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Interface Practices Subcommittee

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Generic Access Platform Enclosure Specification

NOTICE

Document Types and Tags

Document Type: Specification

Document Tags:

☐ Test or Measurement	☐ Checklist	☐ Facility
☒ Architecture or Framework	☐ Metric	☒ Access Network
☐ Procedure, Process or Method	☐ Cloud	☐ Customer Premises

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1. Introduction

1.1. Executive Summary

This specification is intended to standardize a mechanical clamshell housing, the Generic Access Platform (GAP) Enclosure, and associated internal interfaces to enable a common platform for use in a wide variety of outside plant applications.

1.2. Scope

The scope of the Generic Access Platform is to define a mechanical housing that provides physical support for electrical and mechanical components and protection from the outside world for those internal components. The GAP Enclosure specification is intended to define sufficient mechanical and electrical details such that it can be similarly constructed by housing manufacturers. The specification covers external details sufficient for mechanical mountings, ports, environmental details, materials, thermal capabilities. The specification is also intended to cover sufficient internal details such that internal modules can be constructed to fit inside the housing. The specification is intended to facilitate various existing and future technologies. The specification is not intended to define new technologies use-cases or to re-define existing technologies, but rather to enable the physical enclosure and protection of those technologies.

For example, the Generic Access Platform housing could be used as a DOCSIS® Remote PHY node containing a Remote PHY device (RPD) module and RF amplifiers. Another example would be a DOCSIS-backhauled small-cell radio, where the Generic Access Platform housing is used to enclose both a cable modem module and a radio transceiver module with an associated antenna or antenna-array.

In both cases, each modular component is an individual technology subject to specific and existing standards. The Generic Access Platform housing becomes a means to enclose those components as physical modules covered by this GAP specification.

This specification divides the GAP Enclosure into two sub-assemblies: a Base and a Lid which individually support corresponding technology modules.

DOCSIS 4.0 specifications include operation at frequencies up to 1794 MHz and many service providers would like to futureproof their networks for eventual operation up to 3000 MHz.

The GAP Enclosure is capable of 3000 MHz operation but the bandwidth performance is dependent on the performance of the individual components installed in the Enclosure.

1.3. Benefits

The Generic Access Platform Enclosure has the following aims:

- Reduce the number of custom designed and manufactured housings.
- Address this market need ahead of a large growth in outdoor equipment predicted by Distributed Access Architecture (DAA) and smart-city applications.
- Reduced operational expenditure for cable and fiber system operators and telecommunications companies.
- Increased longevity for deployed housing due to re-purposing rather than housing replacement.
- Increased availability and ability to integrate advanced technologies within a modular approach.
- Facilitating inter-operability between different vendor technologies.
- Introduction of a common industry-wide approach to outdoor deployed devices.
- Increased access to market-share for new technology providers.
- Long-term continuity to new technology deployments through standardized modules and evolutionary interfaces.

1.4. Intended Audience

Cable, fiber and telecommunications designers, operators, and engineers.

1.5. Areas for Further Investigation or to be Added in Future Versions

- Addition of higher speed interfaces such as:
  - PCIe (Peripheral Component Interconnect Express) generation 5 and future versions.
  - GAP Internal Module Interface – future higher speed versions.
- Increases in backplane power capability and performance.
- Increased heat dissipation housing design and cooling techniques.
- Updates and extensions to the GAP communication and management protocols
- RF shielding effectiveness requirements out to 3000 MHz
- Future updates to the physical footprints to allow for larger or smaller enclosures, or to address additional markets outside of North America.

2. Normative References

The following documents contain provisions which, through reference in this text, constitute provisions of this document. The editions indicated were valid at the time of subcommittee approval. All documents are subject to revision and, while parties to any agreement based on this document are encouraged to investigate the possibility of applying the most recent editions of the documents listed below, they are reminded that newer editions of those documents might not be compatible with the referenced version.

2.1. SCTE References

[SCTE 48-1] ANSI/SCTE 48-1 2015, Test Method for Measuring Shielding Effectiveness of Passive and Active Devices using a GTEM Cell

[SCTE 91] ANSI/SCTE 91 2021, Specification for 5/8-24 RF & AC Equipment Port, Female

[SCTE 92] ANSI/SCTE 92 2021, Specification for 5/8-24 Plug, (Male), Trunk and Distribution Connectors

[SCTE 143] ANSI/SCTE 143 2018, Test Method for Salt Spray

[GAP Modules]	SCTE 273-1 2021, Generic Access Platform Modules Specification
[SCTE 158]	ANSI/SCTE 158 2016 Recommended Environmental Condition Ranges for Broadband Communications Equipment

2.2. Standards from Other Organizations

[NADCA]	NADCA Publication #402, Product Specification Standards for Die Castings, 2018
[ATIS]	ATIS-0600010.01.2020, Temperature, Humidity, Altitude, and Salt Fog Requirements for Information and Communications Technology (ICT) Equipment Utilized in Outside Plant Environments
[Telcordia]	Telcordia GR3108, Generic Requirements for Network Equipment in the Outside Plant (OSP)
[MIL-STD-889]	MIL-STD-889C, Department of Defense Standard Practice Dissimilar Metals, 2016
[PCIe Gen4 Base]	PCI-SIG PCIe Express Base Specification Revision 4.0, Version 1.0, 2017.
[IEEE 802.3]	IEEE Standard 802.3-2018, IEEE Standard for Ethernet, 2018.

2.3. Published Materials

No normative references are applicable.

3. Informative References

The following documents might provide valuable information to the reader but are not required when complying with this document.

3.1. SCTE References

No informative references are applicable.

3.2. Standards from Other Organizations

No informative references are applicable.

3.3. Published Materials

No informative references are applicable.

4. Compliance Notation

shall	This word or the adjective "***required***" means that the item is an absolute requirement of this document.
shall not	This phrase means that the item is an absolute prohibition of this document.
forbidden	This word means the value specified ***shall*** never be used.
should	This word or the adjective "*recommended*" means that there *may* exist valid reasons in particular circumstances to ignore this item, but the full implications *should* be understood and the case carefully weighed before choosing a different course.
should not	This phrase means that there *may* exist valid reasons in particular circumstances when the listed behavior is acceptable or even useful, but the full implications *should* be understood and the case carefully weighed before implementing any behavior described with this label.
may	This word or the adjective "*optional*" indicate a course of action permissible within the limits of the document.
deprecated	Use is permissible for legacy purposes only. Deprecated features *may* be removed from future versions of this document. Implementations *should* avoid use of deprecated features.

5. Abbreviations and Definitions

5.1. Abbreviations

AC	alternating current
AP	access point
ANSI	American National Standards Institute
ATIS	Alliance for Telecommunication Industry Solutions
AWG	American Wire Gauge
CAN	Controller Area Network
CANH	Controller Area Network high signal
CANL	Controller Area Network low signal
CU	central unit
DAA	Distributed Access Architecture
dB	decibel
DC	direct current
DU	distributed unit
DOCSIS®	Data-over-Cable Service Interface Specifications
DU	distributed unit
EGI	External GAP Interface
EMI	electromagnetic interference
FMA	Flexible MAC Architecture
GAP	Generic Access Platform
GME	GAP Management Entity
HFC	hybrid fiber-coax
Hz	hertz
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IMI	Internal Module Interface

IP	ingress protection
ITU-T	International Telecommunications Union Telecommunication Standardization Sector
MAC	media access control
MHA	Modular Headend Architecture
MHz	megahertz
MIL-STD	military standard
OLT	optical line terminal
OSP	outside plant
PCIe	Peripheral Component Interconnect Express
PHY	physical
PON	passive optical network
RF	radio frequency
RFU	Reserved for Future Use
RMD	Remote MACPHY device
RPD	Remote PHY device
RRH	remote radio head
RU	radio unit
SCTE	Society of Cable Telecommunications Engineers
W	watt
YANG	Yet Another Next Generation (data modeling language)

5.2. Definitions

Definitions of terms used in this document are provided in this section. Defined terms that have specific meanings are capitalized. When the capitalized term is used in this document, the term has the specific meaning as defined in this section.

Base	The specific portion of the Enclosure which remains attached to the strand in an aerial strand-mount installation
Base Entry Port	Base equipment port that supports RF signals and AC powering.
Base Module	Field replaceable modular components which fit into the Base of the GAP Enclosure and plug into either the Base Short Backplane or the Base Module Backplane
Full-Size Base Module	A large Base Module which connects directly to the Base Short Backplane and occupies a significant part of the available Base Module area
Base Module Area	A flat mounting surface which can accommodate multiple variants of Base Modules with standardized mounting holes.
Base Module Backplane	An internal circuit board assembly used for mounting Base Modules and to route signals and DC power to/from Base Modules
Base Short Backplane	An internal circuit board used for mounting Power Supplies and routing signals and DC power to/from Power Supplies; routing signals and DC power to/from the Base Module Backplane or a directly attached Base Module; and routing signals and DC power to/from the Lid Backplane
Base Test Ports	Optional base ports typically used for maintenance activities which utilize external access to internal RF test ports.

Enclosure	The Generic Access Platform housing consisting of Base and Lid, along with internal backplanes for connecting Base Modules, Power Supplies, and Lid Modules
Fiber Tray	Assembly for spooling excess fiber from incoming node service cables, parking/terminating unused fiber connectors, and allowing for mounting of components such as wavelength division multiplexer/demultiplexers (WDM mux/demux).
Lid	The specific portion of the Enclosure which is normally attached to the Base and hinges open for operator access to components inside the Enclosure
Lid Backplane	An internal circuit board used for mounting Lid Modules and to route signals and DC power to/from Lid Modules; routing signals and DC power to/from the Base Short Backplane.
Lid High-Speed Backplane	A Lid Backplane which provides DC power, CAN signals, and high-speed (PCIe and KR) point-point connectivity between a Special Module and other Standard Lid Modules.
Lid Low-Speed Backplane	A Lid Backplane which provides only DC power and CAN signals to Lid Modules and includes 6 Standard Lid Module slots.
Lid Entry Port	Lid equipment port typically used for fiber connections with node service cable.
Lid Module	Field replaceable components which fit into the Lid of the GAP Enclosure and plug into the Lid Backplane
Lid Module Slot	Location for attaching Lid Modules with standardized mounting and connector for DC output and internal communications.
Standard Lid Module	A Lid Module that is not a Special Module.
Port Entry Module Area	Left and right side mounting areas for modules which interface RF and/or AC signals with other GAP Modules for a particular use case.
Power Supply	Voltage converter used to provide DC power for GAP Modules and includes basic monitoring functions and load sharing operation.
Power Supply Slot	Location for attaching GAP Power Supply with standardized mounting holes and connector for DC output, internal communications, and load sharing between Power Supplies.
Reference 3D Model	GAP Reference 3D model associated with this document and published as a STEP file
Special Module	A module that acts as the termination point for high-speed point-point connectivity from up to four (4) Standard Lid Modules.

6. System Overview (Informative)

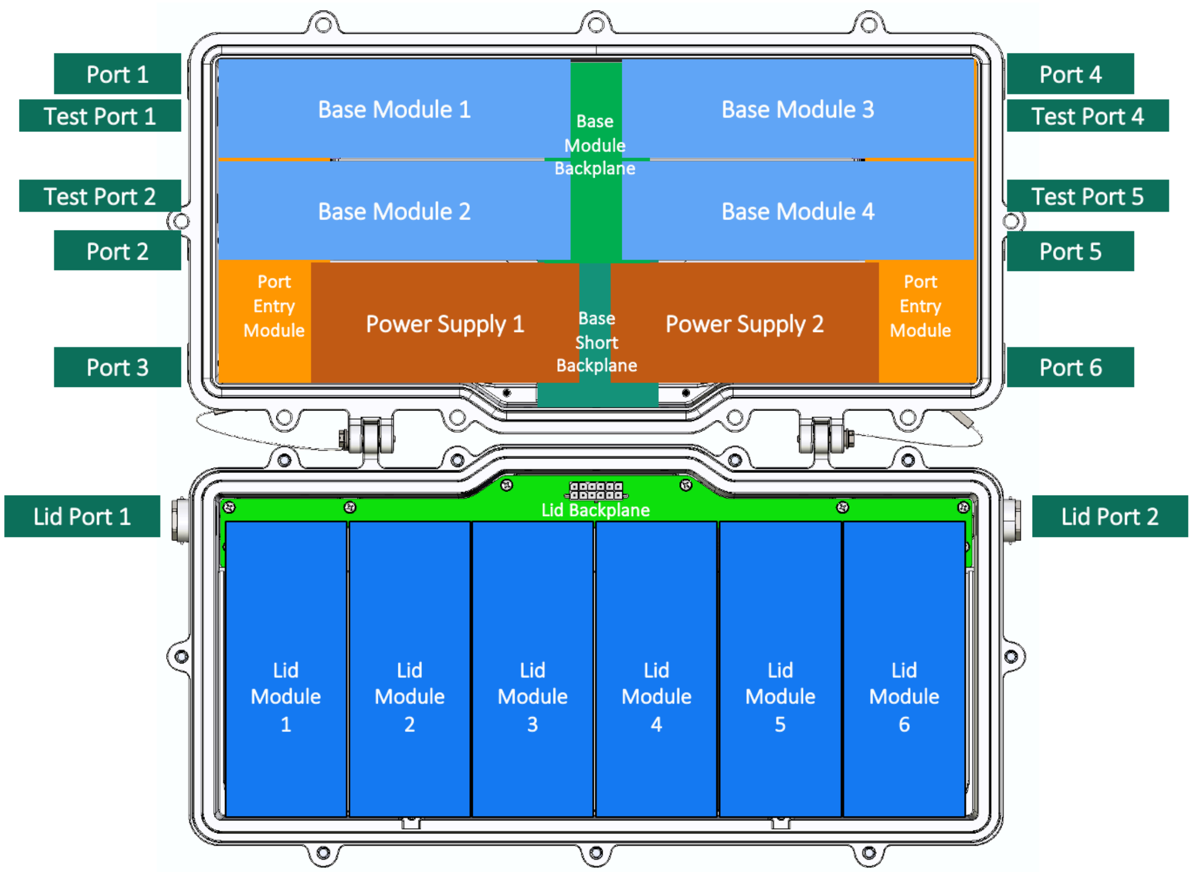


Figure 1 – GAP Reference Architecture

The GAP reference architecture is shown in Figure 1. GAP consists of a clamshell-style enclosure composed of two halves, a Base and a Lid. As a generic platform for outside plant deployment, GAP covers many possible use cases including:

- Distributed Access Architecture (DAA) hybrid fiber coax (HFC) nodes consisting of
  - RF amplifiers
  - Remote MACPHY devices (RMD) based on CableLabs Flexible MAC Architecture (FMA) specifications
  - Remote PHY devices (RPD) based on Modular Headend Architecture (MHAv2) specifications
- Remote optical line terminals (R-OLT) for passive optical networks (PON) based on IEEE or ITU-T PON technology
- Wi-Fi access points (AP) with DOCSIS cable modem or fiber-based backhaul
- 4G eNodeB or remote radio heads (RRH)
- 5G small cells including combinations of central units (CUs), distributed units (DU), and radio units (RU)
- Optical muxponders and field multiplexing/demultiplexing devices
- Ethernet switches

- Edge compute platforms to support distributed processing and compute close to customers
- Many other applications not yet envisioned

The composition of each of these use cases will have unique combinations of modules in both the Base and Lid. The arrangement of functions into specific modules is left to vendor differentiation and innovation but GAP provides a standardized way to mount, power, and perform basic monitoring of these modules.

6.1. GAP Base

The Base half of GAP is the portion which remains attached to the strand (in an aerial strand-mount installation) or other mounting surface and contains the following components:

Base Entry Ports: Six (6) [SCTE 91] equipment ports which support RF signals and AC powering with three (3) per end of the Enclosure.

Base Test Ports: Optional ports typically used for maintenance activities which utilize external access to internal RF test ports.

Port Entry Module Areas: Left and right side mounting areas for modules which interface RF and/or AC signals with other GAP Modules for a particular use case.

Power Supply Slots: Two locations for attaching GAP AC-DC Power Supplies with standardized mounting holes and connector for DC output, internal communications, and load sharing between Power Supplies.

Power Supplies: One or two voltage converters used to provide DC power for GAP Modules which include basic monitoring functions and load sharing operation. GAP supports pre-defined DC voltages of 5.75 V, 12V, and 25 V while also providing a spare auxiliary voltage (Vaux) for vendor-specific use. Vaux is intended to accommodate higher voltages such as 34 V for HFC amplifiers or 48 V for wireless amplifiers.

Base Module Area: A flat mounting surface which can accommodate multiple variants of Base Modules with standardized mounting holes.

Base Module(s): Up to four (4) application-specific modules mounted in the Base. Exact size of Base Modules is left to vendor implementation but a reference DC/communication connector location and pinout are specified. For RF applications, a pairing of Port Entry Module(s) and Base Module(s) from a single vendor is expected but not required. This specification does not dictate exactly which functions reside in the Base but typical uses might include:

- RF amplifier modules for HFC node applications
- DOCSIS cable modem for DOCSIS-fed wireless
- Wireless radios/amplifiers
- Optical amplification and multiplexing/demultiplexing functions

Base Short Backplane: Passive backplane which provides connections for Power Supplies, power/communication with Base Module(s), and Base to Lid power/communications

Base Module Backplane: Optional passive backplane providing power and communication to multiple Base Module(s).

The GAP Base accommodates flexibility in Base Module usage to support various vendor implementations and use cases:

- Up to four individual Base Application Modules – as shown in Figure 1. Separate Base Short Backplane and Base Module Backplanes are needed. Base Modules which occupy 1 or 2 Base Module Slots are possible.
- Single Full-Size Base Module (Tray Style) – as shown in Figure 2 with a single application tray that occupies all four Base Module Slots. Use cases might include an HFC Node scenario where a single RF tray is used like traditional nodes/amplifiers or where a multi-antenna wireless radio requires large space. In this use case, only a GAP Base Short Backplane is needed and the Base Module connects directly to the Base Short Backplane.

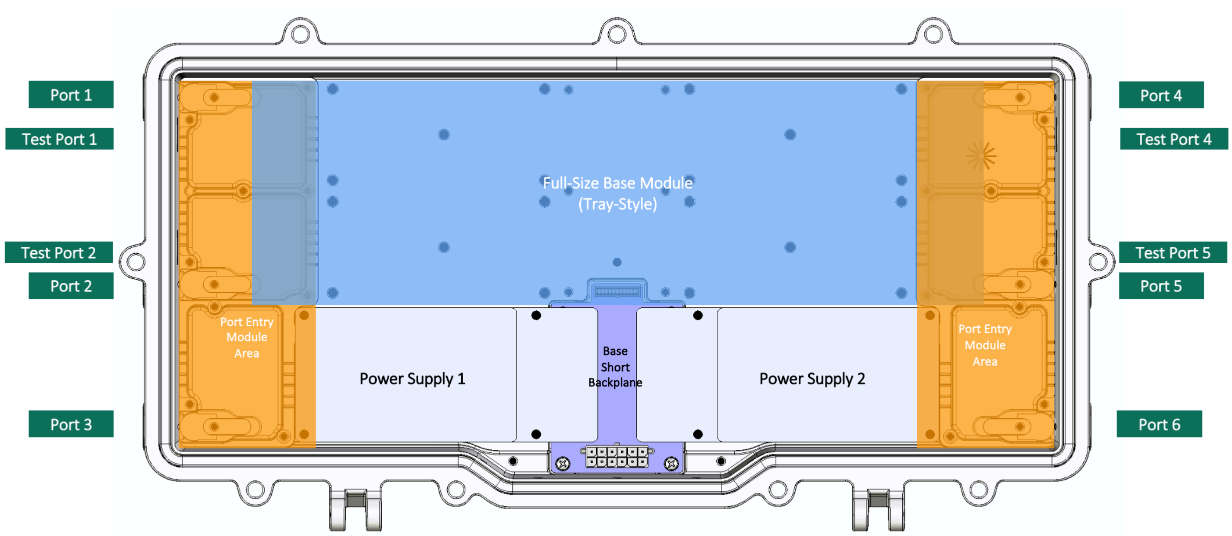


Figure 2 – GAP Base with a Full-Size Base Module (Tray Style)

6.2. GAP Lid

The Lid half of GAP is the portion which hinges open from the base and generally contains digital processing functions for the specific GAP use cases. The Lid contains the following components:

Lid Entry Ports: Two (2) or optionally more [SCTE 91] ports typically used for fiber connections with node service cables with one (1) or more on each end of the Enclosure

Lid Module Slots: Six locations for attaching Lid Modules with standardized mounting and connector for DC output and internal communications.

Lid Module(s): Up to six (6) application-specific modules mounted in the Lid. Individual modules can use more than one Module Slot as needed for thermal dissipation and/or component space. This specification does not dictate exactly which functions reside in the Lid but typically the Lid Module(s) provide uplink connectivity to central operator facilities and uses could include the following:

- RMD or RPD
- Edge compute processing
- Wireless baseband (CU, DU) or radio functions
- Ethernet or PCIe switch

- Optical muxponder
- Software-based access network stack such as MAC and/or upper PHY layer processing

Special Module: A module which acts as the termination point for high-speed point-point connectivity from up to four (4) Lid Modules. The Special Module can only be used with a High-Speed Lid Backplane and connects to a special connector in the left-most location on the High-Speed Lid Backplane.

