GPO 5 +	7
	GPO 5 -	20
Opto O/P 6	GPO 6 +	21
	GPO 6 -	9
Opto O/P 7	GPO 7 +	10
	GPO 7 -	23
Opto O/P 8	GPO 8 +	24
	GPO 8 -	12
+5v		2
		5
		8
		11
Ground		16
		19
		22
		25
		13

SYNCHRONISATION

Impulse Synchronisation sources.
The UN6426 Control Processor module provides the Impulse Core Sync Subsystem, which uses a dedicated network interface for PTP synchronisation (or BNCs for legacy inputs) to generate a timebase for synchronising audio transfer on the backplane. The sync system obtains an audio synchronisation source from the external AoIP network's PTPv2 clock via the 2 SFP connections on the front of the Control Processor module as shown above right.
It also has two BNC connectors on its front panel for incoming legacy system synchronisation sources:

- 1 x TTL word clock input
- 1 x Video clock input

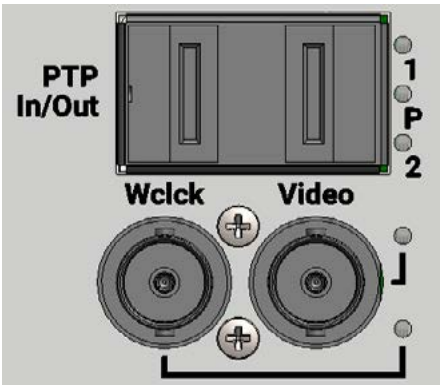
Impulse being an AoIP device requires PTPv2 sync. The core can act as a PTP master, or it can slave to an external PTP master, either way, at least one of the PTP connections on the control processor needs to be connected to the media network to exchange PTP data.

If the core is acting as master, it can either free run or use the wordclock or video inputs to be synchronous with a legacy sync system

The firmware multiplexes these sources based on a priority list and failover arrangement to select & lock-on to an active reference clock or switch to an alternative source if synchronisation is lost. The board also includes an on-board reference clock for use when neither the external AoIP clock or the legacy sync inputs are selected.

AoIP Clock
The IEEE 1588-2008 (PTPv2) standard for Precision Time Protocol (PTP) specifies a mechanism for synchronising multiple endpoints over an ethernet IP network. With high end commercial off-the-shelf network switches and a well-managed network, sub-microsecond synchronisation between endpoints can be achieved.

SYNC INPUTS



PTP specifies that the network has a Grand Master Clock source, which is generally synchronised to a high precision real-time clock source such as GPS. The grand master clock transmits ethernet packets to switches and endpoints across the network, which are returned to the clock source in order to measure round-trip delay.

An algorithm is used to calibrate the delay and synchronise the endpoint to the clock source.

If the grand master clock on a network fails, another algorithm is used to determine the next best clock source on the network, which is automatically nominated as the new grand master.

To synchronise all audio data transfers within the Impulse Core and audio transmission across the external network, a centralised PTP Synchronisation Subsystem is implemented on the core control processor module.

This subsystem synchronises the core to the PTP grand master clock through a pair of SFP connectors providing dedicated connections to primary and secondary AoIP networks. These SFP interfaces can only operate at 1Gbps, which is more than enough for the sparse PTP synchronisation traffic.

If the grand master clocks on the AoIP networks were to fail, it is possible for the Impulse Core to become grand master, synchronising AoIP network endpoints to an internal or legacy input clock source.

This is unlikely in practice as most networks will have backup grand master clocks that are ranked "better" in the best master clock decision algorithm.

The control processor sync subsystem generates a backplane clock signal with encoded sequence numbers in order to synchronise the core routers and DSP and to determine offset between IP packets to achieve coherence between samples transported on different routers in the core.

Legacy Sync Connections
The sync subsystem on the control processor module provides two BNC input connectors on the module front panel in addition to the SFP cages.

These BNC connectors are dedicated to legacy video and wordclock inputs for synchronisation. If a network grand master clock source is unavailable, it is possible to synchronise the Impulse Core PTP as master to a legacy clock source transmitted as a video or wordclock signal.

In such a case, it may be possible for the impulse core sync subsystem to be promoted to grand master and generate PTP ethernet packets to synchronise the AoIP network via the SFP interfaces described above.

The BNC inputs have an input impedance of 75 Ohms. The signals are buffered on the Control Processor module and the video input is passed through a sync-separator device to extract timing information. The logic level video clock and wordclock signals are processed within the sync subsystem to synthesise the local timebase.

See the External sources table above right and below right for information on how to set up synchronisation priority.

The console will always attempt to boot to the highest priority sync selected, and move down the priority list until it finds a valid sync.

If a valid sync later fails, it will move down the list. If no valid sync is present, the system will always default to internal as this is fixed as the last source in the list. The priority will never automatically move back up the list even if a higher priority sync becomes available.

Press the 'Reset To First' button to move back up to the top of the list.

It is important that the required sync source is available before the console boots up otherwise it won't be locked to the correct sync. If this occurs press the 'Reset to first' button after the sync generator is running.

The image below right shows all the available external source formats available to the system.

FIG 2 - EXTERNAL SOURCES PAGE

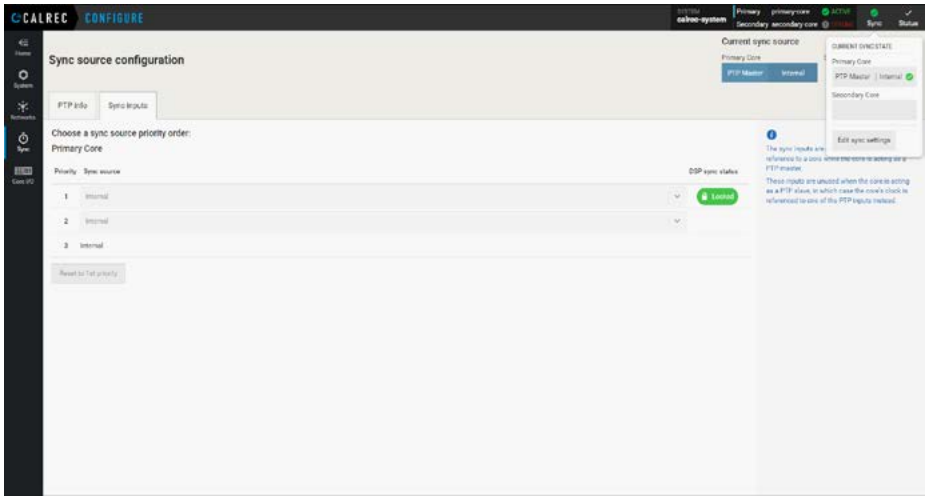
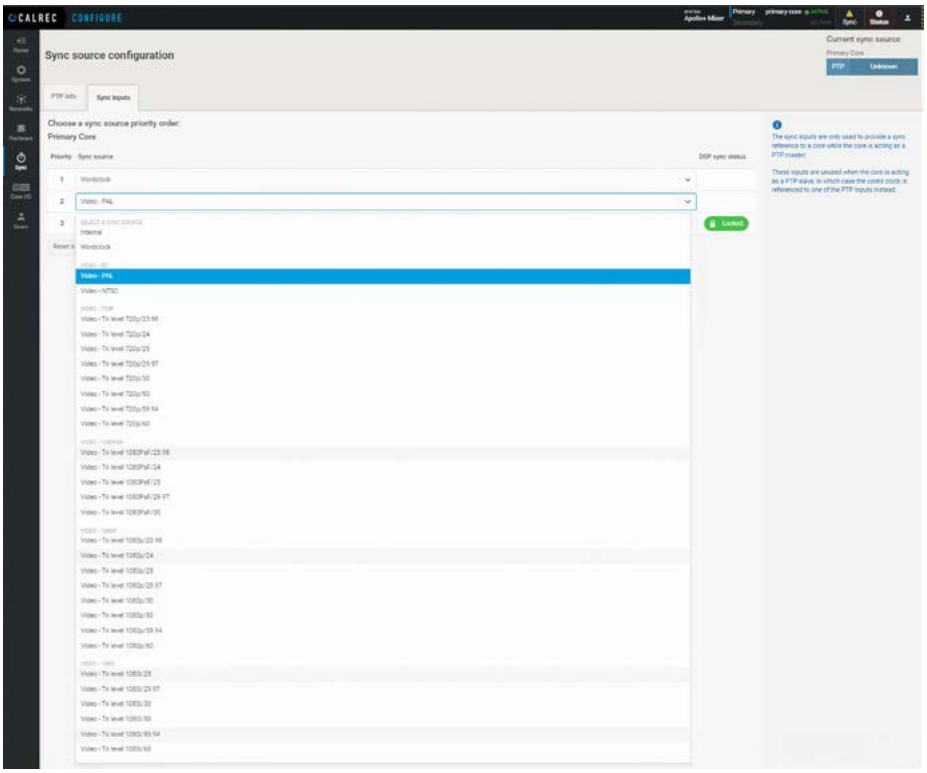


FIG 3 - EXTERNAL SOURCES OPTIONS



SFP – OVERVIEW

The connections between control surface and processing core, as well as all IP network connections, connections between I/O boxes and routers, and router to router connections between different cores, are made via SFP modules (Small Form-factor Pluggable Gigabit Interface Converters).

SFPs can be provided for RJ45 copper connections, as well as for singlemode or multimode fibre on duplex LC connectors. This allows for each port's connection type to be chosen depending on the distance of the run or to match the infrastructure present. SFPs can easily be changed on a port by port basis as and when required.

The correct quantity of SFPs are supplied pre-fitted. The type of each connection - copper, singlemode fibre or multimode fibre, should be specified at the time of order to ensure the correct SFP types are supplied. Additional SFP modules can be ordered if required. If a system is to be connected to an existing IP network, please discuss this with your Calrec project leader, sales person or local distributor to ensure that SFPs are provided and ports provisioned for the additional router to router connections.

SFP MODULES

- Both SFP types above have a handle latching mechanism, shown in the locked position. The unit on the left is a singlemode duplex LC fibre module. The unit on the right is a copper RJ45 module.

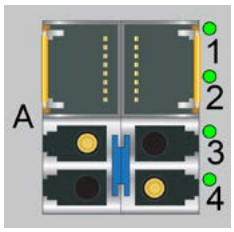
SFP slot orientation

SFP modules plug into front panel slots on router and modular I/O controller cards, and rear panel slots on fixed format I/O boxes. The modules can be fitted or removed whilst the system is powered and without removing or opening any card or box cases.

Note: the orientation of the SFP modules, as shown in the illustrations on this page - modules fitted in even numbered router ports (left hand column) are fitted the opposite way around to those in the odd numbered router ports (right hand column). Likewise for fixed format I/O boxes, the primary SFP module is the opposite way around to the secondary SFP module. The modules are orientated so that the release catch for the RJ45 / LC connector plugs once inserted are on the outside edge.

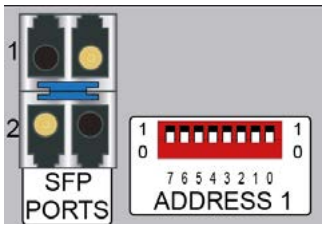
For modular I/O box controller cards, both SFP slots are orientated so that the release catch on the cable / fibre connector are on the right-hand side.

ROUTER CARD SFP ORIENTATION



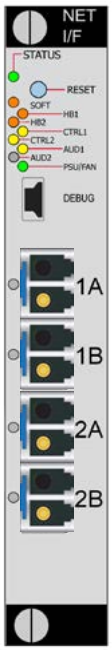
- Router card shown with copper SFPs fitted in ports 1-2, singlemode fibre (button release) in ports 3-4.

FIXED FORMAT I/O BOX SFP



- I/O box shown with singlemode fibre SFPs (button release) fitted.

MODULAR I/O BOX SFP



- Modular I/O controller card SFPs are all orientated the same way around (Button release singlemode fibre SFPs shown).

SFP latching and extraction

Calrec source SFP modules from various manufacturers. All types used conform to the same specification, however the latching mechanism on them can vary slightly.

The standard copper SFPs and some fibre SFPs as shown in the photograph on the previous page have latch / extraction handles. On insertion, the handles should be set against the outer edge (the same side as the release catch on the RJ45 / LC connector plug that fits into the SFP) to lock it into place and prevent accidental removal if cables are pulled.

To remove this style of SFP, remove the cable / fibre and slide the handle (copper) or lift the handle out (fibre) to the inside edge position as shown in the diagram below. The module can then be removed by pulling on the handle.

Other SFPs automatically latch into place when they are inserted fully and have a release button on their inside edge.

The fibre SFPs shown in the orientation diagrams and below are of this type and have blue release buttons. To remove, depress the button using a small flat blade screwdriver or similar tool. The SFP module will then be free to be removed.

SFP slot covers

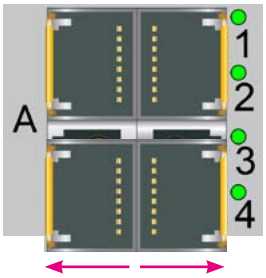
Dust covers should be fitted to all SFP slots that do not have SFP modules fitted in them in order to maintain plug-in connection reliability.

Loose SFP storage

SFP modules are small, yet reasonably expensive devices. When removing or changing SFPs, take care to keep track of them and store loose modules in a clean, dry, and anti-static environment. Fibre SFPs should always have a dust cover fitted into their optical transceiver end when no fibre is connected to them.

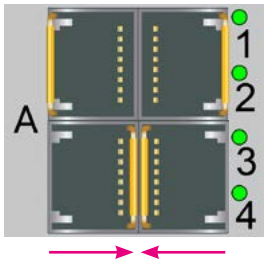
Calrec will not be liable for lost or missing SFP modules, or damage due to poor storage.

SFP WITH HANDLES - LATCHED



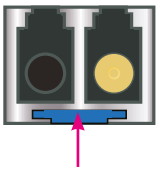
- Both bottom SFPs shown locked in place - Latch / extraction handles in outer (or 'normal' for fibre position.

SFP WITH HANDLES - UNLATCHED



- Both bottom SFPs free to remove - Latch / extraction handles in inner (or 'depressed' for fibre) position.

AUTO-LATCHING SFP



- Depress the release button to remove.

SFP design varies depending on the manufacturer, please ensure that SFPs are correctly latched in place after fitting them. In the event that a connection is not automatically established after hot-plugging an SFP, please reset the unit the SFP is plugged in to.

COPPER SFP CONNECTIVITY

IP network connections and control surface to processing core connections made via copper SFP modules require shielded F/UTP Category 5e or Category 6 cables with shielded RJ45 mating connectors.

Calrec do not supply these cables as it is often preferable to terminate them after they have been run through cable ducting to avoid damaging the terminations, and to be able to cut them to the precise length required.

Shielded cables and connectors
Shielded cabling and connectors are required in order to meet EMC (Electro-magnetic compatibility) standards to comply with the radiated emission limits set in the standard EN55022, as well as to guarantee performance in electrically noisy environments.

F/UTP Cat5e/Cat6 cable has an overall foil shield around the conductor cores. Shielded RJ45 connector plugs have a metallic shield around them which should be clamped / bonded to the shield within the cable. The shield on the connector mates with the chassis of the RJ45 socket that it is plugged into, providing an earth to the cable shield.

The method of attaching the connector shield to the cable shield can vary. Please refer to the connector manufacturer's information for further guidance.

SHIELDED RJ45 CONNECTOR

Conductive connector mating screen clamped / bonded to cable shield

Maximum cable length
The maximum length of Cat5e/Cat6 cables is 90m / 295ft. This is the absolute maximum and needs to include any patch points and cables that may be in the path. If a run between devices exceeds the maximum recommended distance for copper cabling, fibre and optical SFPs should be used instead.

Cable routing considerations
The layout and twist rate of the data cores within Cat5e/Cat6 cables are integral to their performance at high speed over distance. Poor installation practise can seriously impact upon this. The following are general good rules of practise, please refer to the cable manufacturer's information for comprehensive installation rules.

When running Cat5e / Cat6 network cabling, it is important to avoid kinking the cable. Kinks can seriously impair performance. Cable manufacturers advise that kinked cables should be discarded and replaced as the damage caused cannot be addressed simply by straightening the outer appearance.

Cables should not be bent in tight angles, this too can seriously impair performance. Please refer to the cable manufacturer's specification on minimum bend radii.

Excessive pulling force when routing cables can deform the twist rate of the cable cores, causing irreparable damage. Cable manufacturers specify a maximum pulling tension.

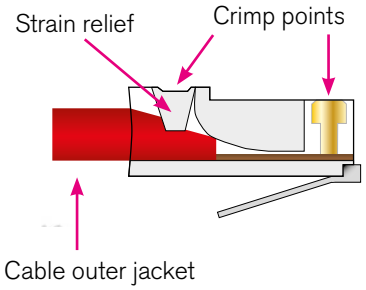
Cable-ties should not be over-tightened as this also deforms the internal structure of the cable. Cable ties should be tight enough only to support the cable weight but not so tight as to cause any visible deformation to the cable's outer jacket.

Large, heavy bundles of cables can be difficult to support using cable-ties without causing damage. 'Velcro' style hook-and-loop cable straps can be a good alternative to plastic cable-ties.

Whilst neatly bundled parallel cable runs are tidy and aesthetically pleasing, they decrease cross-talk immunity which can impact on performance. Avoid neat bundling of network cables over any kind of distance - the majority of a cables length is normally unseen, running under floor or through ducting where they should be loosely laid rather than neatly bundled.