Lid Backplane: Passive backplane which provides power and communication connections for Lid Modules. This version of the specification includes accommodation for two backplanes which share common Lid Modules:

- **Low-Speed Lid Backplane**: power and low-speed basic monitoring capability (shared CAN bus) for up to 6 Lid Modules
- **High-Speed Lid Backplane**: power, low-speed basic monitoring (shared CAN bus), and high-speed point-point connectivity between the Special Module and up to four (4) Lid Modules

Fiber Tray(s) (not shown): Vendor-specific plastic assemblies for spooling excess fiber from incoming node service cables, parking/terminating unused fiber connectors, and allowing for mounting of components such as wavelength division multiplexer/demultiplexers (WDM mux/demux). GAP includes mounting accommodation in the lid walls and allocates a keep out area above the modules to leave room for the fiber tray. The Fiber Tray may also be used for other vendor-specific purposes as long as components stay within the designated area.

6.3. Interoperability Principles

A primary purpose of GAP is to support a mix of modules and components from different vendors coexisting at the same time in the same deployed housing.

The general principles applied to the mix of multiple vendors in this version of the specification include:

- Enclosure may be from a different vendor than any internal modules
- Base and Lid housings may be from different vendors to support lid swap as a field upgrade procedure. This requires ensuring that hinges and sealing surfaces are fully specified
- A mix of Lid Modules from different vendors may be deployed in a single GAP Enclosure
- Base Port Entry Modules are expected to be from the same vendor as any connected HFC RF amplifier in an HFC node use case. This is expected, but not required, to be necessary for vendors to optimize RF performance to meet operator product requirements outside the scope of this specification
- Base Port Entry Modules are field-replaceable without loosening the hardline connector at the node entry port to allow changeover between applications and/or vendors without the challenges of hardline connector movement
- Management communication between modules using the Internal Module Interface (IMI) is read-only except for what is required to implement IMI. Configuration over IMI between modules is vendor specific.

Normative requirements to support these principles are included in the Lid and Base sections of this specification as well as the Module specification.

6.4. GAP Management and Communication

GAP Management and Communication is fully specified in [GAP Modules] and includes two interfaces with differing scopes and requirements. The Internal Module Interface (IMI) is used internally between GAP modules while the External GAP Interface (EGI) is used between a principal module and an external back-office entity.

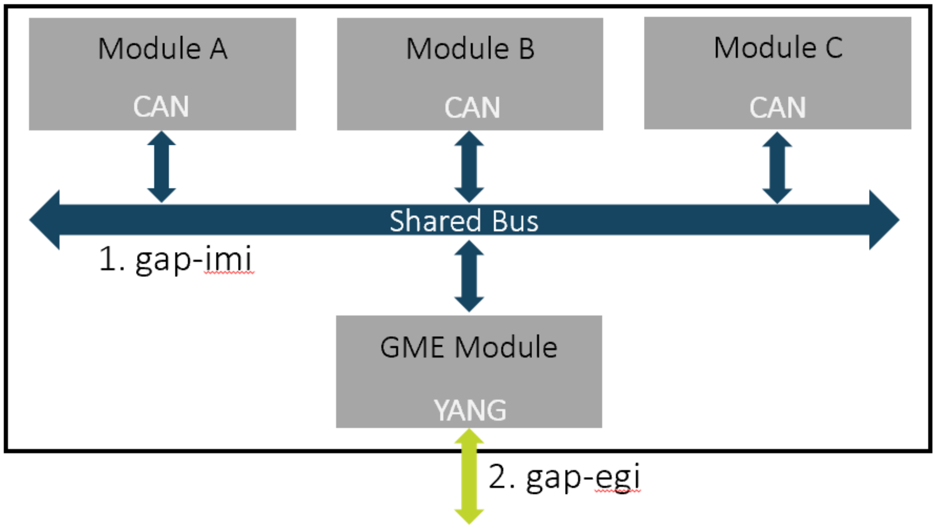


Figure 3 – GAP Management Interfaces

The IMI or GAP-IMI is the internal shared bus available to all GAP modules. This is a low-speed, highly resilient, shared communication bus based on CAN and CANopen where any module can communicate with any other module on the bus. All GAP compliant modules participate in this bus for, at least, inventorying and monitoring purposes. The IMI requirements specify the physical layer, network layer, and some common application layer networking behaviors while also providing mechanisms for vendor-specific extensions.

The EGI or GAP-EGI is the external point-to-point communication from the principal GAP module to an external management entity outside the GAP housing. A single module within a GAP housing deployment, determined during hardware configuration of the housing, is installed as the principal or GAP Management Entity (GME) module. The GME facilitates communication from the outside world to status and control of modules inside the node. The GME module is likely, but not required, to be the main access technology being deployed within the GAP node. It is assumed that the GME module has a high-speed, digital connection to an unspecified back-office entity, such as a 10G Ethernet link over fiber-optics. The EGI requirements specify data-model requirements (in the form of YANG models) to be transported over an unspecified point-to-point communication protocol.

7. Enclosure Requirements

The Enclosure is the complete GAP housing which combines both the Base and the Lid. A 3D reference model ("GAP Reference Model") and associated 2D drawings are normative parts of the specification.

The GAP Reference Model is meant to specify critical 3D features for ensuring compatibility between components from different vendors but is not a complete 3D model for the full Enclosure as it would be deployed in the field. Normative requirements for compliance to the GAP Reference Model are called out in specific subsections of this specification.

Examples of features which may vary between GAP compliant vendor implementations include:

- Heat sink fins (not included in reference model)
- Cosmetic exterior features
- Casting ejector pins and other manufacturing aids
- Wall thicknesses

The Enclosure ***shall*** comply with all 2D drawings provided in Section 11 and 12.

7.1. Enclosure Dimensions

The external dimensions of the enclosure ***shall not*** exceed (22") L x (11.5") H/W x (12") D[1] as oriented in a horizontal position with hinge side down as shown in Figure 4. This includes cooling fins, hinge, and other protrusions. Length is measured from the external face of the Base or Lid Entry Port insert on one side of the enclosure to the external face of the corresponding Entry Port insert on the other side of the enclosure.

[1] Although units of the International System of Units (SI) are the preferred units of measurement in SCTE and American National Standards, United States customary units are commonly used and are consistent with the technology being standardized.

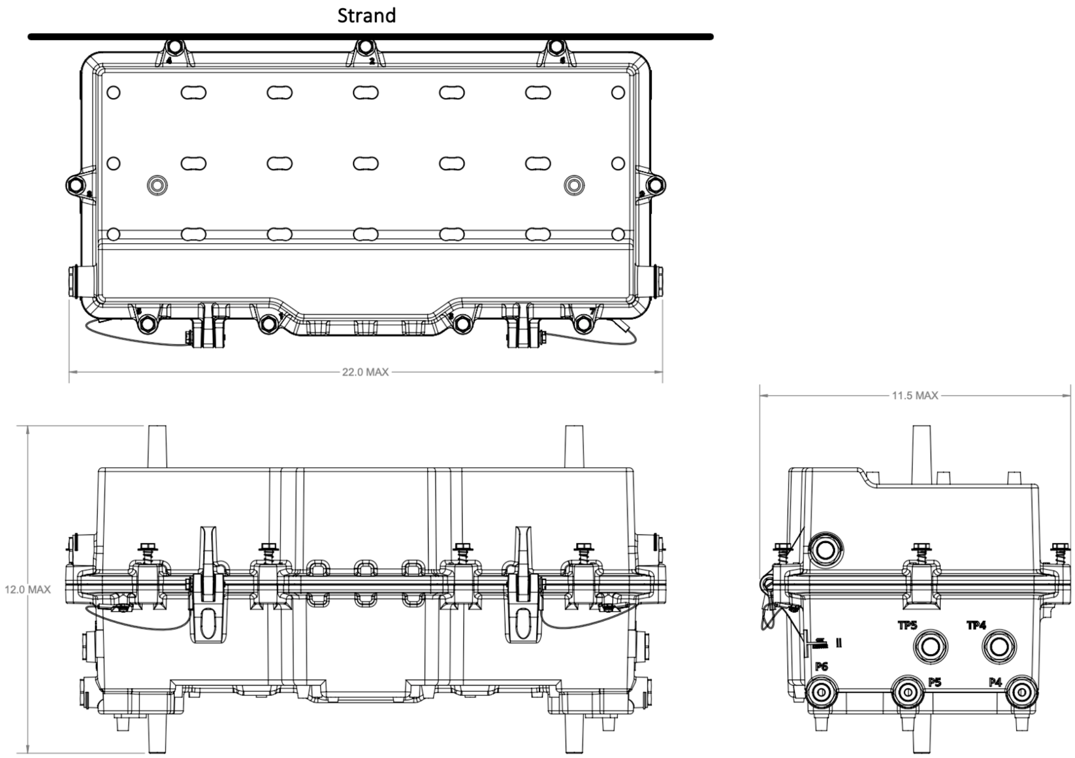


Figure 4 – Enclosure Dimensions

7.2. Enclosure Mounting

The enclosure ***shall*** have two 5/16”-18 threaded inserts on the top surface of the base as indicated in Section 11. These inserts are intended for strand mounting or mounting to a strand wire inside a pedestal.

Bolts used for enclosure mounting ***shall*** use 5/16”-18 threads and ½” hex head.

The enclosure ***shall*** have two 5/16”-18 threaded inserts in the extended bosses on the base as indicated in Section 11. These threaded inserts are intended to allow the enclosure to be hung on a flat surface with separate bracket or to allow for a vendor-specific antenna mounting bracket.

The enclosure ***shall*** have two 5/16”-18 threaded inserts in the extended bosses on the lid as indicated in Section 12. These threaded inserts are intended to allow for a vendor-specific antenna mounting bracket.

7.3. Enclosure Ports

All external ports ***shall*** use metal inserts which are galvanically compatible with the housing.

All external ports ***shall*** use metal port caps which are galvanically compatible with the housing.

Galvanic compatibility is defined as the differential in Anodic Index Voltage between various metals at the junction. [MIL-STD-889] shows the Anodic Index (V) of various common metal platings. For galvanic compatibility, the anodic voltage differential *should* fall within the recommended limits in Table 1.

Table 1 – Recommended Anodic Voltage Differential Limits

Environment	Anodic Index
Salt Spray, Outdoor, High Humidity	± 0.15V
Normal Environment: Indoor non-temperature and non-humidity controlled	± 0.25V
Controlled Environments	± 0.50 V

7.3.1. Enclosure Base Ports

The base ***shall*** have six (6) external Base Entry Ports compliant with [SCTE 91] and located as indicated in Section 11.

The base *should* include one (1) optional Base Test Port for each Base Module Slot, compliant with [SCTE 91].

Optional Base Test Ports *may* omit the heat shrink sleeve ridge.

Optional Base Test Ports *may* have a Port Length less than the Minimum Port Length (Dimension H).

If optional base application module test ports are included, each port ***shall*** be centered relative to Base Module Backplane connectors and located as indicated in Section 11.

7.3.2. Enclosure Lid Entry Ports

The lid ***shall*** have two (2) Lid Entry Ports compliant with the requirements of [SCTE 91] to support fiber or other entry cables into the lid.

The Lid Entry Ports ***shall*** be located with one on each end of the lid as indicated in Section 12.

The lid *may* include additional Lid Entry ports compliant with the requirements of [SCTE 91].

7.4. Enclosure Hinge

Enclosure opening/closing hinge ***shall*** be compatible with the reference drawing in Sections 11 and 12.

All hinge surfaces required to ensure compatibility between Base and Lid components ***shall*** conform to the GAP Reference Model.

All separate hinge pins ***shall*** be stainless steel, removable and incorporate a retention mechanism to prevent accidental loss during an enclosure lid exchange.

7.5. Enclosure Sealing Bolts

Enclosure sealing bolt locations ***shall*** be located as shown in the reference drawing in Sections 11 and 12.

Enclosure sealing bolt locations ***shall*** use stainless steel thread inserts.

Enclosure sealing bolts ***shall*** be ½” hex head with 5/16”-18 threads, captive to the lid, spring-loaded, and constructed of stainless steel.

Torque number sequence for the enclosure sealing bolts ***shall*** be cast on the outside of the enclosure. The torque number sequence ***shall*** comply with the GAP Reference Model.

7.6. Hardline Connector Trim Guide

Hardline connector center pin trim guide ***shall*** be cast on the outside of the enclosure.

7.7. Enclosure Material

The lid and base ***shall*** be manufactured from an A360 die cast aluminum or similar material to meet or exceed thermal dissipation, environmental, and galvanic compatibility requirements defined in this specification.

7.8. Enclosure IP Rating

The enclosure ***shall*** have a rating of Ingress Protection (IP) 68, per International Electrotechnical Commission (IEC) 60529.

7.9. Enclosure Corrosion Resistance

The enclosure ***shall*** be tested for corrosion resistance according to [SCTE 143].

7.10. Enclosure Finish

The enclosure finish ***shall*** meet Class 2, Functional Grade per [NADCA] G-6-6-15.

7.11. Enclosure Internal Heat Transfer Surfaces

All precision flat module heat transfer surfaces ***shall*** have a flatness of 0.005” up to 5” diagonal; each additional inch is 0.001” added. For example, a part with a 2” thermal contact surface needs a minimum of 0.005” flatness or a part with a 15” diagonal surface area would require a minimum 0.015” flatness.

All precision flat module heat transfer surfaces ***shall*** have a surface roughness of 63 micro-inches or better.

7.12. Internal Mounting Points

All internal mounting points designed for Lid Modules, Base Modules, and Power Supplies ***shall*** use #10-32 thread and include stainless steel thread inserts.

All other internal mounting points designed for field replaceable components which are not intended for common replacement (examples include fiber tray or backplanes) ***shall*** use a minimum sized thread of #6-32.

Threaded inserts ***shall*** be designed to avoid backout during normal field maintenance operations.

7.13. Enclosure Gaskets

7.13.1. Base Gasket Location

The Base ***shall*** provide the innermost gasket groove on the enclosure sealing lip and comply with the dimensions in Section 11.

All Base gasket groove surfaces and features ***shall*** conform to the GAP Reference Model.

7.13.2. Lid Gasket Location

The Lid ***shall*** provide the outermost gasket groove on the enclosure sealing lip and comply with the drawing in Section 12.

All Lid gasket groove surfaces and features ***shall*** conform to the GAP Reference Model.

The Lid gasket groove ***shall*** be used to provide environmental sealing.

7.14. RF Shielding Requirements

The shielding effectiveness of the enclosure when measured in accordance with [SCTE 48-1] ***shall*** be as defined in Table 2.

Table 2 – Shielding Effectiveness

Frequency (MHz)	Shielding Effectiveness (dB)
5-1218	≥ 110
1218-1794	≥ 100

7.15. Enclosure Weight

The weight of an empty enclosure with sealing gaskets and port inserts ***shall not*** exceed 33 lbs.

8. GAP Base

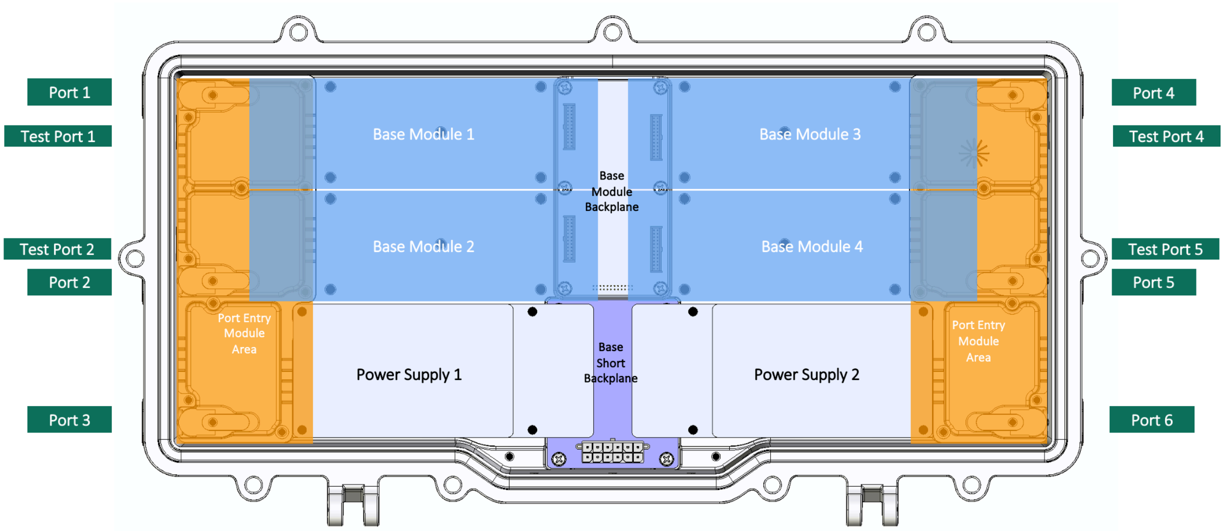


Figure 5 – GAP Base Layout

Figure 5 indicates the layout of the GAP Base components. The GAP Reference Model and 2D drawings in Section 11 provide additional detail.

8.1. Base Port and Module Numbering

Base Entry Ports ***shall*** be numbered as shown in Figure 5.

Base Entry Ports ***shall*** be labelled externally on the Base as “P#” where # is the Base Entry Port number.

Base Test Ports, if included, ***shall*** be numbered as shown in Figure 5.

Base Test Ports, if included, ***shall*** be labelled externally on the Base as “TP#” where # is the Base Test Port number.

Base Modules ***shall*** be numbered as shown in Figure 5. When no Base Module Backplane is installed, the Full-Size Base Module that is installed ***shall*** be considered Base Module 1.

Power Supplies ***shall*** be numbered as shown in Figure 4.

8.2. Base Module Area

The Base ***shall*** support up to 4 Base Modules mounted to the Base Module Area, depending on the installed Base Module Backplane, if any.

The Base Module Area module mounting surface ***shall*** conform to the GAP Reference Model.

The Base Module Area ***shall*** include #10-32 mounting holes C3-C8, C11-C18, C21-C26 as defined in Section 11 to mount Base Module(s). The exact holes used by any particular Base Module(s) is vendor-specific and dependent on the occupied area of the Base Module(s).

8.3. Power Supply Area

The Base ***shall*** accommodate up to two Power Supplies in the Power Supply Area as shown in Figure 5.

The Power Supply Area module mounting surface and left-right wire passthrough groove ***shall*** conform to the GAP Reference Model.

The Power Supply Area ***shall*** include #10-32 mounting holes C1,C2,C9,C10 as defined in Section 11 to mount Power Supply 1.

The Power Supply Area ***shall*** include #10-32 mounting holes C19, C20, C27, C28 as defined in Section 11 to mount Power Supply 2.

8.4. Port Entry Module Areas

The portion of the Base implementation which interfaces with the hardline connectors ***shall*** be considered a "Port Entry Module" as shown in Figure 5.

The Base ***shall*** provide flexible Port Entry Module Areas which support HFC coaxial interfaces from the Base Entry Ports through the use of coaxial port interface modules or coaxial port interfaces integral to a Base Module.

Port Entry Module Areas ***shall*** contain cavity wells in the housing which may be utilized to aid designers in achieving port-to port RF isolation.

These cavity wells *may* also be used as a part of the design to maintain a 75 ohm characteristic from the outside through the Base to Base Modules used for HFC.

These cavity wells and side-side channel *may* also be used as a part of the design to route 50 Hz / 60 Hz AC power from outside the enclosure to the Power Supplies.

All interior surfaces and cavities for the Port Entry Module Areas ***shall*** conform to the GAP Reference Model.

The left Port Entry Module Area ***shall*** include #6-32 mounting holes B1-B12 as defined in Section 11 to mount left side Port Entry Module components for Base Entry Ports 1-3. The exact holes used by any particular Port Entry Module(s) is vendor specific.

The right Port Entry Module Area ***shall*** include #6-32 mounting holes B23-B34 as defined in Section 11 to mount right side Port Entry Module components for Base Entry Ports 4-6. The exact holes used by any particular Port Entry Module(s) is vendor specific.

8.5. Base Backplanes

The Base contains one or more backplane(s) suitable for interconnecting Base Module(s) and Power Supplies.

Two Base Backplanes are specified with use depending on how the Base Modules are arranged as described in Section 6.1.

- Base Short Backplane present in all GAP enclosures
- Base Module Backplane is used to support multiple Base Application Modules

Base Backplanes ***shall*** be field replaceable. Loss of service is expected during GAP Base Backplane replacement since removal of Power Supplies and Base Modules is required.

8.5.1. Base Short Backplane

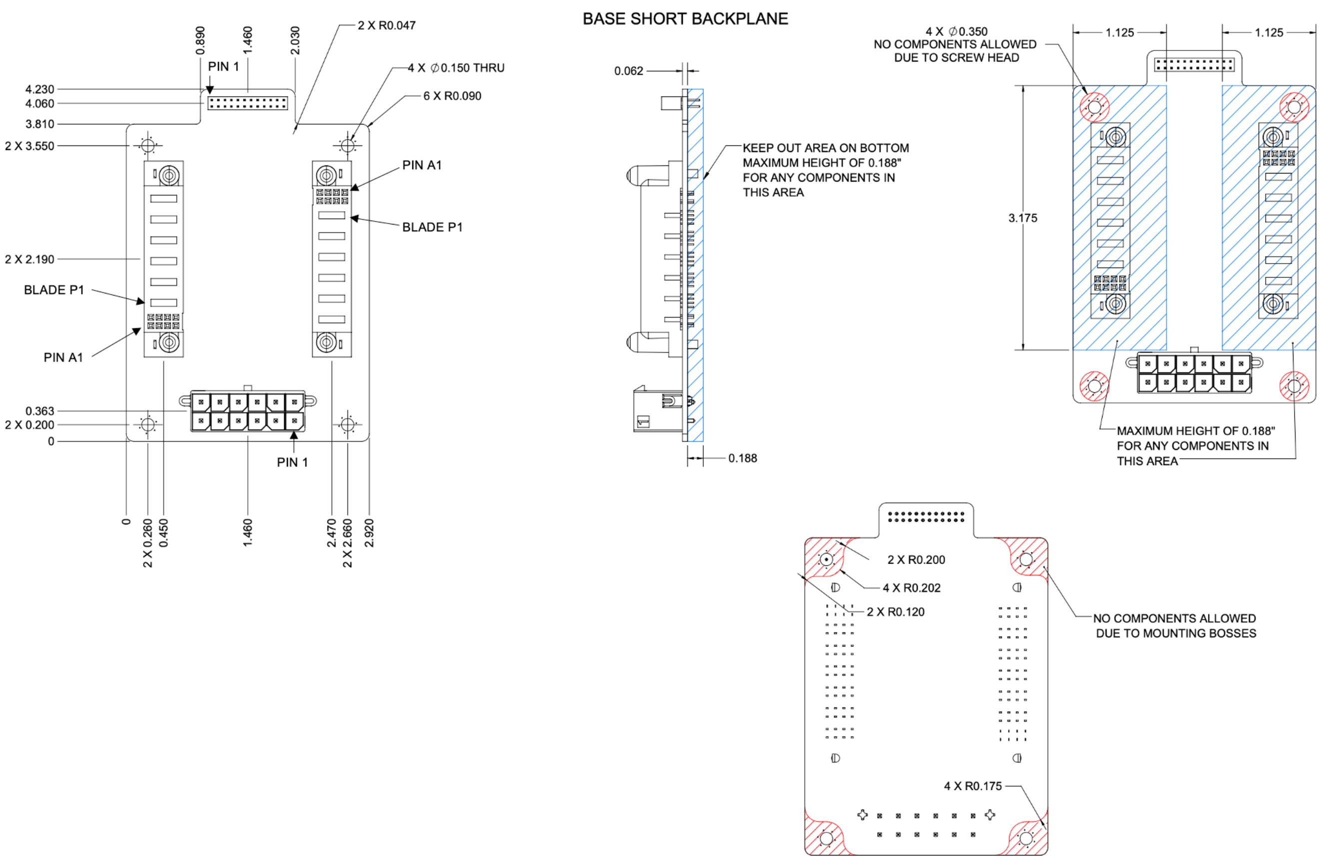


Figure 6 – Base Short Backplane

The Base Short Backplane, as shown in Figure 6, is a passive backplane which provides DC power and GAP-IMI connectivity between Power Supplies, Base Modules, and Lid.

The Base Short Backplane ***shall*** be mounted to the Base using #6-32 holes B13,B14,B21,B22 located as shown in Section 11.

The Base Short Backplane ***shall*** include a Base Module Backplane Connector as defined in Section 8.6 for connection to the Base Module Backplane or a Full-Size Base Module.

The Base Module Backplane Connector ***shall*** be located and oriented on the Base Short Backplane as defined in Figure 6.

The Base Module Connector on the Base Short Backplane *may* be connected directly to a single Base Module (Full-Size Base Module) that occupies the full Base Module Area.

The Base Short Backplane ***shall*** connect Base Module Connector ADDR0 and ADDR1 pins to GND so that a Full-Size Base Module recognizes installation into Slot 1 as described in Section 8.6.1.

The Base Short Backplane Module Connector *may* be connected to the Base Module Backplane to support more than one Base Module.

Base Short Backplane ***shall*** include two (2) Power Supply Backplane Connectors as defined in Section 8.6.2 for Power Supply connections.

The Power Supply Backplane Connectors ***shall*** be located and oriented on the Base Short Backplane as defined in Figure 6.

Base Short Backplane ***shall*** include a Base-Lid Backplane Connector as defined in Section 8.6.3 for connecting DC power and GAP-IMI to Lid Modules through the Lid Backplane.

The Base-Lid Backplane Connector ***shall*** be located and oriented on the Base Short Backplane as defined in Section 11.

Base Short Backplane ***shall not*** include a CAN bus termination resistor.

Base Short Backplane components ***shall*** comply with keepout area heights as defined in Figure 6.

As specified in Section 10.2, the maximum total power budget for the enclosure is 200 W; the maximum current values in Table 8 provide considerable margin. Each power rail on the Base Short Backplane ***shall*** be distributed as traces/planes sized sufficient to support 200 W.

8.5.2. Base Module Backplane

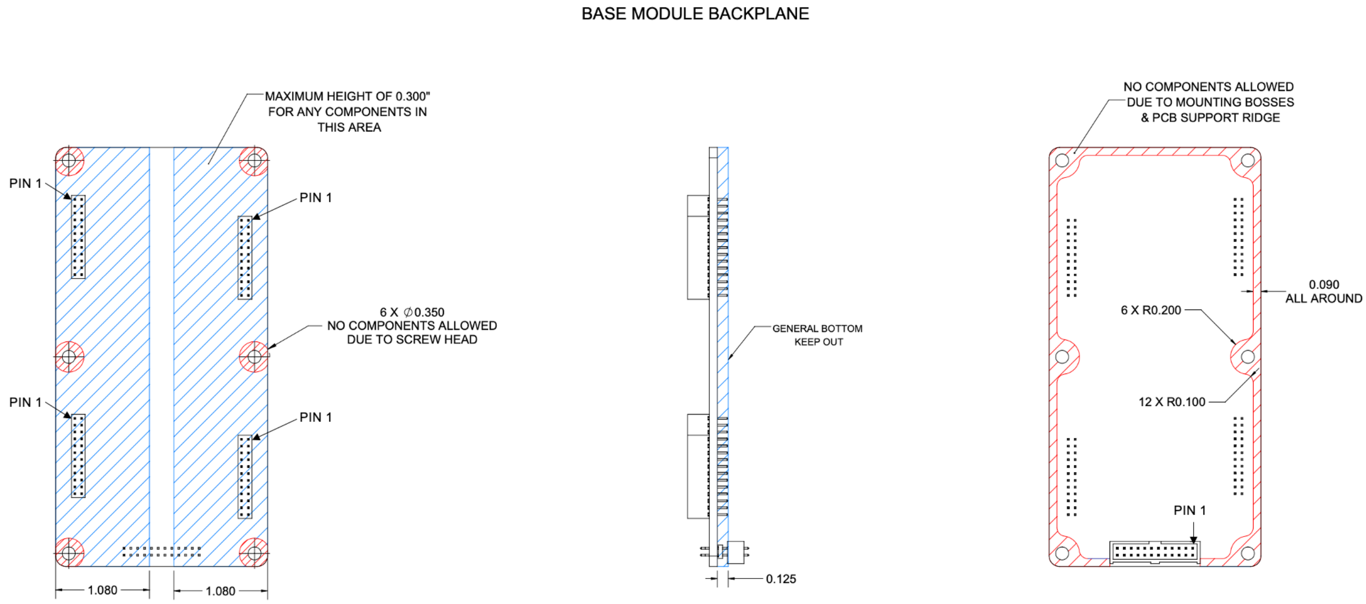


Figure 7 – Base Module Backplane

Base Module Backplane, as shown in Figure 7, ***shall*** include four (4) Base Module Backplane Connectors as defined in Section 8.6.1 to provide DC power and GAP-IMI connectivity to Base Modules.

Base Module Backplane ***shall*** be included for any system intending to support more than a single Base Module.

Base Module Backplane Connectors ***shall*** be located and oriented on the Base Module Backplane as defined in Figure 7.

Base Module Backplane ***shall*** include 120 ohm, 0.25 W termination resistor between CANH and CANL at the bus location furthest from the Base Short Backplane. Note this limits the supply voltage of the CAN transceivers in the Base Modules and Power Supply Module to 5 V maximum.

The Base Module Backplane ***should*** be mounted to the Base using #6-32 holes B15-B20 located as shown in Section 11.

Base Module Backplane components ***shall*** comply with keepout area heights as defined in Figure 7.

Base Module Backplane power rails ***shall*** be routed with traces/planes sized sufficient for the maximum currents listed in Table 4. As specified in Section 10.2.2, the maximum total power budget for Base Modules is 90 W; the maximum current values in Table 4 provide margin.

8.6. Base Connectors

8.6.1. Base Module Backplane Connector

Base Module Backplane Connectors ***shall*** be 2 mm pitch 2x12 connectors as illustrated in Figure 8 below.[2]

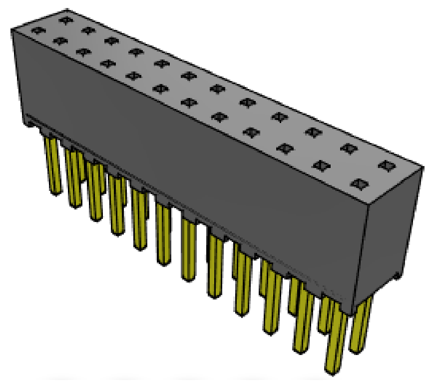


Figure 8 – Base Module Backplane Connector

Base Module Backplane Connector pinout ***shall*** be per Table 3.

Table 3 – Base Module Backplane Connector Pinout

24	22	20	18	16	14	12	10	8	6	4	2
GND	**12V**	**Vaux**	**GND**	**CANH**	**CANL**	**ADDR1**	**5.75V**	**5.75V**	**5.75V**	**25V**	**GND**
23	21	19	17	15	13	11	9	7	5	3	1
12V	**12V**	**Vaux**	**GND**	**GND**	**GND**	**ADDR2**	**5.75V**	**5.75V**	**5.75V**	**25V**	**GND**

The Base Module Backplane signals are broken into 3 classes: Power, Control/Status, and CAN.

The Base Module Backplane Connector ***shall*** be capable of supporting the currents listed in Table 4.

Table 4 – Base Module Backplane Signal Class: Power

Power Rail	Current (A)
5.75V	18 A
12V	9 A
25V	6 A
Vaux	6 A
Ground	21 A

Base Module Backplane Connector signal behavior for the Control/Status signals ***shall*** be as per Table 5.

[2] Connectors that are compliant with Figure 8 include Samtec SQT-112-03-S-D or equivalent. This identification of compliant connectors is not an endorsement of those products or services of those suppliers.

Table 5 – Base Module Backplane Signal Class: Control/Status

Signal	Description
ADDR0	Module slot identifier, see Note 1 following this table
ADDR1	

Note 1: Signals ADDR0 and ADDR1 and ADDR2 identify the Base Module slot numbers 1 through 4 as shown in Figure 5. Base Module slot numbering is shown in Table 6:

Table 6 – Base Module Backplane Module Slot Addressing

Slot	ADDR1	ADDR0
Slot 1	GND	GND
Slot 2	GND	5.75 V
Slot 3	5.75 V	GND
Slot 4	5.75 V	5.75 V

Pullup resistors to 5.75V ***shall*** be 10 kohm and ***shall*** be located on the Base Module Backplane.

The Control/Status signals are DC levels and do not require any specific characteristic impedance or other routing requirements.

CANH and CANL backplane requirements are specified in Section 8.5.1 for Base Short Backplane and Section 8.5.2 for the Base Module Backplane. CANH and CANL signal behavior is specified in [GAP Modules].

8.6.2. Power Supply Backplane Connectors

Power Supplies have two connectors, specified in [GAP Modules]:

- Power Supply Input Cable Connector for AC (or DC) power input coming from a Port Entry Module over a short pigtail
- Power Supply Output Module Connector for DC output, GAP-IMI monitoring, and load sharing connected to the Base Short Backplane

Port Entry Module power supply connector signals and requirements are specified in [GAP Modules].

The Power Supply Backplane Connectors ***shall*** be 6 pin high current blade + 8 signal connector as illustrated in Figure 9.[3]

[3] Connectors that are compliant with Figure 8Figure 9 include Amphenol 51741-10000806AALF, Medlon JYP-F0806B-VT21R or equivalent. This identification of compliant connectors is not an endorsement of those products or services of those suppliers.

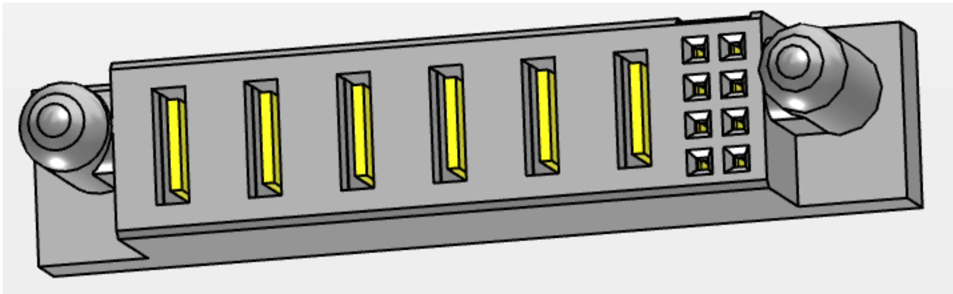


Figure 9 – Power Supply Backplane Connector

Power Supply Backplane Connector pinout ***shall*** be per Table 7.

Table 7 – Power Supply Backplane Connector Pinout

P6	P5	P4	P3	P2	P1	D2	D1
						LSHARE_5.75V	**LSHARE_12V**
						C2	C1
						LSHARE_25V	**LSHARE_Vaux**
5.75V	**Vaux**	**GND**	**12V**	**25V**	**GND**	B2	B1
						GND	**CANH**
						A2	A1
						ADDR0	**CANL**

The Power Supply Backplane Connector signals are broken into 3 classes: Power, Control/Status, and CAN.

The Power Supply Backplane Connector ***shall*** be capable of supporting the currents listed in Table 8.

Table 8 – Power Supply Backplane Connector Signal Class: Power

Power Rail	Current (A)
5.75V	40 A
12V	40 A
25V	40 A
Vaux	40 A
Ground	80 A

Power Supply Output Backplane Connector signal behavior for the Control/Status signals ***shall*** be as per Table 9.

Table 9 – Power Supply Backplane Connector Signal Class: Control/Status

Signal	Description
LSHARE_5.75V	Load share pins with behavior specified in [GAP Modules]
LSHARE_12V	
LSHARE_25V	
LSHARE_Vaux	
ADDR0	Module slot identifier, see Note 1 following this table

Note 1: Signal ADDR0 identify the Power Supply slot with the following connections:

ADDR0 ***shall*** be connected to GND on the Base Short Backplane for Power Supply 1 connector.

ADDR0 ***shall*** be connected to 5.75V using a pullup resistor of 10 kohm on the Base Short Backplane for Power Supply 2 connector.

CANH and CANL backplane requirements are specified in Section 8.5.1. CANH and CANL signal behavior is specified in [GAP Modules].

8.6.3. Base Backplane to Lid Connector

The Base Backplane to Lid Connector ***shall*** be a 5.7 mm pitch latching power connector as illustrated in Figure 10.[4]

Figure 10 – Base Backplane to Lid Connector

[4] Connectors that are compliant with Figure 10 include Molex Mega-Fit 76829-0012 or equivalent. This identification of compliant connectors is not an endorsement of those products or services of those suppliers.

Base Backplane to Lid Connector pinout ***shall*** be per Table 10.

Table 10 – Base Backplane to Lid Connector Pinout

RETENTION TAB					
12	11	10	9	8	7
5.75V	**GND**	**CANH**	**CANL**	**GND**	**12V**
6	5	4	3	2	1
5.75V	**5.75V**	**Vaux**	**GND**	**25V**	**12V**

The Base Backplane to Lid signals are broken into 2 classes: Power and CAN.

The Base Backplane to Lid Connector ***shall*** be capable of supporting the currents listed in Table 11.

Table 11 – Base Backplane to Lid Connector Signal Class: Power

Power Rail	Current (A)
5.75V	31.2 A
12V	20.8 A
25V	10.4 A
Vaux	10.4 A
Ground	31.2 A

The wire used for Base Backplane to Lid connection ***shall*** be 16 AWG minimum to comply with the power rail current ratings in Table 11.

CANH and CANL signal behavior is specified in [GAP Modules].

9. Lid

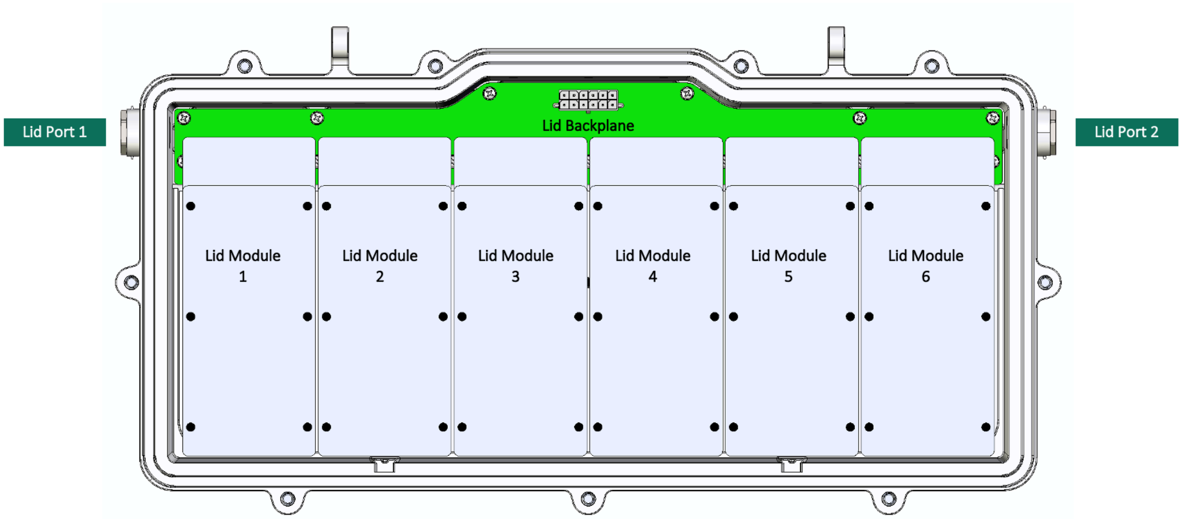


Figure 11 – GAP Lid Layout

Figure 11 shows the layout of the GAP Lid Components.

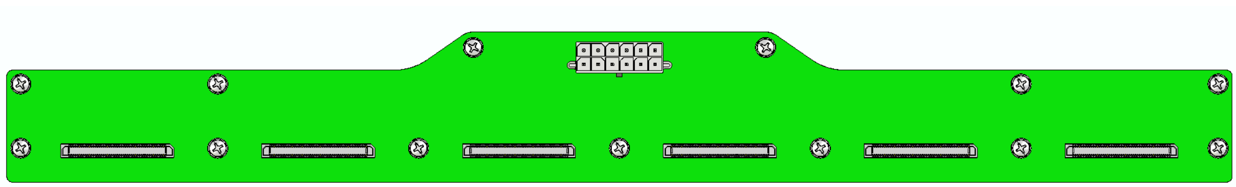


Figure 12 – Low-Speed Lid Backplane

Figure 12 shows the Low-Speed Backplane with six Standard Lid Module Backplane Connectors.

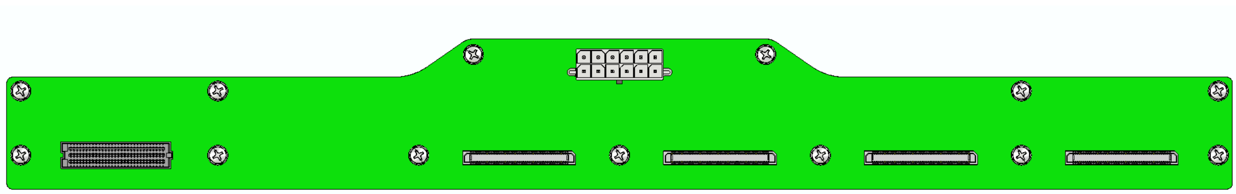


Figure 13 – High-Speed Lid Backplane

Figure 13 shows the High-Speed Backplane with one Special Module Backplane Connector on the far left and four Standard Lid Module Backplane Connectors on the right.