Termination - strain relief
Poor termination and lack of strain relief is one of the most common causes of high speed network cable problems. To properly strain relief the data cores, the outer jacket of the cable should be inserted into the RJ45 housing and held in place once crimped by the strain-relief point, as shown in the following diagram. This also maintains the integrity of the twist rate and shield into the termination, and therefore the full length of the cable conforms to its' intended specification.

STRAIN RELIEVED RJ45 TERMINATION



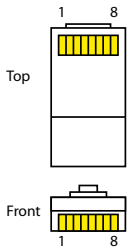
- Note, this is a simplified diagram that does not include the shield.

Slide on outer boots offer additional strain-relief protection but are not sufficient on their own. In order to be able to crimp the cable jacket inside the RJ45 and land the data cores on the terminals, the amount that the jacket is stripped back in relation to the cores needs to be quite accurate. Cables with exposed data cores should not be used as they will be unreliable.

Termination - pin-out

IP network cables use the standard gigabit ethernet pin-out. Performance relies on the positive and negative leg of each signal pair using cores that are twisted together. Calrec recommends that 'straight-through' or 'pin-for-pin' cables are used. 'Cross-over' style cables can be used, however they must be gigabit standard cross-over. Older pin-outs, designed for use with slower ethernet standards only use two of the four pairs, even though all four pairs are terminated. Cross-over variants of this style only cross the pairs that are used (A & B). Gigabit cross-over cables require that the blue (C) pair is crossed with the brown (D) pair as well as the orange (A) pair being crossed with the blue (B) pair.

RJ45 PIN NUMBERING



STANDARD RJ45 PIN-OUT

Pin	Colour	Signal
1	Orange-White	A+
2	Orange	A -
3	Green-White	B+
4	Blue	C+
5	Blue-White	C -
6	Green	B -
7	Brown-White	D+
8	Brown	D -

- For standard wiring, both ends of the cable should be terminated as above

Testing / certification

Calrec strongly recommend that all IP network cabling is properly tested or certified prior to on-site commissioning of the system. Simple test devices that only check the pin-out of the terminations are not sufficient to prove the performance and reliability of high speed data cabling. Certification level test equipment can give a simple pass / fail response but in doing so will test various important factors as well as pin-out.

Certification type tests include determining cable length, measuring skew (timing differences between pairings due to variations in length caused by intentional differences in twist rate), measuring for loss, signal to noise ratio and BERT error checking on data.

Cables that fail certification tests or fail to perform, may appear to function fine in other applications, such as a PC LAN connection where errors leading to retries and therefore delays are acceptable and often unnoticed.

Temporary / reusable cables

Cabling that is not part of a permanent infrastructure, such as temporary runs used for outside broadcasts should be carefully coiled and uncoiled to avoid kinking and they should be regularly tested. Cables showing any sign of damage should be replaced.

FIBRE SFP CONNECTIVITY

Optical SFP modules for fibre connectivity can be used for console to processing core, router to router, and router to I/O connections.

Fibre connectivity is required when the cable run between units exceeds the maximum permissible length for Cat5e/ Cat6 copper cabling. Fibre can also be used for shorter runs if it is simply the preferred medium.

Note that this section only concerns fibre connections made via SFPs. Note that MADI interfaces also have pluggable SFPs which depending on what they are being connected to and may have single-mode or multimode connections in and out of the system. Different MADI interface SFPs are available to provide various types of MADI fibre interface as shown below.

Singlemode vs multimode SFP's

The core within multimode fibre is relatively thick when compared to singlemode. Light travels through multimode fibre at multiple angles, 'bouncing' of the sides of the core as it travels through it, taking multiple paths, or 'modes' of varying length from one end to the other, resulting in pulses being lengthened as they travel. Singlemode fibre has a very fine core and light travels in a single, direct path from one end to the other without affecting pulse length.

The result is that singlemode fibre has a higher bandwidth capacity and lower signal loss allowing much greater distances to be achieved.

Light can be transmitted into multimode fibre using LED's or low powered lasers whilst singlemode uses a higher powered laser.

Bi-Directional SFP's

These SFP's use a simplex LC connector and operate by transmitting and receiving at 2 different frequencies down the same fibre in opposite directions. These have to be used in a Type A /Type B pair. Type A has a TX frequency of 1310nm and a RX frequency of 1550nm whilst its opposite uses a TX frequency of 1550nm and a RX frequency of 1310nm.

Calrec recommend the use of singlemode fibre whenever possible in order to maximise the flexibility in the location of hardware and maintain uniformity across the system by using a single type. If a multimode infrastructure is in place, fibre length, the number of inter-connects and equipment location becomes important.

SFP modules are available in bi-directional, singlemode and multimode fibre types. It is important to select the correct SFP for the type of fibre being used in the installation. If using a mixture of singlemode and multimode fibre, it is important to ensure the correct SFPs are matched to the correct fibre type.

Identification

The release button / handles of fibre SFPs are colour coded - Blue (TypeA) / Purple or Green (TypeB) for bi-directional, Blue for singlemode and Black for multimode.
Blue LC connectors, as shown below should be used to terminate singlemode fibre, and beige connectors for multimode.

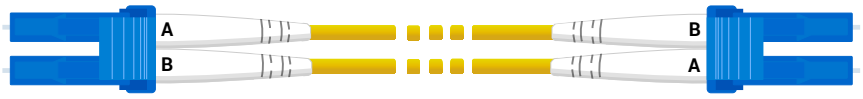
Connectors / terminations

Calrec fibre bi-directional SFPs use simplex LC connectors whilst multimode and singlemode use duplex LC connectors. The duplex termination requires two fibres per connection, one is a send path, the other is a receive path. When terminating the fibre, the send from one end should connect to the receive of the other and therefore they are 'cross-over', terminated A to B and B to A.

SFP / fibre specifications

Specifications are shown in the table below. The maximum distances shown assume a single point to point connection with no intermediary interconnections. Losses should be measured across the total signal path including interconnects - between points of transceiver connection. Losses need to be less than the optical power budget of the SFP transceivers.

DUPLEX LC FIBRES CORRECTLY TERMINATED A TO B & B TO A



BI-DIRECTIONAL LC FIBRE CORRECTLY TERMINATED TYPE A TO TYPE B

SFP COPPER / FIBRE SPECIFICATIONS

Part Number	Description /Cable Type	Type	TX Freq	RX Freq	Bale Colour	Max Dist	Connector Type	GBIC Type	Power Budget
491-194	SFP Module Copper CAT5/6	N/A	N/A	N/A	N/A	90m	RJ45	N/A	N/A
491-087	SFP Module Fibre Multimode 62.5/125um	N/A	850nm	850nm	Black	275m	LC Duplex	SX	7.5dB
As above	SFP Module Fibre Multimode 50/125um	N/A	850nm	850nm	Black	550m	LC Duplex	SX	7.5dB
491-072	SFP Module Fibre Singlemode 8/125um	N/A	1310nm	1310nm	Blue	10km	LC Duplex	LX	8.0dB
491-060	SFP Module Fibre Singlemode 8/125um	N/A	1310nm	1310nm	Blue	70km	LC Duplex	LH	23.0dB
491-195	SFP Module Fibre Bi-Directional 9/125um	A	1310nm	1550nm	Blue	10km	LC Simplex	LX	11.5dB
491-196	SFP Module Fibre Bi-Directional 9/125um	B	1550nm	1310nm	Purple	10km	LC Simplex	LX	11.5dB
491-201	SFP Module Fibre Bi-Directional 9/125um	A	1310nm	1550nm	Blue	40km	LC Simplex	LH	23.0dB
491-200	SFP Module Fibre Bi-Directional 9/125um	B	1550nm	1310nm	Green	40km	LC Simplex	LH	23.0dB

FIBRE - GENERAL RULES

Testing / certification
Calrec strongly recommends that all fibres are properly tested or certified prior to on site commissioning of the system.

A certain amount of signal loss occurs over the length of a fibre path. If the total loss of a path exceeds the optical power budget of the SFPs in use, the system will be unreliable.

Areas of loss
Signal loss occurs in various areas. Splice loss occurs in terminations - at the point where the fibre meets the connector. Typically splice loss should be <0.3dB per termination. Poor termination results in higher loss.

Connector loss occurs at the point where the connector meets the SFP / optical transceiver, or another connector, such as extension interconnects or patch-points. Connector loss should typically be <0.5dB per interconnect. Dust or other contamination between interconnects and scratches on the end surface contact point of the fibre will substantially increase the amount of loss. As such, dust covers should always be fitted to optical transceivers such as SFPs when no fibre is connected and to fibre connectors that are not landed.

As well as splice and connector loss, the fibre itself has inherent loss over distance, typically fibre loss will vary from 3.5dB per Km for multimode down to 0.4dB per Km for singlemode. Poor installation practise and lack of care can damage the fibre and result in substantially increased losses.

Fibre handling practise
It is important to follow the fibre manufacturer's guidelines when handling fibre and installing fibre runs. Some of the main points of concern are:

- Minimum bend radii - fibre should not be bent through too tight an angle. Tight angles can cause significant losses and permanent damage to the fibre. Fibres may pass initial installation testing but can fail at a later date due to stresses on the core of the fibre caused by tight bends.
- Twists, snags and kinks - Twists in fibre runs add stresses to the core which can cause damage over time. Avoid snagging on other cables or conduit which will cause excessive tensions when pulling and can cause kinks and excessive bends in the fibre. When routing through angled conduit, provide enough clearance around corners to avoid the fibres being pulled sharply around the inside of the angle.
- Pulling - observe the manufacturers maximum pulling tension specification. Use pulling tools and lubrication where appropriate. Never pull on the connector.
- Strain relief - fibres should be adequately strain relieved to prevent tension on terminations, however use of plastic cable ties can crush the internal construction of the cable. Hook-and-loop 'Velcro' straps are harder to over-tighten, offer more gentle support and a greater surface area to dissipate the pressure.
- Crushing - never place heavy items on top of unprotected fibre.

Ruggedised fibre
For temporary / re-usable fibre runs , or runs unprotected by conduit, fibre that is likely to be exposed to the elements, snagging or to being stood on, should always be of a ruggedised / armoured type to protect the internal construction of the core.

WARNING

Never look into the end of an optical transceiver or fibre when in use. Laser radiation can be harmful to the human eye and should be avoided.

Remember that when disconnecting a fibre, the transmitting device at the other end may still be active.

Cleaning and preventative maintenance
Contamination of transceiver and fibre mating contact points causes signal loss and can cause permanent damage by scratching.

Dust covers should be fitted to all fibre connectors and SFP optical transceivers when they are not mated. It is also important to ensure that dust covers themselves are kept clean.

When handling fibres without dust covers, do not allow the ends to come into contact with any surface, including fingers.

Specialist materials should be used for the cleaning of mating contact points to avoid further contamination or scratching. The following items are low cost and readily available from camera shops and laboratory suppliers:

- Canned compressed air - it is important to use specialist filtered, clean, dry air, free of contaminants and moisture.
- Isopropyl alcohol. Use with cotton swabs or lint-free wipes to ensure no residue is left.
- Lint free wipes / long fibre, low ash lens paper - needs to be free from chemical additives. Ensure wipes and swabs are stored in a clean environment and are not reused.

Cleaning fibre optic cables and connectors

There are multiple ways to clean fibre-optic cables and connectors.

Included below are some helpful tips to properly clean fibre optic cables.

- Do not allow the end of the fibre optic cable to make contact with any surface including fingers.
- Do not excessively bend the fibre cable. Bending the cable may cause internal breaks along the fibre resulting in poor performance or instability.
- Optics and optic coatings are easily chipped and/or scratched. Use of finger cots or powder free surgical gloves while handling fibre optic cables, will help ensure cleanliness.
- Only fresh (dry) spectroscopic grade Isopropyl Alcohol should be used as a cleaning solvent.
- Ensure that the module power is off and that other light sources are disabled.

Cleaning procedure

1. Blow the fibre surface with a stream of Clean Dry Air, this will dislodge larger loose particles.
2. Place 1-3 drops of spectroscopic grade Isopropyl Alcohol in the centre of a lens tissue.
3. Hold the fibre by the connector or cable, place the wet portion of the lens tissue on the optical surface and slowly drag it across.
4. Examine the surface of the fibre end under high intensity light using a direct magnifying inspection microscope or an indirect video inspection tool if available. If streaks or contaminants still remain, repeat the process using a fresh lens tissue.
5. Immediately install a protective cover over the end of the cable to avoid re-contamination or insert the fibre back into the previously cleaned receptacle for immediate use.

Additional notes

Do not tip the can of Clean Dry Air whilst aerosol spraying as liquid may be released contaminating the surface of the fibre.

Do not use lens paper dry as dry lens paper is extremely abrasive.

Do not use Acetone as a cleaning solvent on the fibre optical surfaces.

To ensure the purity of the Isopropyl Alcohol, do not insert the lens tissue, swabs, etc into the liquid, instead, drip the liquid on to the material.

Cleaning optical transceivers

The best way to clean a transceiver port is to remove particles using a stream of Clean Dry Air.

Included below are some helpful tips to properly clean fibre optic modules.

- Always handle optical SFP modules in an ESD safe manner using the proper safety precautions.
- Ensure that the module power is off and handle the modules with care.
- Always use Clean Dry Air or an approved canned compressed air supply.
- Always hold the can of compressed air upright. Tipping may release liquids into the air stream.
- Do not touch the inner surfaces of the module including the Optical Sub-Assemblies (OSA) or insert any foreign objects into the ports.
- Use of finger cots or powder free surgical gloves are not required but may be used for cleanliness.

Cleaning procedure

1. With the clean dry air, blow the inner barrel of the Transmitter and Receiver Optical Sub-Assemblies (OSA). This will dislodge loose particles.
2. Examine the surface of the OSA lens under high intensity light using the inspection microscope. If contaminants still remain, repeat the process.

Following these guidelines should provide a successful installation and ensure optimum reliability and system performance.

For further information or advice please feel free to contact Calrec.

ARGO
EXTERNAL CONTROL

CALREC

WIRELESS CSCP ROUTER CONFIGURATION

Calrec applications can be connected to the console via a wireless router. The setup options provided by different router manufacturers can differ substantially so this setup guide should be used along with the manufacturer's instructions for your particular router configuration application. Also, some basic networking knowledge is assumed.

As an example the Calrec serial control protocol (CSCP) allows communication with Calrec consoles using the TCP/IP protocol at a pre-determined TCP port number.

CSCP can connect to the Calrec system through a wireless router, through which console functions can be controlled using the CSCP protocol.

Console Configuration
Calrec consoles are pre-configured with a basic CSCP configuration which is disabled by default.

This basic configuration assumes a simple, point to point connection with a wireless router on the same subnet as the processor. This basic setup is unlikely to be suitable for connection to a more complex corporate network.

To setup the basic connection, first configure a virtual adapter for the selected surface under the External Control section of the Calrec Configure application, select the IP address, Subnet Mask and gateway if required and choose which Network interface on the Impulse core to be used. as shown in Fig 1.

For further information on this setup procedure the user should refer to the **Impulse Configure Guide (926-290).**

Then for CSCP usage select **System Settings** from the top right corner of the console or assist application, select **Control Protocols** from the left hand menu, create the CSCP interfaces from that page and click to Enable the CSCP Interfaces as required as shown in Fig 2.

FIG 1 - CSCP CONTROL INTERFACE CONFIGURATION EXAMPLE

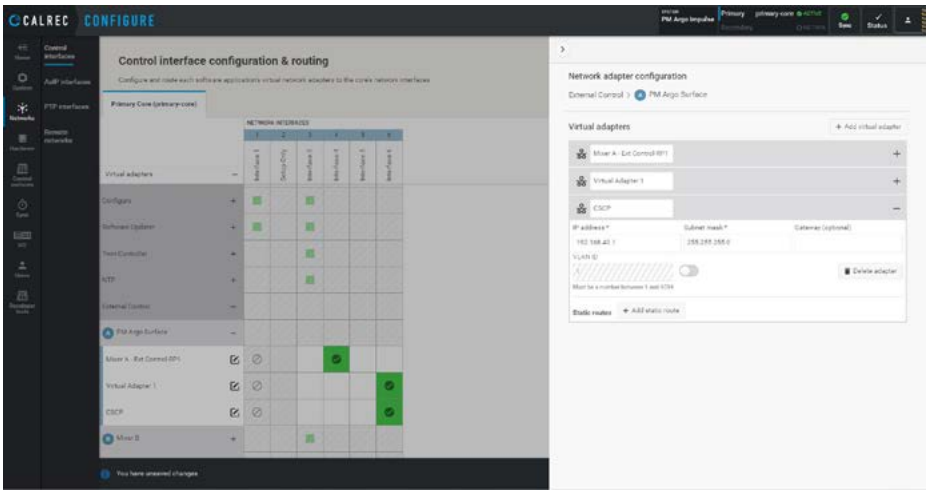
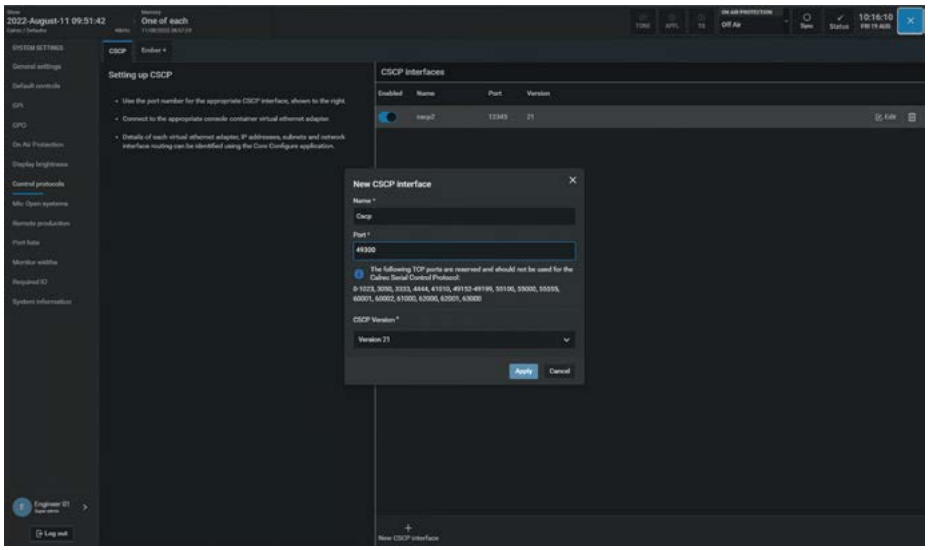


FIG 2 - CSCP CREATE & ENABLE EXAMPLE



	IP Address	Subnet Mask	Port Number
Primary Control Processor example	192.168.40.1	255.255.255.0	49300
Secondary Control Processor example	192.168.40.2	255.255.255.0	49300

The console will now be providing the CSCP connections as shown in this table. Note that the Port number for assist via CSCP shown here is 49300 but it is user configurable and the IP Addresses for the Primary and Secondary control processors are for example only.

Wireless Router Configuration
When the basic configuration has been enabled the console provides CSCP connections, for example here on the 192.168.40/24 subnet so the wireless router LAN connection must be configured to be part of this subnet.

We advise that the wireless router is configured with a LAN IP address for example here of 192.168.40.3 and an IP subnet mask of 255.255.255.0

DHCP Configuration
To connect wireless devices, such as a CSCP device controller, the wireless router should be configured to provide a DHCP (Dynamic Host Configuration Protocol) server to distribute IP addresses to these devices.

The wireless router should be configured as a **DHCP server**: The **IP Start address** or **IP Pool address** should be configured for example here to be **192.168.40.100** and the **IP** or **DHCP pool size** should be set to **4**.

This allows up to four wireless devices to be connected to the console simultaneously and would be allocated IP addresses for example here in the range: 192.168.40.100 to 192.168.40.103.

DNS (Domain Name System) parameters are not required for this setup.

Other Configuration Parameters
Wireless routers provide many different services and it is not possible to cover all setup permutations in this document. Some common considerations are:

- Firewalls should be disabled if possible. If not then the firewall should be configured to enable TCP/IP traffic in both directions on port 49300.
- NAT (Network Address Translation) should be avoided.
- Packet filtering and MAC address filtering should be avoided.

Security Considerations
Wireless LANs (and therefore the console) can be open to any devices that can discover the wireless network and have access to the encryption keys.

It is strongly recommended that the wireless LAN is configured to use some method of encryption.

FIG 3 - PC, CONSOLE AND WIRELESS ROUTER CONNECTIONS EXAMPLE

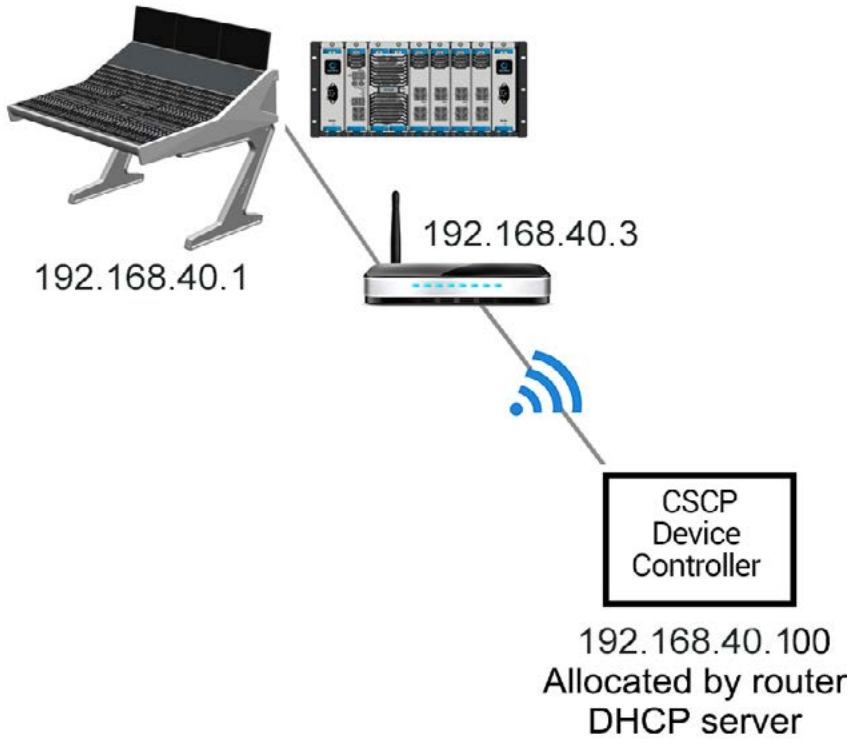
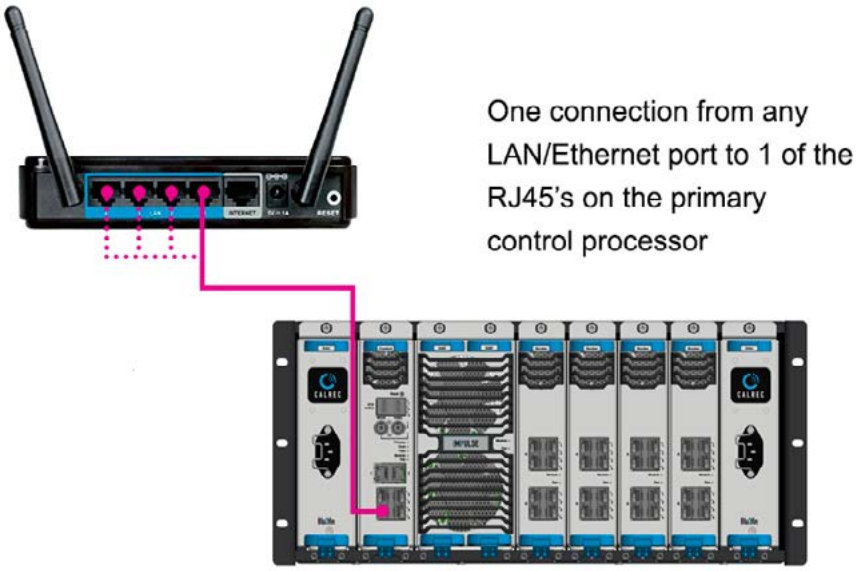


FIG 4 - WIRELESS ROUTER TO CONTROL PROCESSOR CONNECTION



WEP is considered to be insecure so as a minimum you should select WPA(2)-PSK.

This requires both communicating parties to agree on the same keyword or passphrase before access is allowed.

CSCP Device Configuration
CSCP applications should be configured on the CSCP device using IP addresses, for this example 192.168.1.1 to connect to the primary control processor or 192.168.1.2 to connect to the secondary. In this example the CSCP port number should be set to 49300 as shown in Fig 2.

ARGO
CONFIGURATION & SETUP

CALREC

OVERVIEW AND GUI ACCESS

This section covers areas often required by installation engineers to carry out the initial setup and configuration that is required to test the installation and provide a starting template for operators to work with.

Please refer to the **Argo Operator Manual (926-313).pdf**, the **Impulse Installation Manual (926-288).pdf** & **Impulse - Argo Start Up Guide (926-321).pdf** for more comprehensive information on user functionality and getting started on setting up the connections to the Impulse Core, Multiple Console surfaces and Audio Interfaces via the AoIP/AES67 network.

There are a number of Applications used to setup Argo S & Argo Q Systems.

The Impulse core is setup using two different applications:-

The Configure Application
This provides the user with all the facilities needed to configure Impulse Core Systems including the DSP, Sample rate, System Applications, Maintenance, Control Interfaces, AoIP Interfaces, PTPv2 interfaces, Remote networks and Virtual Patchbays. The application is accessed via a web browser at a specific IP address, the default is set to **172.16.255.19.** and is accessed on SFP interface Port 2 of the Impulse core. This is for Setup use only by Calrec Engineers. Once configured other ports and IP addresses will be established for general management of Argo systems including the Configure application typically set to **172.29.1.23.**

For further information on Configure see the **Impulse Configure Application Guide (926-290).pdf**'

The Connect application
This provides the user with the facilities needed to provide the management of AoIP streams and devices. This includes:- AoIP Core Router Interfaces, AoIP Device Interfaces, Transmitters & Receivers setup, Synchronisation, Audio input and output configuration, GPIO configuration, and the Networking of streams to connect transmitters and receivers together. These can be connections to and from Calrec AoIP Devices (or other 3rd party AoIP streams from V1.2 onwards).

The Connect application is served by Impulse processing cores and is accessed via a web browser at a specific IP address, the default is set to **172.16.255.60** from the Setup port on SFP interface port 2 of the Impulse core.

This is for setup use only by Calrec Engineers, once configured, other ports and IP addresses will be established for general management of Argo systems including the Connect application, typically set to **172.29.1.21**. and can be accessed via the management subnet once configured or via the media network on **192.168.30.100** see the **Connect Application Guide (926-292).pdf** in the Networks>Control Interfaces section for further information on configuring AoIP addresses on the core.

The Configure and Connect applications are optimised to be accessed using a Google Chrome web browser, on a Windows 10 or higher based computer platform.

This access is via a standalone PC that can connect into the applications using the appropriate IP address range.

Standalone PC Connections
A standalone PC can be connected into the ethernet switches on the rear of the console surface to provides web browser access to configure the applications.

Some features, such as accessing the Software Updater Application require the user to access this application via a web browser at a specific IP address, the default is set to **172.16.255.40** from the Setup port on SFP interface port 2 of the Impulse core. This is for setup use only by Calrec Engineers.

Once configured other ports and IP addresses will be established for general management of Argo systems including the Software Updater application typically set to **172.29.1.22.**

For further information on the Software Updater process see the **Impulse - Argo Start Up Guide (926-291).pdf'.**

USB Port
A USB port linked to the section processor is available on the MY6574 monitor panel located in the central row of the console. This can be used for backing up and restoring memories or settings from the console. It is designed for portable flash based USB memory devices and as such may not provide power for larger USB hard drives.

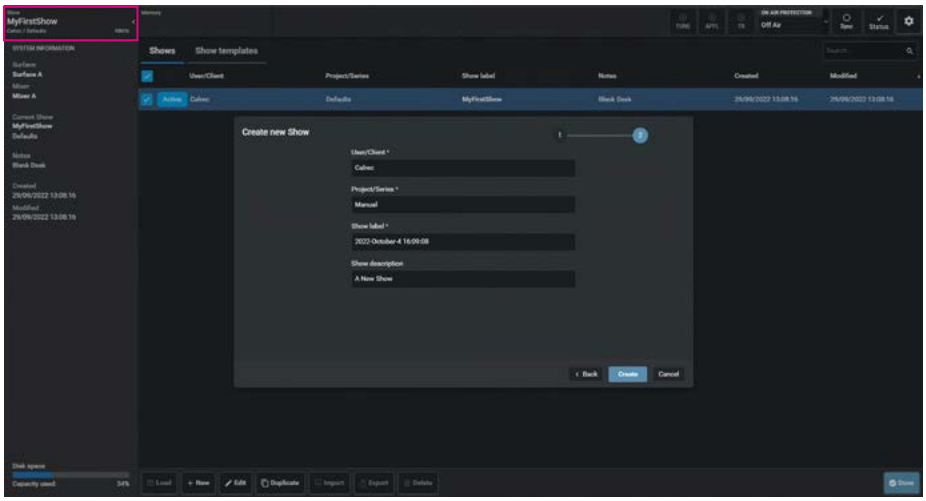
CREATING A CLEAN STARTING POINT

To ensure you are starting from a clean setup, before beginning configuration it is a good idea to create a new show.

Shows contain default settings for the console, including monitor patching, GPI patching and port labelling. Shows also contain multiple user memories which save normal I/O patching, fader assignment and path parameter settings.

To create a new show, go to the **Show** area at the top left of a Touchscreen as highlighted in the image above right and tap on it. This opens the Shows page and at the bottom of the page is a '**+New**' button which when pressed allows the user to create a new show. Choose the Calrec Default as the starting template, enter the details as prompted and click '**Create**' to load the new, clean show onto the console. See Fig 1. The same page allows changes to the show to be saved, as well as other shows to be loaded & saved, please refer to '**Argo Operator Manual (926-313).pdf**

FIG 1 - CREATE NEW SHOW ON THE TOUCH SCREEN APPLICATION



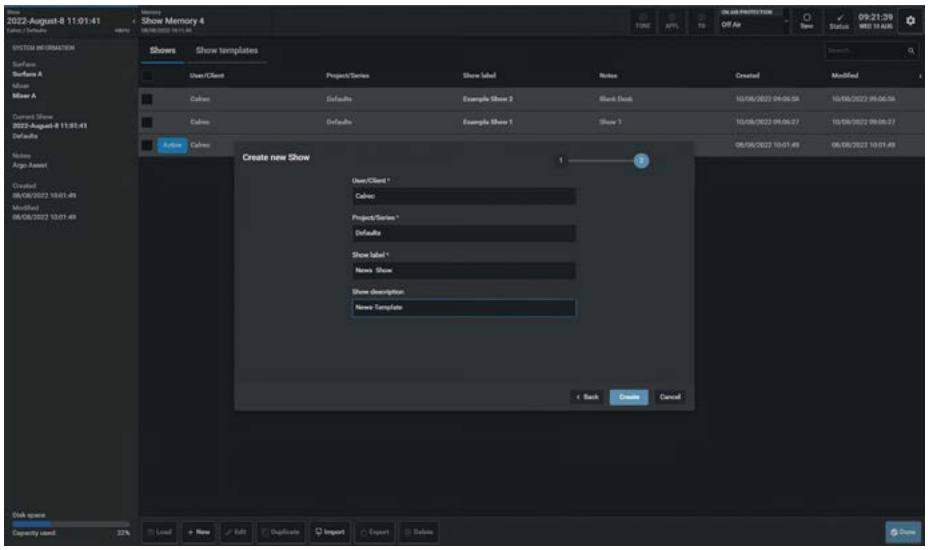
Assist for Argo

This provides an alternative interface to the Touch UI application. It is an application for the Impulse platform which runs in a Web browser on various devices, giving you a virtual online desk running on a laptop. Once connected to the Impulse Core Unit via the interface ports on the front of the Impulse Control Processor module and setup in the Configure application, it uses a web browser to connect to the Assist's UI. See Fig 2.

This allows the user to:-
Set up shows, memories, fader layout, patching, bus setup, labelling, set input and output levels on a fader bed, control input channel parameters including mic gains, routing to outputs and much more, all on their own device with or without a physical console surface attached.

If the user wants to access different pages of the assist application in parallel more pages can be opened by adding further instances of the application arranged in tabs or the user can just drag them out as a new window.

FIG 2 - CREATE NEW SHOW IN THE ASSIST APPLICATION



The primary use-cases for using Assist on this platform are:-

- Headless operational control over Impulse mixers (where there is no Argo control surface).
- Multi-user and remote control over Argo mixers away from a physical surface.

For Further information on Assist refer to **Argo Assist Manual (926-317).pdf**

CONSOLE NAVIGATION

Surface Panel Overview
The image to the right shows a typical console section of an Argo S surface consisting of the following panels:-

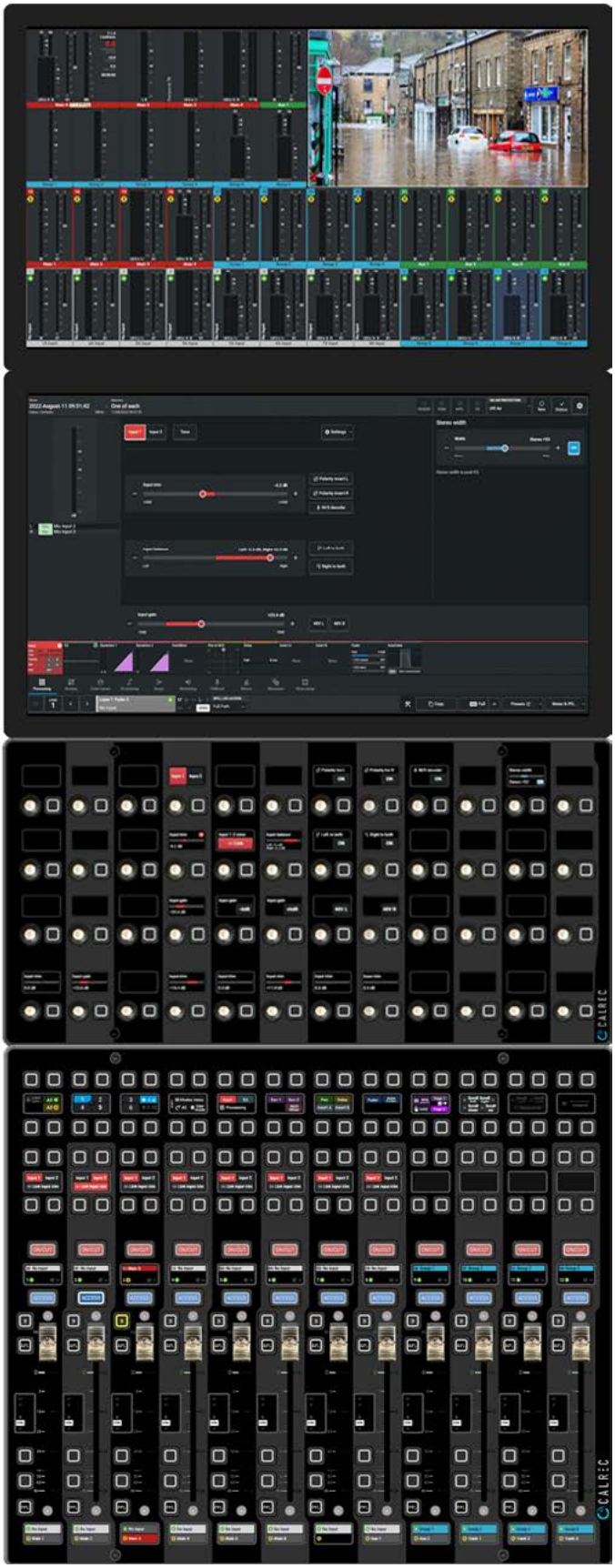
MD6573 TFT Meter panel
Provides the Argo S/Argo Q with a graphical user interface to provide a HD video display of the various audio input and output levels of the console. Typically the Meter panel shows audio metering displays. Multiple upstand metering TFT's are fitted across the console as required.