9.1. Lid Port and Module Numbering

Lid Entry Ports ***shall*** be numbered as shown in Figure 11.

Lid Modules ***shall*** be numbered as shown in Figure 11.

9.2. Lid Module Area

The Lid ***shall*** support up to six (6) Lid Modules mounted to the Lid Module Area as shown in Figure 11. The Low-Speed Backplane allows for up to six (6) Standard Lid Modules. The High-Speed Backplane allows for one (1) Special Module and up to four (4) Standard Lid Modules.

The Lid Module Area ***shall*** be contiguous in surface area to allow Lid Modules to have flexible maximum dimensions.

The Lid Module Area module mounting surface ***shall*** conform to the GAP Reference Model.

The Lid Module Area ***shall*** provide #10-32 mounting holes A1-A36 as defined in Section 12 to mount Standard Lid Modules and Special Modules. The exact holes used by any particular Lid Module is vendor specific.

9.3. Lid Backplane Mechanical

9.3.1. Common Requirements

Requirements in the section are common to all Lid Backplanes: Low-Speed and High-Speed.

Lid Backplane thickness ***shall*** be 2.36mm (0.093”) +/- 10%.

Lid Backplane ***shall*** be mounted using the mounting holes C1-C11, D1, D2 shown in Section 12.

Lid Backplane ***shall*** be mounted to the lid using #6-32 screws.

9.3.2. Low-Speed Backplane

Low-Speed Lid Backplane connectors ***shall*** be located and oriented as shown in Figure 14.

Low-Speed Lid Backplane components ***shall*** comply with keepout area heights as defined in Figure 14.

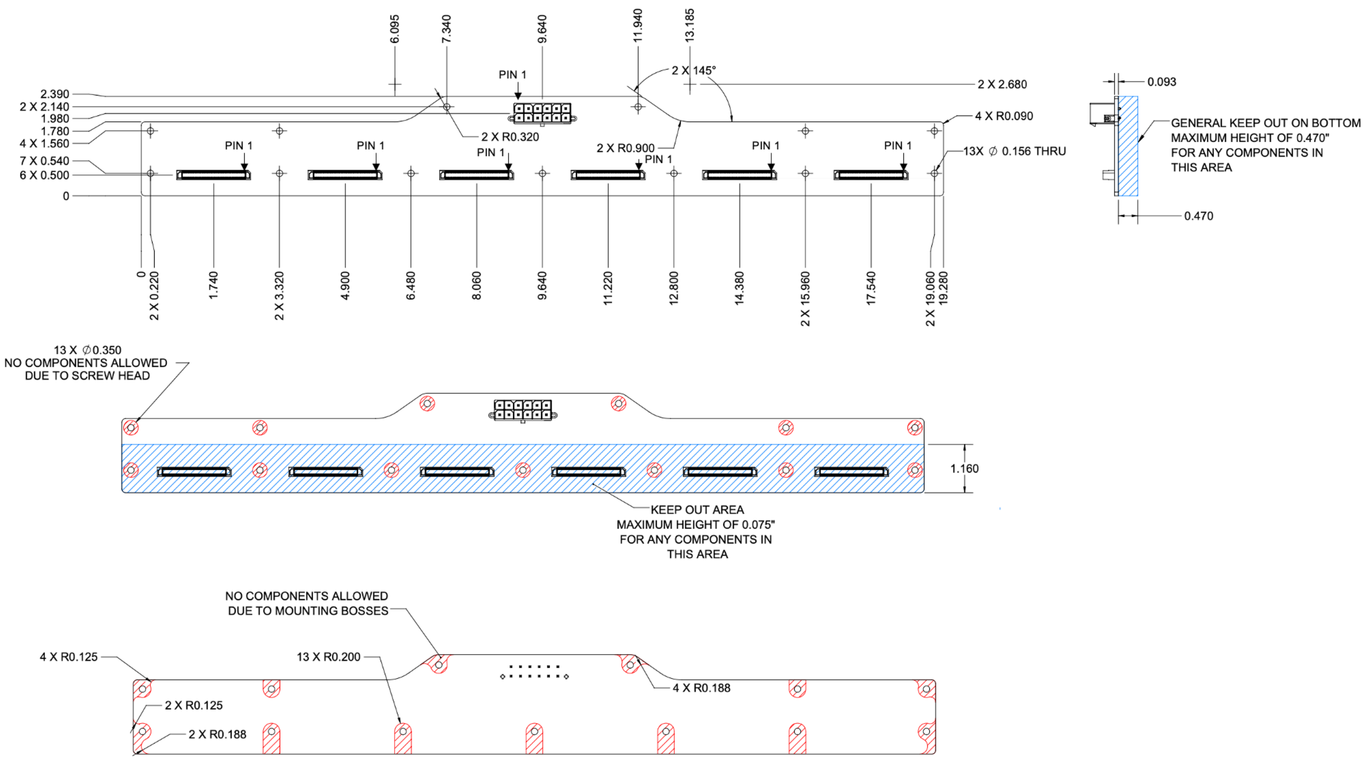


Figure 14 – Low-Speed Lid Backplane Dimensions

9.3.3. High-Speed Backplane

High-Speed Lid Backplane connectors ***shall*** be located and oriented as shown in Figure 15.

High-Speed Lid Backplane components ***shall*** comply with keepout area heights as defined in Figure 15.

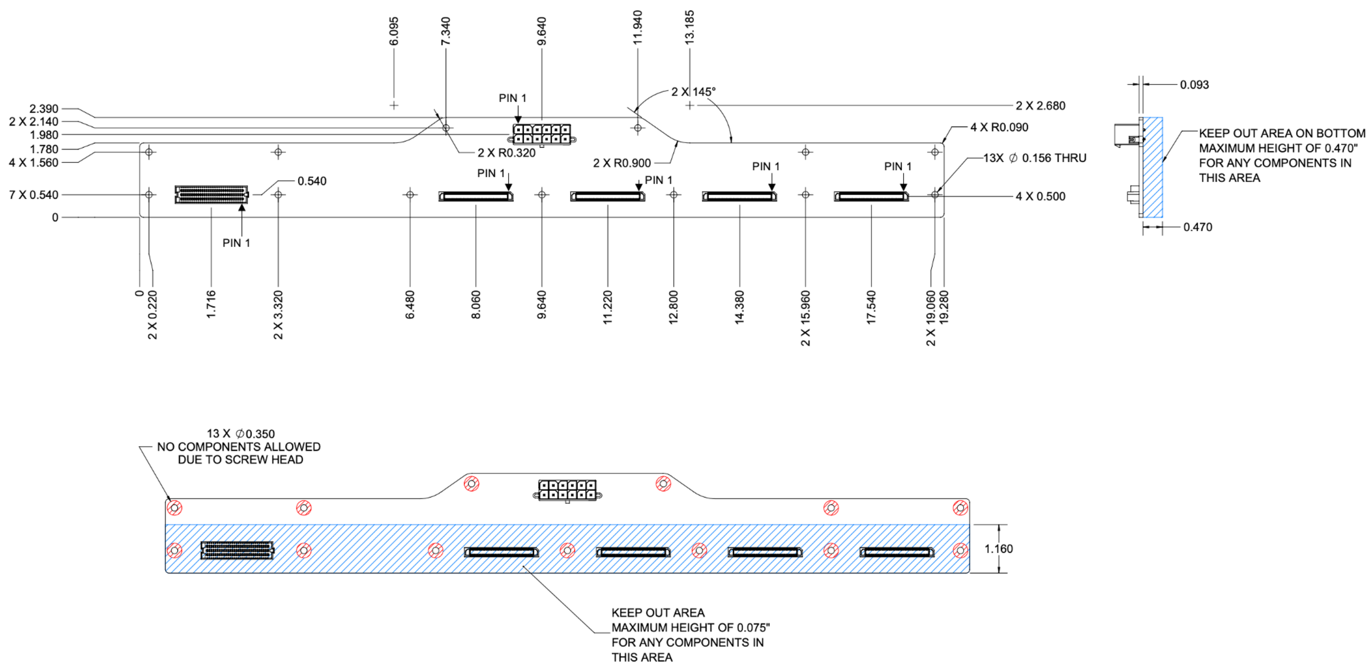


Figure 15 – High-Speed Lid Backplane Dimensions

9.4. Standard Lid Module Backplane Connector

The Standard Lid Module Backplane connector ***shall*** be a 2x49 0.8 mm rugged high-speed socket as shown in Figure 16.[5]

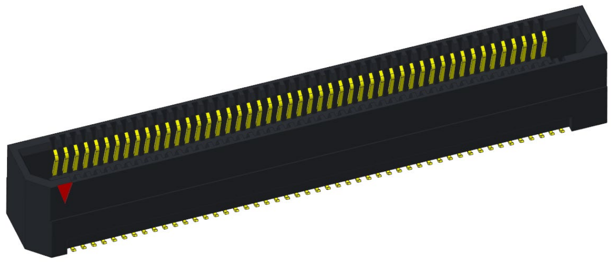


Figure 16 – Standard Lid Module Backplane Connector

Standard Lid Module Backplane Connector pinout ***shall*** be per Table 12.

The following high-speed signal pins ***shall*** be left unconnected on the Low-Speed Backplane:

- All PCIe pin #s: 33, 34, 35, 40, 42, 45, 47, 52, 54, 57, 59, 64, 66, 69, 71, 76, 78, 81, 83
- All KR pin #s: 88, 90, 93, 95

Table 12 – Standard Lid Module Backplane Connector Pinout

#	Signal	Pin Length	#	Signal	Pin Length
1	GND	Long	2	GND	Long
3	PRESENT_N1	Short	4	25V	Short
5	25V	Short	6	25V	Short
7	GND	Long	8	GND	Long
9	12V	Short	10	12V	Short
11	12V	Short	12	12V	Short
13	GND	Long	14	GND	Long
15	12V	Short	16	12V	Short
17	12V	Short	18	12V	Short
19	GND	Long	20	GND	Long
21	Vaux	Short	22	Vaux	Short

[5]Connectors that are compliant with Figure 16 are Samtec ERF8-049-07.0-L-DV-EGP or equivalent. This identification of compliant connectors is not an endorsement of those products or services of those suppliers.

23	Vaux	Short	24	ADDR0	Short
25	GND	Long	26	GND	Long
27	ADDR1	Short	28	CANH	Short
29	ADDR2	Short	30	CANL	Short
31	GND	Long	32	GND	Long
33	PCIe_CLK_N	Short	34	PCIE_RST_N	Short
35	PCIe_CLK_P	Short	36	GND	Short
37	GND	Long	38	GND	Long
39	5.75V	Short	40	PCIe TX0_N	Short
41	5.75V	Short	42	PCIe TX0_P	Short
43	GND	Long	44	GND	Long
45	PCIe RX0_N	Short	46	5.75V	Short
47	PCIe RX0_P	Short	48	5.75V	Short
49	GND	Long	50	GND	Long
51	5.75V	Short	52	PCIe TX1_N	Short
53	5.75V	Short	54	PCIe TX1_P	Short
55	GND	Long	56	GND	Long
57	PCIe RX1_N	Short	58	5.75V	Short
59	PCIe RX1_P	Short	60	5.75V	Short
61	GND	Long	62	GND	Long
63	GND	Short	64	PCIe TX2_N	Short
65	GND	Short	66	PCIe TX2_P	Short
67	GND	Long	68	GND	Long
69	PCIe RX2_N	Short	70	GND	Short
71	PCIe RX2_P	Short	72	GND	Short
73	GND	Long	74	GND	Long
75	GND	Short	76	PCIe TX3_N	Short
77	GND	Short	78	PCIe TX3_P	Short

79	GND	Long	80	GND	Long
81	PCIe RX3_N	Short	82	GND	Short
83	PCIe RX3_P	Short	84	GND	Short
85	GND	Long	86	GND	Long
87	GND	Short	88	KR_TX_N	Short
89	GND	Short	90	KR_TX_P	Short
91	GND	Long	92	GND	Long
93	KR_RX_N	Short	94	GND	Short
95	KR_RX_P	Short	96	PRESENT_N2	Short
97	GND	Long	98	GND	Long

9.5. Special Module Backplane Connector

The Special Module Backplane connector ***shall*** be an 8x30 high-speed high-density open pin-field array socket as shown in Figure 17.[6]

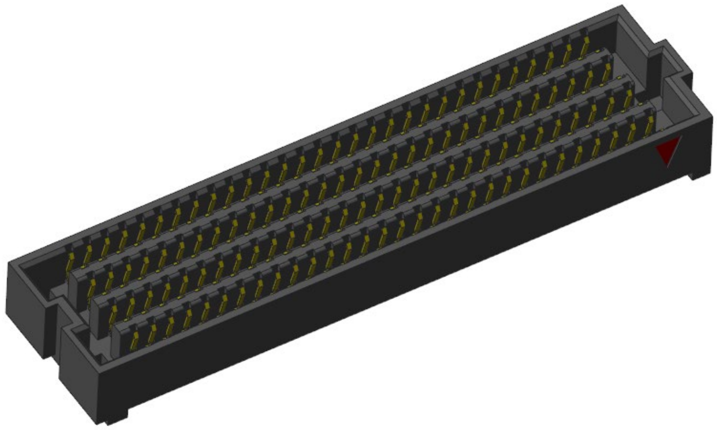


Figure 17 – Special Module Backplane Connector

Special Module Backplane Connector pinout ***shall*** be per Table 13.

All RFU (Reserved for Future Use) connections ***shall*** be left unconnected.

[6] Connectors that are compliant with Figure 17 include the Samtec SEAF-30-05.0-L-08-2-A-K-X or equivalent. This identification of compliant connectors is not an endorsement of those products or services of those suppliers.

Table 13 – Special Module Backplane Connector Pinout

	A	B	C	D	E	F	G	H
1	GND	GND	GND	GND	GND	GND	GND	GND
2	GND	M4_PCIe RX1_P	GND	M4_PCIe RX3_P	GND	M4_PCIe TX1_P	GND	M4_PCIe TX3_P
3	GND	M4_PCIe RX1_N	GND	M4_PCIe RX3_N	GND	M4_PCIe TX1_N	GND	M4_PCIe TX3_N
4	M4_PCIe RX0_P	GND	M4_PCIe RX2_P	GND	M4_PCIe TX0_P	GND	M4_PCIe TX2_P	GND
5	M4_PCIe RX0_N	GND	M4_PCIe RX2_N	GND	M4_PCIe TX0_N	GND	M4_PCIe TX2_N	GND
6	GND	M4_PCIe_CLK_P	GND	M4_PRESENT_N	GND	M4_KR_RX_P	GND	M4_KR_TX_P
7	GND	M4_PCIe_CLK_N	GND	RFU	GND	M4_KR_RX_N	GND	M4_KR_TX_N
8	M3_PCIe RX1_P	GND	M3_PCIe RX3_P	GND	M3_PCIe TX1_P	GND	M3_PCIe TX3_P	GND
9	M3_PCIe RX1_N	GND	M3_PCIe RX3_N	GND	M3_PCIe TX1_N	GND	M3_PCIe TX3_N	GND
10	GND	M3_PCIe RX0_P	GND	M3_PCIe RX2_P	GND	M3_PCIe TX0_P	GND	M3_PCIe TX2_P
11	GND	M3_PCIe RX0_N	GND	M3_PCIe RX2_N	GND	M3_PCIe TX0_N	GND	M3_PCIe TX2_N
12	M3_PCIe_CLK_P	GND	M3_PRESENT_N	GND	M3_KR_RX_P	GND	M3_KR_TX_P	GND
13	M3_PCIe_CLK_N	GND	RFU	GND	M3_KR_RX_N	GND	M3_KR_TX_N	GND
14	GND	M2_PCIe RX1_P	GND	M2_PCIe RX3_P	GND	M2_PCIe TX1_P	GND	M2_PCIe TX3_P
15	GND	M2_PCIe RX1_N	GND	M2_PCIe RX3_N	GND	M2_PCIe TX1_N	GND	M2_PCIe TX3_N
16	M2_PCIe RX0_P	GND	M2_PCIe RX2_P	GND	M4_PCIe TX0_P	GND	M2_PCIe TX2_P	GND
17	M2_PCIe RX0_N	GND	M2_PCIe RX2_N	GND	M4_PCIe TX0_N	GND	M2_PCIe TX2_N	GND
18	GND	M2_PCIe_CLK_P	GND	M2_PRESENT_N	GND	M2_KR_RX_P	GND	M2_KR_TX_P
19	GND	M2_PCIe_CLK_N	GND	RFU	GND	M2_KR_RX_N	GND	M2_KR_TX_N
20	M1_PCIe RX1_P	GND	M1_PCIe RX3_P	GND	M1_PCIe TX1_P	GND	M1_PCIe TX3_P	GND
21	M1_PCIe RX1_N	GND	M1_PCIe RX3_N	GND	M1_PCIe TX1_N	GND	M1_PCIe TX3_N	GND
22	GND	M1_PCIe RX0_P	GND	M1_PCIe RX2_P	GND	M1_PCIe TX0_P	GND	M1_PCIe TX2_P
23	GND	M1_PCIe RX0_N	GND	M1_PCIe RX2_N	GND	M1_PCIe TX0_N	GND	M1_PCIe TX2_N
24	M1_PCIe_CLK_P	GND	M1_PRESENT_N	GND	M1_KR_RX_P	GND	M1_KR_TX_P	GND
25	M1_PCIe_CLK_N	GND	RFU	RFU	M1_KR_RX_N	GND	M1_KR_TX_N	GND
26	GND	PCIE_RST_N	RFU	RFU	GND	RFU	GND	CANL
27	5.75V	5.75V	5.75V	5.75V	GND	AUX	GND	CANH
28	5.75V	5.75V	5.75V	5.75V	AUX	AUX	AUX	GND
29	12V	12V	GND	GND	GND	GND	GND	GND
30	12V	12V	12V	12V	25V	25V	25V	25V

9.6. Lid Backplane to Base Connector

The Lid Backplane to Base Connector ***shall*** be a 5.7 mm pitch latching power connector as illustrated in Figure 18.[7]

Figure 18 – Lid Backplane to Base Connector

The Lid Backplane to Base Connector pinout ***shall*** be per Table 14.

Table 14 – Lid Backplane to Base Connector Pinout

1	2	3	4	5	6
5.75V	**5.75V**	**Vaux**	**GND**	**25V**	**12V**
7	8	9	10	11	12
5.75V	**GND**	**CANH**	**CANL**	**GND**	**12V**
RETENTION TAB					

The Lid Backplane to Base signals are broken into 2 classes: Power and CAN.

The Lid Backplane to Base Connector ***shall*** be capable of supporting the currents listed in Table 15.

Table 15 – Lid Backplane to Base Connector Signal Class: Power

Power Rail	Current (A)
5.75V	31.2 A
12V	20.8 A
25V	10.4 A
Vaux	10.4 A
Ground	31.2 A

[7] Connectors that are compliant with Figure 10 include Molex Mega-Fit 76829-0012 or equivalent. This identification of compliant connectors is not an endorsement of those products or services of those suppliers.

The wire used for Lid Backplane to Base connection ***shall*** be 16AWG minimum to comply with the power rail current ratings in Table 15.

CANH and CANL signal behavior is specified in [GAP Modules].

9.7. Lid Backplane Electrical

9.7.1. Common Requirements

Requirements in the section are common to all Lid Backplanes: Low-Speed and High-Speed.

Mounting holes in the Lid Backplane connector ***shall*** be grounded. The connection between the chassis ground and the individual module signal grounds will be determined by each module designer.

The Lid Backplane signals are broken into 5 classes: Power, Control/Status, CAN, PCIe, KR Ethernet. The Power, Control/Status and CAN signal classes are common to both Low-Speed and High-Speed backplanes.

Table 16 – Lid Backplane Signal Class: Power

Power Rail	Current (A)
5.75V	21.6 A
12V	14.4 A
25V	7.2 A
Vaux	7.2A
Ground	21.6 A

The Power rails ***shall*** be distributed as planes sized sufficient for the maximum currents listed in Table 16. As specified in Section 10.2.1, the maximum total power budget for the Lid is 120 W; the maximum current values in Table 16 provide margin.

Lid Backplane signal behavior for Control/Status signals ***shall*** be as per Table 17.