MU6572 TFT Touchscreen panel
Provides the Argo S/Argo Q with a graphical user interface to provide a HD video display and touch circuitry, to control and display the various control parameters of the console. The lower area of the screen provides a touch method of navigating the console using operational modes and layer selection. Multiple touchscreens are fitted across the console as required.

CA6575 Wild Assign panel
Provides 48 rotary control/button/display cells and can be fitted in the Argo S/Argo Q central control area, for the Argo S, one row of this panel type can be fitted or two rows for the larger Argo Q, to make up the required console layout. Each rotary control cell can be configured to display and control the various continuous and switch parameters as required.

IU6576 Standard Fader panel
Provides the Argo S/Argo Q fader bed, with multiple panels being fitted to make up the required fader quantity. It is fitted with 12 x 100mm throw touch sensitive faders. Each fader strip also has the following controls/displays from bottom to top:- Mini TFT layer display, PFL button, 2 user defined buttons, Mini TFT meter display, AFL button, B-Layer button, Access button, Mini TFT fader display, ON/CUT button. The upper area of the panel has 2 sets of 4 button cells with a Mini TFT Display per cell which can be configured to display the various switch parameters as required. The top row of button cells provides the physical method of navigating the console using operational modes and layer selection.

ARGO S CONTROL SURFACE SECTION



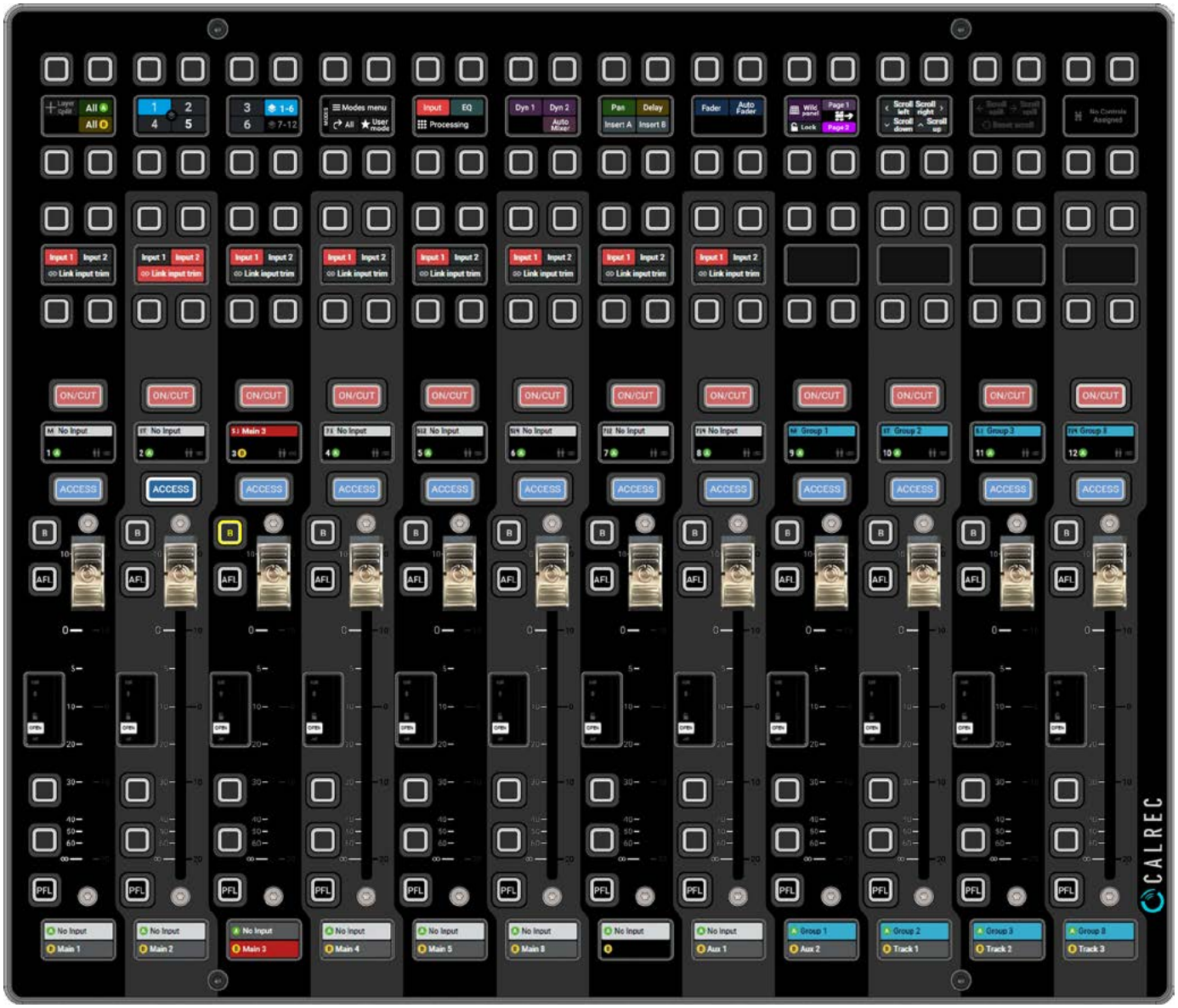
Layer Navigation
The Modes and Layer control row across the top of the panel in combination with the Access buttons row and 'B' button row just below which allows the user to navigate across the various layers of the console of which there are 24 arranged as 12 A/B layers. The 2nd & 3rd button cells in from the left of that row, select which layer the user is accessing and the image below shows that the user is on Layer 1. The next control area to look at are the TFT displays above the Access buttons.

The label at the top of the display shows the name of the audio path that has been placed there with the Fader Layout function as well as the path width. The image below shows the path on Fader 2A has been 'Accessed' as the bottom left of that TFT display shows. Note the 'Main 3' path on fader 3B next to it, the B-layer paths are accessed using the 'B' button as highlighted in Yellow. There is a further TFT display row shown at the bottom of the panel which shows both the A and B layer paths

Mode Navigation
Once the required path has been chosen the user can then decide which mode of control they wish to apply. There are 4 primary modes: Processing, Routing, Buses & Monitoring modes which are selected from the 5th cell in the Modes and Layers row. Once selected, the 5th, 6th, 7th & 8th rows show the various functions within that mode. The image below shows that the user has selected the Processing mode and accessed the Input function.

The Touch screen panel (shown on the previous page) will change to display the Input functions page and all the control parameters that are available for that path. Those parameters can then either be controlled from the Touchscreen using touch and drag gestures, or from the Wild Assign panel using physical rotary controls and buttons cells with their own displays, these controls are shown on the next page.

IU6576 STANDARD 12 FADER PANEL DETAIL

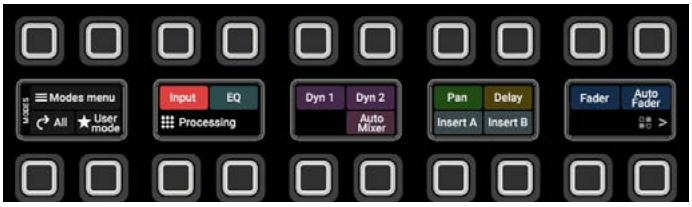


Mode Row Sets

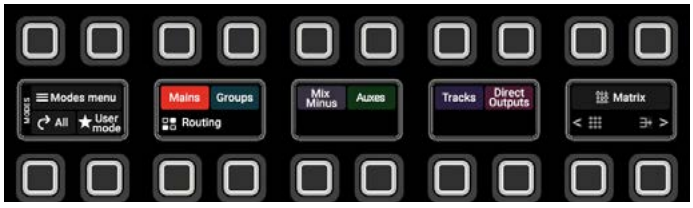
The Mode Row Sets below show the 4 main modes in button control cells 5 thru 8 & their associated function pages for reference.

- The Processing row applies signal processing to the selected path.
- The Routing row selects where the selected path source is sent to as a destination.
- The Buses row selects the various Main, Group Auxiliary and Track bus which may or may not be have been assigned to a fader on the surface, for the purpose of controlling the output level of the chosen bus.
- The Monitoring row selects the required monitoring output, controls its level, cut and dim settings and selects which signal path will be monitored based on the width of the monitoring system.

PROCESSING MODE ROW

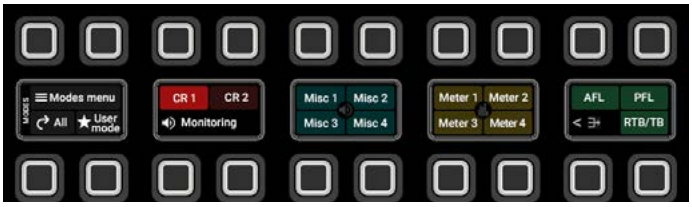


ROUTING MODE ROW



BUSES MODE ROW

MONITORING MODE ROW

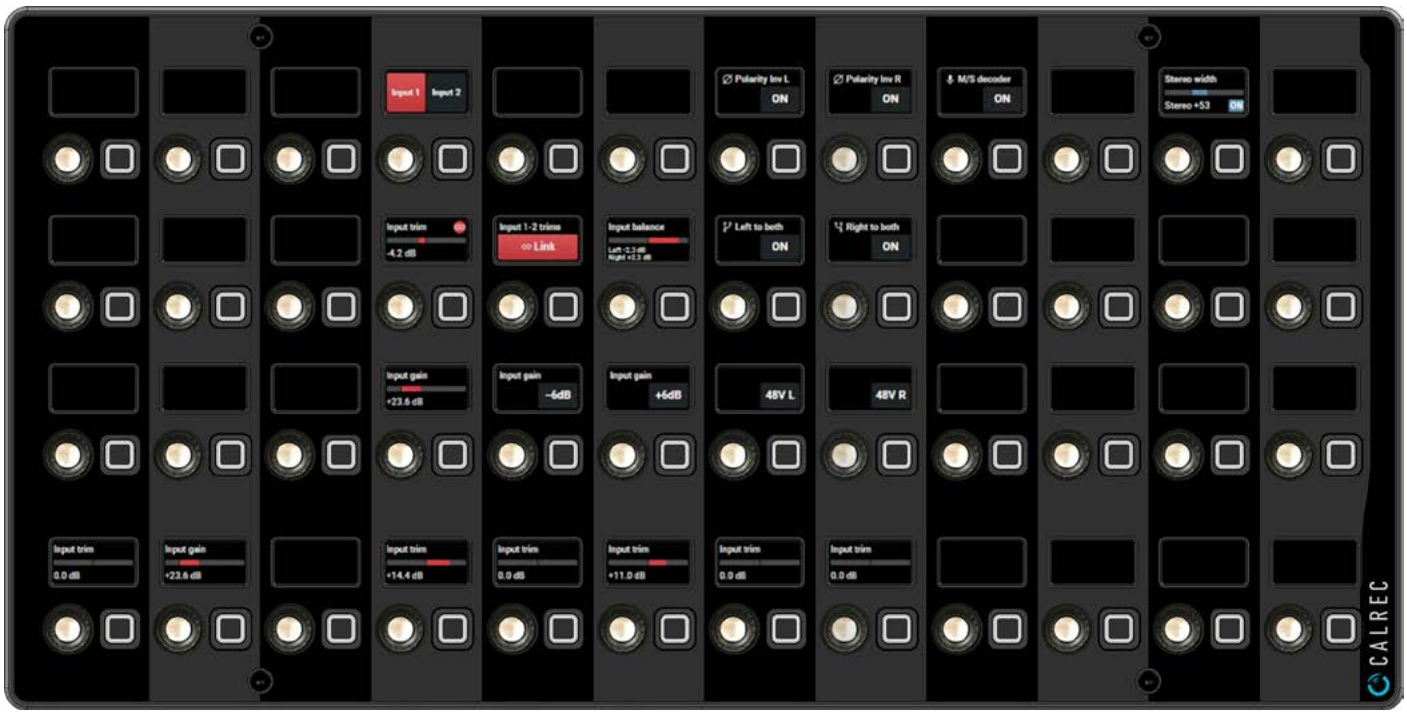


The image below shows the Wild Assign panel in **Processing>Input** mode.
The layout of the controls approximately mimics the layout of the TFT touchscreen and changes according to the type of path and the mode that has been selected.

Here we are looking at the Input controls for a stereo path on Fader 2A which are laid out across the top 3 rows of the panel, which provides up to 36 rotary and button controls cells with an associated TFT display for each parameter displayed.

The bottom row of 12 control cells are used here to display individual Input gain or Input trim levels of each fader strip where valid. This row of controls can be custom defined to display whatever control is required to be at hand from **Show setup>Customise panels.**

CA6575 WILD ASSIGN PANEL DETAIL



Console Touch UI Application
Once the Touch UI application has started, and the user is logged in if not already done so via the Login screen, the menu pages can be selected by tapping on the menu icons across the bottom of the GUI.

The main purpose of the TFT touchscreen panel on the console surface is to run the Console Touch UI application, providing access to various console options. The Touch UI application is launched when the console is powered up. It interacts with the Modes & Layers row of the fader panels providing an alternate method of controlling the console functions and displaying the relevant settings.

The image below shows the layout of the Touch UI application. Along the bottom of the application is the main menu which contains buttons for each of the main sections of the application. In this manual, the instruction to go to the **Processing** mode, it is the equivalent of saying: 'Touch the Processing button in the Touch UI application main menu'.

Once a certain mode has been selected, a list of related sub-menu buttons options will appear just above the main menu row.

Touching one of these buttons will update the main application to display the relevant screen. When for example instructed to go to a certain sub-menu screen, such as **>Processing>Input** it is referring to touching the relevant button on this list, along the bottom edge of the screen. This has the same action as if the Processing and Input buttons had been pressed on the Modes & Layers row of a standard fader panel

The touchscreen display below is selected to show the **Processing>Input** for the path shown bottom left of the screen. Layer 1 Fader 2A, a stereo channel input.

The upper half of the screen shows all the parameter controls associated with the input section of that channel path including metering data and input source identification on the left, Input 1/2 and Tone selections top middle, Input trim, Input balance (if stereo), Input Gain (if it has an analogue mic/line input) and various signal conditioning buttons. To the right of this is shown the Stereo Width control as it is a Stereo path.

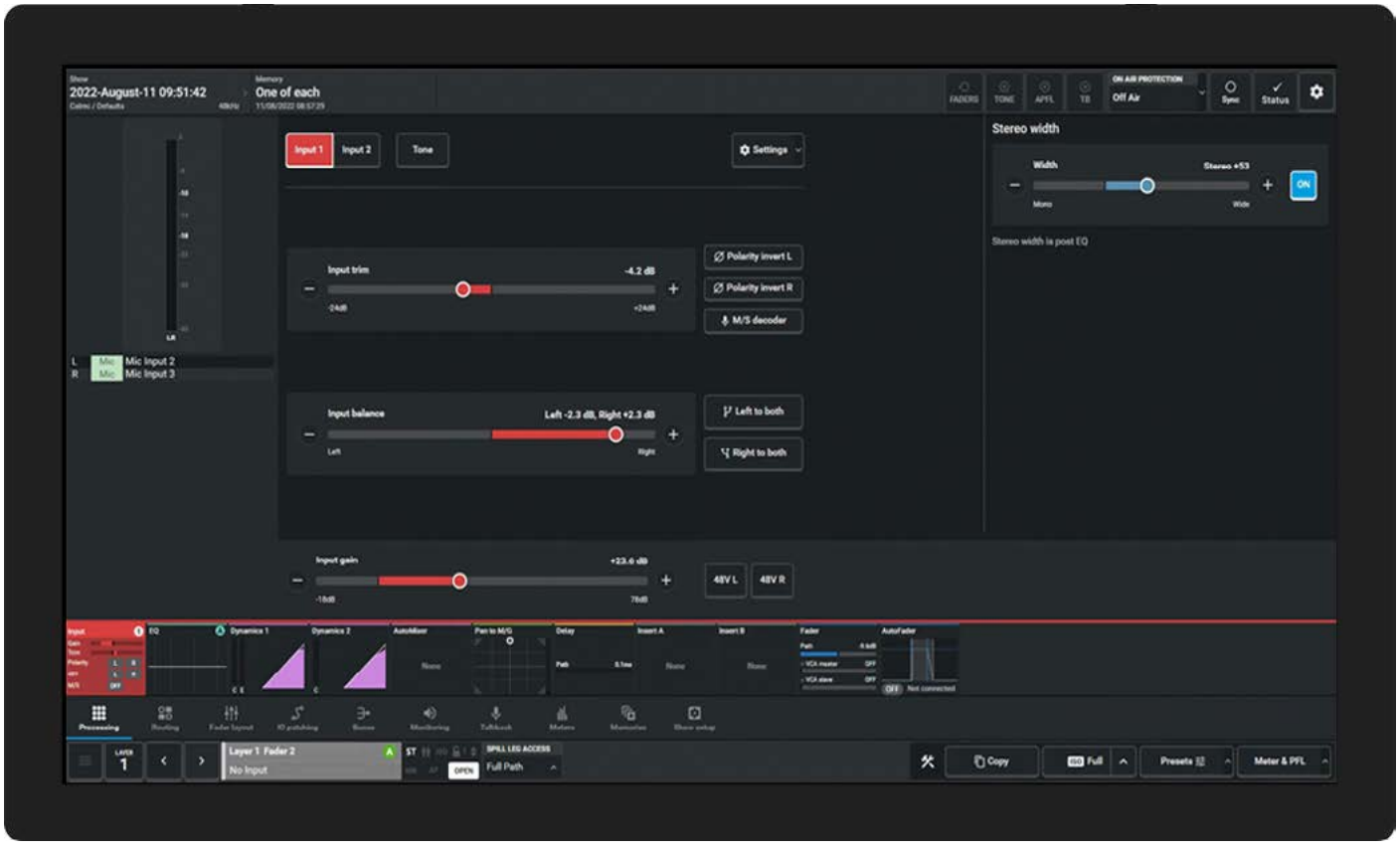
An examination of the Wild assign panel display on the facing page, shows the same information which is controlled from rotary controls and buttons as an alternative to tapping and dragging on the various areas of the touchscreen.

This setup section is here to provide a brief guide to the control and display elements of the system.

For more detailed information on the operation of the Console, see **"Further Reading" on page 90** which lists the various manuals available including the '**Argo Operator Manual (926-313).pdf** & **Argo Assist Manual (926-317).pdf**

Note: some settings within the main application are protected and to make certain changes to the operational layout the user must be logged in as an Engineer rather than an Operator.

MU6572 TOUCHSCREEN PANEL DETAIL



ARGO
PANEL OPTIONS

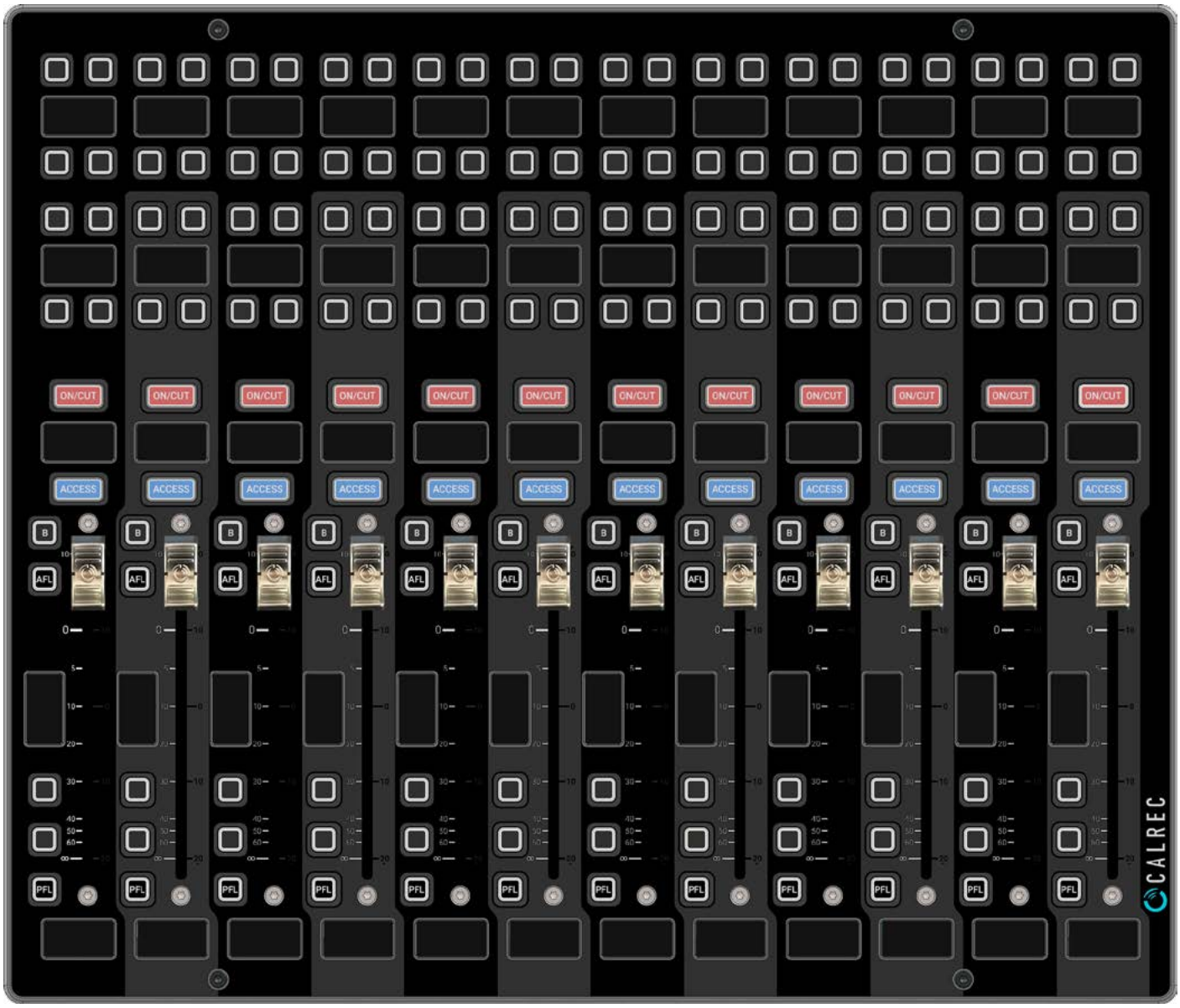
CALREC

STANDARD FADER PANEL – IU6576

The IU6576 Standard Fader panels make up the Argo S/Argo Q fader bed, multiple panels are fitted to make up the required fader quantity.

The IU6576 is 378.5mm wide x 322mm high and is fitted with 12 x 100mm throw touch sensitive faders. Each fader strip also has the following controls/ displays from bottom to top:- Mini TFT layer display, PFL button, 2 user defined buttons, Mini TFT meter display, AFL button, B-Layer button (if required), Access button, Mini TFT fader display, ON/CUT button which can be software configured to light when the fader path is active (ON) or when the fader path is muted (CUT). The upper area of the panel has 2 sets of 4 button cells with a Mini TFT Display per fader which can be configured to display the various switch parameters as required.

IU6576 - ARGO S & ARGO Q STANDARD 12 FADER PANEL



PANEL CONNECTOR LAYOUT

Connections

This panel has two separate connectors for power and control placed on the back of the unit. The Standard Fader panel connects to the UN6539 section processor which provides both power via a 4 pin 12v DC connector and control data via a USB 3 Type B connector which uses the Superspeed pairs to provide 2 x LVDS outputs on each USB 3.0 port for Mini-TFT data to the Control Surface Modules. The USB 2.0 legacy pair in the USB 3.0 connector transports surface control events between panels and host processor.

WILD ASSIGN PANEL – CA6575

The CA6575 Wild Assign panels can be fitted in the Argo S/Argo Q central control area, for the Argo S, one row of this panel type can be fitted and for the larger Argo Q, two rows of this panel type can be fitted to make up the required console layout.

The CA6575 is 378.5mm wide x 190mm high and is fitted with the following controls/displays:-

48 rotary control cells arranged as 4 rows of 12 sets of rotary control cells, with the bottom row separated from the other 3 rows.

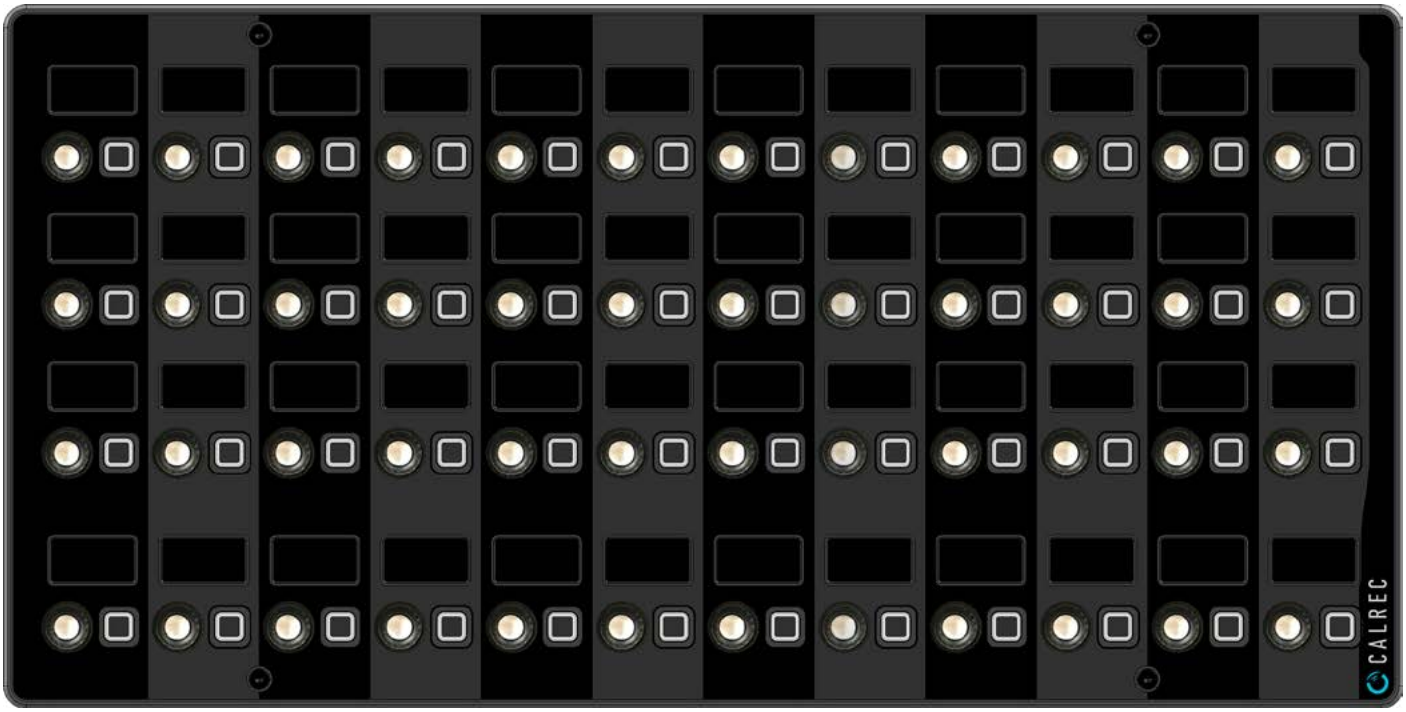
Each control cell contains a rotary shaft encoder control with integral switch.

This is activated by pressing the top of the encoder down this is typically used to reset the parameter which the rotary control is controlling.

It also contains a separate illuminating button and a Mini TFT Display per cell.

Each rotary control cell can be configured to display and control the various continuous and switch parameters as required.

CA6575 - ARGO S & ARGO Q WILD ASSIGN PANEL



PANEL CONNECTOR LAYOUT

Connections

This panel has two separate connectors for power and control placed on the back of the unit.

The Wild Assign panel connects to the UN6539 section processor which provides both power via a 4 pin 12v DC connector and control data via a USB3 Type B connector which uses the Superspeed pairs to provide 2 x LVDS outputs on each USB 3.0 port for Mini-TFT data to the Control Surface Modules. The USB 2.0 legacy pair in the USB 3.0 connector transports surface control events between panels and host processor.

MONITOR PANEL – MY6574

The MY6574 Monitor panel provides the Argo S/Argo Q full control of the various monitoring outputs of the console. Generally one of these panels is fitted per console although more than one can be fitted for multi-user/monitor operation.

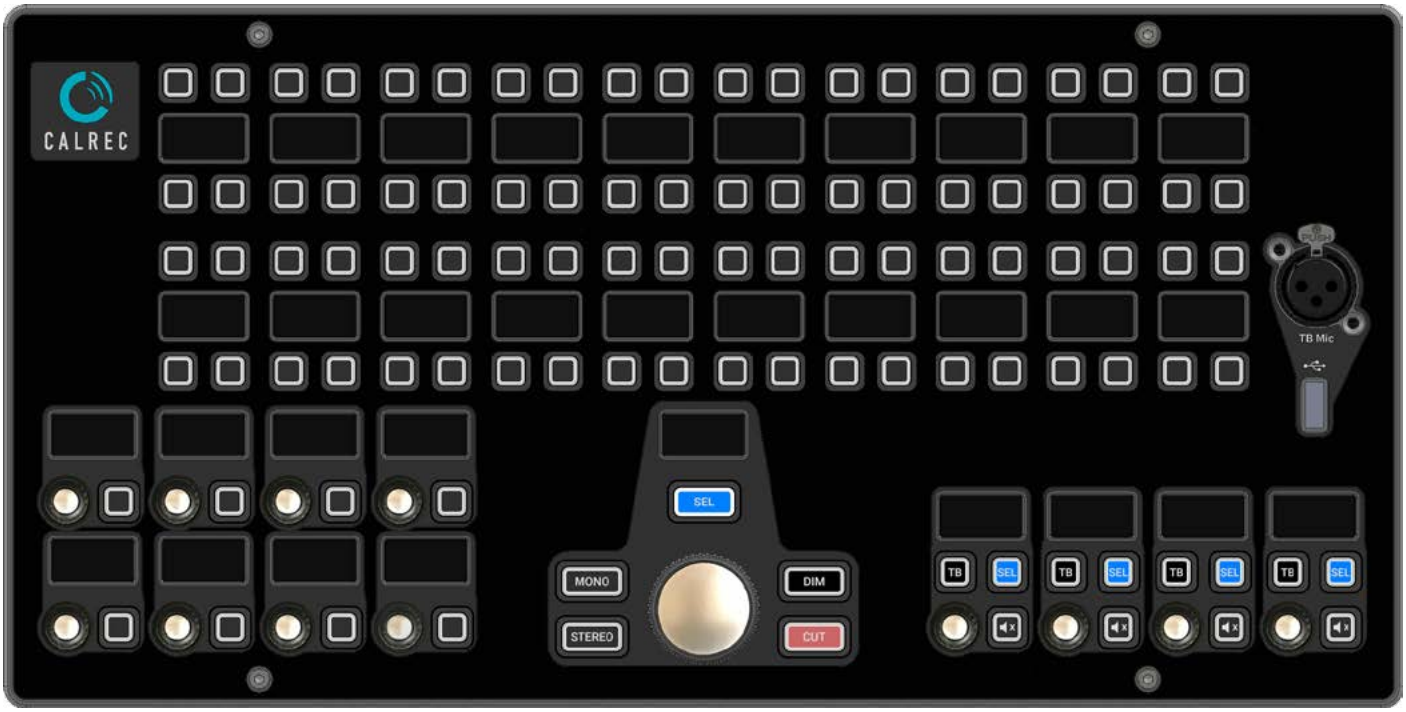
The MY6574 is 378.5mm wide x 190mm high and is fitted with the following controls/displays:- A large rotary control in the centre of the panel is used to provide control for the Main control room monitors, various buttons to CUT/DIM the monitor speakers and the MONO/STEREO buttons change the width of the monitored signal.

The associated Mini TFT display is used to show the current monitor source and level and the **SEL**ector button below opens the monitor source selection shown on the 20 sets of 4 button cells which can be used to provide a variety of control options.Placed to the right of the main monitor control, there are 4 misc monitor control sets each of which has a Talkback button, source **SEL**ector button which operates in the same way as the main monitor **SEL** button described earlier and a Mute button.

Note: the Mute button on Misc monitors may be configured to act as either a Cut or Dim control.

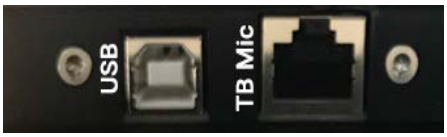
To the left of the main monitor control is placed 8 rotary control cells arranged as 2 rows of 4 sets of rotary control cells, each of which contains: a rotary shaft encoder control with integral switch. This is activated by pressing the top of the encoder down this is typically used to reset the parameter which the rotary control is controlling. It also contains a separate illuminating button and a Mini TFT Display per cell. Each rotary control cell can be configured to display and control the various continuous and switch parameters as required. On the far right of the panel is a USB connector for the user and an XLR connector which can have a microphone fitted to provide Talkback.