Table 17 – Lid Backplane Signal Class: Control/Status

<table>
<tr><th>Signal</th><th>Connector</th><th>Description</th></tr>
<tr><td>PRESENT_N1</td><td>Standard Modules</td><td rowspan="2">Connected to ground on each module. Connection impedance shall be less than or equal to 100 ohms.</td></tr>
<tr><td>PRESENT_N2</td><td>Standard Modules</td></tr>
<tr><td>ADDR0</td><td>Standard Modules</td><td rowspan="3">Module slot identifier, see Note 1 following this table</td></tr>
<tr><td>ADDR1</td><td>Standard Modules</td></tr>
<tr><td>ADDR2</td><td>Standard Modules</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>M4_PRESENT_N</td><td>Special Module</td><td rowspan="4">Pulled high on the Special Module. Connection to the high level shall be 10k or greater.</td></tr>
<tr><td>M3_PRESENT_N</td><td>Special Module</td></tr>
<tr><td>M2_PRESENT_N</td><td>Special Module</td></tr>
<tr><td>M1_PRESENT_N</td><td>Special Module</td></tr>
</table>

Note 1: Signals ADDR0, ADDR1 and ADDR2 identify the Lid Module slot numbers 1 through 6 as shown in Figure 11. ADDR2 is MSB, Lid Module slot numbering is shown in Table 18:

Table 18 – Lid Backplane Module Slot Addressing

Slot	ADDR2	ADDR1	ADDR0
Slot 1	GND	GND	5.75V
Slot 2	GND	5.75V	GND
Slot 3	GND	5.75V	5.75V
Slot 4	5.75V	GND	GND
Slot 5	5.75V	GND	5.75V
Slot 6	5.75V	5.75V	GND

Pullup resistors to 5.75V ***shall*** be 10 kohm and ***shall*** be located on the Lid Backplane.

The Control/Status signals are DC levels and do not require any specific characteristic impedance or other routing requirements.

Table 19 – Lid Backplane Signal Class: CAN

Signal	Connector
CANH	Special Module and all Standard Modules
CANL	Special Module and all Standard Modules

CANH and CANL signals ***shall*** be routed as a differential pair with 120 ohm characteristic impedance.

CANH and CANL signals ***shall*** be routed in a daisy chain topology similar to what is shown in Figure 19 so that the traces run from the Base-Lid Backplane Connector directly past Lid Module 1 (or Special Module connector), then past each Lid Module in succession until they pass Lid Module 6 and end at the bus termination resistor.

The stub lengths between the bus and the module connectors ***shall*** be less than 2.0”.

The Lid Backplane ***shall*** provide a 120 ohm, 0.25 W termination resistor between CANH and CANL at the end of the bus to the right of Lid Module 6. Note this limits the supply voltage of the CAN transceivers in Lid Modules to 5 V maximum.

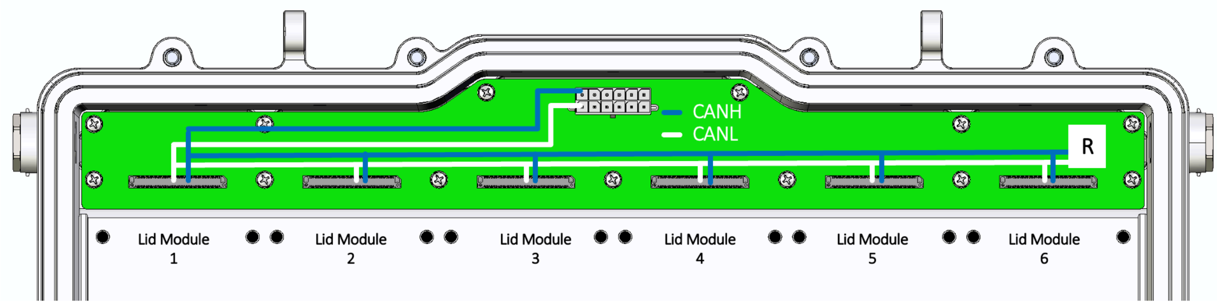


Figure 19 – CAN Bus Lid Backplane Routing

9.7.2. Low-Speed Backplane

No electrical requirements are included which are specific to the Low-Speed Backplane.

9.7.3. High-Speed Backplane

PCIe and KR signal classes are only used in the High-Speed Backplane.

Connections between the Special Module and each Standard Lid Module for PCIe use ***shall*** be as per Table 20.

Table 20 – Lid High-Speed Backplane Signal Class: PCIe

Signal	Connectors
M4_PCIe_RX1/2/3/4_P/N	Special Module and Standard Lid Module 4
M4_PCIe_TX1/2/3/4_P/N	Special Module and Standard Lid Module 4
M4_PCIe_CLK_P/N	Special Module and Standard Lid Module 4
M3_PCIe_RX1/2/3/4_P/N	Special Module and Standard Lid Module 3
M3_PCIe_TX1/2/3/4_P/N	Special Module and Standard Lid Module 3
M3_PCIe_CLK_P/N	Special Module and Standard Lid Module 3
M2_PCIe_RX1/2/3/4_P/N	Special Module and Standard Lid Module 2
M2_PCIe_TX1/2/3/4_P/N	Special Module and Standard Lid Module 2
M2_PCIe_CLK_P/N	Special Module and Standard Lid Module 2
M1_PCIe_RX1/2/3/4_P/N	Special Module and Standard Lid Module 1
M1_PCIe_TX1/2/3/4_P/N	Special Module and Standard Lid Module 1
M1_PCIe_CLK_P/N	Special Module and Standard Lid Module 1
PCIE_RST_N	Special Module and all Standard Lid Modules

The PCIe traces ***shall*** be routed point-to-point with differential traces of 100 ohms characteristic impedance. All terminations and AC coupling are to be internal to the modules.

The backplane routing of PCIe signals ***shall*** be compliant with [PCIe Gen4 Base].

Connections between the Special Module and each Standard Lid Module for KR Ethernet use ***shall*** be as per Table 21.

Table 21 – Lid High-Speed Backplane Signal Class: KR Ethernet

Signal	Connectors
M4_KR_RX_P/N	Special Module and Standard Lid Module 4
M4_KR_TX_P/N	Special Module and Standard Lid Module 4
M3_KR_RX_P/N	Special Module and Standard Lid Module 3
M3_KR_TX_P/N	Special Module and Standard Lid Module 3
M2_KR_RX_P/N	Special Module and Standard Lid Module 2
M2_KR_TX_P/N	Special Module and Standard Lid Module 2
M1_KR_RX_P/N	Special Module and Standard Lid Module 1
M1_KR_TX_P/N	Special Module and Standard Lid Module 1

The KR Ethernet traces ***shall*** be routed point-to-point with differential traces of 100 ohms characteristic impedance. All terminations and AC coupling are to be internal to the modules.

The backplane routing of KR Ethernet signals ***shall*** be compliant with [IEEE 802.3] Clause 72.

9.8. Management and Inventory

The Lid Backplane *may* be a participant in GAP-IMI as defined in [GAP Modules] for inventory purposes.

9.9. Fiber Tray

The Fiber Tray and associated mounting components ***shall not*** extend outside the area defined in the Reference 3D Model. The Fiber Tray area *may* be used for other supporting components as long as they don’t extend outside the area defined in the Reference 3D Model.

The Fiber Tray *should* attach using #8-32 mounting holes E2-E4 shown in Section 12.

10. Enclosure Thermal Design

The goal of the enclosure thermal design is to provide operating point guidance for module thermal design. The Enclosure operating point is the reference temperature for a given set of cable node operating conditions, Enclosure heatsink configurations and assumptions noted below.

10.1. Module and Enclosure Heat Transfer

Enclosure heat transfer to the environment is by natural convection (fanless) and radiation. Any heat transfer through mounting points is negligible and ***shall not*** be accounted for. Internally, module heat transfer to the Enclosure internal surface is by conduction.

10.1.1. Natural Convection & Radiation

The Enclosure ***shall*** rely on natural convection and radiation from the enclosure external surfaces (including fins) to the surrounding environment. In practice, in an outside plant condition (strand) for example, there will be airflow but this specification does not make a determination for mean airflow and direction. Hence, airflow is only due to buoyancy-driven airflow due to the temperature difference between the Enclosure surface and local air.

For natural convection operation, radiation can be 30% to 50% of the overall system heat transfer depending on Enclosure surface finish, temperature of nearby equipment and other environmental sources/sinks. The Enclosure specification assumes radiation exchange between the Enclosure surfaces and the environment. The driving temperature difference for radiation exchange is the surface temperature of the Enclosure and the ambient temperature from specification.

10.1.2. Solar Loading

Enclosures exposed to direct sunlight, such as strand mount or pole mount locations, will have an elevated operating point due to solar irradiance.

In field operation, the temperature rise of the Enclosure surface will depend on geographical location, equipment direction (facing south, west, etc.), orientation and surface finish (white paint, as cast with conversion coating, etc.). The peak surface temperature occurs approximately with the peak solar load at solar noon.

The Enclosure thermal specification does not make a determination for solar loading from an OSP environmental perspective. Instead, the Enclosure thermal specification aligns with the typical qualification standards for solar load testing.

10.1.1. Module Contact Resistance

The GAP Modules (Power Supply, Base Modules, Lid Modules) require thermal management, which is achieved by conduction cooling from the GAP Module to the Enclosure.

For field serviceability requirements, the contact surfaces ***shall not*** be connected with any gel- or paste-type heat sinking compounds. Thermal interface material, if used, ***shall*** be adhered to the removable module being thermally coupled, and not to the enclosure. Thermal interface material, if used, ***shall not*** hold dirt or dust.

For optimum thermal performance, both contact surfaces have flatness and surface finish requirements defined in Section 7.11.

The contact pressure between the mating surfaces, which is inversely related to the contact resistance between the modules, is determined by the number of fasteners used to mount the module and the expected torque of the fasteners. Typically, this will be an aluminum-to-aluminum dry contact interface.

From thermal testing with a Lid housing and single-width thermal load plates, the temperature difference between the thermal load plate and Lid base was approximately 4.5 ºC. To get the same temperature difference in the corresponding thermal model, the contact resistance was modeled as a 1 mm block, same footprint as the module, with a conductivity of 0.67 W/mK.

10.2. Enclosure Power Dissipation

The Enclosure power dissipation ***shall not*** exceed 200 W. The power dissipation limit is a function of thermal performance and line supply requirements.

The Enclosure power dissipation is assumed to be constant. Any transient variation or lower, time-averaged power dissipation is not accounted for by the Enclosure thermal specification.

10.2.1. Lid Power Dissipation

For Lid operating point determination, the power dissipation limit ***shall not*** exceed 20 W per slot (120 W total Lid power dissipation). Since the total power limit for the enclosure is 200 W, for thermal evaluation of Lid operating point the Base is limited to 80 W.

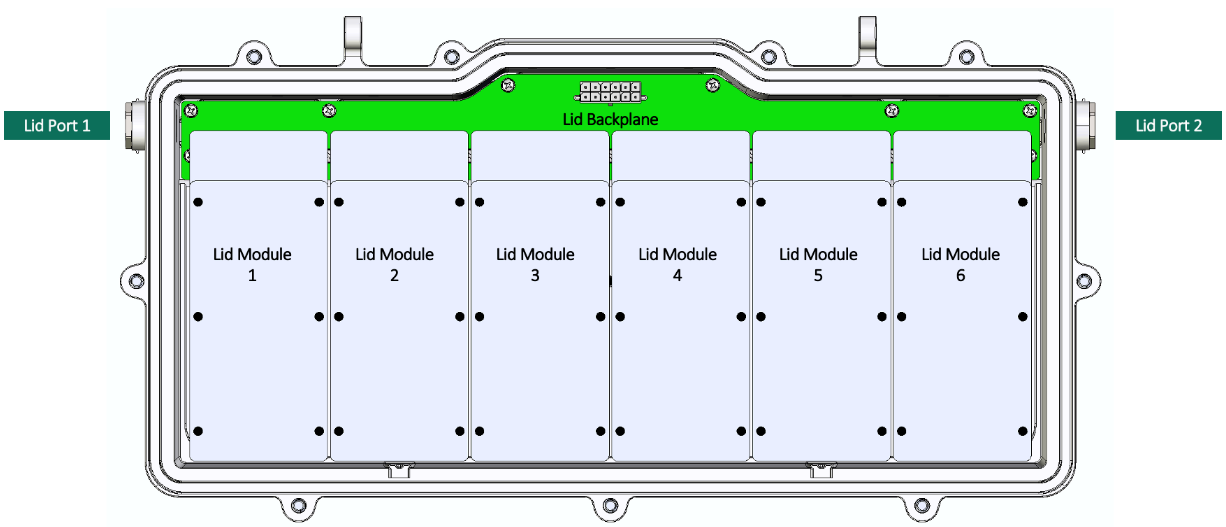


Figure 20 – Enclosure Lid Module Slots (Limited to 20 W each)

10.2.2. Base Power Dissipation

For Base operating point determination, the power dissipation limit for the installed Power Supplies ***shall not*** exceed 30 W (30 W for one Power Supply, or 30 W spread across two Power Supplies) and the power dissipation limit for each Base Module ***shall not*** exceed 22.5 W. Since the total power limit for the Enclosure is 200 W, for thermal evaluation of Base operating point the Lid is limited to 80 W.

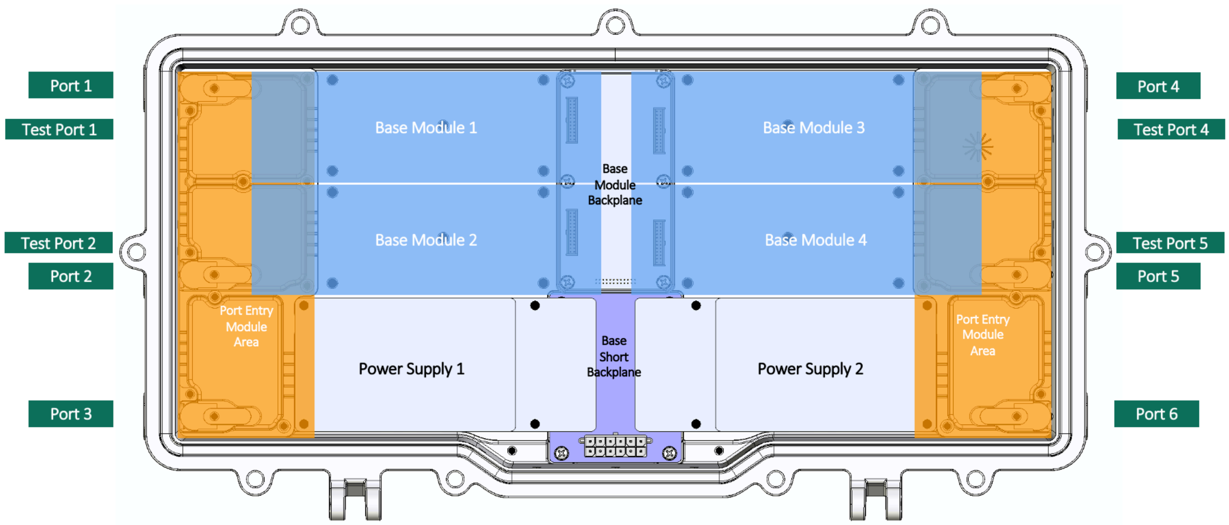


Figure 21 – Enclosure Base with Base Module and Power Supply Locations

10.2.3. OSP Environmental Specifications

For a cable node operating under OSP conditions, there can be a wide range of factors that influence the Enclosure operating point:

- Premise installation: strand, pedestal, pole, vault, wall
- Orientation (horizontal, vertical)
- Geographical location
- Enclosure extended surfaces (fins): vertical, angled, pin fins, no fins
- External Surface Finish: as-cast with conversion coating, painted

Most of the factors are comprehended by industry specifications for OSP, which have been developed to account for the worst-case operating conditions from a thermal performance perspective.

Table 22 – Standards Applied for Enclosure Operating Point Determination

Standard	Thermal Specification	Notes
ANSI/SCTE 158	-40 to +60 ºC	Class 1, Condition A
ATIS-0600010.01.2020	-40 to +46 ºC (+solar)	Class 4, unprotected environment
Charter Communications	-40 to +60 ºC	Charter MUST target Charter SHOULD target of +65 ºC Charter MUST target for cold soak: System can be powered and operate properly after a 1 hour cold soak at -40 ºC (-40 ºF) in an unpowered state.
Telcordia GR3108	-40 to +65 ºC -40 to +46 ºC (+solar)	Class 2 Class 4, points to ATIS spec& GR487

For the standards that do not list a solar load requirement it is assumed that solar loading is accounted for by the relatively higher operating ambient condition.

For the standards that do list a solar load requirement, the specification defines how the solar load should be applied and at what level. Since most enclosure housings will have finned primary surfaces, the use of luminaries instead of strip heaters is advised.

The standards define test conditions to ensure that test chamber temperatures are controlled and that any incident airflow is limited to 0.1 m/s or less near the unit under test. These test conditions align with the natural convection requirement and the assumption of a "dead air" (no wind) condition around the Enclosure.

10.2.4. Enclosure Operating Point Dependencies

From the discussion earlier, the following parameters are used for the thermal analysis:

- Module contact resistance block: k = 0.67 W/mK
- Surface emissivity: 0.3 for chemical conversion, 0.9 for painted
- Solar absorptivity: 0.21 (white paint) for solar evaluation
- Extended Surfaces (fins): angled, vertical, pin fin
- Orientation: horizontal, vertical
- Altitude: sea level
- Lid power: 120 W (20 W/slot) (Base power @ 80 W)
- Base power: 120 W (Lid power @ 80 W)

With the parameters above there could be up to 24 combinations to evaluate. For the enclosure thermal specification, the following parameters are fixed, which reflect the typical configuration expected for a cable node.

- Ambient Temperature: 60 ºC (includes any heating effects of solar load)
- Extended Surfaces (fins): angled
- Orientation: horizontal (long dimension of node (22”) parallel to ground)

10.2.5. Operating Points

The operating point is determined from a system model that has been verified with test data. For an operating ambient of 60 ºC the following enclosure operating points are expected:

- Base/Lid Module Contact Surface: 86 ºC
- Enclosure Internal Air Temperature: 80 ºC

10.2.6. Module Thermal Design with Lid/Base Operating Point

Using a standalone module model, an estimate for module thermal performance can be determined. To apply the operating point to the module model, the module should include a section of the enclosure base (same footprint as the module) and contact resistance block between the enclosure base and module that is 1mm thick (same footprint as the module) and has a conductivity of k = 0.67 W/mK. The “bottom” of the enclosure base will have a fixed temperature condition set to 86 ºC

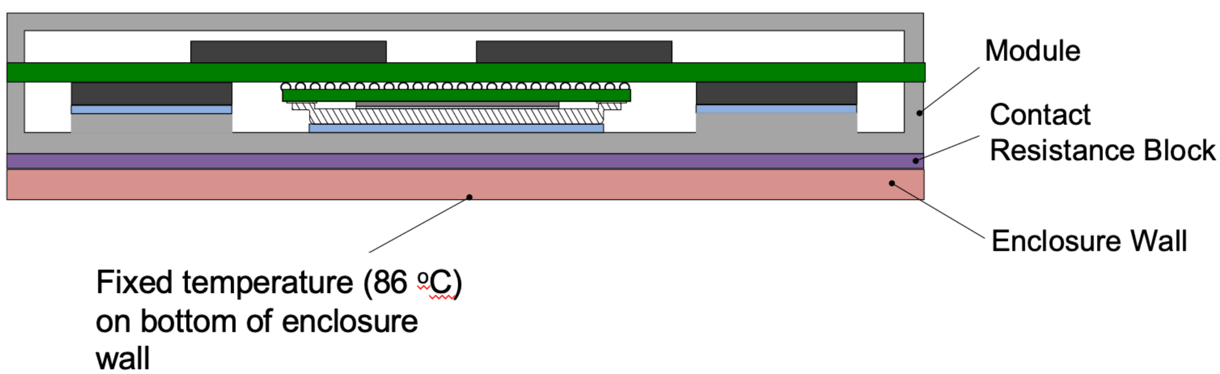


Figure 22 – Boundary Conditions for Module Thermal Evaluation

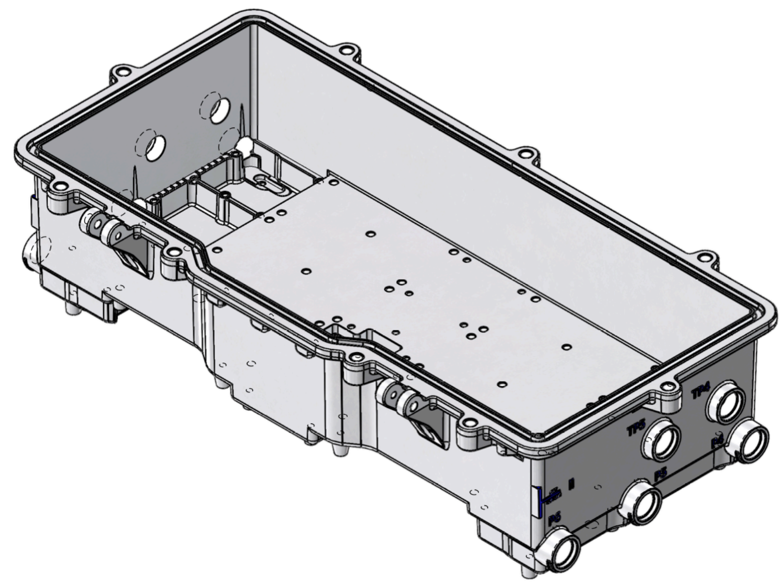
The enclosure wall and contact resistance block will have the same footprint of the module with the following respective attributes:

- Contact Resistance Block: 1.0 mm thick with conductivity k = 0.67 W/mK
- Enclosure Wall: 4.32 mm thick, Cast Al (k = 100 W/mK)

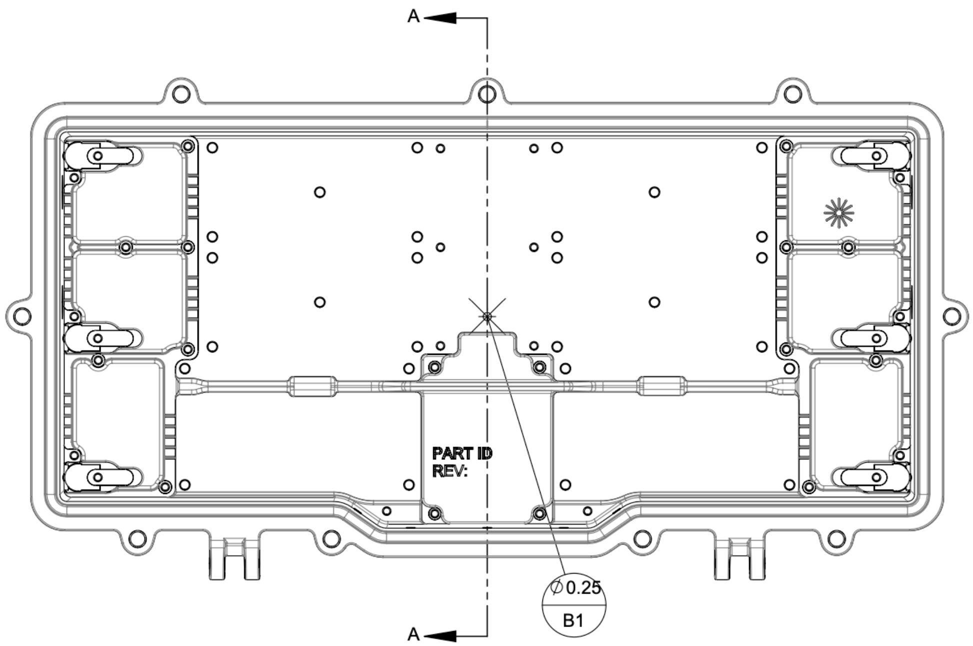
11. GAP Base 2D Drawings

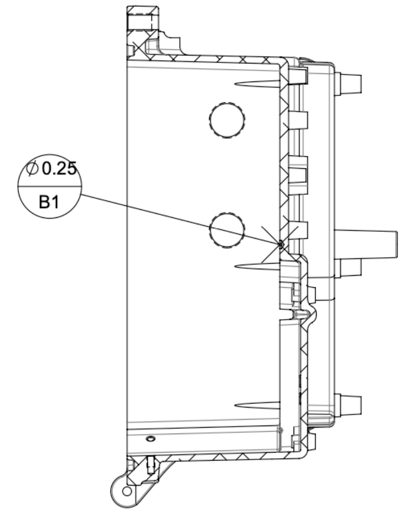
NOTES (UNLESS OTHERWISE SPECIFIED:

1. MATERIAL: A360 DIE CAST ALUMINUM OR EQUIVALENT
2. SURFACE FINISH: CLASS 2, FUNCTIONAL GRADE PER NADCA G-6-6-15
3. SEE TABLE 1 FOR STANDARD TOLERANCES
4. SEE TABLE 1 FOR PRECISION TOLERANCES
5. DIMENSIONED TO PRIMARY DATUM -A-, OR -B-
6. ALL NON-SPECIFIED GEOMETRY TO BE COMPLIANT WITH PROVIDED 3D MODEL
7. FINISHED SURFACE IS MACHINED TO ESTABLISH PRECISION HEAT SINK SURFACE
8. PART SETUP & INSPECTION: DATUM PLANE -A- IS ESTABLISHED BY MINIMAL MATERIAL REMOVAL FROM DIECAST SURFACE. DATUM -B- IS ORTHOGONAL TO -A- AT THE CENTER OF THE HOUSING.
9. THIS SURFACE MACHINED TO FINAL DIMENSION
10. ALL DIMENSIONS IN INCHES
11. ALL INSERT LOCATIONS MUST BE DRILLED AND TAPPED PER MANUFACTURERS RECOMMENDATIONS
12. INSTALL ALL INSERTS PER MANUFACTURERS GUIDELINES
13. ALL THREAD INSERTS MUST BE STAINLESS STEEL



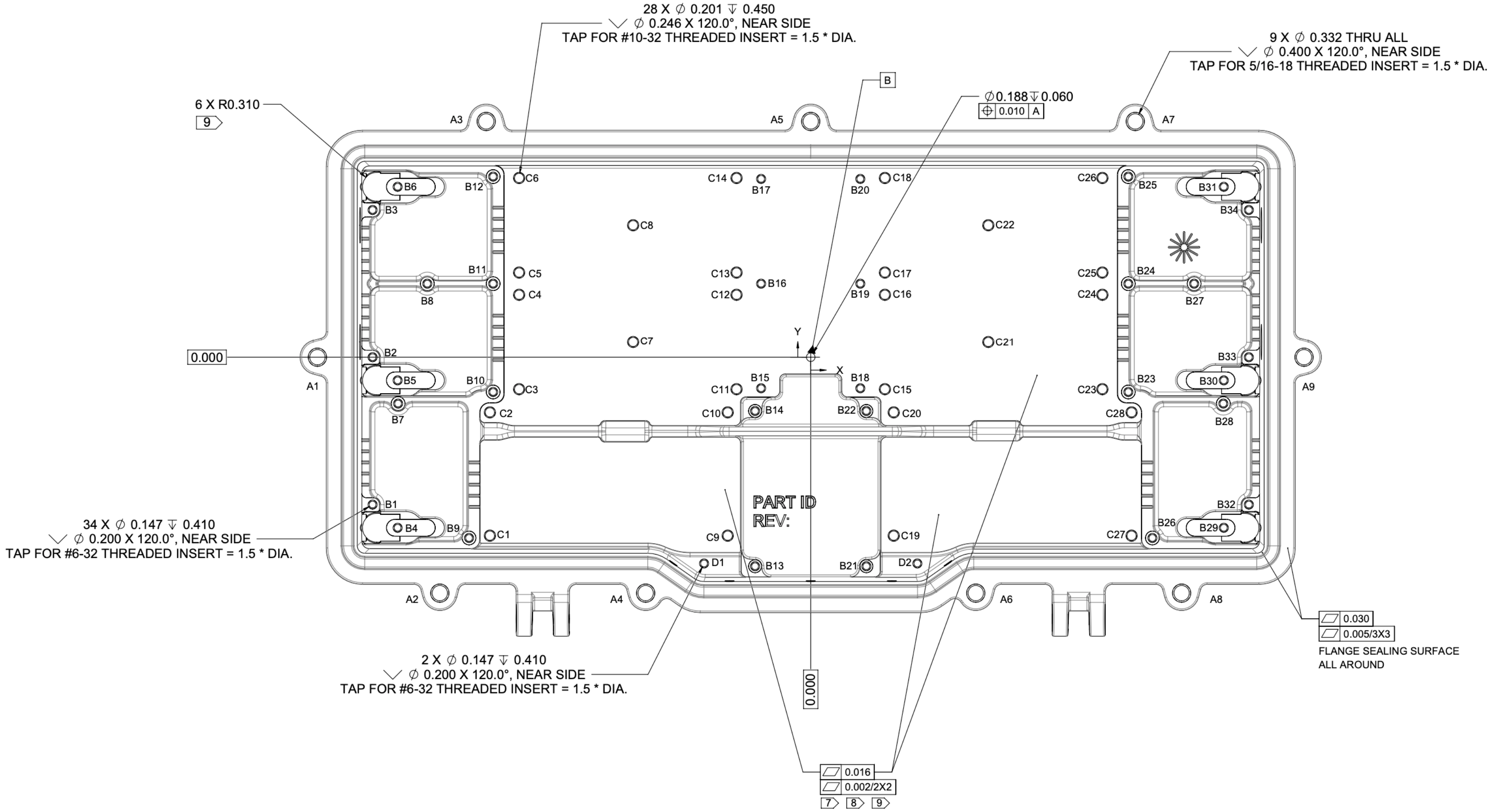
	DIMENSIONAL TOLERANCE		
	FIRST INCH	PER ADD. INCH	ADD ACROSS PARTING LINE
STANDARD	±0.010	±0.001	0.005
PRECISION	±0.0020	±0.0010	0.003
TOLERANCES PER NADCA S-4A-1-15, P-4A-1-15, S-4A-2-15, P-4A-2-15, S-4A-3-15, P-4A-3-15			
TABLE 1			





SECTION A-A
SCALE 1 : 3

PLAN VIEW HOLES
SEE TABLE ON FOLLOWING PAGE
FOR LOCATION DATA



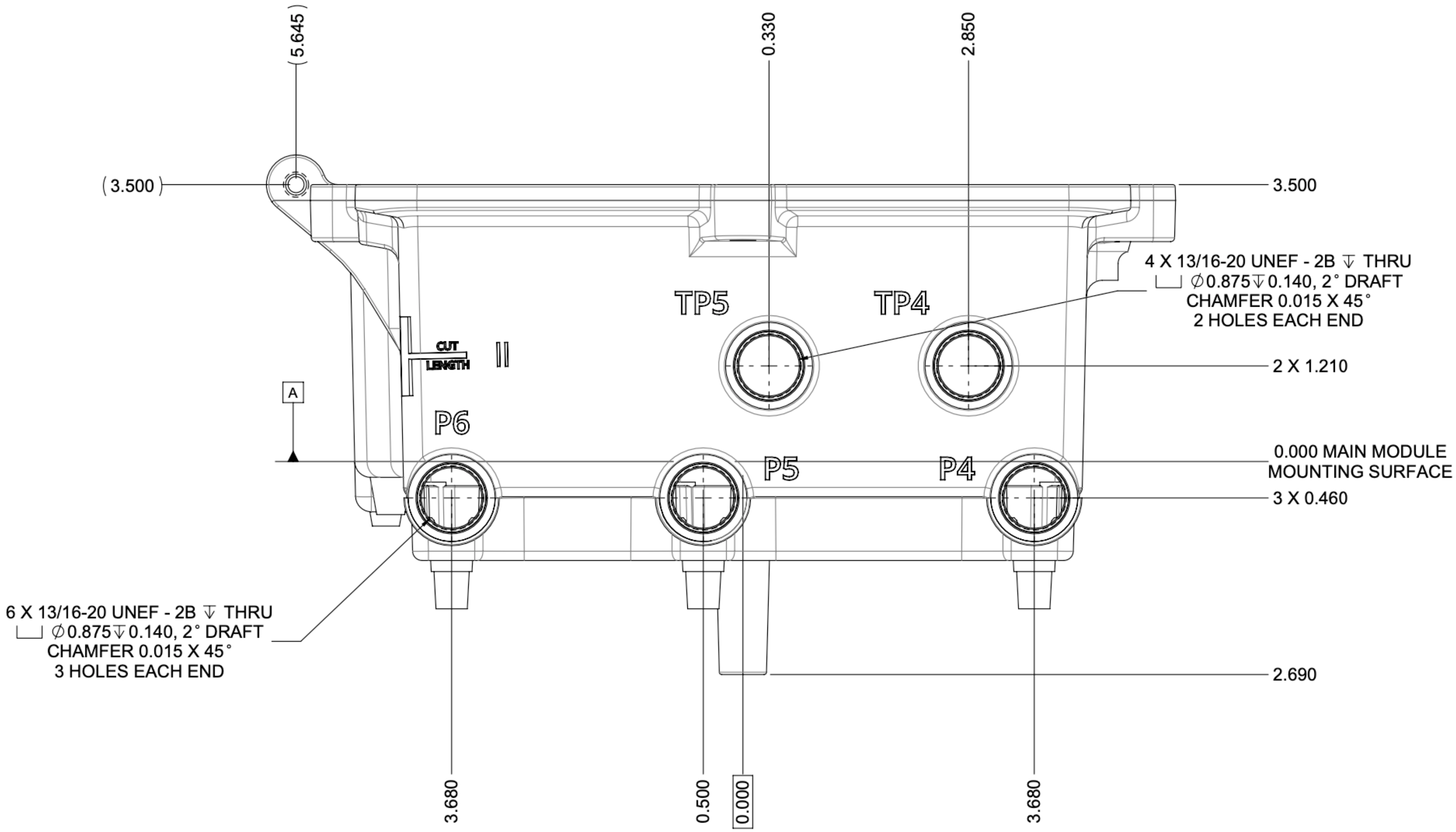
HOLE CHART

HOLE LOC	X LOC	Y LOC	SIZE
A1	-10.640	0.000	5/16-18 STI UNC
A2	-8.000	-5.090	5/16-18 STI UNC
A3	-7.000	5.090	5/16-18 STI UNC
A4	-3.560	-5.090	5/16-18 STI UNC
A5	0.000	5.090	5/16-18 STI UNC
A6	3.560	-5.090	5/16-18 STI UNC
A7	7.000	5.090	5/16-18 STI UNC
A8	8.000	-5.090	5/16-18 STI UNC
A9	10.640	0.000	5/16-18 STI UNC
B1	-9.450	-3.180	#6-32 STI UNC
B2	-9.450	0.000	#6-32 STI UNC
B3	-9.450	3.180	#6-32 STI UNC
B4	-8.910	-3.680	#6-32 STI UNC
B5	-8.910	-0.500	#6-32 STI UNC
B6	-8.910	3.680	#6-32 STI UNC
B7	-8.900	-1.000	#6-32 STI UNC
B8	-8.270	1.590	#6-32 STI UNC
B9	-7.370	-3.900	#6-32 STI UNC
B10	-6.850	-0.750	#6-32 STI UNC
B11	-6.850	1.590	#6-32 STI UNC
B12	-6.850	3.900	#6-32 STI UNC
B13	-1.200	-4.510	#6-32 STI UNC
B14	-1.200	-1.160	#6-32 STI UNC
B15	-1.070	-0.670	#6-32 STI UNC
B16	-1.070	1.590	#6-32 STI UNC
B17	-1.070	3.850	#6-32 STI UNC
B18	1.070	-0.670	#6-32 STI UNC
B19	1.070	1.590	#6-32 STI UNC
B20	1.070	3.850	#6-32 STI UNC
B21	1.200	-4.510	#6-32 STI UNC
B22	1.200	-1.160	#6-32 STI UNC
B23	6.850	-0.750	#6-32 STI UNC
B24	6.850	1.590	#6-32 STI UNC
B25	6.850	3.900	#6-32 STI UNC
B26	7.370	-3.900	#6-32 STI UNC
B27	8.270	1.590	#6-32 STI UNC
B28	8.900	-1.000	#6-32 STI UNC
B29	8.910	-3.680	#6-32 STI UNC
B30	8.910	-0.500	#6-32 STI UNC
B31	8.910	3.680	#6-32 STI UNC
B32	9.450	-3.180	#6-32 STI UNC
B33	9.450	0.000	#6-32 STI UNC
B34	9.450	3.180	#6-32 STI UNC

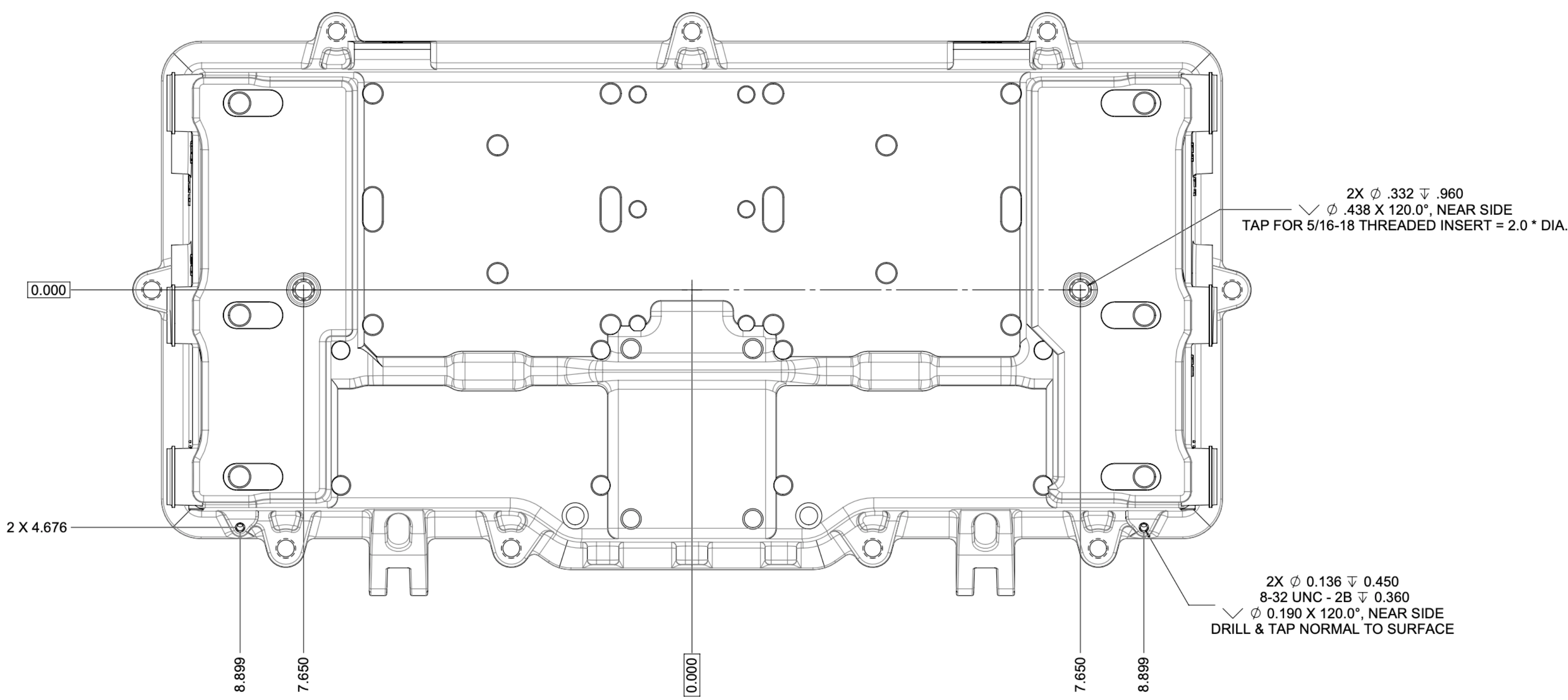
HOLE LOC	X LOC	Y LOC	SIZE
C1	-6.920	-3.850	#10-32 STI UNF
C2	-6.920	-1.190	#10-32 STI UNF
C3	-6.290	-0.690	#10-32 STI UNF
C4	-6.290	1.350	#10-32 STI UNF
C5	-6.290	1.830	#10-32 STI UNF
C6	-6.290	3.870	#10-32 STI UNF
C7	-3.830	0.330	#10-32 STI UNF
C8	-3.830	2.850	#10-32 STI UNF
C9	-1.790	-3.850	#10-32 STI UNF
C10	-1.790	-1.190	#10-32 STI UNF
C11	-1.600	-0.690	#10-32 STI UNF
C12	-1.600	1.350	#10-32 STI UNF
C13	-1.600	1.830	#10-32 STI UNF
C14	-1.600	3.870	#10-32 STI UNF
C15	1.600	-0.690	#10-32 STI UNF
C16	1.600	1.350	#10-32 STI UNF
C17	1.600	1.830	#10-32 STI UNF
C18	1.600	3.870	#10-32 STI UNF
C19	1.790	-3.850	#10-32 STI UNF
C20	1.790	-1.190	#10-32 STI UNF
C21	3.830	0.330	#10-32 STI UNF
C22	3.830	2.850	#10-32 STI UNF
C23	6.290	-0.690	#10-32 STI UNF
C24	6.290	1.350	#10-32 STI UNF
C25	6.290	1.830	#10-32 STI UNF
C26	6.290	3.870	#10-32 STI UNF
C27	6.920	-3.850	#10-32 STI UNF
C28	6.920	-1.190	#10-32 STI UNF
D1	-2.300	-4.450	#6-32 STI UNC
D2	2.300	-4.450	#6-32 STI UNC

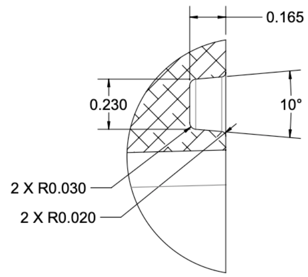
NOTES:

1. **HOLE LOCATION NOTES: 5**
2. **LOCATION TOLERANCE OF HOLES:**
   - **RELATIVE TO DATUM -B-: ±0.015"**
   - **WITHIN EACH PATTERN: ±0.005"**