MY6574 - ARGO S & ARGO Q MONITOR PANEL



PANEL CONNECTOR LAYOUT

TB MIC & USB CONNECTOR LAYOUT



Connections

This panel has two separate connectors for power and control placed on the back of the unit. The Monitor panel connects to the UN6539 section processor, which provides both power via a 4 pin 12v DC connector and control data via a USB 3 Type B connector which uses the Superspeed pairs to provide 2 x LVDS outputs on each USB 3.0 port for Mini-TFT data to the Control Surface Modules.

The USB 2.0 legacy pair in the USB 3.0 connector transports surface control events between panels and host processor.

Additional Monitor Connections

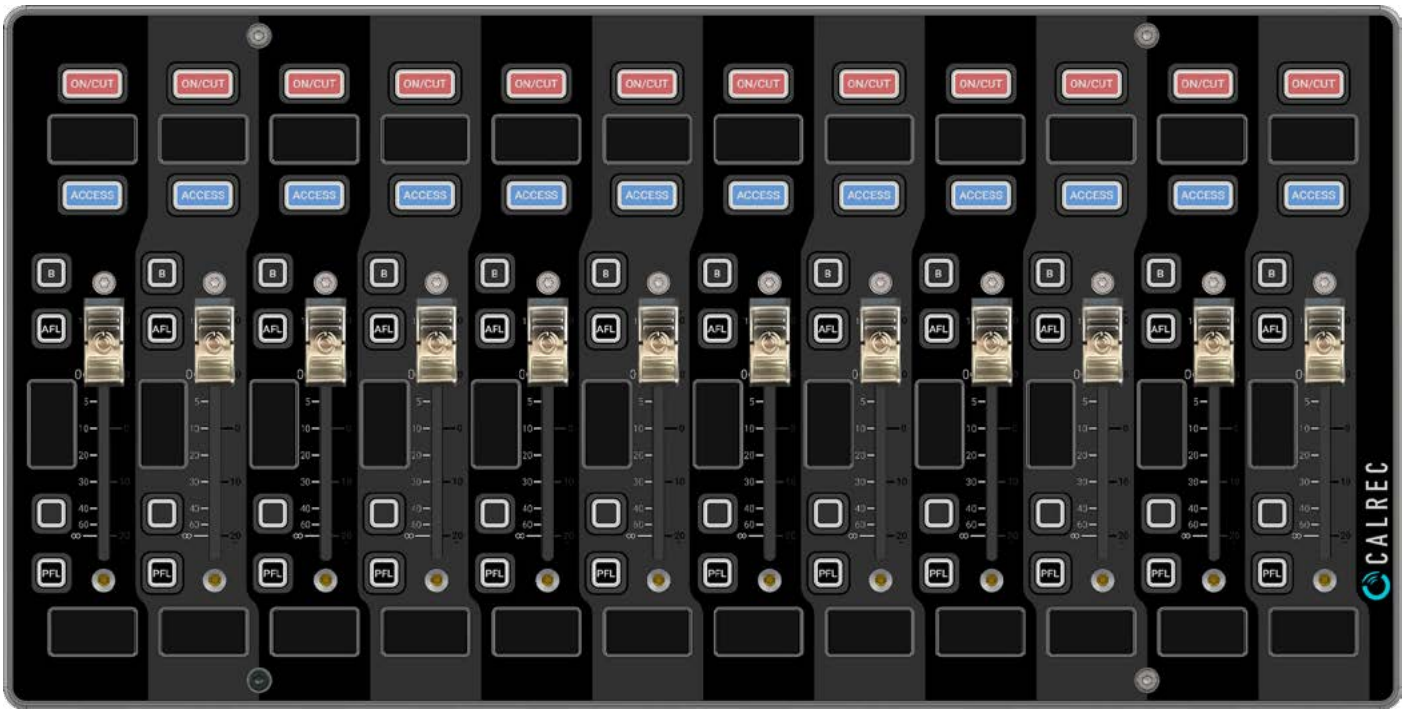
This panel has two additional connectors as shown bottom left, for the User USB 2 Type B port which is connected to the Section processor and an RJ45 connector which uses the Studio Hub pin out to connect the Talkback Mic to the back of the JB6549 Combo AoIP I/O device.

SHORT FADER PANEL – IU6577

The IU6577 Short Fader panels can be fitted in the Argo S/Argo Q central control area, for the Argo S, one row of this panel type can be fitted and for the larger Argo Q, two rows of this panel type can be fitted to make up the required console layout.

The IU6577 is 378.5mm wide x 190mm high and is fitted with 12 x 65mm throw touch sensitive faders. Each short fader strip also has the following controls/ displays from bottom to top:-
Mini TFT layer display, PFL button, 1 user defined button, Mini TFT meter display, AFL button, B-Layer button (if required), Access button, Mini TFT fader display, ON/CUT button which can be software configured to light when the fader path is active (ON) or when the fader path is muted (CUT).

IU6577 - ARGO S & ARGO Q SHORT FADER PANEL



PANEL CONNECTOR LAYOUT

Connections

This panel has two separate connectors for power and control placed on the back of the unit. The Short Fader panel connects to the UN6539 section processor which provides both power via a 4 pin 12v DC connector and control data via a USB 3 Type B connector which uses the Superspeed pairs to provide 2 x LVDS outputs on each USB 3.0 port for Mini-TFT data to the Control Surface Modules.

The USB 2.0 legacy pair in the USB 3.0 connector transports surface control events between panels and host processor.

TFT TOUCHSCREEN PANEL – MU6572

The MU6572 TFT Touchscreen panel provides the Argo S/Argo Q with a graphical user interface to provide a 1920px x 1080px TFT video display and touch circuitry, touch control and display of the various control parameters of the console. These panels are generally fitted across the required surface size.

The MU6572 is 378.5mm wide x 228mm high and uses a 1920px x 1080px TFT to display rendered graphics and composited video data generated on the section processor via the DP Display port 1.4 interface. It is fitted with a multi-touch digitiser circuit also connected from the Section Processor via USB that allows the user to select operations from a menu based GUI and to use touch control to adjust the console parameters.

It can also optionally display Input video via the Video SFP inputs on the section processor.

The image below shows an example of an interactive Equaliser page, with the sliders and buttons controllable via touch.

The Display backlight level and enable control are provided using baseband signalling over unused DP pairs on the DP connector.

MU6572 - ARGO S & ARGO Q TFT TOUCHSCREEN PANEL

DISPLAY CONNECTOR LAYOUT

Connections

This panel has three separate connectors for touch, power and video display placed on the back of the panel.

The TFT Touchscreen Panel connects to the UN6539 section processor which provides:

Touch control via a USB 2 Type B connector.

Power Input via a 4 pin 12v DC connector.

Video display data via a DP Display port 1.4 Interface using a full size DP latching connector.

TFT METER PANEL – MD6573

The MD6573 TFT Meter panel provides the Argo S/Argo Q with a graphical user interface to provide a 1920px x 1080px TFT video display of the various audio input and output levels of the console. Typically the Meter panel shows audio metering displays. These panels are generally fitted across the required surface size.

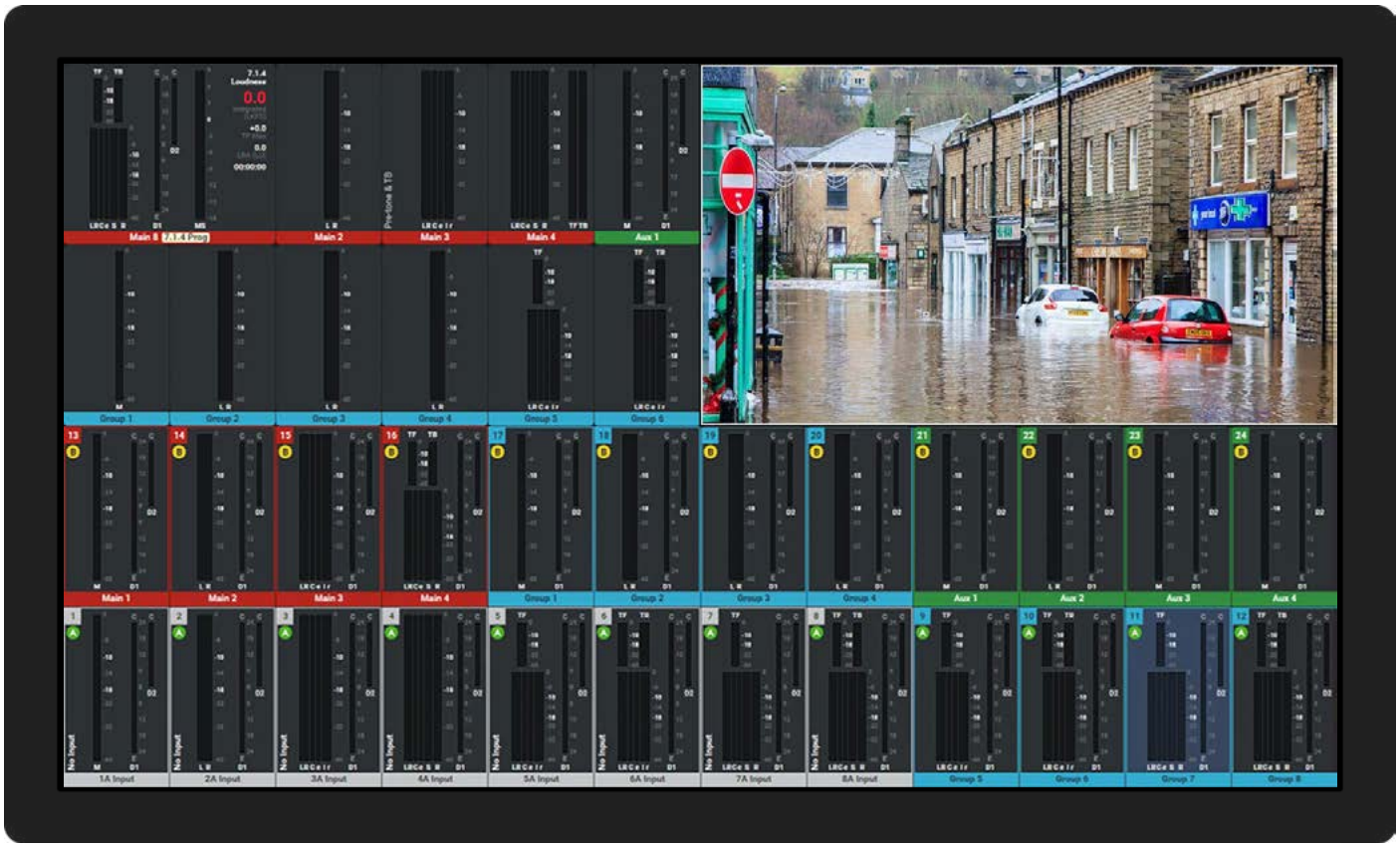
The MD6573 is 378.5mm wide x 228mm high and uses the same 1920px x 1080px TFT screen as the MU6572. It is primarily used to display Audio Meters Rendered Bar Graphs and optionally display Input video via the Video SFP inputs on the section processor.

The image below shows an example combination of Audio Metering and a 1/4 screen input video image.

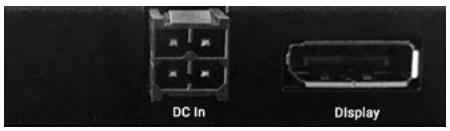
The TFT Meter display does not use the touch control circuitry as it is a display only module so no USB touch connection is required.

The Display backlight level and enable control are provided using baseband signalling over unused DP pairs on the DP connector.

MD6573 - ARGO S & ARGO Q TFT METER PANEL



DISPLAY CONNECTOR LAYOUT



Connections

This panel has two separate connectors for power and video display placed on the back of the panel.

The TFT Meter Panel connects to the UN6539 section processor which provides:

Power via a 4 pin 12v DC connector.

Video display data via a DP Display port 1.4 Interface using a full size DP latching connector.

ARGO
SPECIFICATIONS

CALREC

GENERAL SPECIFICATIONS

The digital signal processing element of the Impulse core allows a combination of different 'Console Pack' sizes.

DSP Pack Sizes for Argo S & Argo Q

The Impulse Core has a number of DSP Packs available for Argo S & Argo Q which can be installed in the DSP Module. The table below shows each pack size which can be used in conjunction with any Argo S or Argo Q console. The console will have been provided with the DSP Pack under licence ordered at the time of purchase and other DSP pack licences may be purchased to provide more processing facilities as required.

SIGNAL PROCESSING AND PACK SIZES AT 48KHZ

DSP Pack Licence Name	Argo S/Argo Q Pack 8	Argo S/Argo Q Pack 7 & Pack 7B	Argo S/Argo Q Pack 6 & Pack 6B	Argo S/Argo Q Pack 5 & Pack 5B/5C
Input Channels	2048	1792	1536	1122 OR 1024 Pack 5C
Main Output Buses	Up to 16 buses from 192 mono legs Mains & Groups pool	Up to 16 buses from xxx mono legs Mains & Groups pool	Up to 16 buses from xxx mono legs Mains & Groups pool	Up to 16 buses from xxx mono legs Mains & Groups pool
Audio Group Buses	Up to 48 buses from 192 mono legs Mains & Groups pool	Up to 48 buses from 192 mono legs Mains & Groups pool	Up to 48 buses from 192 mono legs Mains & Groups pool	Up to 48 buses from 192 mono legs Mains & Groups pool
Track/IFB Output Buses	Up to 96 buses from 96 mono legs pool	Up to 96 buses from 96 mono legs pool	Up to 96 buses from 96 mono legs pool	Up to 96 buses from 96 mono legs pool
Track/IFB Sends in Path	4	4	4	4
Aux Output Buses	Up to 48 buses from 48 mono legs pool	Up to 48 buses from 48 mono legs pool	Up to 48 buses from 48 mono legs pool	Up to 48 buses from 48 mono legs pool
Direct/Mix-Outputs per Channel-Group	Up to 4 outputs from 1024 mono legs pool	Up to 4 outputs from 1024 mono legs pool OR 768 mono legs pool on Pack 7B	Up to 4 outputs from 768 mono legs pool OR 512 mono legs pool on Pack 6B	Up to 4 outputs from 768 mono legs pool OR 512 mono legs pool on Pack 5B & Pack 5C
Insert Send & Returns	2 x Inserts/path from 1024 mono legs pool	2 x Inserts/path from 1024 mono legs pool OR 896 mono legs pool on Pack 7B	2 x Inserts/path from 384 mono legs pool	2 x Inserts/path from 384 mono legs pool
EQ on Channels Groups, Mains, Auxes & Tracks	6 band parametric EQ 6/12 dB8v shelves and 6/12/18 db8v filters on Bands 1 & 6	6 band parametric EQ 6/12 dB8v shelves and 6/12/18 db8v filters on Bands 1 & 6	6 band parametric EQ 6/12 dB8v shelves and 6/12/18 db8v filters on Bands 1 & 6	6 band parametric EQ 6/12 dB8v shelves and 6/12/18 db8v filters on Bands 1 & 6
Dynamics	2 x compress/limiters 1 x expander/gate/ducker with sidechain source selection per Channel & Group 2-band sidechain EQ per Channel 1-band sidechain EQ per Group & Main. 2 x compress/limiters per Aux & Track	2 x compress/limiters 1 x expander/gate/ducker with sidechain source selection per Channel & Group 2-band sidechain EQ per Channel 1-band sidechain EQ per Group & Main 2 x compress/limiters per Aux & Track	2 x compress/limiters 1 x expander/gate/ducker with sidechain source selection per Channel & Group 2-band sidechain EQ per Channel 1-band sidechain EQ per Group & Main 2 x compress/limiters per Aux & Track	2 x compress/limiters 1 x expander/gate/ducker with sidechain source selection per Channel & Group 2-band sidechain EQ per Channel 1-band sidechain EQ per Group & Main 2 x compress/limiters per Aux & Track
Input Delay	Up to 5.4s/input from 256 mono legs pool	Up to 5.4s/input from 256 mono legs pool	Up to 5.4s/input from 256 mono legs pool	Up to 5.4s/input from 256 mono legs pool
Path Delay	Up to 5.4s/path	Up to 5.4s/path	Up to 5.4s/path	Up to 5.4s/path
Output Delay	Up to 5.4s/output from 256 mono legs pool	Up to 5.4s/output from 256 mono legs pool	Up to 5.4s/output from 256 mono legs pool	Up to 5.4s/output from 256 mono legs pool

Multiple Consoles & DSP Packs

The DSP carrier module can be loaded with up to 4 Mezzanine modules which allows up to 4 Argo consoles to operate simultaneously. These are arranged in pairs (first pair provides mixers A & B, second pair provides mixers C & D)

These Impulse DSP Pairing options for multiple console use are shown on page 78.

Note: in some console pairing combinations, the number of Direct Outputs are reduced ,these DSP packs are known as **PACK 5B, 6B & 7B** also note that in one case there is also a reduction in the number of channels in **PACK 5C** from 1122 to 1024.