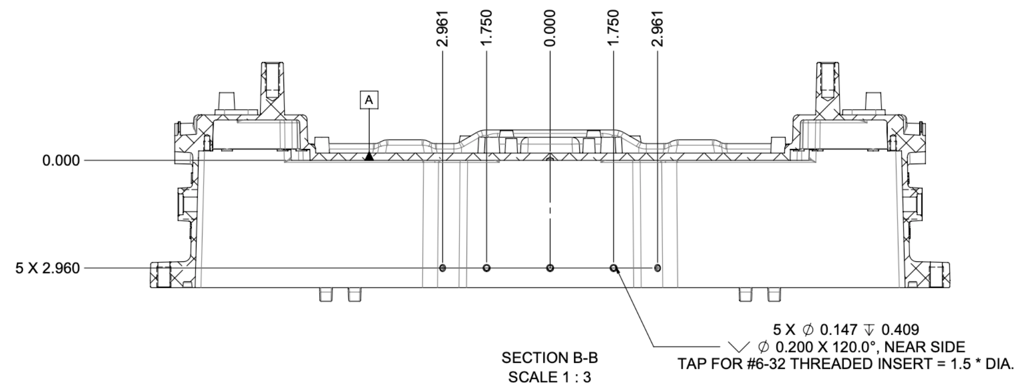


5.645
0.330
2.850
3.500
3.500
TP5
TP4
4 X 13/16-20 UNEF - 2B ↧ THRU
⌴ ∅0.875↧0.140, 2° DRAFT
CHAMFER 0.015 X 45°
2 HOLES EACH END
CUT
LENGTH
2 X 1.210
A
P6
P5
P4
0.000 MAIN MODULE
MOUNTING SURFACE
3 X 0.460
6 X 13/16-20 UNEF - 2B ↧ THRU
⌴ ∅0.875↧0.140, 2° DRAFT
CHAMFER 0.015 X 45°
3 HOLES EACH END
2.690
3.680
0.500
0.000
3.680

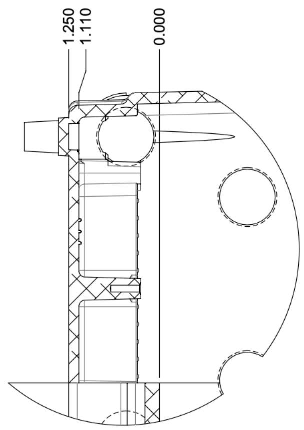

2X ∅ .332 ↧ .960
∅ .438 X 120.0°, NEAR SIDE
TAP FOR 5/16-18 THREADED INSERT = 2.0 * DIA.
0.000
2 X 4.676
2X ∅ 0.136 ↧ 0.450
8-32 UNC - 2B ↧ 0.360
∅ 0.190 X 120.0°, NEAR SIDE
DRILL & TAP NORMAL TO SURFACE
8.899
7.650
0.000
7.650
8.899



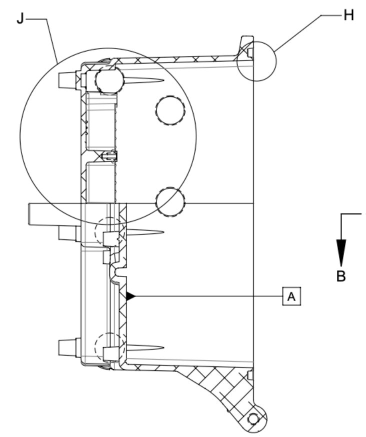
DETAIL H
SCALE 2 : 1



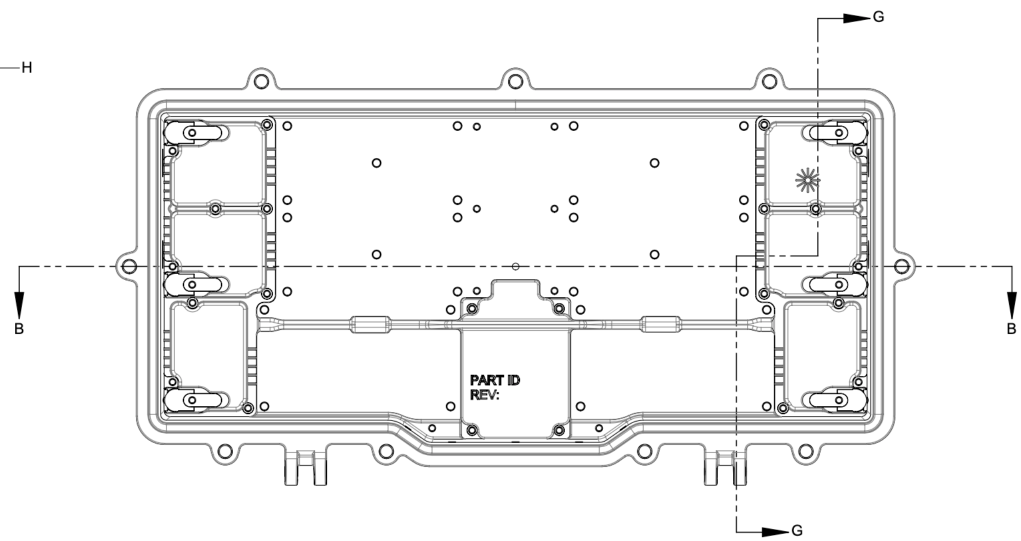
SECTION B-B
SCALE 1 : 3

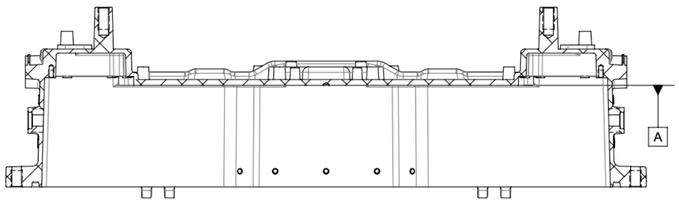


DETAIL J
SCALE 2 : 3
6 LOCATIONS

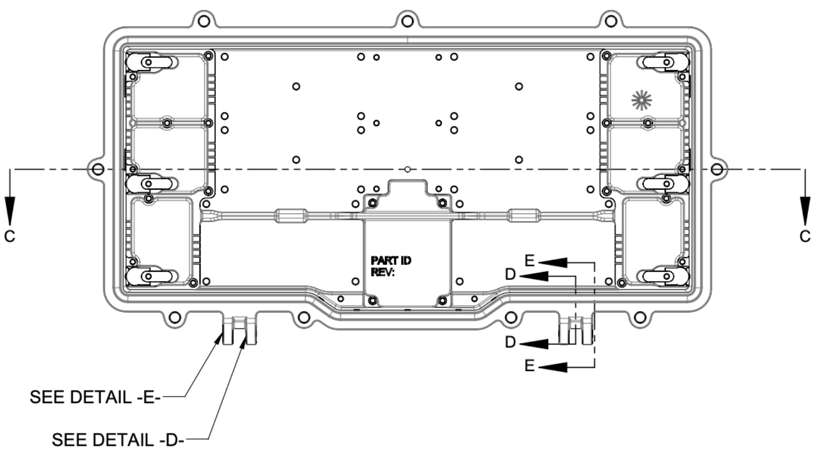


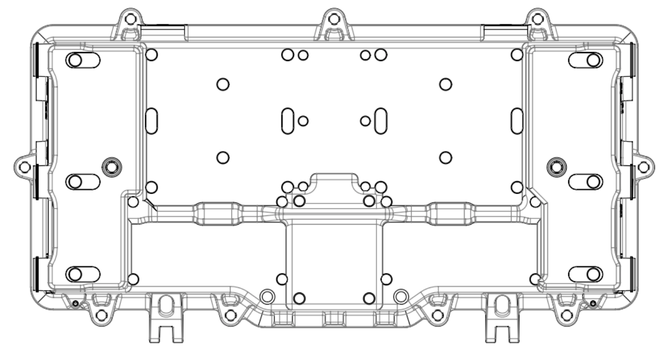
SECTION G-G
SCALE 1 : 3

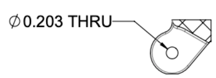




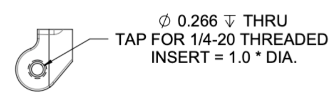
SECTION C-C



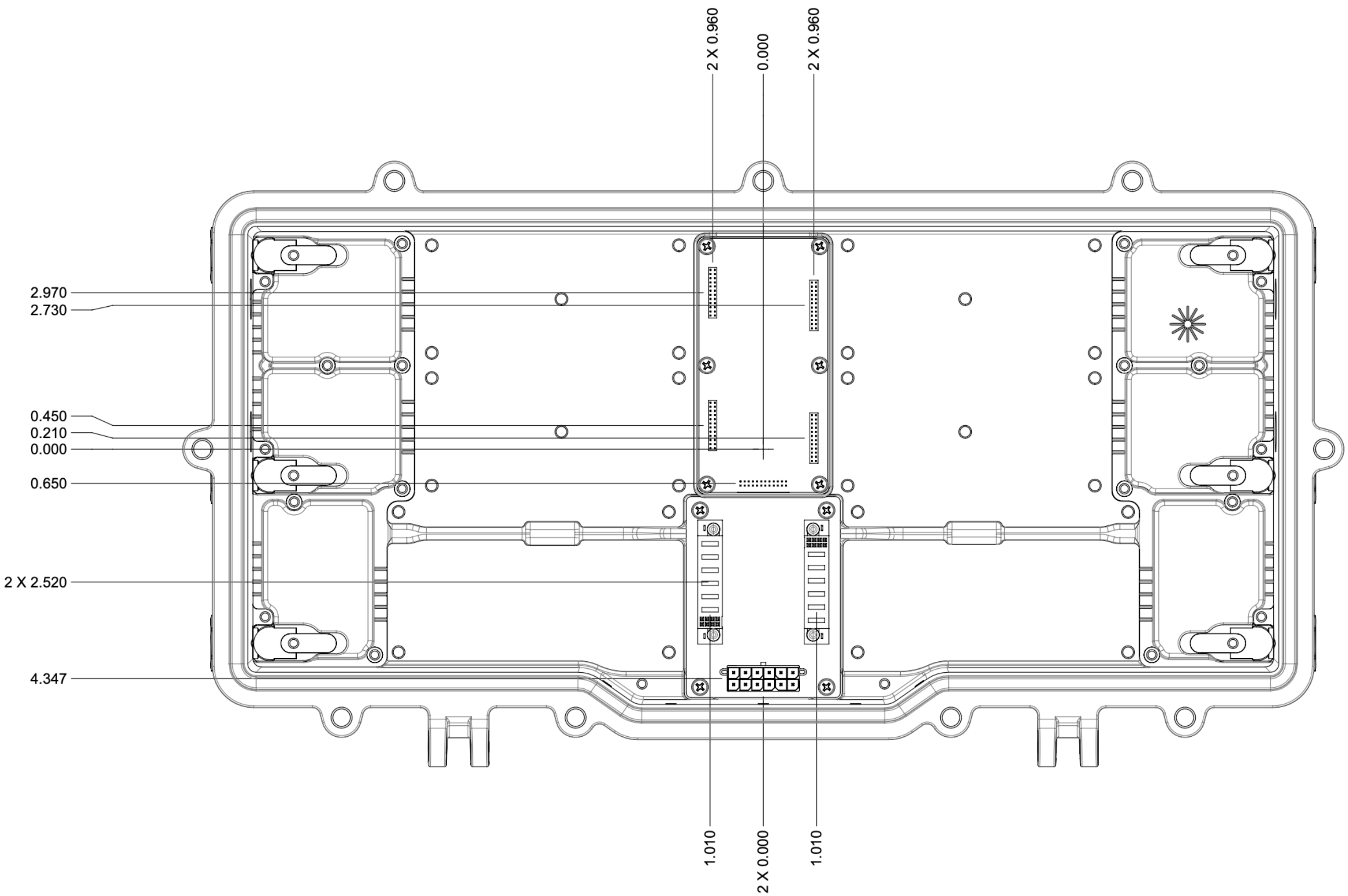




SECTION D-D
SCALE 1 : 2
2 LOCATIONS



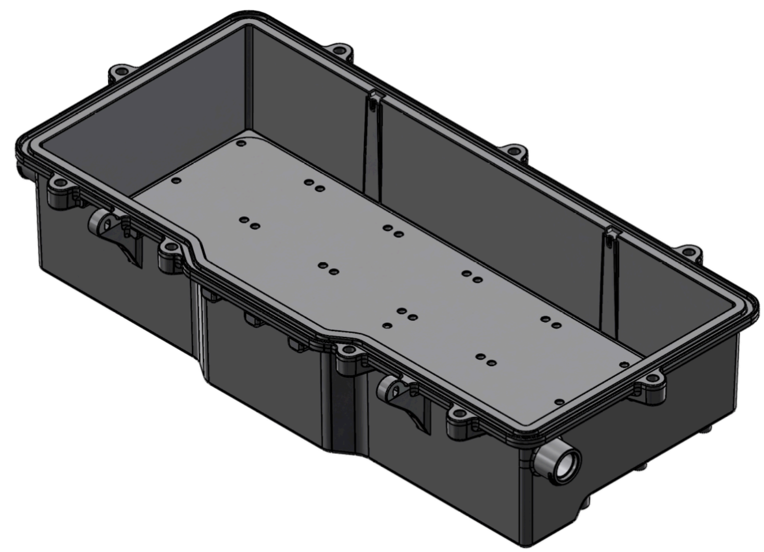
SECTION E-E
SCALE 1 : 2
2 LOCATIONS


2 X 0.960
0.000
2 X 0.960
2.970
2.730
0.450
0.210
0.000
0.650
2 X 2.520
4.347
1.010
2 X 0.000
1.010

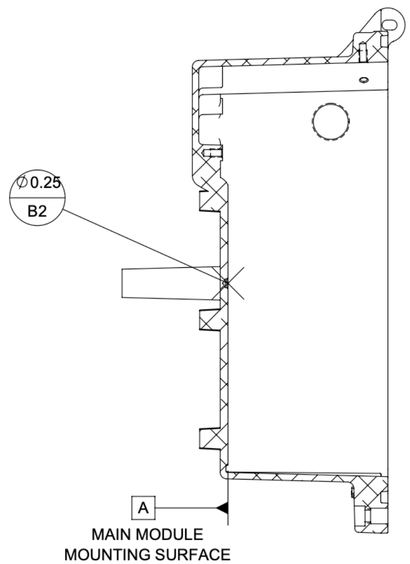
12. GAP Lid 2D Drawings

NOTES (UNLESS OTHERWISE SPECIFIED:

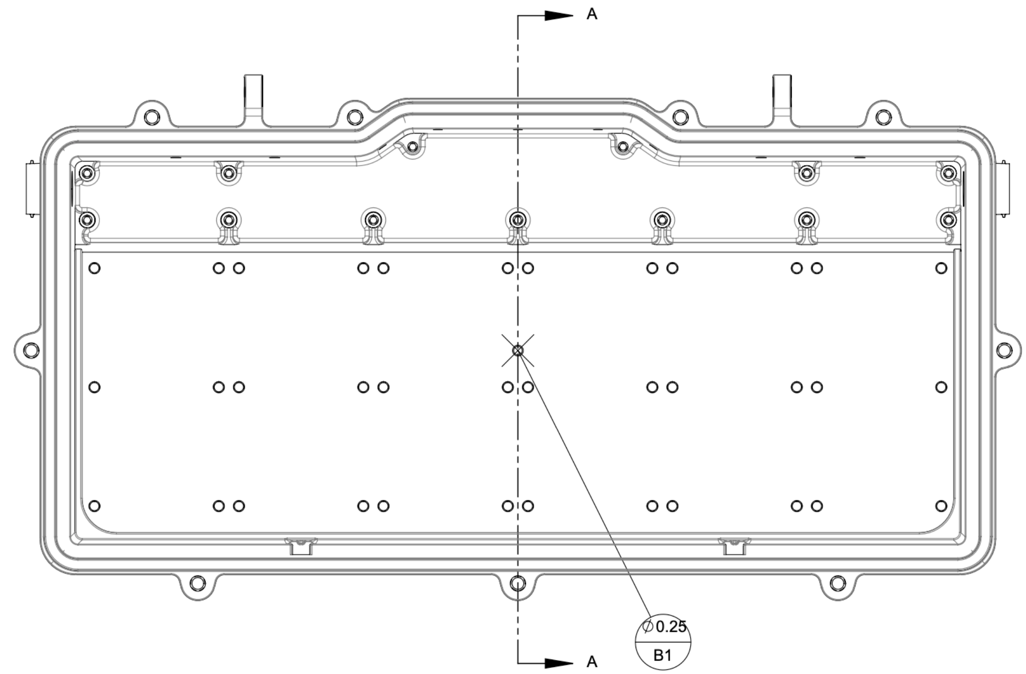
1. MATERIAL: A360 DIE CAST ALUMINUM OR EQUIVALENT
2. SURFACE FINISH: CLASS 2, FUNCTIONAL GRADE PER NADCA G-6-6-15
3. SEE TABLE 1 FOR STANDARD TOLERANCES
4. SEE TABLE 1 FOR PRECISION TOLERANCES
5. DIMENSIONED TO PRIMARY DATUM -A-, OR -B-
6. ALL NON-SPECIFIED GEOMETRY TO BE COMPLIANT WITH PROVIDED 3D MODEL
7. FINISHED SURFACE IS MACHINED TO ESTABLISH PRECISION HEAT SINK SURFACE
8. PART SETUP & INSPECTION: DATUM PLANE -A- IS ESTABLISHED BY MINIMAL MATERIAL REMOVAL FROM DIECAST SURFACE. DATUM -B- IS ORTHOGONAL TO -A- AT THE CENTER OF THE HOUSING.
9. THIS SURFACE MACHINED TO FINAL DIMENSION
10. ALL DIMENSIONS IN INCHES
11. ALL INSERT LOCATIONS MUST BE DRILLED AND TAPPED PER MANUFACTURERS RECOMMENDATIONS
12. INSTALL ALL INSERTS PER MANUFACTURERS GUIDELINES
13. ALL THREAD INSERTS MUST BE STAINLESS STEEL



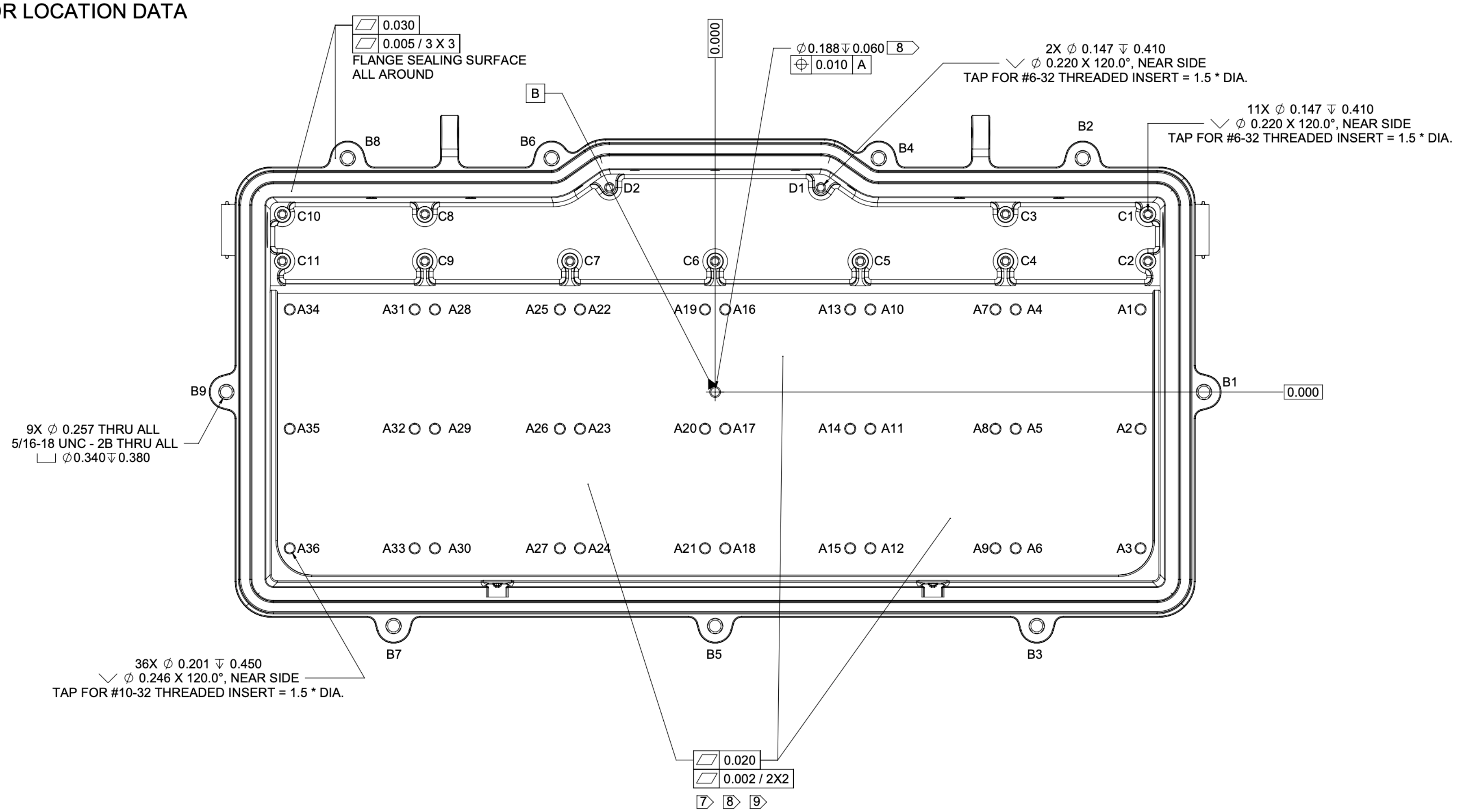
	DIMENSIONAL TOLERANCE		
	FIRST INCH	PER ADD. INCH	ADD ACROSS PARTING LINE
STANDARD	±0.010	±0.001	0.005
PRECISION	±0.0020	±0.0010	0.003
TOLERANCES PER NADCA S-4A-1-15, P-4A-1-15, S-4A-2-15, P-4A-2-15, S-4A-3-15, P-4A-3-15			
TABLE 1			



SECTION A-A
SCALE 2 : 5



PLAN VIEW HOLES
SEE TABLE ON FOLLOWING PAGE
FOR LOCATION DATA



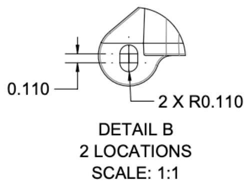
HOLE CHART

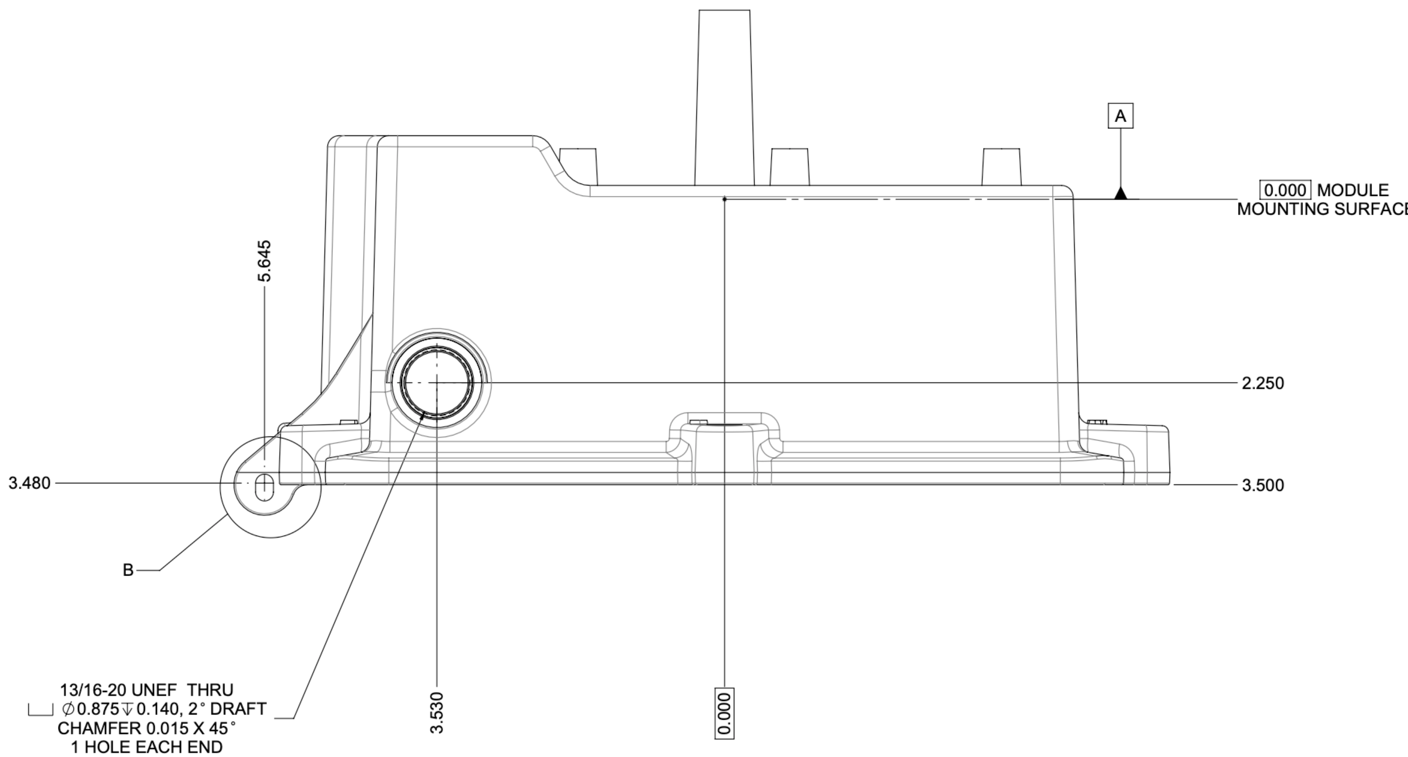
HOLE No.	X LOC	Y LOC	SIZE
A1	-9.260	-1.800	#10-32 STI UNF
A2	-9.260	0.800	#10-32 STI UNF
A3	-9.260	3.400	#10-32 STI UNF
A4	-6.540	-1.800	#10-32 STI UNF
A5	-6.540	0.800	#10-32 STI UNF
A6	-6.540	3.400	#10-32 STI UNF
A7	-6.100	-1.800	#10-32 STI UNF
A8	-6.100	0.800	#10-32 STI UNF
A9	-6.100	3.400	#10-32 STI UNF
A10	-3.380	-1.800	#10-32 STI UNF
A11	-3.380	0.800	#10-32 STI UNF
A12	-3.380	3.400	#10-32 STI UNF
A13	-2.940	-1.800	#10-32 STI UNF
A14	-2.940	0.800	#10-32 STI UNF
A15	-2.940	3.400	#10-32 STI UNF
A16	-0.220	-1.800	#10-32 STI UNF
A17	-0.220	0.800	#10-32 STI UNF
A18	-0.220	3.400	#10-32 STI UNF
A19	0.220	-1.800	#10-32 STI UNF
A20	0.220	0.800	#10-32 STI UNF
A21	0.220	3.400	#10-32 STI UNF
A22	2.940	-1.800	#10-32 STI UNF
A23	2.940	0.800	#10-32 STI UNF
A24	2.940	3.400	#10-32 STI UNF
A25	3.380	-1.800	#10-32 STI UNF
A26	3.380	0.800	#10-32 STI UNF
A27	3.380	3.400	#10-32 STI UNF
A28	6.100	-1.800	#10-32 STI UNF
A29	6.100	0.800	#10-32 STI UNF
A30	6.100	3.400	#10-32 STI UNF
A31	6.540	-1.800	#10-32 STI UNF
A32	6.540	0.800	#10-32 STI UNF
A33	6.540	3.400	#10-32 STI UNF
A34	9.260	-1.800	#10-32 STI UNF
A35	9.260	0.800	#10-32 STI UNF
A36	9.260	3.400	#10-32 STI UNF

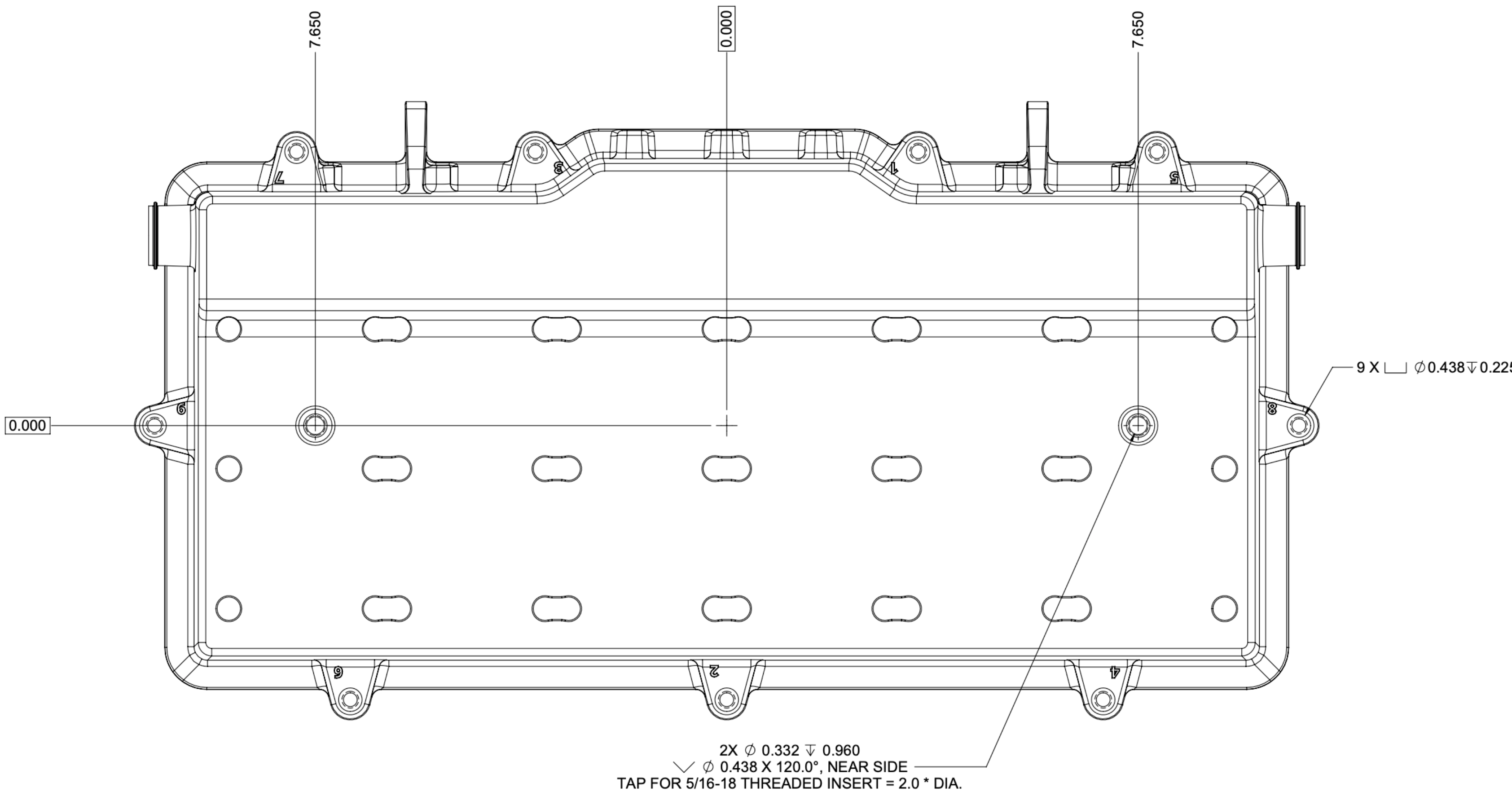
HOLE No.	X LOC	Y LOC	SIZE
B1	-10.640	0.000	5/16-18 UNC
B2	-8.000	-5.090	5/16-18 UNC
B3	-7.000	5.090	5/16-18 UNC
B4	-3.560	-5.090	5/16-18 UNC
B5	0.000	5.090	5/16-18 UNC
B6	3.560	-5.090	5/16-18 UNC
B7	7.000	5.090	5/16-18 UNC
B8	8.000	-5.090	5/16-18 UNC
B9	10.640	0.000	5/16-18 UNC
C1	-9.420	-3.870	#6-32 STI UNF
C2	-9.420	-2.850	#6-32 STI UNF
C3	-6.320	-3.870	#6-32 STI UNF
C4	-6.320	-2.850	#6-32 STI UNF
C5	-3.160	-2.850	#6-32 STI UNF
C6	0.000	-2.850	#6-32 STI UNF
C7	3.160	-2.850	#6-32 STI UNF
C8	6.320	-3.870	#6-32 STI UNF
C9	6.320	-2.850	#6-32 STI UNF
C10	9.420	-3.870	#6-32 STI UNF
C11	9.420	-2.850	#6-32 STI UNF
D1	-2.300	-4.450	#6-32 STI UNF
D2	2.300	-4.450	#6-32 STI UNF

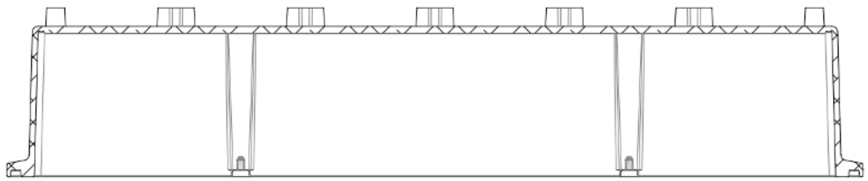
NOTES:

1. HOLE LOCATION NOTES: 5
2. LOCATION TOLERANCE OF HOLES:
    - RELATIVE TO DATUM -B-: ±0.015"
    - WITHIN EACH PATTERN: ±0.005"

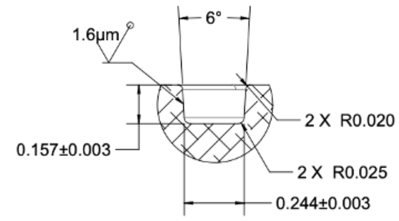

0.110
2 X R0.110
DETAIL B
2 LOCATIONS
SCALE: 1:1


A
0.000 MODULE
MOUNTING SURFACE
5.645
2.250
3.480
3.500
B
13/16-20 UNEF THRU
⌴ ∅0.875 ↧ 0.140, 2° DRAFT
CHAMFER 0.015 X 45°
1 HOLE EACH END
3.530
0.000

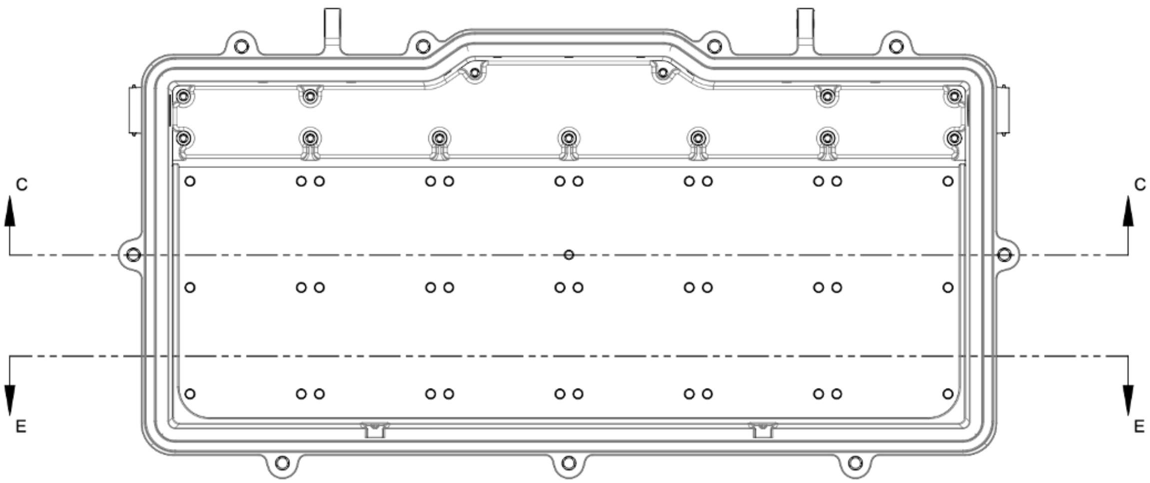

7.650
0.000
7.650
0.000
9 X ⌴ ∅0.438 ↧ 0.225
2X ∅ 0.332 ↧ 0.960
⌵ ∅ 0.438 X 120.0°, NEAR SIDE
TAP FOR 5/16-18 THREADED INSERT = 2.0 * DIA.

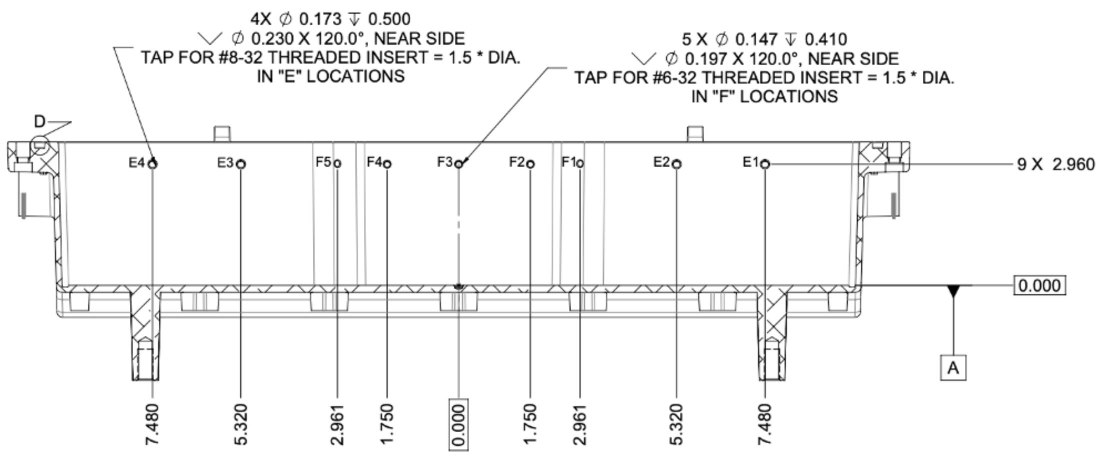


SECTION E-E

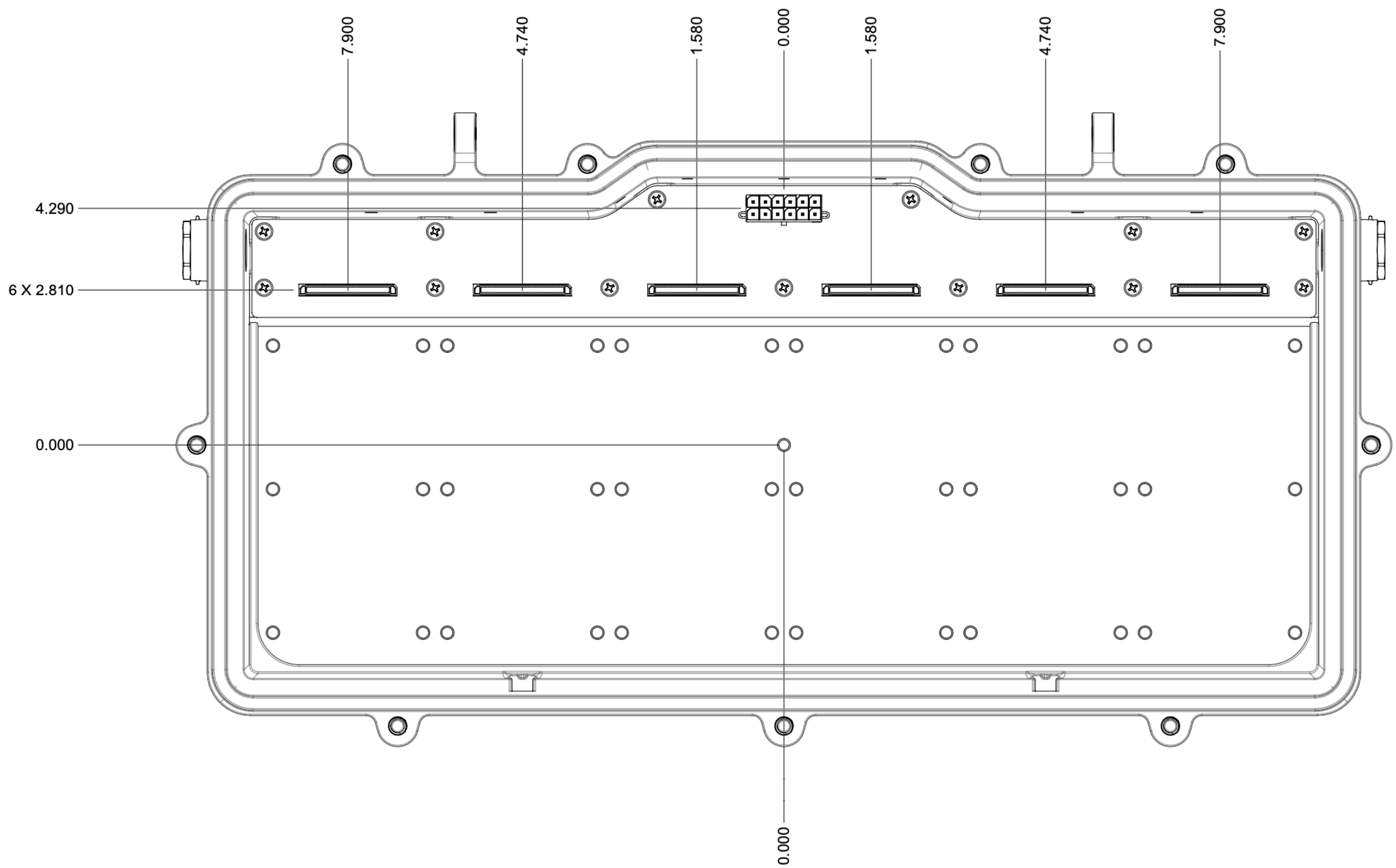


DETAIL D
SCALE 2 : 1





SECTION C-C


7.900
4.740
1.580
0.000
1.580
4.740
7.900
4.290
6 X 2.810
0.000
0.000

HIGH SPEED BACKPLANE