DSP Pack Licence Name	Argo S/Argo Q Pack 4	Argo S/Argo Q Pack 3	Argo S/Argo Q Pack 2	Argo S/Argo Q Pack 1
Input Channels	768	512	384	256
Main Output Buses	Up to 16 buses from 192 mono legs Mains & Groups pool	Up to 16 buses from 192 mono legs Mains & Groups pool	Up to 16 buses from 192 mono legs Mains & Groups pool	Up to 16 buses from 96 mono legs Mains & Groups pool
Audio Group Buses	Up to 48 buses from 192 mono legs Mains & Groups pool	Up to 48 buses from 192 mono legs Mains & Groups pool	Up to 48 buses from 192 mono legs Mains & Groups pool	Up to 48 buses from 96 mono legs Mains & Groups pool
Track/IFB Output Buses	Up to 64 buses from 64 mono legs pool	Up to 64 buses from 64 mono legs pool	Up to 64 buses from 64 mono legs pool	Up to 48 buses from 48 mono legs pool
Track/IFB Sends in Path	4	4	4	4
Aux Output Buses	Up to 32 buses from 32 mono legs pool	Up to 32 buses from 32 mono legs pool	Up to 32 buses from 32 mono legs pool	Up to 32 buses from 32 mono legs pool
Direct/Mix-Outputs per Channel-Group	Up to 4 outputs from 512 mono legs pool	Up to 4 outputs from 512 mono legs pool	Up to 4 outputs from 512 mono legs pool	Up to 4 outputs from 256 mono legs pool
Insert Send & Returns	2 x Inserts/path from 256 mono legs pool	2 x Inserts/path from 256 mono legs pool	2 x Inserts/path from 256 mono legs pool	2 x Inserts/path from 128 mono legs pool
EQ on Channels Groups, Mains, Auxes & Tracks	6 band parametric EQ 6/12 dB8v shelves and 6/12/18 db8v filters on Bands 1 & 6	6 band parametric EQ 6/12 dB8v shelves and 6/12/18 db8v filters on Bands 1 & 6	6 band parametric EQ 6/12 dB8v shelves and 6/12/18 db8v filters on Bands 1 & 6	6 band parametric EQ 6/12 dB8v shelves and 6/12/18 db8v filters on Bands 1 & 6
Dynamics	2 x compress/limiters 1 x expander/gate/ducker with sidechain source selection per Channel & Group 2-band sidechain EQ per Channel 1-band sidechain EQ per Group & Main. 2 x compress/limiters per Aux and Track	2 x compress/limiters 1 x expander/gate/ducker with sidechain source selection per Channel & Group 2-band sidechain EQ per Channel 1-band sidechain EQ per Group & Main. 2 x compress/limiters per Aux and Track	2 x compress/limiters 1 x expander/gate/ducker with sidechain source selection per Channel & Group 2-band sidechain EQ per Channel 1-band sidechain EQ per Group & Main. 2 x compress/limiters per Aux and Track	2 x compress/limiters 1 x expander/gate/ducker with sidechain source selection per Channel & Group 2-band sidechain EQ per Channel 1-band sidechain EQ per Group & Main. 2 x compress/limiters per Aux and Track
Input Delay	Up to 5.4s/input from 256 mono legs pool	Up to 5.4s/input from 128 mono legs pool	Up to 5.4s/input from 128 mono legs pool	Up to 5.4s/input from 128 mono legs pool
Path Delay	Up to 5.4s/path	Up to 5.4s/path	Up to 5.4s/path	Up to 5.4s/path
Output Delay	Up to 5.4s/output from 256 mono legs pool	Up to 5.4s/output from 128 mono legs pool	Up to 5.4s/output from 128 mono legs pool	Up to 5.4s/output from 128 mono legs pool

DSP MIXER PAIRING OPTIONS

DSP Pack Licence Name	Argo S/Argo Q Mixer A	Argo S/Argo Q Mixer B	Argo S/Argo Q Mixer C	Argo S/Argo Q Mixer D
Base Pack 1	Pack 1 Pack 1	None Pack 1	Pack 1 Pack 1	None Pack 1
Base Pack 2	Pack 2 Pack 2 Pack 2	None Pack 1 Pack 2	Pack 2 Pack 2 Pack 2	None Pack 2 Pack 2
Base Pack 3	Pack 3 Pack 3 Pack 3 Pack 3	None Pack 1 Pack 2 Pack 3	Pack 3 Pack 3 Pack 3 Pack 3	None Pack 1 Pack 2 Pack 3
Base Pack 4	Pack 4 Pack 4 Pack 4 Pack 4 Pack 4	None Pack 1 Pack 2 Pack 3 Pack 4	Pack 4 Pack 4 Pack 4 Pack 4 Pack 4	None Pack 1 Pack 2 Pack 3 Pack 4
Base Pack 5	Pack 5 Pack 5 Pack 5B Pack 5B Pack 5B Pack 5C	None Pack 1 Pack 2 Pack 3 Pack 4 Pack 5C	Pack 5 Pack 5 Pack 5B Pack 5B Pack 5B Pack 5C	None Pack 1 Pack 2 Pack 3 Pack 4 Pack 5C
Base Pack 6	Pack 6 Pack 6 Pack 6B Pack 6B	None Pack 1 Pack 2 Pack 3	Pack 6 Pack 6 Pack 6B Pack 6B	None Pack 1 Pack 2 Pack 3
Base Pack 7	Pack 7 Pack 7B	None Pack 1	Pack 7 Pack 7B	None Pack 1
Base Pack 8	Pack 8	None	Pack 8	None

Notes: Mixers A & B reside on the first pair of Mezzanine cards slots 0 & 2 and Mixers C & D reside on the second pair of Mezzanine cards slots 1 & 3 on the DSP carrier module, and the mapping of the Mixer packs to the actual surfaces can be swapped around as required.

ROUTER CONNECTIONS IN/OUT OF CORE

Router Modules 1 of 4	2048 x 2048 (1 Router Module) up to 8192 x 8192 (4 Router Modules)
AoIP Connections	4 + 4 redundant connections per router
Audio Channels per 1Gbps AoIP Connection	Up to 256 bi-directional

CONTROL SURFACE SIZES FOR ARGO S/ARGO Q INDEPENDENT OF PACK SIZE

Argo	2048/1792/1536	1122	768	512	384	256
Max Physical Faders	96 Standard + 96 Short	96 Standard + 96 Short	96 Standard + 96 Short	96 Standard + 96 Short	96 Standard + 96 Short	96 Standard + 96 Short
Fader Layers	12 dual layers	12 dual layers	12 dual layers	12 dual layers	12 dual layers	12 dual layers

POWER/ENVIRONMENTAL SPECIFICATION

CONTROL SURFACE

Power	The console has two IEC AC power inlets feeding two sets of internal power distribution for each set of 4 sections. Although the console will operate with one inlet supply per 4 sections, we recommend both inlets are powered. This will ensure continued operation should a PSU or AC source fail. The operating AC supply voltage is 100V–240V +/-10%. The inrush current is actively limited to 13A peak at 230V (6.5A at 115V) per 4 x internal PSU. This much reduces the chance of a nuisance trip or fuse blow from a hot start after a momentary brownout or blackout of the AC power. The total peak inrush current and quiescent current can be specified for any size of console. There is a peak operating current when the motorised faders move. The worst case is if all the faders move end to end where the peak power will be 4 Watts per fader for <120ms. Active PFC (Power Factor Correction) is employed in the power supplies and the PF (Power Factor) is typically greater than 0.88 dependant on console size. The power measurements for 4 sections, 3 sections, 2 sections & 1 section are shown below.
Heat Output & Efficiency	The Heat output from the console is typically 0.9 times the RMS VA (Volts x Amperes). These figures can be provided for any size of console. The PSU efficiency under all operating conditions is typically greater than 85%, dependant on console size.
Cooling	The control surface is cooled by natural air convection. The air intake is on the underside of the console and the outtake is along the top rear of the console. At least 50mm (2') clearance must be maintained for these vents.
Operating Ambient Air Temperature	Short Term: 5°C - 35°C Long Term: 15°C - 30°C
Relative Humidity	5% – 80% Non-condensing

ARGO CONSOLE PER-SECTION POWER MEASUREMENTS

VAC (V)	Volt AC (RMS) (V)	Steady State RMS Current (A)	* Worst Case RMS Current (A)	**4-Section Power Measurements** Mains Measurements below were taken at wall socket with Plug-in Power measurement Adapter (NB:240V only) * **All faders moving at once**				
				Volt AC (Plug-in adapter) (V)	Current (Plug-in adapter) (A)	Power Factor (Plug-in adapter) (%)	Power (Plug-in adapter) (W)	Power Max (Plug-in adapter) (W)
240	237.3	1.420	1.650	239	2.81	54	363	459
115	115.1	1.642	2.300					
100	101.3	1.858	2.600					

ARGO CONSOLE PER-SECTION POWER MEASUREMENTS CONTINUED

VAC (V)	Volt AC (RMS) (V)	Steady State RMS Current (A)	* Worst Case RMS Current (A)	3-Section Power Measurements Mains Measurements below were taken at wall socket with Plug-in Power measurement Adapter (NB:240V only) * All faders moving at once				
				Volt AC (Plug-in adapter) (V)	Current (Plug-in adapter) (A)	Power Factor (Plug-in adapter) (%)	Power (Plug-in adapter) (W)	Power Max (Plug-in adapter) (W)
240	235.7	1.050	1.115	237	2.12	54	276	354
115	115.7	1.221	1.439					
100	100.9	1.392	1.638					

VAC (V)	Volt AC (RMS) (V)	Steady State RMS Current (A)	* Worst Case RMS Current (A)	2-Section Power Measurements Mains Measurements below were taken at wall socket with Plug-in Power measurement Adapter (NB:240V only) * All faders moving at once				
				Volt AC (Plug-in adapter) (V)	Current (Plug-in adapter) (A)	Power Factor (Plug-in adapter) (%)	Power (Plug-in adapter) (W)	Power Max (Plug-in adapter) (W)
240	235.4	0.840	0.910	237	1.77	47	192	247
115	115.0	0.999	1.061					
100	100.4	1.079	1.220					

VAC (V)	Volt AC (RMS) (V)	Steady State RMS Current (A)	* Worst Case RMS Current (A)	1-Section Power Measurements Mains Measurements below were taken at wall socket with Plug-in Power measurement Adapter (NB:240V only) * All faders moving at once				
				Volt AC (Plug-in adapter) (V)	Current (Plug-in adapter) (A)	Power Factor (Plug-in adapter) (W)	Power (Plug-in adapter) (W)	Power Max (Plug-in adapter) (W)
240	237.2	0.642	0.660	239	1.26	33	105	126
115	115.2	0.765	0.770					
100	100.5	0.811	0.885					

ARGO CONSOLE SINGLE SECTION PANEL MEASUREMENTS (STEADY STATE) - 240V ONLY

Criteria	Steady State RMS Current (A)	Current (Plug-in Adapter) (A)
PSU's Only	0.470	0.93
+ Section Processor	0.549	1.01
+ Cisco Switch	0.563	1.11
+ Touch TFT	0.576	1.11
+ Meter TFT	0.582	1.14
+ Standard Fader Panel only	0.590	1.17
+ Short Fader Panel only	0.597	1.16
+ Wild Assign Panel only	0.594	1.17
+ Monitor Panel only	0.594	1.17

ARGO CONSOLE UNIT WEIGHTS

Unit Number	Unit Name	Weight (Kg)
CA6575	Wild Assign Panel	1.73
491-329	Cisco Switch	2.58
EG6623	Argo Q 3-Section chassis (empty)	27.66
ET6674	Argo Q Stand (3-Section)	20.50
IU6576	Standard Fader Panel	4.04
IU6577	Short Fader Panel	2.91
JB6549	AoIP Combo I/O (unbalanced)	1.38
MD6573	Meter TFT (non-touch) + bracket	2.66
MU6572	Touch TFT Panel (case only)	2.30
MY6574	Monitor Panel	1.94
UN6539	Section Processor	2.14
ZN6578	PSU Module	1.39

IMPULSE PROCESSING CORE

Power	The impulse processing core is fitted with two AC mains input power supply modules. The core will be fully functional on one PSU, however both should be fitted and fed where possible from separate sources to provide redundancy against both PSU failure and external power loss. The operating AC supply voltage is 100V–240V +/-10%. The inrush current is actively limited to 13A peak at 230V (6.5A at 115V) per power supply module. This much reduces the chance of a nuisance trip or fuse blow from a hot start after a momentary brownout or blackout of the AC power. The quiescent current can be specified for any configuration of core. Active PFC (Power Factor Correction) is employed in the power supplies and the PF (Power Factor) is greater than 0.9 under all operating conditions.		
Heat Output & Efficiency	The heat output from the core is nominally 0.93 times the RMS VA (Volts x Amperes). These figures can be provided for any core configuration.		
Cooling	The core is cooled by fan assisted convection. Air is drawn in from the front into each of the modules except for the PSU's that use a large heat sink. The DSP module has two 80mm fans mounted on its front panel, the Control Processor Module and each of the four Router modules have two 40mm fans one mounted in the front panel and one in the bottom of the module blowing upwards. This fan arrangement pulls air through the module frame which then exits through vents across the top and rear of the core. All fans are speed monitored and System Status error message are generated for any failures. To ensure air can flow through the card frame freely, the air vents at the rear of the core should be left clear and unobstructed. No clearance is required above or below the core for cooling.		
Operating Ambient Air Temperature	0°C - 40°C		
Relative Humidity	5% – 80% Non-condensing		
Supply Voltage	**240V Operation**	**115V Operation**	**100V Operation**
Supply Current	1.62 A	3.23 A	3.72 A
Power Factor	0.94	0.99	0.99
Power Dissipation (Heat)	365 W	368 W	368 W
Cooling	The Impulse Core Unit is 5U and is cooled under control with fan assistance. The PSU's are cooled by heatsink only, however the Control Processor, Router and DSP modules are cooled by a variety of fans. Fan speed is monitored and system status warnings are generated if fans fail. The front & rear panels of the unit should be unobstructed to allow airflow. No clearance is required above or below the unit.		
Operating Ambient Air Temperature	0°C - 40°C		
Weight	25 Kg		
Dimensions	444mm Width x 223mm Height x 500mm Depth (483mm Wide Front Panel)		

FIXED FORMAT I/O

Power	All fixed format I/O units have two IEC AC power inlets and are fitted with dual power supplies. Units will be fully functional on one PSU, however both should be fed where possible from separate sources to provide redundancy against both PSU failure and external power loss. The operating AC supply voltage is 100V–240V +/-10%. The peak inrush current is limited (cold start). Figures are available for all units. This reduces the chance of a nuisance trip or fuse blow from power up. The RMS quiescent current figures are available for all types of I/O box.
Power Factor	All fixed format I/O units require less than 75W of input power. The internal power supplies fitted have passive filtering (as opposed to active power factor correction) to reduce the harmonics to within the limits of the standard EN61000-3-2. At the time of writing the standard does not apply to equipment <75W. If the lower limit is ever reduced the units will be compliant and as such are future proof.
Heat Output & Efficiency	The Heat output from fixed format I/O units depends on the supply voltage and loading. Typically it is 0.55 times the RMS VA (Volts x Amperes) at 230V & 0.7 times the RMS VA at 115V. Heat output figures are available for all types of I/O box. The low power PSU efficiency is again dependant on supply voltage and loading, generally >70%.
Cooling	All fixed format I/O units of 2U or greater are cooled under control with fan assistance. Operation is not dependant on the fan; it is there to extend the operating life of the unit. There is an 80mm low power, low speed and low noise fan mounted to the right hand side panel of each unit venting air. Fan speed is monitored and System Status warnings generated if fans slow or fail. Air is drawn in through the left hand side panel. The side panels of all fixed format I/O units should be unobstructed with at least 50mm (2') clearance to allow airflow. No clearance is required above or below the unit. I/O units may be mounted in an open bay providing the ambient air temperature is within limits (see below). The units may also be housed in any air conditioned bay.
Acoustic Noise	<27 dB SPL (A-weighted, 1m from front).
Operating Ambient Air Temperature	0°C - 35°C
Relative Humidity	5% – 80% Non-condensing

MODULAR I/O

Power	Modular I/O frames are fitted with dual power supplies and have 2 IEC mains input connectors. Units will be fully functional on one PSU, however both should be fed where possible from separate sources to provide redundancy against both PSU failure and external power loss. The operating AC supply voltage is 100V–240V +/-10%. The peak inrush current is limited (cold start). This reduces the chance of a nuisance trip or fuse blow from power up. The RMS quiescent and peak inrush current figures are dependant upon the quantity and type of I/O cards fitted. Please refer to the AoIP I/O manual for more details on modular I/O.
Heat Output & Efficiency	The Heat output from modular I/O units depends upon the quantity and card types fitted, please refer to the AoIP I/O manual for more detail on modular I/O.
Cooling	Fans mounted to the PSUs at the back of the core draw air through the PSUs and the core itself. Air is drawn up through the base of the core which is recessed to allow air to enter through the side, and for the units to be mounted with no clearance above or below. The bottom of the sides of the modular I/O box should be unobstructed with at least 50mm (2') clearance to allow airflow. Modular I/O units may be mounted in an open bay providing the ambient air temperature is within limits (see below). The units may also be housed in air conditioned bays.
Operating Ambient Air Temperature	0°C - 35°C
Relative Humidity	5% – 80% Non-condensing

TYPE R -1U I/O BOXES

AD6501 Combo I/O	240V Operation	115V Operation	100V Operation
Supply Current	0.22 A	0.37 A	0.41 A
Power Factor	0.60	0.79	0.84
Power Dissipation (Heat)	31 W	34 W	34 W
Cooling	This 1U Rack is cooled by natural ventilation and does not require fan assistance, having sufficient surface area to radiate heat adequately. The side panels of the I/O unit should be unobstructed with at least 50mm (2') clearance to allow airflow. No clearance is required above or below the unit.		
Operating Ambient Air Temperature	0°C - 40°C		
Weight	4.6 Kg (Includes US6525 AoIP Board weighing 0.04Kg)		
Dimensions	430mm Width x 44mm Height x 363mm Depth (483mm Wide Front Panel)		

AD6502 Analogue I/O	240V Operation	115V Operation	100V Operation
Supply Current	0.29 A	0.50 A	0.57 A
Power Factor	0.60	0.77	0.77
Power Dissipation (Heat)	41 W	44 W	44 W
Cooling	This 1U Rack is cooled by natural ventilation and does not require fan assistance, having sufficient surface area to radiate heat adequately. The side panels of the I/O unit should be unobstructed with at least 50mm (2') clearance to allow airflow. No clearance is required above or below the unit.		
Operating Ambient Air Temperature	0°C - 40°C		
Weight	4.7 Kg (Includes US6525 AoIP Board weighing 0.04Kg)		
Dimensions	430mm Width x 44mm Height x 363mm Depth (483mm Wide Front Panel)		

JD6503 AES I/O	240V Operation	115V Operation	100V Operation
Supply Current	0.13 A	0.13 A	0.14 A
Power Factor	0.36	0.88	0.85
Power Dissipation (Heat)	11 W	13 W	12 W
Cooling	This 1U Rack is cooled by natural ventilation and does not require fan assistance, having sufficient surface area to radiate heat adequately. The side panels of the I/O unit should be unobstructed with at least 50mm (2') clearance to allow airflow. No clearance is required above or below the unit.		
Operating Ambient Air Temperature	0°C - 40°C		
Weight	3.3 Kg (Includes US6525 AoIP Board weighing 0.04Kg)		
Dimensions	430mm Width x 44mm Height x 239mm Depth (483mm Wide Front Panel)		

AUDIO PERFORMANCE SPECIFICATION

AES3ID UNBALANCED DIGITAL INPUTS

Format	AES/EBU (AES3) 24-bit. Also suitable for use with SPDIF (IEC958 type 2) signals
Interface, Input Sensitivity	75 Ohm unbalanced (BNC), 0.3V–1.2V Pk-Pk
Sample Rate Conversion	24-Bit switchable on all AES inputs, SRC Range 30kHz to 100kHz
SRC THD+N	-117dB @ 1kHz, 0.00014%

AES3ID UNBALANCED DIGITAL OUTPUTS

Format	AES/EBU (AES3) 24-bit
Interface	75 Ohm unbalanced 1V Pk–Pk (nominal) into 75 Ohm load (BNC)
Jitter	<0.015UI (2.5ns) peak

AES3 BALANCED DIGITAL INPUTS (MODULAR I/O ONLY)

Format	AES/EBU (AES3) 24-bit.
Interface, Input Sensitivity	110 Ohm balanced (XLR or D-Type). 0.2V-7.0V Pk-Pk
Sample Rate Conversion	24-Bit switchable on all AES inputs, SRC Range 30kHz to 100kHz
SRC THD+N	-117dB @ 1kHz, 0.00014%

AES3 BALANCED DIGITAL OUTPUTS (MODULAR I/O ONLY)

Format	AES/EBU (AES3) 24-bit
Interface	110 Ohm balanced (XLR or D-Type)
Jitter	<0.015UI (2.5ns) peak

ANALOGUE INPUT SPECS (FIXED FORMAT & MODULAR I/O)

Analogue - Digital Conversion	24 Bit
Input	Electronically Balanced
Input Impedance	2k Ohms at mic level gain settings 10k Ohms at line level gain settings
Sensitivity	+18 / -78dB for Mic/Line Inputs
Equivalent Input Noise	-127dB (150 Ohm source)
Distortion	-1dBFS @ 1kHz – Better than 0.003% -20dBFS @ 1kHz – Better than 0.006% -60dBFS @ 1kHz – Better than 0.3%
Frequency Response	20Hz to 20kHz +/- 0.5dB on Mic/Line Inputs
Input CMR (Common Mode Rejection)	>75dB (Typical 85dB) on Mic/Line inputs
Crosstalk	-105dB or better on adjacent channels with 0dBFS tone at 1kHZ on Source
Notes	Analogue input for 0dBFS can be pre-set globally to +28, +24, +22, +20, +18 or +15dBU Pre-fader headroom on mic inputs is adjustable globally from +24dB to +36dB in 2dB steps For analogue inputs/outputs the system can handle analogue levels of up to +27 dBu from analogue input to analogue output at line up These levels must be attenuated in the system before they are fed to digital outputs

ANALOGUE OUTPUT SPECS (FIXED FORMAT & MODULAR I/O)

Digital - Analogue Conversion	24 Bit
Output Balance	Electronically balanced. 20Hz to 20kHz, better than -35dB, typically -45dB
Output Impedance	<40 Ohms
Distortion	-1dBFS @ 1kHz – Better than 0.006% -20dBFS @ 1kHz – Better than 0.003% -60dBFS @ 1kHz – Better than 0.3%
Frequency Response	20Hz to 20kHz +/- 0.25dB
Notes	Analogue output for 0dBFS matches input setting into >1kOhms (+24dBu max into 600 Ohms)

AUDIO PERFORMANCE DATA

Digital to Digital (AES3) Distortion	-1dBFS, 20Hz to 10kHz – Better than 0.0001%
Digital to Digital (AES3 with SRC) Distortion	-1dBFS, 20Hz to 10kHz – Better than 0.0002%
Frequency Response (Analogue Input to Output)	20Hz to 20kHz +/- 0.5dB

SYNCHRONISATION INPUTS

48KHz Synchronisation	PTPv2 Grand Master Clock TTL Wordclock (48kHz) Video Internal Crystal Reference

LATENCY @ 48KHZ SAMPLE RATE *

From	To	Via	Samples	@48kHz
AES3 inputs (SRC off)	AES3 Outputs	Port to port	TBC	TBC
	AES3 Outputs	Channel, group, and aux, track or main output	TBC	TBC
	Analogue Outputs	Port to port	TBC	TBC
	Analogue Outputs	Channel, group, and aux, track or main output	TBC	TBC
		Turning SRC on adds to the above:	+ 39	+ 0.813ms
Mic/Line inputs	AES3 Outputs	Port to port	TBC	TBC
	AES3 Outputs	Channel, group, and aux, track or main output	TBC	TBC
	Analogue Outputs	Port to port	TBC	TBC
	Analogue Outputs	Channel, group, and aux, track or main output	TBC	TBC

* Note: These latency figures are not yet available.

DYNAMIC RANGE FOR ANALOGUE AND AES3 (INPUTS)

Analogue INPUTS	system set for				
to Digital Outputs with 0 dB gain	+18 dBu = 0 dBFS		110 dB		
	+24 dBu = 0 dBFS		116 dB		
to Analogue Outputs with 0 dB gain *	N/A		118 dB		

AES3 UNBALANCED DIGITAL INPUTS	system set for	SRC on I/P		SRC on I/P	
to Digital Outputs with 0 dB gain	N/A	off	138 dB	on	130 dB
to Analogue Outputs with 0 dB gain	+18 dBu = 0 dBFS	off	111 dB	on	111 dB
	+24 dBu = 0 dBFS	off	117 dB	on	117 dB

AES3 BALANCED DIGITAL INPUTS (MODULAR I/O ONLY)	system set for	SRC on I/P		SRC on I/P	
to Digital Outputs with 0 dB gain	N/A	off	138 dB	on	130 dB
to Analogue Outputs with 0 dB gain	+18 dBu = 0 dBFS	off	111 dB	on	111 dB
	+24 dBu = 0 dBFS	off	117 dB	on	117 dB

DYNAMIC RANGE FOR ANALOGUE AND AES3 (OUTPUTS)

Analogue OUTPUTS	system set for	SRC on I/P		SRC on I/P	
from Digital Inputs with 0 dB gain	+18 dBu = 0 dBFS	off	111 dB	on	111 dB
	+24 dBu = 0 dBFS	off	117 dB	on	117 dB
from Analogue Inputs with 0 dB gain *	N/A	N/A	118 dB		

AES3 UNBALANCED DIGITAL OUTPUTS	system set for	SRC on I/P		SRC on I/P	
from Digital Inputs with 0 dB gain	N/A	off	138 dB	on	130 dB
from Analogue Inputs with 0 dB gain	+18 dBu = 0 dBFS	N/A	110 dB	N/A	
	+24 dBu = 0 dBFS	N/A	116 dB	N/A	

AES3 BALANCED DIGITAL OUTPUTS (MODULAR I/O ONLY)	system set for	SRC on I/P		SRC on I/P	
from Digital Inputs with 0 dB gain	N/A	off	138 dB	on	130 dB
from Analogue Inputs with 0 dB gain	+18 dBu = 0 dBFS	N/A	110 dB	N/A	
	+24 dBu = 0 dBFS	N/A	116 dB	N/A	

* The analogue to analogue dynamic range is achieved because the system can accept analogue signals of up to +28 dBu from input to output at 0 dB gain. Obviously, an analogue input of up to +28 dBu must be attenuated to output this digitally, but this attenuation will maintain the Dynamic Range of the input, as the analogue input noise will be attenuated by the same amount as the signal, and the analogue input noise will still be dominant above the noise floor of the digital system.

AES3 BALANCED DIGITAL INPUTS (ON TYPE R - UR6500, AD6501 AND JD6503) & (ON ARGO - JB6569)

Format	AES/EBU (AES3) 24-bit.
Interface, Input Sensitivity	110 Ohm balanced (D-Type), 0.2V-7.0V Pk-Pk
Sample Rate Conversion	24-Bit switchable on all AES inputs, SRC Range 30kHz-100kHz
SRC THD+N	-117dB @ 1kHz, 0.00014%

AES3 BALANCED DIGITAL OUTPUTS (ON TYPE R - UR6500, AD6501 AND JD6503) & (ON ARGO - JB6569)

Format	AES/EBU (AES3) 24-bit
Interface	110 Ohm balanced (D-Type)
Jitter	<0.015UI (2.5ns) peak

ANALOGUE INPUT SPECS (ON TYPE R - UR6500, AD6501 AND AD6502)

Analogue - Digital Conversion	24 Bit
Input	Electronically Balanced
Input Impedance	5.4k Ohms at mic/line level gain settings
Sensitivity	+18 / -78dB for Mic/Line Inputs
Maximum Input Level	24dBu
Frequency Response	20Hz to 20kHz +/- 0.25dB on Mic/Line Inputs
Distortion	-1dBFS @ 1kHz - Better than 0.005% (-86dB) -20dBFS @ 1kHz - Better than 0.003% (-90dB) -40dBFS @ 1kHz - Better than 0.03% (-70dB)
Dynamic Range(CCIR-RMS)	-116dB
Idle Channel Noise	-116dBFS (88dBu)
Equivalent Input Noise	-126dB (150 Ohm source)
Input CMR (Common Mode Rejection)	>90dB at a 52dB gain setting >75dB at a 4dB gain setting
Crosstalk	-115dB or better on adjacent inputs with 0dBFS tone at 1kHz on Source
Phantom power current limit	9.5mA / channel

ANALOGUE OUTPUT SPECS (ON TYPE R - UR6500, AD6501 AND AD6502)

Digital - Analogue Conversion	24 Bit
Output Balance	Electronically Balanced
Output Impedance	31 Ohms
Maximum Output Level	24dBu
Frequency Response	20Hz to 20kHz +/- 0.25dB
Distortion	-1dBFS @ 1kHz - Better than 0.002%(-93dB) -20dBFS @ 1kHz - Better than 0.003% (-90dB) -40dBFS @ 1kHz - Better than 0.03% (-70dB)
Dynamic Range (CCIR-RMS)	-113dB
Idle Channel Noise	-113dBFS (85dBu)
Crosstalk	-105dB or better on adjacent outputs with 0dBFS tone at 1kHz on Source

AES3 UNBALANCED DIGITAL INPUTS (ON ARGO - JB6549)

Format	AES/EBU (AES3) 24-bit. Also suitable for use with SPDIF (IEC958 type 2) signals
Interface, Input Sensitivity	75 Ohm unbalanced (BNC), 0.3V-1.2V Pk-Pk
Sample Rate Conversion	24-Bit switchable on all AES inputs, SRC Range 30kHz-100kHz
SRC THD+N	-1dBFS @ 1kHz - Better than 0.00002%

AES3 UNBALANCED DIGITAL OUTPUTS (ON ARGO - JB6549)

Format	AES/EBU (AES3) 24-bit Also suitable for use with SPDIF (IEC958 type 2) signals
Interface	75 Ohm unbalanced 1V Pk-Pk into 75 Ohm load (BNC)
Jitter	<0.015UI (2.5ns) peak * Provisional

ANALOGUE INPUT SPECS (ON ARGO - AD6548, DA6544, JB6549 & JD6569)

Analogue - Digital Conversion	24 Bit
Input	Electronically Balanced
Input Impedance	5.2k Ohms balanced line to line at mic/line level gain settings
Sensitivity	+18 / -78dB for Mic/Line Inputs
Maximum Input Level	24dBu, balanced, <1% THD+N
Frequency Response	20Hz to 20kHz +/- 0.25dB on Mic/Line Inputs
Distortion	-1dBFS @ 1kHz - Better than 0.005% -20dBFS @ 1kHz - Better than 0.002% on AD6548, <0.005% on DA6544 & JB6549 -60dBFS @ 1kHz - Better than 0.2% on AD6548, <0.5% on DA6544 & JB6549
Equivalent Input Noise	-129dB, on AD6548, -128dB on JB6549 @ 22kHz BW, max gain, (150 Ohm source)
Input CMR (Common Mode Rejection)	>74dB on AD6548, >75dB on DA6544 & JB6549 (1kHz @ unity gain) on Mic/Line Input
Crosstalk	-93.5dB on AD6548 adjacent inputs with +4dBu tone at 1kHz on Source

ANALOGUE OUTPUT SPECS (ON ARGO - DA6544, JB6549 & JD6569)

Digital - Analogue Conversion	24 Bit
Output Balance	Electronically Balanced
Output Impedance	32 Ohms
Maximum Output Level	24dBu
Frequency Response	20Hz to 20kHz +/- 0.3dB
Distortion	-1dBFS @ 1kHz - Better than 0.005%) -20dBFS @ 1kHz - Better than 0.005%) -40dBFS @ 1kHz - Better than 0.05%)
Crosstalk	*-103dB on adjacent outputs with 0dBFS tone at 1kHz on Source

*Provisional value

FURTHER READING

Impulse has a number of Manuals associated with it. This is the Argo Installation Manual:-

1. Impulse - Argo Product Info Sheet (926-320)
This information sheet shows how to collect information on Impulse.

2. Impulse - Argo Start Up Guide (926-321)
This guide shows how to Power Up and Access/Configure the Impulse core, Configure the Surface IP connections, Connect the Surface to the Impulse Cores, Power Up the Surface & Create a New Show, Configure Network Switches & Devices, Access the Configure/Connect/Software Updater/Assist* applications, Update the Core Software to the latest version (optional), Configure AoIP Router & AoIP Device IP addresses, Connect Audio Switches & AoIP Devices to the Core and Examine an example system.

3. Impulse Installation Manual (926-288) * Updated for Argo S & Argo Q
This contains a number of chapters including an overview of the Impulse system, Defining the system elements of an Impulse core, Core DSP pack options, Synchronisation, Surface Connections, AoIP network connections, Redundancy, AoIP network examples, External Control connections and Technical specifications.

4. Impulse Configure Application Guide (926-290) * Updated for Argo S & Argo Q
This defines how Impulse system Core(s) can be configured and partitioned into different mixing surfaces with varying amounts of DSP processing channels available in different 'Pack' sizes under licence. It provides guidance on updating the system software, backing up and restoring user data, setting the sample rate, controlling the application containers that run the system and provide maintenance logs. It's also used to configure the IP addresses of the Network Interface Controllers for the application containers, manage the Remote Network interfaces such as the RP1, AoIP interfaces for the Audio Routers, PTPv2 interfaces for synchronisation, setting up synchronisation sources and Core I/O Virtual Patchbays.

5. Connect Application Guide (926-292)
This defines how the Impulse/Type R Core IP Input and Output streams are connected to AoIP based interfaces and how the AoIP streams are managed including GPIO devices. These can be connections to and from either Calrec AoIP Devices or other 3rd party AoIP streams.

6. AoIP I/O Manual (926-293)
This contains information about AoIP devices available for use with Impulse/Type R in terms of Control, Audio & GPIO Connections.

7. Argo Installation Manual (926-312)
This contains technical information about the configuration, installation and setup of the Argo surface for use with Impulse systems.

8. Argo Operator Manual (926-313)
This defines how an installed Argo console is configured and controlled via its surface. It includes creating/managing shows, setting up shows in terms of configuring paths, displaying and controlling the fader surface, saving and loading snapshots and patching inputs and outputs to the channels and buses. There are then various sections about parameter access including:- processing, routing, configuring and controlling the buses & outputs and setting up the monitoring & metering. The show setup and system settings sections provide configuration tools for both show and system configuration.

9. Argo Assist Manual (926-317)
This defines how an Argo with or without a physical console is setup and controlled via Calrec Assist, which is Calrec's web-based user operation tool.

USER NOTES

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